THURSDAY, FEBRUARY 1, 1917.

## OIL-FIELD TECHNOLOGY.

*Oil-Field Development and Petroleum Mining.* By A. Beeby Thompson. Pp. xix + 648. (London: Crosby Lockwood and Son, 1916.) Price 25*s.* net.

THIS is practically a second edition of the author's previous volume on the same subject, with transposition of the leading divisions of the title. It is, however, by no means a mere reprint, extensive alterations having been effected by correction, addition, and excision. Readers interested in some only of the many branches of the subject will doubtless consider that both the last two processes might well have been carried further, but an impartial survey of the work will show that the author is gifted with a judicious sense of proportion in the allotment of attention to the several sections of his complex topic, only stopping at the door of the refinery, the operations within which are beyond the scope of the volume, and are merely summarised in some half-dozen pages.

Somewhat more than half the work is concerned with the technology of exploitation and transport, but a fair degree of consideration is accorded to the geological questions of the original formation of petroleum, its mode of accumulation, and the effect of tectonic movements. The author naturally deals at greater length with the more important factors of composition and structure of strata, as affecting the concentration of oil, than with the more purely academic problems of the primary formation of the hydrocarbons from their parent organic matter, animal or vegetable. Ample space is, nevertheless, occupied by a careful balancing of the more or less contradictory evidence on this point, with a general deduction in favour of catalytic action by anaerobic enzymes shortly after inclusion in sediment. This provisional hypothesis obviates at least many of the objections which have been advanced against the more vaguely enunciated theory of organic origin, now generally accepted. That this was ever controverted is attributable to the absence of co-operation between geologists and chemists, so that wholly untenable hypotheses have been advocated or supported by leading chemists; not that there was any doubt whatever that petroleums had been produced synthetically in the laboratory, but that geological considerations precluded the acceptance of this as a natural method of formation. The converse error, through geologists proposing chemical impossibilities, is probably rarer, though not wholly unknown.

Apart from the question of origin, the texture and tectonic structure of the rocks of an oil-bearing region are shown to have a most important bearing on the productivity of the field. Not only do oil-bearing rocks, like all the coarser mechanical deposits, occur in lenticular masses, often of very abrupt angles of attenuation, but even in continuous sandstones the porosity (and consequent passage of fluids) may be largely reduced by calcitic or siliceous cementation, irrespective of the coarseness or fineness of the grains or pebbles composing the bulk of the rock. Some very coarse conglomerates have been rendered wholly impervious by such cementation, occurring sporadically, and thus removing those portions of the rock from the category of productive "sands."

The migration of oil under pressure, generally with the aid of flexures, faulting, or other tectonic disturbance, is dealt with at length, as its importance merits, and is illustrated by heavy yields of oil from horizons wholly devoid of it except where forced into contact with productive members of the geological series. As the author remarks, erroneous deductions may easily be drawn from imperfectly studied phenomena. Our knowledge of the physics of the subterranean flow of oils is yet little more than the empirical record of observed details not permitting the formulation of anything beyond tentative proposition of working hypotheses. The chief difficulty lies in the weight to be assigned to unknown quantities in the many relevant factors—pressure, gravity, capillarity, surface-tension, solution of gas in oils, effect of underground temperature on viscosity, original structure of the rocks, with its modification by tectonic action, by the disturbance of equilibrium in exploitation through the rapid removal of vast bulks of oil and sand, and to some extent by the vibration due to abrupt stoppages of the flow by temporary choking of the boreholes.

Caution in the interpretation of surface indications is enjoined rather as regards forecast of quantity and quality than as depreciating their value as guides to probable supplies, but oil-films on streams may be some distance from their source, or may arise from certain vegetable compounds. Films of iron peroxide, although instantly distinguishable by their incoherence, have often misled careless observers.

The author purposely refrains from entering upon the exceedingly intricate chemistry of petroleum beyond a very brief summary of the physical characters of a few typical oils. He shows that the supposed difference in original source between asphaltic and paraffinoid oils is based upon inaccurate data, many fields yielding both classes, and frequently in admixture.

The whole constitutes a useful treatise on the branches to which the author has devoted special attention, and the localities cited in illustration are mostly those of his personal investigation.

The orthography of Russian and other place-names is often open to individual choice, and there are few real misprints, such as "menelite." Prof. Mrazec's term "diapir" (for masses of older rock forced up through softer strata) should not be spelt "diaper." "Commendable criticism" (p. 125) is clearly a slip for "commendatory criticism." In the footnote on p. 116, XII. should be LXI. In the index are several unimportant errors, not affecting position, but Ackverdoff for Akhverdoff may be noted, and Quayaguayare would be more serious were not Guayaguayare given in its right place.

## ARBOREAL HABITS AND THE EVOLUTION OF MAN.

*Arboreal Man.* By Prof. F. Wood Jones. Pp. x +230. (London: Edward Arnold, 1916.) Price 8*s.* 6*d.* net.

EVER since anatomy became separated from physiology and practical medicine it has run the risk of being assimilated with the material with which it deals and itself becoming a "dead subject." By a curious paradox this tendency became specially pronounced when the publication of "The Origin of Species" gave a great impetus to research in morphology, although Charles Darwin himself never failed to take into consideration the physiological and psychological factors which directly or indirectly affected the evolution of animal structure. But when the study of morphology led certain anatomists to regard their subject as what they were pleased to call a "pure science," worthy of being cultivated "for its own sake," and not merely as the geography of the territory the medical student would exploit when he became a physician or surgeon, an unfortunate tendency developed to disregard any treatment of the subject which might expose it unduly to the latter interpretation. As a result it suffered from the lack of those vitalising influences which the study of the functions naturally exerts upon attempts to explain structure.

The outstanding merit of the book which Prof. Wood Jones has given us is that it impresses upon the mind of the student the importance of studying *living* animals and human beings as the indispensable method for really understanding the meaning of their anatomy.

The somewhat ambiguous title emphasises the fact that his main theme is the examination of the far-reaching and determining influence of arboreal habits in the evolution of man's structure, distinctive abilities, and outlook. The general idea is not new, but it needed restating and expounding in the light of our current knowledge. Prof. Wood Jones had added much new information as the result of his own investigations, and has presented the whole argument with all the lucidity and brilliance of the conspicuously successful teacher he has proved himself to be. The book represents the Arris and Gale lectures as they were actually given at the Royal College of Surgeons. If he had been expounding the subject in another way, no doubt the author would have given fuller bibliographical references and discussion of the evidence. But in its present form the work can be confidently recommended to students as an exceptionally clear and sober exposition of certain of the factors in human evolution which have in the past not received the amount of attention their importance merits. The book is illustrated with characteristic samples of the author's clever draughtsmanship.

G. ELLIOT SMITH.

## PHILOSOPHY.

(1) *The Contingency of the Laws of Nature.* By Emile Boutroux. Authorised translation by Fred Rothwell. Pp. ix+196. (Chicago and London: The Open Court Publishing Co., 1916.) Price 5*s.* net.

(2) *The Dreams of Orlow.* By A. M. Irvine, with an Introduction by J. Arthur Hill. Pp. 256. (London: George Allen and Unwin, Ltd., 1916.) Price 5*s.* net.

(3) *A Modern Job: an Essay on the Problem of Evil.* By Etienne Giron, with Introduction by Archdeacon Lilley. Authorised translation by Fred Rothwell. Pp. 92. (Chicago and London: The Open Court Publishing Co., 1916.) Price 2*s.* 6*d.* net.

(1) M. EMILE BOUTROUX'S essay was originally presented as a thesis to the Sorbonne in 1874. Its aim was to find a new vindication of the freedom of the human will. The great difficulty which is always supposed to beset the libertarian is to reconcile free-will in man with the strict determination of natural objects which are governed by immutable laws. The author undertakes to show that there are no such laws. What really exist are uniformities which are similar to the uniformities in behaviour of a man who has formed very regular habits. "Contingency" in the title of the essay means "non-necessity," and the laws of Nature are not necessary, though they are regular. So long as we regard the laws of Nature as necessary we render illusory all life and liberty. And so the author claims that he has "restored to man that reality and effective influence over the course of things which common sense attributes to them, but which purely intellectualist or voluntarist philosophies, like those of Germany for the most part, declare to be inconceivable and illusory."

It is evident that the aim which M. Boutroux has set before himself is one which will command widespread sympathy, but the method by which he endeavours to realise his aim is too abstract and formal to be satisfactory. For the greater part of his book he is arguing against presuppositions and is attacking conceptions which, though widely current forty-two years ago, are not accepted to-day by any considerable body of philosophic opinion. The highly abstract (and therefore unsatisfying) character of the author's argument is seen most plainly, perhaps, in his second chapter, on Being. "On the lowest rung of the ladder of things given we find *being* or *fact* pure and simple, as yet indeterminate. Can we say that it exists necessarily?" The author's answer is, of course, that we cannot say so. On this whole question, however, our comment must be that the conception of pure indeterminate being is empty and futile. It stands in the forefront of Hegel's system, but since the date when this essay first appeared the Hegelian system has fallen out of favour, and men have turned to more concrete and fruitful inquiries. Altogether we are inclined

to doubt whether the Open Court Publishing Company and Mr. Rothwell have done much service to philosophic thought by bringing forward this early thesis, or whether its republication will add much to the author's very considerable reputation in England.

(2) Miss Irvine's book is curious and interesting, and many people will read it through to the end who will be unconvinced of its value as a contribution either to science or to religion. It records under a thin veil of fiction the experiences of a young lady who could dream what she called True Dreams—that is, dreams which were recognised as different from waking reality, but were regarded by the dreamer as incursions into some supernatural—or shall we say "astral"?—plane of existence. A work of this character has no clear scientific value, but it has the merit of stimulating inquiry and directing attention to an important and little-explored field of human experience.

(3) M. Etienne Giron's essay on the problem of evil follows very closely upon the model of its prototype. His "modern Job" is a Dutch descendant of the patriarch, distinguished by the possession of great wealth and the practice of every virtue. Suffering the severest bereavements and financial misfortunes, he is comforted by three friends and by his faithful servant. The book belongs to the literature of Christian exhortation rather than to that of philosophy.

## ARBORICULTURAL PATHOLOGY.

*Tree Wounds and Diseases: Their Prevention and Treatment, with a special chapter on Fruit Trees.* By A. D. Webster. Pp. xx+215. (London: Williams and Norgate, 1916.) Price 7*s.* 6*d.* net.

"TREE Wounds and Diseases" is a popular account of the nature and treatment of the ailments and injuries to which trees are liable, and may serve as an introduction to more scientific treatises like Hartig's "Diseases of Trees" and Gillanders's "Forest Entomology." To one branch of the subject, practical tree-surgery, Mr. Webster pays more attention than these authors, who wrote from the sylviculturist's point of view. The forester handling large masses of woodland aims at the retention of only healthy and well-formed trees, from which sound timber will be ultimately harvested, and accordingly removes in his thinning operations all decaying, deformed, and injured trees. The arboriculturist is concerned with the preservation of trees for shade and ornament rather than for future use as timber, and is often called upon to repair decay and ward off impending dangers from historic and ornamental trees in parks and towns. Mr. Webster, as a practical man with considerable experience, discusses in three short chapters such problems as the filling of hollow trunks, the support of heavy branches by iron bands and connecting rods, the guying of limbs to prevent splitting, and the pruning of diseased trees. He cites examples of old and decaying trees to which careful treatment has given a new lease of life, such as the elms in Regent's Park, the chestnuts in Greenwich Park, and the Wilberforce oak in Holwood Park, Kent. His remarks upon the numerous injurious influences to which trees are exposed in towns deserve attention, some of these not being generally known, as the escape of gas, which often causes the sudden and mysterious death of previously healthy trees. Piling earth round the stem, as is sometimes done in street improvements, may also prove fatal.

The chapters dealing with fungus and insect attacks are slight and sketchy, and do not contain sufficient descriptive details to render identification easy, though some of the figures may be helpful in this respect. The chapter enumerating the special enemies of each species of tree is very incomplete, and will be of little value to the forester or park superintendent, who must resort to the larger works already mentioned. This book, however, is useful as directing the attention of landowners and other non-professional readers to the many preventable causes which spoil the appearance and ultimately cause the death of much ornamental timber in Britain.

## OUR BOOKSHELF.

*Insect Enemies.* By C. A. Ealand. Pp. xiii+223. (London: Grant Richards, Ltd., 1916.) Price 6*s.* net.

MR. EALAND has done good service in publishing his book on insect enemies. The work is cast in popular form, which fact may in the eyes of some detract from its merits; but, as the author justly observes, "unless and until those who have no scientific training are told of the activities of insects in language which they can understand, they can hardly be expected to be other than phlegmatic concerning the work of entomologists. The best methods of dealing with these enemies of mankind may be revealed by the comparatively few economic entomologists, but the great work of eradication can, in many cases, only be accomplished by the active co-operation of the general population." In accordance with the views here expressed, the insect pests of forest, orchard, flower and vegetable garden, farm crops, domestic animals, household, and warehouse are briefly but not inadequately dealt with, a final chapter being devoted to insects that are directly injurious to man. The treatment is naturally not exhaustive, and it may be doubted whether the remedial measures proposed are in all cases set forth in sufficient detail to be of much practical service unless the directions for use are supplemented from other sources. An appendix gives useful information as to the preparation of insecticides, though not as to the precise method of employing them. A few errors have escaped the author's notice; "*Trochilium apiformis*" is an awkward collocation, and in Fig. 7 the representations of male and female sawfly are reversed.

*Large-scale Map of the Salonika Battle Front.* (London: J. W. Bacon and Co., Ltd.) Price 1*s.* net on paper, 1*s.* 6*d.* net on cloth.

THIS map, on a scale of 5 miles to 1 in., shows the country to the north of Salonika as far as lat. 42° 10′ N., and east to Kavalla and west to Monastir. It is layer coloured, and the contour interval is 1000 ft. International boundaries are clearly shown, and a red line indicates the approximate position of the Allies' front. Railways and main roads are shown, as well as swamps. The map is carefully executed and contains plenty of names. No doubt it could be improved by the addition of a 500-ft. contour line, but it is the best cheap war map of this region which has yet appeared.

## 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.*]

### Talbot's Observations on Fused Nitre.

AMONG the little remembered writings of that remarkable man, H. F. Talbot, there is an optical note in which he describes the behaviour of fused nitre (nitrate of potash) as observed under the polarising microscope. The experiments are interesting and easily repeated by anyone who has access to a suitable instrument, by preference one in which the Nicols can be made to revolve together so as to maintain a dark field in the absence of any interposed crystal.

"Put a drop of a solution of nitre on a small plate of glass, and evaporate it to dryness over a spirit-lamp; then invert the glass, and hold it with the salt downwards and in contact with the flame. By this means the nitre may be brought into a state of fusion, and it will spread itself in a thin transparent film over the surface of the glass.

"Removed from the lamp it immediately solidifies, and the film in cooling cracks irregularly. As soon as the glass is cool enough, let it be placed beneath the microscope (the polarisers being crossed, and the field of view consequently dark)."

I have found it better to use several drops spread over a part of the glass. And instead of inverting the plate in order to melt the nitre, I prefer to employ the flame from a mouth blow-pipe, caused to play upon the already heated salt. The blow-pipe may also be used to *clean* the glass in the first instance, after a preliminary heating over the flame to diminish the risk of fracture. Further security is afforded by keeping down the width of the strip, for which half an inch suffices.

Talbot describes how, under the microscope, there appear crystalline plates of irregular shape, often fitted together like a tesselated pavement, each plate forming a single crystal. If one plate is darkened by rotation of the Nicols, the others remain visible in varying degrees of brightness. If the plates are thin, the light is white; but with more salt they display colour, and the colour is not always uniform over the whole plate, indicating a variable thickness. But this condition of things is not permanent. After perhaps a quarter of an hour the plates break up in a surprising fashion, and the general appearance is totally changed.

Moreover, the transformation may be accelerated. "Let a film of fused nitre be obtained in the manner already mentioned, and let it be allowed to cool during three or four minutes. The plate of glass should be turned round upon the stage of the microscope until the crystalline film is darkened as accurately as possible. Things being thus adjusted, let the observer touch the film with the point of a needle while he is observing it in the microscope. He will perceive that the touch immediately produces a luminous spot on the dark surface, and this spot will slowly expand itself in all directions like a luminous wave. This is a very curious object, but difficult to describe." And further on:—"If, however, we touch it prematurely, as, for instance, during the first minute after it has become solid, this change does not take place."

I have made a few trials to ascertain whether the life of the plates can be prolonged. Protection from atmospheric moisture did little good. Another plate, kept for five hours at a temperature not much short of that of boiling water, was found to have undergone transformation. But, as might be expected, a higher temperature over a diminutive gas flame acted as a safeguard, and the plate after removal behaved like one newly formed.

I have found that nitre may be replaced by *chlorate* of potash, with the advantage that the plates will keep (at any rate in an artificially warmed room) for weeks, and perhaps indefinitely. The appearances are similar, but less beautiful, as colour is not so often developed. The chlorate is more fusible than nitre, and the heat should not be pushed beyond what is needed for fusion.

Other salts—for example, silver nitrate—which fuse in the anhydrous state without decomposition may also be employed, as is probably known to those who prepare objects for the microscope. But Talbot's early observations on nitre are rather special, and deserve recall as they seem to be but little known.

RAYLEIGH.

### "Plants in Health and Disease."

ON p. 331 of NATURE of December 28, 1916, the writer of the review of the book entitled "Plants in Health and Disease" remarks:—"The accounts of such pests as the cabbage-root fly and the onion fly, which have been very active this year, are particularly clear. We could only wish that the measures whereby these pests are to be combated were half as good." With reference to the cabbage-root fly, I am glad now to be able to report that an efficient measure for dealing with that widespread pest has been tested under my direction during the past season.

Mr. J. T. Wadsworth, research assistant in this department, has conducted a series of experiments with American tarred felt paper discs, and a full account of the work will appear in the next issue of the *Annals of Applied Biology*. The tarred felt discs each measure 2½ in. square, and are provided with a slit which enables them to be slipped round the stems of young cabbages and cauliflowers so soon as the latter are planted out in the field. Each disc is pressed flat upon the surface of the soil round the plant, and no further attention as a rule is needed. Its primary function is to act as a mechanical obstacle, preventing the flies from laying their eggs on the soil in the usual position, close around the plant. Out of 816 cabbages used in these experiments, half of them were provided with the discs, and the remainder left unprotected. Only one plant was lost out of the 408 protected examples, while fifty-four unprotected cabbages were severely attacked. With regard to cauliflowers, the results were even more striking. Alto-

gether 932 of these plants were utilised, and, similarly, half were provided with the discs and the rest left unprotected. From among the protected cauliflowers twenty-four were lost, as compared with 294 plants out of a similar number of unprotected ones. One of the advantages of this method over the more familiar use of paraffin and sand or soot is that a single application is sufficient, whereas the other remedies have to be reviewed periodically.

In addition to Mr. Wadsworth's experiments, I supplied three growers with the American discs, giving full instructions as to their manipulation. One grower at Chorlton (near Manchester), who was supplied with 100 discs, reported that no single case of root-maggot attack was noted where they were used. Another grower, at Prestwich (Cheshire), wrote to say that he had fifty cabbages with the discs on, and only two of them were attacked. Out of the fifty control plants most of them were infested. The third observer (at Nottingham) used 100 discs, and reported that out of eighty-four protected cauliflowers only five were apparently attacked, and none were lost. From among twenty unprotected plants only twelve survived.

It is remarkable that a simple and effective measure should have attracted so little attention in this country or elsewhere in Europe. It appears to have been overlooked that its value has frequently been demonstrated in Canada and the United States. I may add that we hope to be able to have a supply of tarred felt paper discs available for use in this country during the forthcoming spring, when every effort will be needed to conserve the food supply of the nation.

A. D. IMMS.

Department of Agricultural Entomology,
Manchester University.

## The Decimal System and Summer Time in France.

THE frequent references to the necessity of introducing the decimal system which one reads in the public Press at present suggest some considerations which an experience of more than two years with the B.E.F. has confirmed. It is surprising with what facility the average soldier becomes accustomed to French money. Everything out here is bought and paid for on the decimal system. The men and officers receive their pay in French money. I have seen bills made out and paid by officers' orderlies which show they are quite at home in the French system. It is, of course, perfectly evident that the time gained in schools and colleges, if we were to replace many confusing weights and measures now in use by the decimal system, would be of great importance. Here in France half a kilo is called a pound; a sou is called a halfpenny. There would be no need for us to change familiar names if we are lucky enough to adopt the decimal system. It may be said that everybody out here has become familiar with decimal money, weights, and lengths, and knows roughly the ratios between them and corresponding British measure. The present opportunity is one which ought not to be missed. The stern teacher—war—has taught us to give up so many of our out-of-date ways that the imposition of the decimal system would soon be an accomplished fact if our rulers would only listen to those who really know.

This naturally suggests some facts connected with the introduction of "summer time." Whatever advantages that measure may have had from the point of view of those living in large towns, and of those whose time is their own (and they are many), it must certainly be confessed that in the case of the farming class in France it has been a complete failure. In fact, it exists only in name. I have spoken with the farmers on the subject, and they all assured me that it was no good to them. The hottest time of the day is about 2.0 p.m. Now, according to the summer-time programme, the greatest heat corresponds to 3.0 p.m. If, then, the farmer dines at noon (which is universal) he must do his afternoon's work during the hottest hours of the day. As a matter of fact, the farmers make no change in their habits. Many of them do not change their clocks, and dine at 1.0 p.m. according to summer time. But see the result. The schools must follow the legal time, the children get home for their dinners an hour before the family has begun to dine, with the result that there is the greatest confusion in a household, especially where the mother has to work in the fields. Again, there is the disadvantage that those occupied with cattle, as in Ireland, have an extra hour of darkness for their most important industry.

The case of Ireland is especially hard. Since the abolition of "Irish time" there is already an extra half-hour of darkness in the mornings; if the clock in Ireland is put back another hour it will mean that in many places the extra darkness in the mornings will be more than an hour and a half. It seems to the writer that the greatest care should be taken before the present system of summer time is made perpetual. It would be much better and much more scientific and more straightforward if the opening hour of all public offices, etc., was advanced an hour, and their time of closing treated in the same way. In conclusion, I may add, as a proof of the confusion which exists in some parts of France, the list of services in the parish church had to be written in two columns, the legal time being in ordinary figures, the summer time in Roman numerals.

C. F.

France, January 22.

## Meldola Memorial.

A MOVEMENT has recently been initiated to institute, at the Finsbury Technical College, a reference library of chemical books in memory of the late Prof. Raphael Meldola, F.R.S., who formerly presided over this school of applied chemistry.

We beg to bring under your notice this appeal, which has met with generous support from many former students of Prof. Meldola, because we believe that his other friends outside the college circle would welcome the opportunity of helping to make this memorial a fitting tribute to a strenuous life spent in the pursuit of science in many varied aspects.

The proposed chemical library would be of the utmost utility to past and present students of this college, and, in all probability, suitable arrangements could be made to render it available to the scientific public for purposes of special references. It would be situated in a part of London where such facilities are at present non-existent.

Donations towards the memorial fund would be greatly appreciated by the undersigned committee and by all who have at heart the development of applied chemistry, a branch of science which the war has shown to be of national importance.

J. L. BAKER (*Hon. Treasurer*).
J. H. COSTE.
M. O. FORSTER.
H. F. KNIGHT.
G. T. MORGAN.
F. W. STREATFEILD.
C. H. BUTCHER, A. W. H. UPTON (*Hon. Secretaries*).

Finsbury Technical College, Leonard Street,
City Road, London, E.C.

## CHANGES IN THE RHONE GLACIER.[1]

WE are indebted to Swiss naturalists for initiating a careful study of glaciers, and this has been extended, as we learn from the *Zeitschrift für Gletscherkunde*, to many of the most important regions on the earth's surface. In the majority of these their history, prior to the last few years, is a blank. That their glaciers have advanced and retreated is obvious, but when and at what rate is unknown. In the Alps, however, traditions exist which preserve a fairly trustworthy account of the more notable movements for at least two centuries, and the volume now issued by the Swiss Natural History Society, to which M. P. L. Mercanton is the principal contributor, gives, with some mention of these, the results of careful observations of the Rhone Glacier since 1874.

As two well-known passes, the Furka and the Grimsel, command magnificent views of this glacier, it has for long been noticed by travellers, and is represented in illustrations to books before the days of photography, the earliest which has any value dating from 1777. Besson says that the glacier was then advancing, and had four distinct terminal moraines, one at 216 ft., another at 269 ft., a third at 551 ft., and the last at 771 ft. Shepherds told him it had been retreating for twenty years. In September, 1826, there were about four well-marked terminals, besides two or three others less distinct. But it must have advanced rapidly between this date and 1834, for in that year its end was near a newly built auberge, and the swollen aspect of the lower part of the glacier suggests that it was still moving forwards. In 1848 this tongue covered half the Gletsch valley, but there were still four distinct terminal moraines in front of it, which in the next year had been reduced to two.

A more complete record exists, as might be expected, for the two well-known glaciers at Grindelwald, and as they are only about twenty-five miles distant in a straight line from the Rhone Glacier, their phases are likely to correspond. In 1540 these had greatly shrunk, but they made an equally marked advance from 1575 to 1600, and attained, during the next two years, the greatest extension on record. A retreat then began, which became important between 1661 and 1686, but the glaciers advanced again in 1703, and retired in 1720. From 1743 to 1779 was a period of marked advance, which culminated in the latter year, and was followed by a retreat, which, if the shepherds of the district can be trusted, had already set in with the Rhone Glacier. But in 1819 the Grindelwald glaciers had again become large, though they had not reached the limit of 1602. Then came a period of retreat, but between 1840 and 1855 they again moved forward, like the other glaciers of the Alps, though not to their former limit; then, in the latter year, the recession began, which lasted, with slight oscillations, not always in correspondence, until 1912, when both glaciers moved forward. But this retreat was at first very slow, for in 1858 the torrent from the Lower Glacier issued from an ice-cave on the bed of the main valley, and the deep gorge, now made accessible, was wholly hidden by the ice. In that year also the Rhone Glacier had a swollen end, and in the following one the writer saw the Gorner Glacier at Zermatt ploughing up the turf in front. But two or three years later the retreat became rapid, so that by 1870 the gorge and the old marble quarry at Grindelwald had been exposed.

It is difficult to account for these variations in the size of glaciers. The information collected during recent years indicates that, as a rule,

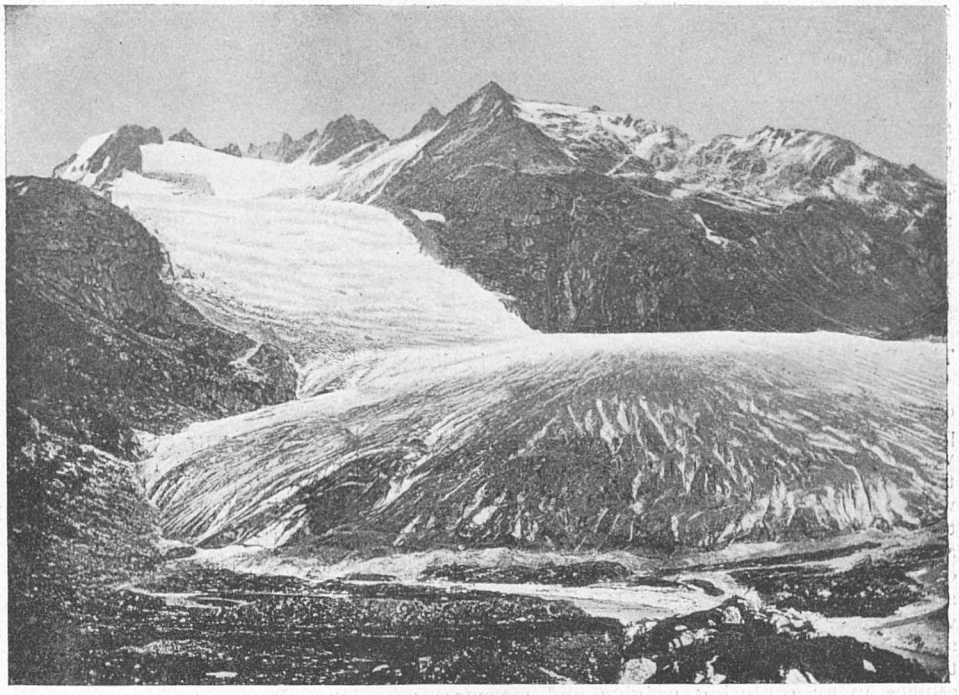

FIG. 1.—The Rhone Glacier in August, 1849. From a daguerreotype.

[1] "Vermessungen am Rhonegletscher, 1874-1915." Geleitet und herausgegeben von den Gletscher-Kommission der Schweizerischen Naturforschenden Gesellschaft (Neue Denkschriften der Schweizerischen Naturforschenden Gesellschaft). Band lii. Pp. 190 + maps and illustrations. (Bâle, Geneva, and Lyons: Georg and Co., 1916.)

diminution has affected a wide area, and thus suggests a cause operating on a large part, if not the whole, of the earth's surface; while, as the supply basin is limited in valley glaciers, it would require a considerable rise or fall in the mean temperature materially to affect the volume of them, neither of which has been observed. Still, an increased or diminished precipitation of snow on the *névé* of the ice-stream would affect the latter, besides altering the surface ablation of the stream itself. But as the amount of precipitation increases in ascending a mountain range from the lowlands, and then diminishes, much may depend upon the position of the zone on which it is at a maximum. As that zone probably does not exceed, at any rate in the Alps, a thousand feet

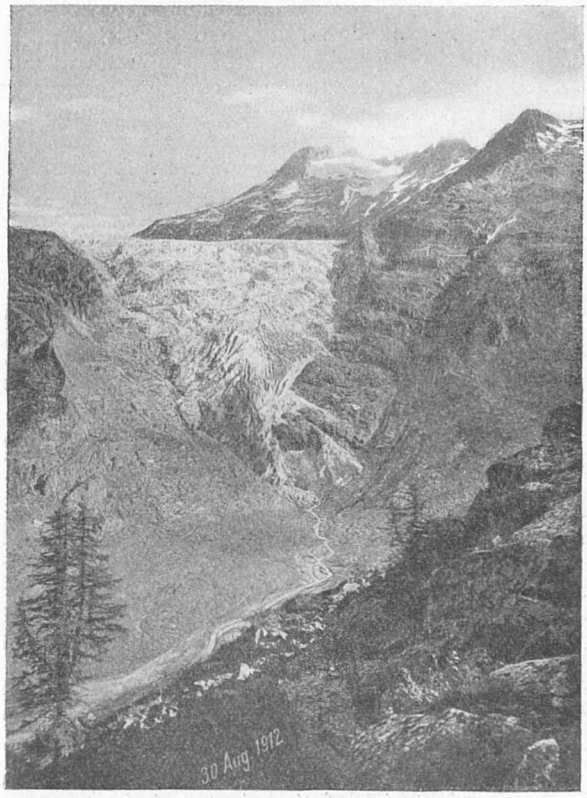


FIG. 2.—The Rhone Glacier on August 30, 1912.

vertical, rather small variations in the mean temperature or snowfall of a region may produce somewhat marked effects. The last period of diminution, now more than half a century, seems to bear no relation to either the eleven-year sunspot period or Brückner's thirty-five-year one, and thus suggests a complication of causes. Be that as it may, in this memoir on the Rhone Glacier the variations in its length, area, volume, and level, the snowfall and ablation, the movement of its several parts, and the relation between the velocity of the surface and the thickness of the ice, are all placed on record, so that students of glaciers owe a debt of gratitude to the authors of this volume and the Swiss Natural History Society.

T. G. BONNEY.

## SOURCES OF NITROGEN COMPOUNDS IN THE UNITED STATES.[1]

THE problem of how to turn the vast store of uncombined nitrogen which exists in the atmosphere into useful products may be said to have been only seriously attacked within the lifetime of the present generation. It had its origin in the growing demand for forms of combined nitrogen suitable for use in the arts, and more particularly in agriculture, the oldest of all the arts. But circumstances arising out of the present world-wide struggle, affecting in greater or less degree every nation, but more particularly those engaged in the war, have forced the problem into still greater prominence by demonstrating how intimately it is bound up with the question of national defence. Indeed, as regards the Central Powers, their very existence is dependent upon it, as they now painfully realise.

Accordingly nearly every highly developed nation is considering it, and its urgency is shown by the circumstance that its solution is no longer left wholly to individual effort or private enterprise. Even our own Government, hitherto not very prompt to initiate action in such matters, has been moved to recognise its national importance, and has got so far as to appoint at least two committees associated with public departments to consider and report upon it.

In this connection it is of interest to note how the question strikes American expert opinion. This is revealed in the publication before us by Dr. C. G. Gilbert, recently issued by the Smithsonian Institution.

As the author points out, in the extension of chemical needs, as in the development of cyaniding in industry, of refrigeration in the preservation of foodstuffs, and more especially in the increased use of fertilisers, nitrogen compounds are now necessary not only to the welfare, but to the very existence of a people living under modern conditions of economic development. Until within a few years past, the yields from India, from Continental sewage-farms, together with the natural supplies from South America, have met the demand for nitrates. Ammoniacal compounds have been produced in rapidly increasing quantities, as by-products, in the various methods of the destructive distillation of coal, peat, and oil-shale; in producer and blast-furnace gas; in bone carbonising, in sewage and garbage disposal, and in a variety of other methods; and the sulphate of ammonia thus obtained bids fair to overtake, if not largely to supplant, Chile saltpetre as a fertiliser. But even these combined sources are now proving inadequate to meet the world's demands, and the increasing necessity has stimulated efforts to effect the synthetic production of ammonia and nitric acid from atmospheric nitrogen.

Of the several methods of accomplishing this synthesis there are at present, so far as is known, only three which are commercially practicable,

[1] "Sources of Nitrogen Compounds in the United States." By Dr. C. G. Gilbert. (Smithsonian Institution, Washington, 1916.)

viz. the arc method, the cyanamide process, and the Haber process. It is with the working and the results of these processes that Dr. Gilbert's report is particularly concerned. In what follows we purpose to summarise, as briefly as possible, the main conclusions to which his critical examination leads him.

The arc method in its present state of efficiency requires from 2·75 to 3 h.p.-year of electric power per ton of nitric acid yield. Having regard to conditions in the United States, the 2·75 h.p. needed for the fixation of the nitrogen in one ton of nitric acid costs in power-expense alone more than 40 dollars per ton of product. Inasmuch as the fertiliser equivalent in Chile saltpetre is already available at about the same price, the arc method is not commercially feasible under present conditions in America. Notwithstanding this, the U.S. Government is said to be contemplating a twenty million dollar project for atmospheric nitrogen fixation as a military measure. If this sum were put into power-site development it would furnish about 150,000 h.p., capable of yielding about 50,000 tons of nitric acid, or only about a quarter of that needed in military emergency. To satisfy Government requirements a power generation of about 600,000 h.p. would be needed, or some 50,000 h.p. more than the total Niagara power development. As a commercial proposition for peace-time working the arc method offers not a single advantage, and is of very doubtful benefit even as a measure of military preparedness.

The cyanamide process yields three main products, viz. cyanamide, ammonia, and nitric acid, the nitric acid being the end product instead of the first, as in the arc method. Up to the nitric acid stage the power consumption is approximately $\frac{1}{2}$ h.p.-year per ton of nitric acid, or about one-sixth to one-fifth of that of the arc method, and the normal peace-time first product is at once applicable to agricultural purposes. A consideration of all the circumstances makes it abundantly evident that the cyanamide process far outweighs in applicability, convenience, and economy the arc method. When all is reckoned it requires only from three-fifths to two-thirds of the total power involved in the arc method manufacture, in addition to the value of a product normally in demand as against one for which there is relatively very little constant requirement.

The Haber process is exclusively worked in Germany. It is a catalytic process involving many technical difficulties which have hitherto prevented its extension even under present exigencies. Its production of ammonium sulphate is said to amount to 200,000 tons a year. Nothing is known as to comparative costs, but inasmuch as the process would seem not to have greatly extended, its permanent position is still open to doubt.

The general conclusions at which Dr. Gilbert arrives are: (1) That the arc method has not thus far demonstrated its capacity to meet agricultural requirements at all, and defence requirements only very imperfectly. (2) Such knowledge as there is of the Haber process seems to show that its record of achievement is against it, and in any case it is unsuited to American conditions, at least in its present stage of development. (3) The cyanamide process is readily capable of a development which at once meets the requirements for a cheapened nitrogenous fertiliser, of which the nitrogen content can be converted into nitric acid. But whatever may be the relative value of these different synthetic processes, and whatever the future may have in store for them, Dr. Gilbert is evidently disposed to believe that it is by the systematic extension of the coking industry, and by the more rational treatment of our coal, so as to increase the yield of by-products, that the main increase in our supply of nitrogenous fertilisers is to be looked for immediately. He calculates that in America a total of about 700,000 tons of sulphate of ammonia would be possible if all coking were of a by-product nature, and he confidently predicts that not far short of this amount will be reached when the ovens now in course of erection in the States are in full working order. In the meantime are we doing all that we can in this direction? T. E. THORPE.

## *LITERATURE AND SCIENCE IN EDUCATION.*

WHEN Dr. Johnson kept school at Lichfield in 1736 he drew up a "Scheme for the Classes of a Grammar School," which his biographer, Boswell, inserted in the pages of the famous "Life" with the remark that "Johnson well knew the most proper course to be pursued in the instruction of youth." The scheme consisted of Latin accidence, translation, and syntax in the lower classes, with the addition of Greek in the third class. No other subject was mentioned. For a hundred years or more this was broadly the basis of the system adopted throughout English grammar schools, with the addition of a little arithmetic, geography, and history.

Dr. Sleath, High Master of St. Paul's School down to 1847, is reported to have said once to an inquiring parent: "Madam, at St. Paul's we teach only Latin and Greek. We give three half-holidays a week that boys may learn mathematics."

In the early fifties of the nineteenth century a little experimental science crept in almost shamefacedly, introduced by the peripatetic teacher with his box of tricks. But probably the first instance of a systematic teaching of science by resident teachers was at the well-known school at Queenwood, Hants, with Frankland and Tyndall as the masters. This was in 1847, but it was not until twenty years later that this example was followed in other schools. Then Clifton took the lead in 1867, and was followed immediately by the Manchester Grammar School. Since that day matters have improved so substantially that there are few schools of any pretensions which do not possess a good laboratory and competent teachers.

Such facts might seem to justify the question by representatives of the older subjects: "What more do you want, then, and what do you mean by the neglect of science?" The fact is that there

has not been, and in some quarters there is not at the present time, that straightforward dealing with the question to which the advocates of more science think they are entitled. The reluctance of the literary people to yield up a fair proportion of the time-table to the modern studies lies at the root of the matter. It is now a question of curriculum, and even in the schools which boast laboratories and appliances the controversy will never end until this barrier is overcome. It is, therefore, particularly gratifying to observe the attitude of the Headmasters' Conference as represented by the resolutions printed in NATURE of January 4 (p. 359). Among the resolutions passed the following is conspicuous:—

(*a*) That it is essential to a boy's general education that he should have some knowledge of the natural laws underlying the phenomena of daily life, and some training in their experimental investigation. (*b*) That, in the opinion of this Conference, this can best be ensured by giving to all boys adequate courses of generalised science work, which would normally be completed for the ordinary boy at the age of sixteen. (*c*) That, after this stage, boys who require it should take up science work of a more specialised type.

Nothing can be better as a statement of a generalised opinion, and we may hope that headmasters will see that it is put into practical effect. There is some ground for belief that this hope will not be in every case disappointed. The address delivered on Tuesday, January 9, by the Rev. J. R. Wynne-Edwards as president of the Inporated Association of Headmasters (see NATURE, January 11, p. 380) does not appear to be the utterance of a man who is toying with the question, and the distribution of hours at the Leeds Grammar School, of which he is headmaster, would doubtless be found more satisfactory than in some other places. There is not great divergence of opinion in respect to fundamental principles, if we except a comparatively few extreme partisans on both sides. But a satisfactory position is not allotted to the natural sciences in those schools in which an engineering or military side composed of specialists has been established, while the majority of the boys in the school—namely, those to be found on the classical side, which includes many of the best—are put off with two hours a week or less in a time-table which covers thirty hours for other subjects. It is not the function of the schools to provide a body of scientific specialists, but every boy and girl in the kingdom should have time and opportunity for the acquisition of some degree of familiarity with the chief methods and conclusions of the observational and experimental sciences. Concentration on special or technical matters should not be encouraged before the age of sixteen or seventeen, and should not be sought in the curriculum of a general education. The testimony of a business man on this point ought to serve to correct the views of many parents, and it is worthy of notice that Mr. W. L. Hichens (chairman of Messrs. Cammell Laird and Co.), in an important paper contributed to the same meeting, expressed the opinion that "specialised education at school was of no practical value."

On the second day of the meeting (January 10) a paper was read by Mr. A. D. Hall, F.R.S., a Development Commissioner and formerly director of the Rothamsted Experimental Station, on "A General Course of Science for the Secondary School." Mr. Hall made no claim for any kind of training directly applicable to industry. He desired to see a broad and liberal treatment of science, and in the outline he proceeded to sketch he included a larger share than is customary of studies in the domain of biology. In doing this he was not afraid of the charge of smattering. It would be interesting indeed to look into the details of his scheme of work, remembering that this is the outcome of the mature experience of a former schoolmaster. Mr. Hall was at one time chief science master in King Edward's School, Birmingham.

A paper by Mr. A. C. Benson, Master of Magdalene College, Cambridge, read before the Royal Society of Arts on December 20 on the subject of "Literature and Science in Education," will be welcomed by all teachers of science and others interested in progress towards the compromise which must be arrived at if peace is to be secured. Mr. Benson is a well-known literary man with full experience as a teacher, having been for twenty years a master at Eton. It is all the more gratifying, therefore, to find the conciliatory spirit, the liberality of view, and the freedom from prejudice which pervade his paper. It is impossible adequately to summarise it, and it should be read especially by headmasters. One point on which he lays emphasis is the importance of securing good and enthusiastic teachers, and this implies the necessity for rendering the teaching profession more attractive than it has been in the past. With regard to subjects he says: "I do not believe in intellectual progress being possible without intellectual interest"—a view which will be generally acceptable to the present generation, even among those who are not old enough to look back to the time when Latin grammar with plenty of cane was looked upon as the one effectual and economical basis of education.

## *LORD CROMER, O.M., F.R.S.*

NOT only those who have worked in Egypt, but all who are interested in that country, will have learned with deep regret of the death of Lord Cromer on Monday last, January 29.

On returning to Egypt in 1883, six years after his first appointment there as a Commissioner of the Debt, Lord Cromer found the country in a state of administrative chaos after the suppression of Arabi's rebellion, while bankruptcy appeared imminent. In the Sudan, troubles were already assuming a threatening aspect, and the dervish revolt was shortly to take place. Under such conditions the most urgent needs were to reorganise the administration of the country, and to re-establish its financial position by developing the great agricultural resources of the Nile Valley and Delta. The provision at the International

Convention at London in 1885 of a million sterling to be devoted to irrigation was the first step towards the regeneration of Egypt, which has since gone on with scarcely a check on the lines which he then laid down. Those first six or seven years were years of rigid economy, when all expenditure had to be strictly curtailed and every source of revenue carefully husbanded, but by 1890 the race against bankruptcy was won, and it became possible to deal more generously with various branches of the Administration.

Lord Cromer was always keenly sympathetic towards education, and year by year as means became more ample the grants for it were increased. Schools for elementary vernacular education and secondary and technical schools were established in constantly increasing numbers throughout the country, while the training of teachers to staff them was likewise taken in hand. In a Mohammedan country the education of the female population always presents especial difficulties, but an ever-increasing number of girls' schools have gradually been established throughout Egypt.

Efficient irrigation of the cultivable land being the prime necessity of Egypt's existence, the first grant which made the restoration of the Delta Barrage practicable was followed by many others, and Lord Cromer supported unceasingly the demands of the irrigation engineers until the present system of dams, barrages, and distributing canals had been, if not completed, at least largely achieved. Closely related to irrigation is the agriculture of the country, and the investigations necessary to improve the principal crops had always his warm support.

"The principal function of Government," said Lord Cromer in his report for the year 1903, "is the prevention of epidemic diseases," and to provide adequately for the sanitation of the country was increasingly his care as resources became greater. Recent visitations of cholera and bubonic plague have shown how much success has been obtained in this direction; while the hospitals and medical schools which now exist have made many forget the appalling conditions which prevailed in that country forty years ago.

The geological survey and the cadastral survey of Egypt, from which developed the recent geodetic work in the Nile Valley, are further instances of the way in which Lord Cromer encouraged the more scientific aspects of work of practical importance.

In Egypt archæology has a vast and important field of activity, and while his own interests were most closely connected with the classical period, Lord Cromer supported all projects for the better conservation of ancient buildings and the investigation of the past history and the ancient civilisation of the country. To his advocacy we owe the systematic study of the Nile Valley in Nubia, which, besides the archæological results, has yielded in the hands of Prof. Elliot Smith such important evidence relating to the Egyptian race.

After his retirement from Egypt his interest in science led him, by becoming president of the Research Defence Society, to aid the opposition to the ignorant outcry against vivisection, since he recognised its importance in furthering the advancement of medicine and surgery. In 1911 he was elected a fellow of the Royal Society as one who had rendered service to science.

Laden with heavy responsibilities of administration, and fully occupied by the many problems which Egypt presented, he still found time to take interest in all new investigations which were being undertaken; his kindly advice and powerful aid were always available to those who were playing their part in the reconstruction of Egypt, and to them he was one on whose support they could always confidently depend. H. G. L.

## NOTES.

AMONG the list of honours conferred by the King on officers of the Army, the Royal Army Medical Service has reason to be gratified by the number bestowed upon its members. Sir Alfred Keogh, the Director-General, is promoted to be G.C.B., sharing this distinction with Sir William Robertson. Sir Alfred Keogh was a former Director-General of the Army Medical Service, and subsequent to his retirement became rector of the Imperial College of Science and Technology, but soon after the outbreak of war was recalled to his former post. He found the Royal Army Medical Service confronted with a task of the first magnitude, and its staff numerically wholly inadequate to cope with the work before it. Within a few months he made a new force of it; numbers of the younger medical practitioners were enrolled in its ranks, and senior members of the medical profession—physicians, surgeons, hygienists, and specialists in all branches—were attached to it in a consultative capacity. For two years this virtually new force has worked harmoniously and efficiently. Never before have the wounded been so promptly and so adequately cared for, while the prevention of the numerous diseases which are so liable to follow on war and the train of an army has never been more successfully accomplished.

THE KING has been pleased to confer the Companionship of the Order of the Bath, for services rendered in connection with the war, upon Lieut.-Col. G. H. Barling, vice-chancellor of the University of Birmingham, who is now serving as a consulting surgeon to the British Army in France. The honour of Companionship of the Order of St. Michael and St. George has also been conferred for war services upon Major Bertram Hopkinson, F.R.S., professor of mechanism and applied mechanics, Cambridge University.

WE regret to see in the *Morning Post* of January 30 the announcement of the death, at eighty-two years of age, of Mr. John Tebbutt, of Windsor, New South Wales, where he had an observatory and carried on very valuable astronomical work for many years.

SURGEON-GENL. SIR G. H. MAKINS will deliver the Hunterian oration before the Royal College of Surgeons of England on Wednesday, February 14. The subject will be the influence exerted by the military experience of John Hunter on himself and on the military surgeon of to-day.

IT is announced in the *Times* of January 29 that summer time will be reintroduced in Germany and Austria-Hungary on April 1, and will last until the end of September. Apparently, therefore, the reported rejection of the proposal by a committee of the Prussian Diet, referred to last week (p. 414), was either incorrect or will be disregarded.

WE note with regret that the *Engineer* for January 26 records the death of Mr. James Stirling at the age of eighty-one years. Mr. Stirling was locomotive engineer to the South-Eastern Railway from 1878 to 1898, and introduced many improvements, including the steam reversing gear. He was a member of the Institution of Civil Engineers and also of the Institution of Mechanical Engineers.

THE President of the Board of Agriculture and Fisheries has appointed a committee of representative agriculturists to advise him on questions arising in connection with the increased production of food. The committee is constituted as follows:—The Right Hon. R. E. Prothero (chairman), the Right Hon. Sir Ailwyn E. Fellowes (vice-chairman), the Right Hon. F. D. Acland, the Right Hon. Henry Hobhouse, the Hon. Edward G. Strutt, Sir Sydney Olivier (Board of Agriculture), Mr. W. W. Berry (Development Commissioner), Mr. S. W. Farmer, Mr. F. L. C. Floud (Board of Agriculture), Mr. A. D. Hall (Development Commissioner), Mr. S. Kidner, Mr. T. H. Middleton (Board of Agriculture), Mr. A. Moscrop, Mr. H. Padwick (National Farmers' Union), Mr. R. G. Paterson, Mr. G. G. Rea, Mr. E. Savill, Mr. Leslie Scott, and Prof. W. Somerville. Mr. E. M. Konstam (who has joined the department for the duration of the war) is the secretary of the committee.

ACCORDING to a telegram (*Daily Mail*, January 26) Dr. T. B. Robertson, professor of biochemistry in the University of California, has succeeded in isolating from an extract of the pituitary gland a substance which has the power to influence and regulate the growth of the body. That the secretion of the pituitary gland does take a part in regulating the growth of the body has been known since 1886, when that remarkable growth disturbance which Marie named acromegaly was discovered to be directly related to a diseased condition of the pituitary gland. In 1895 Oliver and Schäfer surprised medical men by isolating from the pituitary gland a substance which has a powerful influence on unstriped muscle fibres and on the walls of blood-vessels. The effects produced by extracts from the pituitary gland are so complex and diverse that it is highly probable it may produce several different substances which act as hormones on the tissues of the body. Hitherto the element which acts as a growth-sensitiser or regulator has not been identified.

A NUMBER of influential persons interested in the development of the resources of the Empire have formed themselves into a committee, of which Sir Starr Jameson is for the present acting as chairman, Mr. Almeric Paget, M.P., as honorary treasurer, and Mr. Wilson Fox as honorary secretary. The committee, which represents every party in the State, has for its ultimate object the appointment of a board to develop the Empire's resources; but in the meantime it has been inquiring into various questions in order to present a *prima facie* case for the consideration of the Government. The committee has the following purposes:—(1) To advocate (*a*) the conservation for the benefit of the Empire of such natural resources as are, or may come, under the ownership or control of the Imperial, Dominion, or Indian Governments; (*b*) the development of selected resources of the Empire under such conditions as will give to the State an adequate share of the proceeds; (*c*) the appointment in due time of a Board for the Conservation and Development of the Resources of the Empire, so that Imperial effort may be concentrated on assets ripe for development for the common good of the Empire. (2) To take such action as may from time to time appear to be desirable in order to disseminate information in regard to the objects of the committee, to arouse and maintain public interest, to enlist public sympathy and support, and to co-operate with other committees and associations having similar objects.

DR. H. R. MILL, director of the British Rainfall Organisation, contributes a special article to the *Times* of January 25 on the rainfall of 1916. Detailed results are given for 131 stations. Last year is shown to have been generally a wet year; the rainfall was far in excess of the average at most stations, and slightly below it at only a few. A map shows the distribution of rainfall, and forestalls the fuller results, from about 5000 stations, which will appear later in "British Rainfall, 1916." A deficiency of rainfall for 1916 is shown in the extreme south-west of Wales and the north-west of Devon and Cornwall, and in two areas in the centre of England, one stretching east and south from the north of Anglesey and the estuary of the Mersey, the other in the south-east of Yorkshire. The area over which the year was relatively dry was much less than in any other of the last twelve years, except perhaps 1912. The excess of rain was most pronounced in the south of England, the centre of Scotland, and the south-west, north-west, and east of Ireland. The wettest part of England was in the district of East Grinstead, where the excess was about 40 per cent. In Scotland the excess of rainfall was 20 per cent. over nearly one-half of the country, while in parts there was an excess of more than 40 per cent. The whole of Ireland was wet; the greatest excess of more than 30 per cent. stretched inland from Dublin Bay. No year since 1903 has been wetter than last year in Scotland and Ireland, while the British Isles as a whole have only been wetter than 1916, during the last fifty years, in 1903, 1882, 1877, and 1872. In London the total measurement for the year was 34·01 in., which is 35 per cent. above the average for fifty years. In 1903, the wettest year on record, the rainfall was 38·10 in., and the only other year since 1858 with as much rain as 1916 was 1878, with 34·08 in.

MR. A. W. CARDINALL, in the January issue of *Man*, describes a collection of stone implements from Ashanti. Most of them are of normal types, but one specimen is peculiar from its remarkable size—14·5 cm. in length, and maximum breadth 5·5 cm. In its coarse flaking it resembles specimens collected by M. Xavier Stainer from the Congo, but in the Ashanti weapon its rounded cutting edge is perfectly distinct, and there is no doubt that this has been produced by grinding.

WE have received the list of seeds of hardy herbaceous plants, trees, and shrubs available for exchange from the Royal Botanic Gardens, Kew, forming Appendix I. of the Kew Bulletin for 1917. We are glad to notice that the list is a full one, and shows that this important side of the work of a botanic garden has been fully maintained during the past year, despite the large number of men who are absent on military duties.

WART disease of potatoes, which has caused such serious loss in the north of England, is difficult to eradicate from a district owing to the length of time

the soil may remain infected with the fungus, *Synchytrium endobioticum*, which is its cause. Owing to the thick coats which cover the sporangia no method of killing them has been discovered, so that soil treatment as a remedy is of no practical use. Experiments recently carried out at the pathological laboratory of the Royal Botanic Gardens, Kew, by Mr. A. D. Cotton (see Kew Bulletin, 1916, No. 10) have proved that, in addition to the potato, our common English weeds, *Solanum nigrum* and *S. dulcamara*, can be infected with wart disease, and a few small warts containing the characteristic sporangia of the fungus have been produced on the roots of these two plants. Though these plants may not be active sources of soil infection, it is clear that they should be removed from a wart-disease area.

IN reference to our recent note (NATURE, vol. xcviii., p. 395) as to the replacement of materials in sedimentary rocks by iron pyrites, Mr. C. Carus-Wilson writes that he has described a case from the base of the Cainozoic strata in Bournemouth Bay, where a lignitic vegetable mud in the interstices of a sandstone has been thus changed into a pyritic cement.

A HANDSOME addition has been made to the representation of regional geology by the publication of a colour-printed geological map of Mysore on the scale of 1 in. to 8 miles (approximately 1 : 500,000). The whole of the rocks are assigned to the Archæan era, with the exception of the "sheet laterite" of the north, which is probably in the main of Cainozoic age. The map, compiled under Dr. Smeeth's direction by the Department of Mines and Geology of Mysore, gives a clear and harmonious picture of the great folded masses of crystalline rocks, striking N.N.W. from southern India, until they are concealed by the enormous Cretaceous lava-flows of the Bombay Presidency and Haidrabad. Dr. Smeeth's general description of the country was noticed in NATURE, vol. xcvii., p. 505.

*Naturen* for October, 1916, contains an appreciative review of the geological work of Prof. Amund Helland, of the University of Christiania, written by Hr. P. A. Øyen in connection with the seventieth birthday of this veteran observer. An attractive portrait accompanies the memoir. The author usefully reminds us that Helland stands as one of the great pioneers in glacial studies, and that before he was thirty years of age he undertook a journey to Greenland in order to satisfy himself of Ramsay's views on the relation of fjords and cirques to ice-action. This notice makes us turn with pleasure to Helland's paper published in the Quarterly Journal of the Geological Society of London in 1877 (vol. xxxiii.), where the origin of cirques in alternations of frost and thaw, combined with the presence of a transporting glacier, is very clearly stated. Hr. Øyen remarks that even the famous discussion on glacial erosion in Stockholm in 1910 added little to what had been put forward many years before by Ramsay, Lorange, and Helland.

THE Weekly Bulletin of the Hawaiian Volcano Observatory is in reality a monthly paper of some twelve pages, and is supplied to the members of the Hawaiian Volcano Research Association. Movements and changes in the Kilauea crater are reported under weekly headings, and, beginning with the bulletin for August, 1916, photographic plates of the surface of the lava-lake of Halemaumau are issued by Mr. T. A. Jaggar, jun., so as to form a continuous record. The importance of such observations lies in the fact that the stages leading up to a disturbance of unusual magnitude cannot be missed, as is commonly the case where active volcanoes attract spasmodic attention. The Hawaiian Observatory may aid in explaining the circular plugs of lava, with radial structure, described as "craterlets" in the Deccan Trap (L. L. Fermor and C. S. Fox, Records Geol. Surv. India, vol. xlvii., p. 81, 1916). These occur in a limited region of the Chhindwara district of the Central Provinces, and are now well illustrated, so that we may hope for their recognition elsewhere as the basal portions of spiracles and lava-bubbles.

THE difficulty in the spelling and transliteration of place-names arises out of the insufficient number of characters for separate sounds which our alphabet contains. This has been partly overcome by geographical authorities in different countries using an alphabet devised for the purpose, but all present difficulties in the way of phonetic representation. In the Memorial volume of the Transcontinental excursion of 1912 of the American Geographical Society, Mr. G. G. Chisholm suggests an international alphabet as a standard of reference. By comparison with this alphabet geographical authorities of different countries might decide the signs to be used for particular sounds in their own alphabet. Mr. Chisholm would like the sounds of this alphabet recorded on gramophone records, a copy of which could be kept by every important geographical society.

IN the *Geographical Review* for December (vol. ii., No. 6) some account is given of the new Museum of the American Indian, the foundation-stone of which was laid in New York in November, 1915. The museum, which will occupy part of the same block as the American Geographical Society, is the outcome of the collections of Mr. George G. Heye, and will contain everything of value to the student of the American Indian, from Fuegia to the Arctic regions. Up to the present all the funds for the furtherance of the work, including many expeditions, publications, and the purchase of collections, have been furnished by Mr. Heye and his mother. Mr. Heye has now turned over all his collections to a board of trustees, of which he has been elected chairman. Mr. Heye retains the directorship. The new building will probably be completed in the spring.

ELECTROSTATIC methods have sometimes been tried with doubtful success for separating minerals of nearly the same specific gravity. Writing in the *Rendiconti del R. Istituto Lombardo* (xlix., 15), Dr. Pietro Riboni now proposes a new arrangement consisting of a horizontal plane conductor at zero potential, and a cylindrical charged conductor fixed above it with its axis parallel to the plane. The conducting particles fly to and fro between the two conductors, becoming alternatively positively and negatively charged, and owing to the curvature of the lines of force which are arcs of circles, coupled with the effects of gravity and possibly elasticity, they gradually make their way outwards. The dielectric particles, on the other hand, tend to travel towards the places where the intensity of the field is greatest, and are found in the centre of the field. Although this method is described mainly with a view to the separation of metallic particles, it might be interesting to try whether it could be used to eliminate coal-dust from shore gatherings of foraminifera.

THE proximity to the field of Italian military operations of portions of the remarkable formation known as the Karst adds interest to a paper in *Scientia* (xx., 8), by Luigi De Marchi, on "The Waters of the Carso" (in Italian, with French translation by Dr. S. Jankelevitch). The tableland between Trieste and Abbazia is simply honeycombed with craters, some no larger than a room, some hundreds of yards in diameter, the hollows of which are cultivated with potatoes, while at Abbazia springs of cold fresh water

really resist the action of gasolene would be of the highest benefit.

A difficulty lies in the fact that the tanks are large (say 20 to 100 gallon capacity). The structural problems would be serious. The tanks now used are large and of metal. Vibration causes much difficulty and leakage.

(*e*) Metal coating. The protecting of the metal parts of an airplane, especially the fittings and cables, is a serious problem. A material is desired that would really prevent dangerous corrosion. Nickel-plating over copper is very good, but will not suffice. Rust strikes through very rapidly. Baked enamel is the best coating. It is impossible to apply in many cases.

(*f*) Sound. The question of eliminating the noises involved in the operation of aircraft is one of importance. The peculiar note of the propeller of a Zeppelin can be heard for several miles, and is usually the first warning of its approach at night.

3. *Miscellaneous.*—(*a*) Physiological. Study the physiological and psychological effects of low-density air at high altitudes on the performance of pilots.

(*b*) Transparent wing covering for airplanes. A wing covering which would answer the following general requirements would be of great value to military aviation :—

Weight not more than 5 oz. per square yard.

It should present reasonably great resistance to flame.

It should be reasonably proof against action of salt water, moist air, extreme dryness, and quick temperature changes.

It should not stretch in any direction. Its ability to retain its original form as placed on the airplane is very important.

It should have tensile strength of at least 75 lb. per inch width in any direction.

Its tendency to tear and split because of tack holes through it, or because of bullet holes, should be as small as possible.

(*c*) Development of light alloys for airplane construction. Pure aluminium or aluminium alloys. It is believed that a great deal can be done in this direction. So far no alloy has been developed, except possibly in Germany, which can compare with average Alaskan spruce in its "specific tenacity."

(*d*) The structure of gusts. It is believed that this is of sufficient importance to aviation to warrant considerable expense in its study.

Painstaking investigation of the character of eddy formations caused when wind strikes trees, hollows, cliffs, etc., and the character of disturbances created by canyons, swamps, deserts, etc., would be of great value to aviators.

This can be done not only by smoke and toy balloon work in the vicinity of obstructions such as the above, but also by photographic work in wind channels.

A set of simple rules laying down just what the aviator may expect on one side or another of canyons, cities, trees, lakes, and swamps would be very helpful in aviation.

(*e*) Radio-apparatus for aircraft. The subject of radio-intercommunication between aircraft in flight, and between aircraft and the earth, requires for its solution the highest possible efficiency and trustworthiness combined with minimum weight.

A present tendency is to separate entirely the power plant from the main engine of an aircraft. The generator body in this case has a stream-line figure, and a separate small air-screw is provided. Among other methods the oscillion is being tried as the actual source of continuous electromagnetic waves.

(*f*) Bullet-proof gasolene tanks. Development of a material with which to line or construct tanks to contain the gasolene in an airplane in which a bullet hole will quickly close, entirely or at least partly. This would enable many a flyer to get back to his own lines after having been fired upon.

(*g*) Development of a fabric as good as, or better than, Irish linen for the covering of airplanes. There has not been manufactured in the United States a fabric suitable for use in covering airplanes.

The fabric should answer all requirements laid down under *transparent wing covering*, and be, in addition, such as to shrink the proper amount without harm when cellulose solution is applied.

It is possible that long-fibre cotton might be developed that would answer the purpose.

We must become independent in all lines affecting our military aviation. To-day we depend entirely upon Ireland and England for our linen, and the supply is becoming very low in the United States.

(*h*) Aviator's clothing. Much has still to be done in devising non-inflammable and protective clothing for aviators. This question is intimately connected with personal armour and safety in case of fall.

(*i*) Ground-speed indicator. An instrument which would measure the actual speed of an aircraft over the ground would be useful in the operation of military machines.

4. *Physics of the Air.*—A number of physical properties of air, important in the problems of aviation, were also discussed.

## *UNIVERSITY AND EDUCATIONAL INTELLIGENCE.*

BIRMINGHAM.—Miss Helen Caddick has presented to the University a valuable collection of examples of the art of primitive peoples. The collection, which has been made by Miss Caddick in numerous travels, includes specimens from Central Africa, Tonga and Fiji Islands, New Zealand, and Peru. It is hoped that the gift may form the nucleus of an ethnological museum for the University.

LONDON.—At a meeting of the Senate held on January 24, the Vice-Chancellor (Sir Alfred Pearce Gould) being in the chair, Mr. J. J. Guest, of Trinity College, Cambridge, was appointed as from February 12 next to the University readership in graphics and structural engineering tenable at University College, in succession to Dr. W. H. Eccles, reader in graphics, who has been appointed professor of applied physics and electrical engineering at Finsbury Technical College.

The following doctorates have been conferred by the Senate :—*In Chemistry* : Mr. Guy Barr, an external student, for a thesis entitled "Researches in Relation to the Tensile Strength of Fabric, and the Effects of Experimental Variations on the Result of Tensile Tests," and other papers. *In Botany* : Mr. R. C. McLean, an external student, for a thesis entitled "Studies in the Ecology of Tropical Rain Forests," and other papers.

OXFORD.—On January 30 the preamble of the Statute creating the status of "advanced student" and prescribing the conditions on which advanced students may obtain certain degrees came before Congregation. An able speech in favour of the Statute was delivered by the Rev. E. M. Walker (Queen's), who was supported by Prof. Perkin, Waynflete professor of chemistry, and as to the principle of the Statute by Mr. S. Ball (St. John's), Dr. Macan, Master of University College, and Dr. F. C. Schiller (Corpus). The last three speakers argued in favour of the degree of doctor of philosophy being offered under the Statute, instead of that of D.Sc. or D.Litt. as was at present contemplated. Notice was given of an amendment to be proposed in this sense. The only

speaker in opposition was Prof. J. E. Holland (All Souls), who thought that council should have proceeded by resolution rather than by Statute. On a division the preamble was carried by 69 to 7.

THE KING has consented to open the School of Oriental Studies, London Institution, on Friday morning, February 23.

DR. C. E. MOSS, Botany School, Cambridge, has been appointed professor of botany in the South African School of Mines and Technology, Johannesburg.

AT the request of Mr. Fisher, Prof. Gilbert Murray, professor of Greek, Oxford University, is undertaking temporary work at the Board of Education, taking the place of Mr. H. F. Heath, C.B., now Secretary of the Department of Scientific and Industrial Research. Mr. Heath was head of the Universities Branch of the Board, and also Director of Special Inquiries and Reports.

ONE of the sections of the report to the Prime Minister of the Speaker's conference on electoral reform, which was issued on Tuesday, deals with university representation. The following recommendations are made:—(*a*) The Universities of Oxford and Cambridge shall continue to return two members each; the electorate shall be widened, and, in order to secure a proper representation of minorities, each voter shall be allowed to vote for one candidate only. (*b*) The Universities of Durham, Manchester, Birmingham, Liverpool, Leeds, Sheffield, Bristol, and the University of Wales shall receive representation; these universities shall be grouped with the University of London so as to form a single constituency returning three members elected on the system of a single transferable vote. (*c*) The combined Universities of Edinburgh and St. Andrews and of Glasgow and Aberdeen shall also be grouped so as to form a single constituency returning three members under the system of a single transferable vote. (*d*) As regards all universities, the obtaining of a degree shall be the basis for electoral qualification.

THE following resolutions were passed at the annual meeting of the Association of Science Teachers, held at the University of London on January 6:—(1) That the science teaching in the schools should aim at developing in the pupils (*a*) the power to observe accurately, to reason logically from observed facts, to frame hypotheses and to test these hypotheses by means of their own experiments; (*b*) a spirit of interest and inquiry with regard to the world around them and the universe at large, an interest in the growth of knowledge in the past, and an appreciation of some of the wider problems with which science deals at present and which influence modern thought and modern activities. (2) That in order to accomplish the first of these aims a thorough course of experimental work in the laboratory is absolutely necessary, that such a course should be continuous, or nearly so, from the ages of twelve to sixteen, and that in this course the pupils should, so far as possible, be encouraged to attack problems for themselves. (3) That as such a course by itself would necessarily cover a very narrow field, the work should be supplemented by teaching or by activities on the part of the pupils themselves, designed to bring them into contact with the wider issues indicated in (1. *b*). (4) That if science is to play its due part in the curriculum as indicated in the foregoing resolutions lessons encouraging the children to observe the phenomena of Nature should be given from the earliest ages, while between the ages of twelve and sixteen not less than an average of one-seventh of the teaching hours of the school should be given to science.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Geological Society**, January 10.—Dr. A. Harker, president, in the chair.—H. A. **Baker**: The Palæozoic platform beneath the London Basin and adjoining areas, and the disposition of the Mesozoic strata upon it. With an appendix by Dr. A. M. Davies. The author carries on the work of tracing the contours of the Palæozoic platform of S.E. England. By comparing these with the contours of the base of the Gault, the probable boundaries of the areas of the platform that were only submerged finally under the Gault sea are determined. The effects of post-Cretaceous tilting and warping are analysed. The successive Mesozoic overlaps on the platform, their probable areas, and the tectonics of the platform are discussed. Evidence is given for a second Charnian axis, proceeding southeastwards through Norfolk and Suffolk, east of Kent, to the North of France.—Dr. C. **Lapworth**: Balston Expedition to Peru: report on graptolites collected by Capt. J. A. Douglas, R.E. The graptolites were collected from the rocks of the Inambari district. The specimens are recorded as all occurring in the same locality, but it is not known whether they were obtained from a single zone. The lithology of the containing rocks and the mode of preservation of the graptolites are similar to those obtaining in the richest of graptolite-bearing strata of Britain, Europe, and North America. Taken as a whole, this graptolite fauna may best be compared with that of the Upper Arenig formation of Britain and its North American equivalents. The assemblage of graptolites discovered in Bolivia a few years ago by Dr. J. W. Evans corresponds closely with this Peruvian fauna, and was probably derived from the southward continuation of the same Andean graptolite-band. The Douglas collection of Peruvian graptolites greatly strengthens the inference that in Arenig-Llandeilo times there was open-sea communication admitting of the circulation of sea-currents along some as yet undetermined line or lines, connecting these widely separated regions, which must have extended across the equator and apparently throughout a length nearly equal to that of half the circumference of the globe.

**Linnean Society**, January 18.—Sir David Prain, president, in the chair.—Prof. F. O. **Bower**: The morphology of the sorus of ferns. The isolated sporangium (monangial sorus of Prantl) is frequent among primitive Filicales. The distal or marginal position of the sorus is prevalent in primitive types. The transition from a marginal to a superficial position has frequently occurred. Interpolation of sporangia has led to increased complexity of the sorus. In simple, gradate, and mixed sori thus constituted the receptacle varies: it is not a stable entity, but a result of elaboration of the vein-ending on which the sporangia are seated. Superficial extension of sori occurs. Duplication of sori also occurs. Fusion of sori occurs progressively in various phyla. The fusion-sorus may disintegrate, but not necessarily along the original lines of fusion. The identity of the sorus may be lost by acrostichoid development, which has occurred along numerous lines of phyletic advance. The more complex sori of ferns, as they are now seen, are referable along such lines of comparison to marginal or distal monangial sori. Such a position of isolated or few sporangia is found to prevail in plants of the Lower Devonian period. The marginal placentation of seed-plants is probably more than a mere analogy.

**Aristotelian Society**, January 22.—Dr. H. Wildon Carr, president, in the chair.—C. E. M. **Joad**: Monism in the light of recent developments in philosophy. A monistic theory confuses two distinct propositions. A

thing is what it is, not only because it has a place in the universe, and because of its relations to other things, but also because those relations are not the thing. To assert that a thing is its relations involves a second and quite different proposition. A thing indeed presupposes reality and its connections with it, just as our apprehension of a truth presupposes reality. But when we assert that a thing is what it is because of its connections with reality, we do not mean that the thing is its connections. They condition it, but it is separate from them. The other main monistic argument is to the effect that the ultimate Real being one and indivisible, all analysis by means of which we arrive at a world composed of things and relations is a false abstraction of thought, which leads us away from Reality. It is true that a whole, although created by its parts, is more than their sum. A whole, as opposed to an aggregate, is a unity—a new entity which has come into being by their synthesis. But such a whole clearly has parts which it cannot be a fiction to distinguish from one another. The fact that analysis of a whole into parts destroys the whole does not mean that it also destroys the parts, or that the parts are not really its parts, or that they cannot exist as distinguished from one another.

PARIS.

**Academy of Sciences**, January 2.—M. C. Jordan (later M. A. d'Arsonval) in the chair.—G. **Bigourdan**: The principle of a new zenithal telescope.—Ch. **Depéret** and L. **Gentil**: An upper Miocene marine fauna in the R'arb, western Morocco.—C. **Guichard**: The K networks of general quadrics.—W. **Kilian** and J. **Révil**: The Pleistocene formations and the morphology of the Arc valley, Savoy.—G. **Julia**: The reduction of binary forms with real coefficients of any degree whatever.—G. H. **Hardy** and S. **Ramanujan**: An asymptotic formula for the number of partitions of $n$.—E. **Belot**: The theory of spiral nebulæ and the true sense of their rotation.—J. **Guillaume**: Observations of the sun made at the Observatory of Lyons during the third quarter of 1916. Observations were possible on eighty-nine days, and the results are given in three tables showing the number of spots, their distribution in latitude, and the distribution of the faculæ in latitude.—C. K. **Reiman**: The absolute density of hydrobromic acid. The gas was prepared by three independent methods, the final purification being by liquefaction and fractional distillation in a vacuum. The mean of thirty-one determinations is 3·6442 grams per litre.—P. **Gaubert**: The indices of refraction of the rhombohedral carbonates. Figures are given for gioberite, siderite, dialogite, smithsonite, dolomite, ankerite, and mesitite. The value of the indices of refraction of various dolomites, ankerites, etc., agrees with that obtained by calculation on applying the laws governing the relations between the indices of an isomorphous mixture and those of its components, but the agreement is only approximate.—V. **Commont**: The Pre-Quaternary Somme-Oise.—E. **Harlé** and J. **Harlé**: The maritime dunes of the coast of Gascony.—A. **Nodon**: Observations of the atmospheric disturbances during the months of October and November, 1916. Confirming earlier researches, there is found to be a close relation between the solar perturbations, electromagnetic disturbances, and disturbances of the terrestrial atmosphere.—Ph. **Flajolet**: Disturbances of the magnetic declination at Lyons (Saint-Genis-Laval) during the third quarter of 1916.—P. de **Beauchamp**: New researches on sexuality in Dinophilus.—L. **Lindet**: Waste in alcoholic fermentation.—F. **Garrigou**: Special examination of urines for the rapid and correct choice of a thermal station.—O. **Laurent**: The realisation of siamoisism in animals. Experiments on grafting together two different animals.—P. Lecomte du **Noüy**: The relative *rôle* of surface and perimeter in the phenomenon of cicatrisation of wounds at the surface and the formula which interprets them.

January 8.—M. A. d'Arsonval in the chair.—The president announced the death of Prof. Chauveau, in his ninetieth year.—M. **Hamy**: The approximate value of a definite integral.—P. **Appell**: An extension of the equations of the theory of vortices and of the equations of Weber.—M. de **Sparre**: Calculation of the hammer in a water-main formed of two sections of different diameters.—M. **Depage**: The secondary transformation of open into closed fractures. A detailed description of a new application of Carrel's method for irrigating fractures.—W. H. **Young**: A new set of conditions for the convergence of Fourier's series.—M. **Petrovitch**: The limit of extensibility of an arc of certain curves. The curves, the deformation of which is examined, are such that on going from one extremity to the other none of the $x$ co-ordinates changes the sense of its variation, each of them increasing or decreasing along the arc.—M. **Souslin**: A definition of measurable B ensembles without transfinite numbers.—N. **Lusin**: The classification of M. Baire. Some consequences of the results of M. Souslin in the preceding paper.—L. **Hartmann**: The systematic variation of the value of the kinetic energy in the elastic rebound of bodies. According to experiment, in the elastic shock of bodies the sum $mV^2+m'V'^2$ is not constant and independent of V and V′, contrary to the proposition of Leibnitz.—J. **Olive**: The mechanical trace of the ballistic hodograph.—E. **Esclangon**: The reflection and refraction of isolated waves at the surface of separation of two fluids in repose or in motion.—A. **Pereira-Forjaz**: Spectrographic studies of Portuguese minerals of uranium and zirconium. Results are given for chalcolites from Sabugal and Nellas, autunite from Nellas, and zircon from Alter Pedroso. Radium was present in the chalcolites.—P. **Fallot**: The geology of the island of Ibiza.—F. **Grandjean**: The orientation of anisotropic liquids on the cleavages of the crystals. An account of the examination of anisaldazine, *p*-azoxyanisol, and *p*-azoxyanisolphenetol. It is concluded that the property of orientation of an anisotropic liquid on a determined cleavage is not a reticular property.—J. **Deprat**: The geological exploration of the part of Yun-nan comprised between the Tonkin frontier, the Kwang-si, and the Kwei-tcheou.—Ph. **Glangeaud**: The substratum of the volcanic massif of Mont Dore.—E. **Belot**: Provisional trace of the curve described by the magnetic north pole since 1541.—Mlle. Y. **Dehorne**: A new Stromatopore from the Lusitanian of Cezimbra (Portugal).—P. **Lesage**: The germination of the seeds of *Lepidium sativum* in solutions of electrolytes.—C. **Galaine** and C. **Houlbert**: A new arrangement for the rapid filtration of potable waters after their purification by the Lambert-Laurent process. After treatment with potassium permanganate, the removal of the precipitated oxide of manganese presents practical difficulties. It is proposed to modify the apparatus so that the purification and filtration take place in the same vessel, without transference and possible re-contamination.—F. **Dienert** and G. **Mathieu**: Search for typhoid and paratyphoid bacilli.

## BOOKS RECEIVED.

Recherches sur les Mouvements Propres des Etoiles dans la Zone Photographique de Helsingfors. By R. Furuhjelm. Pp. 190. (Helsingfors: Société de Littérature Finnoise.)

Compressed Air Practice in Mining. By D. Penman. Pp. vii+221. (London: C. Griffin and Co., Ltd.) 5*s*. net.

A Handbook of Briquetting. By Prof. G. Franke. Translated by F. C. A. H. Lantsberry. Vol. i. Pp. xxviii+631. (London: C. Griffin and Co., Ltd.) 30*s*. net.

Diderot's Early Philosophical Works. Translated and edited by M. Jourdain. Pp. v+246. (Chicago and London: The Open Court Publishing Co.) 4*s*. 6*d*. net.

The Geometrical Lectures of Isaac Barrow. Translated, with Notes and Proofs, by J. M. Child. Pp. xiv+218. (Chicago and London: The Open Court Publishing Co.) 4*s*. 6*d*. net.

New Essays concerning Human Understanding. By G. W. Leibniz. Together with an Appendix consisting of some of his Shorter Pieces. Translated by A. G. Langley. Second edition. Pp. xix+861. (Chicago and London: The Open Court Publishing Co.) 12*s*. net.

Contributions from the Jefferson Physical Laboratory and from the Cruft High-Tension Electrical Laboratory of Harvard University for the Year 1915. Vol. xii. (Cambridge, Mass.)

Chemical Discovery and Invention in the Twentieth Century. By Sir W. A. Tilden. Pp. xvi+487. (London: G. Routledge and Sons, Ltd.) 7*s*. 6*d*. net.

Le Traitement des Plaies Infectées. By A. Carrel and G. Dehelly. Pp. 177. (Paris: Masson et Cie.) 4 francs.

Les Dysenteries, le Cholera Asiatique, le Typhus exanthématique. By H. Vincent and L. Muratet. Pp. 184. (Paris: Masson et Cie.) 4 francs.

Registration of Business Names. By H. W. Jordan. Pp. 32. (London: Jordan and Sons, Ltd.) 6*d*. net.

Elementary Dynamics of the Particle and Rigid Body. By Prof R. J. Barnard. Pp. vii+374. (London: Macmillan and Co., Ltd.) 6*s*.

## DIARY OF SOCIETIES.

*THURSDAY*, FEBRUARY 1.

ROYAL SOCIETY, at 4.30.—An Application of the Theory of Probabilities to the Study of *a priori* Pathometry. Part II.: Sir Ronald Ross and Miss H. P. Hudson.—An Investigation into the Periodicity of Measles Epidemics in London from 1703 to the present day by the Method of the Periodogram: Dr. J. Brownlee.—The Causes responsible for the Developmental Progress of the Mammary Glands in the Rabbit during the Latter Part of Pregnancy: Capt. J. Hammond.—The Post-œstrous Changes occurring in the Generative Organs and Mammary Glands of the Non-pregnant Dog: F. H. A. Marshall and E. T. Halnan.

ROYAL INSTITUTION, at 3.—The Mechanism of Chemical Change: Prof. F. G. Donnan.

CHEMICAL SOCIETY, at 8.—Chromium Phosphate: A. F. Joseph and W. N. Rae.—The Detection of Traces of Mercury Salts in Toxicological Work: K. C. Browning.—"Stepped" Ignition: R. V. Wheeler.—The Catalytic Bleaching of Oils, Fats, and Waxes: H. Rai.—Alkaloidal Derivatives of Mercuric Nitrite: P. C. Rây.—Synthesis of a Derivative of the Lowermost Homologue of Thiophene: P. C. Rây and M. L. Dey.—The Detergent Action of Soap: S. U. Pickering.—The Occlusion of Iron by the Phospho-molybdate Precipitate: E. H. Archibald and H. B. Keegan.

MATHEMATICAL SOCIETY, at 5.30.

LINNEAN SOCIETY, at 5.—Some Plants that might occur in Britain: C. E. Salmon.—Recent Exploration of the Abrolhos Islands: Prof. W. A. Herdman.—*Mentha exigua*, Mill: J. Britten.—The Structure of the Leaves of Hybrid Orchids: J. Charlesworth and J. Ramsbottom.

*FRIDAY*, FEBRUARY 2.

ROYAL INSTITUTION, at 5.30.—Recent Physiology and the War: Prof. C. S. Sherrington.

*SATURDAY*, FEBRUARY 3.

GEOLOGISTS' ASSOCIATION, at 3.—President's address: The Study of the Archæan Rocks, with Special Reference to Scotland: G. Barrow.

*MONDAY*, FEBRUARY 5.

ROYAL SOCIETY OF ARTS, at 4.30.—Town Planning and Civic Architecture: Prof. A. Beresford Pite.

ARISTOTELIAN SOCIETY, at 8.—Valuation and Existence: F. C. Bartlett.

VICTORIA INSTITUTE, at 4.30.—Islam and Animism: Rev. Dr. S. M. Zwemer.

ROYAL GEOGRAPHICAL SOCIETY, at 5.30.—Thirty Years' Work of the Royal Geographical Society: Dr. J. Scott Keltie.

*TUESDAY*, FEBRUARY 6.

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

ZOOLOGICAL SOCIETY, at 5.30.—Structure and Functions of the Mouth-parts of the Palæmonid Prawns: L. A. Borradaile.—Scolex in the Cestode Genus Duthiersia, and on the Species of that Genus: Dr. F. E. Beddard.—Report on the Deaths which occurred in the Zoological Gardens during 1916: Prof. H. G. Plimmer.

RÖNTGEN SOCIETY, at 8.15.—Some Properties and Applications of Selenium: Dr. E. E. Fournier d'Albe.

INSTITUTION OF CIVIL ENGINEERS, at 5.30.—The Main Drainage System of London: G. W. Humphreys.

*WEDNESDAY*, FEBRUARY 7.

ROYAL SOCIETY OF ARTS, at 4.30.—The Future of British Spas: Dr. R. F. Fox.

GEOLOGICAL SOCIETY, at 5.30.

ENTOMOLOGICAL SOCIETY, at 8.

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Quantitative Estimation of Mercury in Organic Compounds: J. E. Marsh and O. G. Lye.—The Shrewsbury and Knapp Process for the Detection of Coconut Oil: G. D. Elsdon.—The Detection of Rose Petals in Blue Pill: W. Partridge.

*THURSDAY*, FEBRUARY 8.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Dynamics of Revolving Fluid: Lord Rayleigh.—Deflection of the Vertical by Tidal Loading of the Earth's Surface: Prof. H. Lamb.—Spontaneous Generation of Heat in Recently Hardened Steel: C. F. Brush and Sir R. Hadfield.

ROYAL INSTITUTION, at 3.—The Mechanism of Chemical Change: Prof. F. G. Donnan.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Frequency Changers: R. Townend.

OPTICAL SOCIETY, at 7.30.—Annual Meeting.—More Notes on Glass Grinding and Polishing: J. W. French.

*FRIDAY*, FEBRUARY 9.

ROYAL INSTITUTION, at 5.30.—Experimental Phonetics and its Utility to the Linguist: D. Jones.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Anniversary Meeting.

MALACOLOGICAL SOCIETY, at 7.—Annual Meeting. Presidential Address: Systematic List of the Marginellidæ: J. R. le B. Tomlin.

## CONTENTS.



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

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

*Editorial Communications to the Editor.*

*Telegraphic Address:* PHUSIS, LONDON.

*Telephone Number:* GERRARD 8830.