THURSDAY, MAY 24, 1917.

ENGINEERING AERODYNAMICS.

The Flying-Machine from an Engineering Standpoint. By F. W. Lanchester. Pp. viii + 135. (London: Constable and Co., Ltd., 1916.) Price 4*s.* 6*d.* net.

THE greater part of this book is a reprint of the James Forrest lecture delivered by the author, and referred to already in NATURE of August 13, 1914. In the preface Mr. Lanchester lays so much stress on the new section called "The Theory of Sustentation" that no excuse is necessary for confining the remarks of this notice to the theory.

After reading the preface and the considerable claims made for the theory, a student of the subject will naturally look for a theory founded on the equations of motion, or at least on grounds not essentially experimental. It is, then, a surprise to find an almost complete absence of mathematical formulæ and reasoning, and any knowledge of orthodox hydrodynamics leads to questions as to the validity of many of the steps taken. After a time it is inevitable that the student will turn for relaxation to Kutta, whom Mr. Lanchester claims as a kindred spirit.

Kutta's mathematical problem is not difficult to follow, though doubts may be felt as to the physical meaning of his results. He takes as the subject of his analysis the two-dimensional flow of an inviscid fluid round a lamina in the form of a circular arc. Except for the case of a plane lamina moving in its own plane, it is well known that the Eulerian system of equations leads to a solution in which the velocity is infinite at two points, the leading and trailing edges of the lamina. To meet this difficulty Kutta introduces a circulation of the main mass of fluid, and chooses the amount of the circulation so as to avoid one of the infinite values for the velocity. There does not appear to be any limit to the angle of incidence or the curvature of the arc beyond which Kutta's method cannot be applied. To deal with the second point of infinite velocity Kutta found it necessary to change from a lamina to a body having a rounded leading edge, and this idea was put into better mathematical form by Joukowsky.

Kutta compares his calculated forces with those observed in wind channels, and claims good agreement after making an allowance for skin friction. This is essentially an empirical justification, and no attempt appears to have been made to show that the cyclic motion of an inviscid fluid has any mathematical connection with the real motion of a viscous fluid.

Having read Kutta, one returns to Mr. Lanchester. The difficulty of two points of infinite velocity is met by saying that if the section is properly shaped the flow is "conformable," *i.e.* includes the lamina in one of the stream lines, and further attention is confined to "conformable" wing shapes. In addition to a cyclic motion Mr. Lanchester introduces a pair of trailing vortices, which appear to extend Kutta's analysis from two dimensions to three dimensions. These vortices appear as though set up in the conventional inviscid fluid. The mechanism is not shown to us, and nowhere in the theory is there a clear distinction between the irrotational cyclic motion and the rotational flow in the vortices, nor even an estimate of the strength of the cyclic component. The theory ends with a formula for calculating the "sustentation" and "the aerodynamic resistance." To compare the results with those for a real fluid Mr. Lanchester estimates from experimental data a quantity which he calls "direct resistance," and which he adds directly to the "aerodynamic resistance." In the writer's view the theory, however excellent as an empirical formula, has no independent basis, and its utility is determined by the number of experimental observations which it will hold together.

Conventional hydrodynamics is interesting as a mathematical study, but work based on the properties of an inviscid fluid can scarcely be said to lead to results of value in explanation of the observed motion of real fluids. The equations of motion for a viscous fluid were given to us by Stokes, and are to be found in Lamb's treatise on hydrodynamics. For slow motion and very viscous fluids there is reason to believe that the motion is steady, and some solutions of the equations have been obtained, the most important being that of the flow in capillary tubes which leads to our best-known method for determining the value of the coefficient of viscosity.

Osborne Reynolds showed that the mathematical assumption of steady motion fails to account for observations when the fluid motion is rapid, and failure has led to approximations instead of to a fuller solution of the equations of motion of a viscous fluid. The physical conditions of the problem are usually modified by removing any trace of viscosity in order to make a simpler mathematical problem. Mr. Lanchester adopts this method in part, and is supported by all the standard treatises in the world. To a serious student of fluid motion such half-hearted theories produce difficulty and do not help to an understanding of the subject in its physical bearings.

Failure to satisfy the conditions observed may arise from defective equations or inability to solve correct equations. The evidence provided by Stanton and Pannell's experiments on surface friction in pipes appears to leave no doubt that the definition of viscosity derived from slow motions is sufficient for turbulent motion, and we must conclude that inability to deal with the mathematical analysis is the root trouble. An examination of the problem immediately brings into prominence a fundamental difference between inviscid and viscous fluids, the first of which may have a tangential velocity relative to a surface with which it is in contact, whilst the second has no relative velocity. It is not even

permissible to consider an inviscid fluid as the limit of one in which viscosity has been indefinitely reduced. No real fluid is known in which the viscosity is small enough to admit slipping at a solid boundary, or, for that matter, at any point in the fluid itself.

There is need for a solution of the well-known equations of motion for a viscous fluid, and great possibilities appear to exist for the student who has the courage to look the issue squarely in the face.

THE BRIQUETTING OF FUELS.

A Handbook of Briquetting. By Prof. G. Franke. Translated by Fred. C. A. H. Lantsberry. Vol. i., *The Briquetting of Coals, Brown Coals, and Other Fuels.* Pp. xxviii+631. (London: Charles Griffin and Co., Ltd., 1916.) Price 30*s.* net.

THE work before us is a translation of the first part of Prof. Franke's well-known and important work on briquetting. The entire work deals with the whole subject of briquetting as applied to a very wide range of materials, but the first part, the translation of which has now been issued, is confined to the briquetting of coal. Although the full title is "The Briquetting of Coals, Brown Coals, and other Fuels," the author has practically confined himself to the two fuels that he has specified; nothing is said as to the briquetting of peat, although this part of the subject is far from unimportant, nor has the briquetting of other materials, such as sawdust, been dealt with. Within the limits in which he has chosen to confine himself the author has, however, done his work excellently well, and his book may fairly be regarded as a standard treatise on the subject.

The book is practically divided into two parts, the first dealing with the briquetting of bituminous coal, the second with the briquetting of lignite. The latter part is of less practical interest to us in this country, merely because we possess no deposits of lignite, with the exception of the quite unimportant ones at Bovey Tracey, in Devonshire, but is likely to be welcomed in British colonies where lignite exists. The first part, however, deals with a subject of most pressing importance, the urgency of which we have barely begun to realise. It is quite well known amongst coal-miners that millions of tons of small coal of the non-coking kind, unsuitable, therefore, for coke-making, are annually left behind in our collieries and lost for ever to the nation, because such coal is practically unsaleable, or at any rate commands but a very low price so long as round coal can be bought at a reasonable rate. Yet this small coal is every bit as valuable as lump coal as a source of heat, and could quite as readily be turned to good account. The thrifty Germans have, however, learnt to utilise what we waste, and hence it is that the manufacture of coal briquettes, or patent fuel, as it is usually called here, has made comparatively little progress in this country, whilst it has attained very important dimensions in Germany. Thus, according to Prof. Franke, the briquette production of Great Britain in 1906 was $1\frac{1}{2}$ millions of tons, whereas that of the German Empire (bituminous coal only) was $3\frac{1}{2}$ millions, whilst the respective production of bituminous coal was 255 millions and 137 millions of tons. One reason is that our adherence to old-fashioned, conservative methods stands in the way of the extended use of patent fuel in this country; we export fully 90 per cent. of the briquettes that we do produce, for which reason the manufacture of patent fuel is confined to our sea-board, and centres mainly in South Wales. On the other hand, some of the coals produced in our central coalfields, *e.g.* Nottingham and Derby, are exceedingly well suited to the production of briquettes, and the small coal of these districts ought to be thus utilised instead of being wasted.

Any colliery proprietor who is contemplating the manufacture of briquettes will find in the present work the fullest information as to every detail and every aspect of the subject, the author having performed his task in the most painstaking manner; perhaps the only fault that could be found is that he is somewhat too meticulous. Thus it scarcely seems necessary to describe, as he does in detail, the construction and mode of action of the ordinary Watts governor as applied to a simple horizontal engine that is used to drive a briquette press, but this fault is one on the right side. His successive chapters in the first part treating of bituminous coal are devoted to the raw materials, namely, coal and binders, crushing, mixing, drying, kneading and heating, pressing, loading and storage, design of complete plants, and economies and statistics; whilst the second part deals with lignite briquettes in an equally comprehensive fashion.

Whilst, therefore, we have nothing but praise for the manner in which the author has done his work, we must regret that the same cannot be said of the translator. This is, in fact, one of the poorest translations that we have ever seen. Two essential qualifications for producing an acceptable translation are a thorough knowledge of the language of the original and a good practical acquaintance with the subject-matter of the work. The translator, however, does not seem to understand German technical terms or to know their English equivalents. The result is a series of blunders, more or less grotesque, some of them veritable schoolboy "howlers." His ignorance of German is shown on the very first page, where he translates *Kohlensteine* by "coal-stones," and *Kohlenziegel* by "coal-bricks," whereas a moderate knowledge of the language would have told him that the proper words were "coal-bricks" and "coal-tiles" respectively. He translates *Setzmaschine, i.e.* "jig," by the utterly meaningless phrase "settling machine," and *Montanwachs*, literally "mine-wax" (a bitumen derived from lignite), he calls "Montana wax"! "Trans-

port band" may be an exact transliteration of the German original, but an English engineer would employ the usual phrase "conveyor-belt," in the same way that he would speak of the "flue" of a stove, and not, as the translator has done, of a "smoke-pipe." Unless the reader of this unsatisfactory translation himself knows German, he would be hard put to it to discover that what the translator calls the hard cast-iron "covers" of crushing rolls are really chilled iron roll-shells. No good purpose can be served by further extending this list of blunders; enough has been said to show that the reader must be on his guard throughout the book, and will have to use his ingenuity in order to arrive at the author's real meaning in many unintelligible passages.

Messrs. Griffin and Co. have earned for themselves a high reputation for their splendid series of technological publications, which have been productive of the utmost benefit to our industries, and it is a matter for grave regret that the present volume should fall so far below the high standard of excellence of these works. It is sincerely to be hoped that if a translation of the second volume of Prof. Franke's book is in hand, they will take care to have the proofs revised by someone capable of doing justice to the original.

H. L.

PROBLEMS OF BEHAVIOUR.

(1) *What is Instinct? Some Thoughts on Telepathy and Subconsciousness in Animals.* By C. Bingham Newland. Pp. xv+217. (London: John Murray, 1916.) Price 6s. net.

(2) *Studies in Animal Behavior.* By Dr. S. J. Holmes. Pp. 266. (Boston: Richard G. Badger, 1916.) Price 2.50 dollars.

THESE two books deal with the same subject—animal behaviour; but they could scarcely be more sharply contrasted, for the one is scientific and the other is not.

(1) Mr. Newland, as sportsman and field naturalist, has many interesting facts to submit and personal observations to relate, which is all to the good; but he has ventured on a line of interpretation where verification is impossible. His study of adaptive behaviour has led him to the conclusion that "the marvellous precision and fitness of these actions can only be attributed to Omniscience manifesting in the creature." In spite of the abundant illustrations of "trial and error" procedure to be found among animals, he tells us that "the creatures involved make no tentative experiments, but the perception of how and when to act comes to them subconsciously." But it is not exactly their own subconscious mind that operates; it is a "subconscious principle directly transmitted from the 'mainspring'—All-Mind." The life-principle (soul) of the insect or other member of the animal world is a centre of subconsciousness, temporarily set apart, but ever "in touch" with the All-Conscious. Hence their infallibility! Mr. Newland is altogether too metaphysical.

(2) We breathe a different atmosphere in Dr. Holmes's careful study, which adheres to scientific methods and verifiable formulæ. The book begins with an historical sketch which shows how the pendulum has swung many times between the extremes of generosity and parsimony, reading the man into the beast and reducing the animal to an automatic machine. The second chapter pictures the stages in the evolution of parental care, which is regarded as an extension of reproductive processes and as the foundation of social instincts. It is long, however, before it becomes necessary to insist on the psychical aspect of behaviour, which, objectively considered, cannot but be described as very efficient parental care.

The next three chapters deal with tropisms, which are prominent among lower organisms, and enter as components into the more complex activities of higher animals. While there are many orientations that may be described as tropisms and regarded as inevitable reflex effects, there are in other cases sundry complications which suggest more than the involuntary reaction of a "reflex machine." There is apparent selection of random movements, and there are modifications of routine which are consequent on experience. An account is given of the widespread phenomenon of the reversal of tropisms, and the variety of causes by which it is induced.

In regard to "learning" Dr. Holmes writes: "Given the power of forming associations between responses, the animal acquires new habits of action by repeating those responses which arouse instinctive acts of a congruous kind, and by discontinuing those responses which arouse instinctive acts of an incongruous kind." "The new things an animal learns to do are done because they have been assimilated to its instinctive activities." "The securing of any advantage through the method of trial and error presupposes congenital modes of response which are adapted to secure the welfare of the individual." Blundering into success would be of no service unless the organism were capable of turning to advantage its fortunate trial movement. "In order to do this the organism must be provided for the situation by its inherited endowment." "It is inheritance that affords the means by which inheritance is improved." We cannot do more than refer to the author's suggestive discussion of the way in which behaviour may help to mould form, of the analogy between behaviour and development, of the twofold origin of "feigning death," of the diverse modes of sex-recognition, and of the *rôle* of sex in the evolution of mind. The last chapter gives a charming account of a study of a bonnet monkey's mind.

The whole book is vividly interesting, and while the author flies a number of kites, he is careful to distinguish between fact and theory. He shows true scientific caution in stating his own views, and fair-mindedness in his criticism of those which he rejects. A distinctive feature of his method is the combination of analytic and genetic inquiry.

J. A. T.

OUR BOOKSHELF.

Studies in Insect Life, and Other Essays. By Dr. A. E. Shipley. Pp. ix+338. (London: T. Fisher Unwin, Ltd., 1917.) Price 10*s.* 6*d.* net.

IT is Dr. Shipley's gift to write scientific essays artistically, using many-coloured lights from reading and experience to illumine and humanise hard grey facts. He has humour and a light touch, and things are so interesting to himself that they become interesting to us. Not that we pretend to explain his style, which permits of luminous, dignified discourse on lice and fleas, as well as on fisheries and grouse. "Le style," said Buffon, "est comme le bonheur; il vient de la douceur de l'âme."

The book, based on previously published essays and lectures, has eleven chapters, dealing with insects and war, honey-bees, humble-bees, wasps, the depths of the sea, fisheries, Sir John Murray, grouse-disease, zoology in the time of Shakespeare, the revival of science in the seventeenth century, and hate. We have seen no more successful rapidly drawn picture of a haunt of life than is to be found in the chapter on "The Romance of the Depths of the Sea." Another fine picture of a very different kind is that of Sir John Murray. It is very interesting to have Dr. Shipley's lively summary of his own investigations on what is called "grouse-disease," of which, adapting Sydney Smith, he says: "Little stoppages, food pressing in the wrong place, a vext duodenum, and an agitated blind-gut, and there you have 'grouse-disease.'"

In the essay on hate an exposition is given, after Cannon and others, of the part the secretion of the supra-renal capsules plays in "the bodily changes which occur in states of extreme pain, fear, or rage, and serve to place 'un enragé' in an eminently favourable state for wreaking his passion on his opponent." It has been suggested that the use of golden mice in connection with emerods may have implied some awareness of the correlation between rodents (with their fleas) and bubonic plague; Dr. Shipley wonders whether the ancient Hebrews knew anything about the potency of the supra-renal capsules, because they were so very particular in their burnt offerings to offer up "the fat upon the kidneys." We have but one fault to find with this entertaining volume, that it comes to an end too soon.

The Tutorial Chemistry. Part ii., *Metals and Physical Chemistry.* By Dr. G. H. Bailey. Edited by Dr. W. Briggs. Third edition. Pp. viii+460. (London: W. B. Clive, University Tutorial Press, Ltd., 1917.) Price 4*s.* 6*d.*

THE general character of this widely known textbook was described in the review of the first edition which was published in NATURE for April 14, 1898 (vol. lvii., p. 559). In the present issue the second half of the section of the book dealing with physical chemistry has been completely recast by Mr. H. W. Bausor. The whole text has been revised, and the pages concerned with crystallography have been transferred to an appendix.

LETTERS TO THE EDITOR.

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The Stability of Lead Isotopes from Thorium.

SINCE my recent letter on the subject of "thorium" lead (NATURE, February 15, p. 469) I have had some correspondence with Dr. Arthur Holmes, who, in agreement with Boltwood, had previously concluded from geological evidence that lead could not be the end product of thorium, because thorium minerals often contain so little lead in comparison with what is to be expected from their age. He pointed out that the age of Ceylon thorite as determined from the ratio of lead to thorium was curiously anomalous. Taking, as preferable, Rutherford's values for the periods of uranium and thorium, 0·72 and 1·9 ($\times 10^{10}$ years) respectively (in the ratio of 1 to 2·6, instead of 3·2, the figure used in the previous letter), the proportion of the thorite lead derived from the thorium would be 95·5 per cent., and from the uranium 4·5 per cent. The quantity of thorium lead per gram of thorium would be 0·0062. The rate of growth would be $4{\cdot}72 \times 10^{-11}$ gram of lead per gram of thorium per year, and the age of the mineral 131 million years. A Ceylon pitchblende (U=72·88 per cent., Pb=4·65 per cent.) has a ratio of lead to uranium of 0·064, giving the age as 512 million years, and Dr. Holmes considers that this is likely to be of the same geological age as the thorite, and to be, of all the Ceylon results, the most trustworthy for age measurements.

It must be remembered that there are two end products of thorium, both being isotopes of lead with the same atomic weight. Thorium-C, an isotope of bismuth, disintegrates dually, 35 per cent. of the atoms expelling first an α and then a β ray, and 65 per cent. first a β and then an α ray. More energy is evolved in the latter mode than in the former, and although the two isotopes have the same atomic mass and the same chemical character, there may be a difference in stability. From analogy with the uranium series, where the same thing is true for radium-C, except that all but a minute fraction of the atoms follow the second mode, it is the 65 per cent. isotope of thorium lead which should further disintegrate, for it is analogous to radium-D.

On the supposition that only the 35 per cent. isotope is stable enough to accumulate, the age of the mineral calculated from the data given would become 375 million years, in nearer agreement with the pitchblende. But the most interesting point is that if we take the atomic weight of the lead isotope derived from thorium as 206·0, and that from thorium as 208·0, and calculate the atomic weight of thorite lead on this basis, we get the same value, 207·74, which I obtained from the density, and Hönigschmid obtained for the atomic weight (207·77).

The question remains, What does the unstable isotope change into? Clearly the rate of change must be excessively slow to account for the apparently complete decay of the radiation of thorium-C. A β or an α ray expelled would result in the production of bismuth or mercury respectively, elements of which I could find no trace in the lead group separated from 20 kilos of mineral. But an α and a β change would produce thallium, which is present in the mineral in amounts that sufficed for chemical as well as spectroscopic identification. On this view, then, this particular lead should give a feeble specific α or β radiation, in addition, of course, to that produced by other lead isotopes present. Circumstances do not permit me to test the

point, but I understand Prof. Stefan Meyer may be making some examination of the radiations of the material, and the results he obtains will therefore be of very great value in deciding this point.

FREDERICK SODDY.

Aberdeen, May 14.

PROF. SODDY having given me the privilege of reading his letter in advance, I should like to take the opportunity of directing attention to the geological age of the thorium minerals of Ceylon, and to a few further statistics bearing on the suggestion that only 35 per cent. of thorium produces a stable isotope of lead. I am indebted to my friend, Mr. E. J. Wayland, late assistant mineral surveyor of Ceylon, for the following provisional classification (in order of age) of the older rocks of the island:—

(6) Newer pegmatites and quartz reefs.
(5) Welipatanwila series of sediments.
(4) Pyroxenites.
(3) Hornblende, zircon, and other pegmatites of the Balangoda series (source of thorite and thorianite). Galle group, and crystalline limestones (?)
(2) Charnockite series (pyroxene granulites).
(1) Older rocks of the basal complex, including gneisses, with monazite and zircon, pegmatitic secretions, and dioritic intrusions.

This classification clears up much of the mystery in which the thorium minerals of Ceylon have hitherto been shrouded. It was thought at first that they belonged to two distinct periods (Nos. (1) and (3) in the above list), and as the figures in the table given below clearly indicate, the belief was curiously supported by the Pb/U ratios. However, it is now fairly established that thorite and thorianite do not occur in the older rocks of the basal complex, and therefore the higher lead-ratios are misleading for age measurement. The only lead-ratios of any value for this purpose are those of *uraninite* and *zircon*, the former being of the same age as the thorium minerals, while the latter belongs to the pre-Charnockite zirconiferous rocks, and is therefore very much older.

In the following table I have recalculated the lead-ratios on the assumption that 35 per cent. of thorium gives lead as a stable end product; or, in other words, that, weight for weight, thorium produces in any given time only one-seventh as much lead as uranium.

Mineral	Pb per cent.	U per cent.	Th per cent.	Pb/U	Pb/(U+0·14 Th)
Thorianite	2·66	10·4	67·1	0·26	0·133
,,	2·30	11·1	60·3	0·21	0·117
,,	2·10	9·5	63·7	0·22	0·110
,,	2·36	11·4	69·5	0·21	0·110
,,	2·42	12·8	69·4	0·19	0·102
,,	2·76	21·0	44·1	0·23	0·100
Thorite	1·28	4·6	62·8	0·28	0·094
Thorianite	2·78	23·0	55·0	0·121	0·090
,,	2·70	23·8	55·9	0·114	0·085
,,	1·87	13·1	67·3	0·14	0 082
,,	2·16	24·8	54·9	0·087	0·066
,,	2·38	27·8	51·7	0·086	0·066
Thorite	0·78	3·5	59·2	0·22	0·065
,,	0·36	1·62	54·4	0·22	0·045
Average	—	—	—	0·18	0·09
Uraninite	4·65	72·88	7·7	0·064	0·063
Zircon	0·092	0·56	0·01	0·164	0·164

(For references see Proc. Geol. Assoc., vol. xxvi., p. 301, 1915.)

The recalculated ratios approach that of uraninite much more closely than do the simple Pb/U ratios, and thus they support Prof. Soddy's suggestion better than might have been expected from analyses of thorium minerals.

I have elsewhere pointed out the unsuitability of thorium minerals for age determination or correlation, and this is particularly so in the case of minerals from the Palæozoic igneous rocks of Langesundfjord, Norway. Mr. Lawson and myself based our former conclusion that lead could not be the end product of thorium largely on analyses of these minerals. However, I have now recalculated the ratios on the assumption that thorium has one-seventh the lead-producing power of uranium, and it is satisfactory to find that, when thorium is less than five times as abundant as uranium, the ratios agree as closely on this calculation as do the simple lead-ratios. When thorium is more than five times as abundant as uranium neither set of ratios gives any approach to agreement, although the minerals from any one locality agree among themselves. (For the analyses referred to, see *Phil. Mag.*, vol. xxviii., p. 832, 1914; and Proc. Geol. Assoc., vol. xxvi., p. 302, 1915). Thus, having found from experience that the pernicious and irregular behaviour of thorium minerals is apt to be very misleading, I must admit that their evidence is worthless in the absence of atomic weight determinations.

An atomic weight determination by Richards and Lembert on lead from Ceylon thorianite may be used (in the same way as Prof. Soddy has used his own and Hönigschmid's measurements) to test the question of end product. The thorianite referred to contained 60 per cent. Th and 20 per cent. U, and therefore if the whole of the thorium disintegrated into lead, the atomic weight should be 207·32; whereas if only 35 per cent. of the thorium formed lead, then the atomic weight should be 206·73. Remembering that the presence of original lead is implied by the high lead-ratios of the above table, and that such exogenous lead would raise slightly the latter figure, one finds with pleasure that the atomic weight actually found was 206·82. Prof. Soddy's suggestion thus affords a happy compromise as to the end products of thorium; there is already accumulative evidence in its favour, and as yet there is none against it. In particular it is satisfactory to observe that if the suggestion should receive decisive demonstration, then the estimates of geological time already based on lead-ratios are not appreciably affected.

ARTHUR HOLMES.

Imperial College of Science and Technology, S.W.7, May 16.

THE SUSPENDED PUBLICATION OF THE "KEW BULLETIN."

WE learn with astonishment that it appears to have been decided to suspend the publication of the *Kew Bulletin*. We say "appears," because it seems almost incredible to anyone with a sense of proportion of the issues involved that such an unfortunate step can really be seriously contemplated. It is, however, announced that the Controller of H.M. Stationery Office (the publisher) has been instructed to form a priority list of printed books and to defer the publication of everything which is not essential, that it has been ruled that the *Kew Bulletin* is not essential, and that its publication has therefore been suspended. It would be of interest to know what steps were taken to enable a considered judgment to be arrived at as regards this useful publication, and to what extent those responsible for its discontinuance are competent to form a just opinion on the merits of what is mainly a technical journal.

The objects served by the *Kew Bulletin* since

its inception in 1887, partly as the result of a suggestion made in the House of Commons, are manifold and far-reaching. Not only does it serve as the official organ in which the results of scientific activity at Kew are largely given to the world; it also serves the very important function of placing at the disposal of the economic and scientific gardens in India and the Colonies the latest facts in economic botany that may be of importance to them.

It must be remembered that Kew is the central institution of a great system of smaller institutes established in every region of the Empire, and that these institutes exist to further the material prosperity of the countries in which they are situated. The principal sources of wealth in most of our foreign possessions consist for the most part of vegetable products, and it is difficult to overrate the importance of keeping the botanical stations, remote as they mostly are from the main channels of current scientific work, continually informed on relevant matters which from time to time reach the great clearing-house at Kew. It must be evident to everyone that any action which tends to lower the efficiency of these institutes of economic botany must operate in a manner detrimental to the material interests of the country or countries thus affected. It is difficult to believe that either the India Office or the Colonial Office, which are both concerned with the functions that only Kew is in a position effectively to discharge, can have been consulted in the matter, or, if they had been so consulted, that they could have approved of a step so unsound alike on economic and financial grounds.

Furthermore, it should not be forgotten that Kew receives a good deal from other countries by way of exchange for the *Bulletin*, which it is now proposed to suspend. We understand that enemy countries, although their colonial interests are as nothing compared with our own, have, nevertheless, not seen fit to interfere with the continued publication of their own corresponding journals.

In fact, the same official lack of appreciation of the importance of scientific inquiry and research which was a matter of common knowledge amongst our competitors before the war still continues to sap the foundations of our recognised claims to our foreign possessions, which should largely rest on the encouragement of their material development on sound economic, and therefore on scientific, lines.

It is earnestly to be hoped that the action apparently taken may be reconsidered before we allow ourselves, as a colonial Power, to be made ridiculous, and as a business people to stand committed to the policy of penny wise and pound foolish.

Unless we learn in time the lessons which this war is enforcing on every side, namely, that the way of prosperity in the future lies in promoting scientific knowledge and in utilising the results of scientific investigation, it will make but little difference in the long run whether we win the war or not. For we should assuredly lose in the far more serious conflict that is certain to follow it, a conflict in which the claim for superiority will be inexorably decided against any nation which refuses to take full advantage of that knowledge which is power in a sense far more real than ever before. J. B. F.

CONSERVATION OF WILD LIFE IN CANADA.

IN spite of the energy with which the Canadians are devoting themselves to the prosecution of the war and its successful conclusion, the necessity of conserving our natural resources is not being forgotten. Not the least important of these resources is the wild life of the Dominion. The economic value of the wild life to the country is fully realised by the Canadian Government. On this account it is taking steps to conserve, while it is still able to do so, the wild life upon which many of its economic interests depend. The necessity of greater protection for the species of migratory birds which are important to agriculture as insect destroyers was mainly responsible for the conclusion of the recent international treaty with the United States for the protection of migratory birds in Canada and the United States. This treaty is undoubtedly the most important and far-reaching measure ever taken in the history of bird protection. The full text of the treaty and the circumstances responsible for its consummation are given in an article by the present writer in the *Agricultural Gazette of Canada* for December last. In addition to the protection of insectivorous birds, the treaty provides that no species of migratory wild-fowl, such as ducks, geese, or shore-birds (plovers, sandpipers, etc.), shall have a longer open season than three and a half months, and the open seasons are so restricted as to prevent the killing of the birds in the breeding season. Close seasons for periods of several years are provided for certain species of birds the continued existence of which has become seriously menaced.

In the north-west territories the fur-bearing animals and such larger animals as the barren-ground caribou and musk-ox constitute the only available natural resources, and the existence of the present and future populations of large portions of that unorganised territory largely depends on the presence of such wild life. Steps are therefore being taken to ensure the conservation of the northern wild life by improved legislation. In order that this problem may be carefully studied with a view to the adoption of an adequate policy for the protection and use of the wild-life resources of the country, the Canadian Government has recently appointed an inter-departmental Advisory Board on Wild Life Protection, consisting of the following:—Mr. James White, Assistant to the Chairman of the Commission of Conservation (chairman); Mr. D. C. Scott, Deputy-Superintendent of Indian Affairs; Mr. J. B. Harkin, Commissioner of Dominion Parks; Dr. R. M. Anderson, in charge of mammals in the National

Museum; and the present writer, who is secretary of the Board.

The Dominion and Provincial Governments have been active in the establishment of animal parks for the protection of game and non-game mammals and birds, and many thousands of square miles of territory have now been reserved as animal refuges, where hunting is absolutely prohibited.

The successful effort of the Canadian Government in preventing the extermination of the American bison, or buffalo, is noteworthy. The original herd of 750 buffalo that the Government purchased in the United States in 1907 and placed in a special enclosed buffalo park of 168 square miles at Wainwright, Alberta, has now increased to more than 2400, and altogether above 3000 buffalo are now under Government protection, including the wild herd of about 500 head in the Peace River region south-west of Great Slave Lake. With the view of ascertaining the possibilities of the buffalo in relation to agriculture, the Canadian Department of Agriculture is now carrying on experiments in crossing the buffalo with domestic cattle, as the cross-bred animals, like the buffalo, are so admirably suited to withstand the most rigorous conditions of a northern environment and produce excellent beef and superior robes.

A report published by the Commission of Conservation on the fishes, birds, and game of Canada last year gives an excellent account of the manner in which these problems are being dealt with in Canada. Constituting as Canada does the last stronghold of the big-game animals of the North American continent, it is hoped and believed that we shall be successful in preventing the reduction to the point of extermination of the many forms of wild life of interest and importance alike to the settler, the sportsman, and the zoologist.

C. GORDON HEWITT.

PROF. JOSEPH RIBAN.

PROF. JOSEPH RIBAN, honorary professor of the Faculty of Sciences of Paris, who has just died at the ripe age of eighty, was one of a type of French chemists which is fast disappearing. Born at Montpellier, he was originally destined for a career in medicine, but under the influence of Balard, the discoverer of bromine, he was led to interest himself in problems connected with pharmacological chemistry, and took up the study of the toxic principle of redoul (*Coriaria myrtifolia*), which he found to be a glucoside and named corianmyrtine. His work on the physiological, chemical, and physical properties of the new substance occupied him during the greater part of 1864, and the results appeared in a couple of memoirs which were published in the *Journal de Pharmacie* and in the Bulletins of the Chemical Society of Paris. Although he continued to follow medicine, Riban was more and more attracted to chemistry, and his nomination as professor of chemistry and technology at the Ecole Normale of Cluny eventually settled his career. In 1869 he joined his old master Balard at Paris as *préparateur* of his course at the Collège de France.

The Franco-German War interrupted his chemical studies, and during the siege of Paris he was a zealous collaborator of Alphonse Guérin at the military hospital in the Rue des Récollets. On the termination of hostilities he was able to resume his chemical work, and a number of papers appeared in rapid succession, on the products of the condensation of valeric aldehyde, and on aldehydes condensed by the elimination of water, known as *aldanes*, on the terpenes and their chlorohydrates, on terebene, and on camphene. Riban's investigations in what is confessedly one of the most intricate and difficult fields of organic chemistry attracted considerable attention at the time of their publication. They gained for him his degree of doctor of physical sciences, and eventually, in 1875, the Jecker prize. The first samples of synthetic camphor arising out of these researches were shown in the Exhibition of 1878.

Riban now became associated with Berthelot at the Collège de France, and was transferred to the Sorbonne, where he became assistant-professor of quantitative chemical analysis. He practically abandoned inquiry in organic chemistry, devoting himself more particularly to general problems of applied chemistry, especially to questions of hygiene. In addition to his work as director of the analytical laboratories at the Sorbonne, he lectured at the Ecole des Beaux-Arts, and was named a member of the Conseil d'Hygiène. These various public duties left Riban little time for original research, but he published a number of notes and minor communications on compounds of phosphine and on the decomposition of metallic formates and acetates in presence of water, as well as some papers relating to eudiometry and analytical chemistry. He was an active contributor to the "Encyclopédie Chimique" and to the "Dictionnaire de Chimie," and in 1899 published a treatise on electrochemical analysis which enjoyed a considerable reputation.

Riban became a vice-president of the French Chemical Society in 1898, and a vice-president of the Conseil d'Hygiène in 1899. He was a careful, conscientious teacher, distinguished for the clarity and simplicity of his exposition, and a painstaking and accurate experimentalist whose work rests upon a solid and durable foundation.

NOTES.

THE valuable article on rhubarb which appears elsewhere in the present issue was prepared for the *Kew Bulletin*, the publication of which has been suspended on the ground of shortage of paper. When we see the waste of paper used in Parliamentary Reports, National Service propaganda, and by Government departments generally, and place this by the side of the amount required for the continued publication of such a periodical as the *Kew Bulletin*—Imperial in its scope and influence—we begin to despair that our State

officials will ever possess true standards of value in matters pertaining to science. The subject is dealt with in an article on another page; and all we wish to say here is that we are glad to accord the hospitality of our columns to a contribution intended for the *Kew Bulletin*, and that we earnestly hope action will be taken to secure the continuance of a publication which is more essential now than ever it was. So many misleading statements have recently been made about rhubarb that such an accurate account of the plant as is given in the present article, if made widely known to the public, should save much suffering and needless loss of life.

WE notice with much regret the announcement of the death on May 18, at seventy-eight years of age, of Sir Alexander R. Binnie, past president of the Institution of Civil Engineers, and from 1890 to 1902 chief engineer to the London County Council.

THE late Lord Justice Stirling's herbarium, consisting chiefly of about 6000 varieties of mosses and liverworts from many parts of the world, has been presented by Lady Stirling to the Tunbridge Wells Natural History Society.

THE Canadian Government has recently appointed Dr. C. Gordon Hewitt to be consulting zoologist, in addition to his duties as Dominion entomologist and chief of the entomological branch of the Department of Agriculture. The duties of the office will be to advise in matters relating to the protection of birds and mammals and the treatment of noxious species.

THE death is announced, in his eighty-fifth year, of Dr. Ephraim Cutter, a distinguished American microscopist and inventor of many surgical and gynæcological instruments. He was a pioneer in American laryngology, and had studied the morphology of raw beef since 1854. In 1894 he discovered the tuberculosis cattle test. He was an expert in food values, and was the author of more than 800 contributions to the literature of medical science.

AN association having the title, Society of Industrial Chemistry, has recently been formed in France. The honorary president of the new society is Prof. Haller, of the Institute, and its object is the development of the chemical industry in France in order that it may be given that prominence which will be necessary in the after-war struggle. The society comprises manufacturers, engineers, and chemists. The headquarters of the society are at 49 rue des Mathurins, Paris.

THE Franklin medal of the Franklin Institute, Philadelphia, has been awarded to Dr. H. A. Lorentz, For.Mem.R.S., president, Royal Academy of Sciences, Amsterdam, and professor of mathematical physics, University of Leyden. The Franklin medal has also been awarded to Admiral D. W. Taylor, Chief Constructor, Chief of Bureau of Construction and Repair, United States Navy. The medals were presented on May 16, when an address was given on "The Science of Naval Architecture" by Admiral Taylor.

AT the annual meeting of the Royal Geographical Society on Monday the medal awarded to Mr. G. G. Chisholm by the American Geographical Society was presented to him by Mr. Page, the United States Ambassador. The Royal medals and other awards announced in NATURE of March 22 were presented by the president, Mr. Douglas W. Freshfield. The president referred to work being done by geographers in different parts of the war area, and he remarked:—"In a hero of the recent sea-fight against odds off Dover—a fight that recalls the glorious traditions of the days of Queen Elizabeth—we are proud to recognise an Antarctic explorer, the second in command of Capt. Scott's last expedition, Capt. Evans. It is the same energy and spirit that lead men to face the Antarctic blizzard or the foe that walks in darkness off our own coasts." Sir Thomas H. Holdich has been elected president of the society in succession to Mr. Freshfield.

WE learn with deep regret that 2nd Lieut. H. E. O. M. Dixon, Seaforth Highlanders, has died of wounds in France. The son of the Rev. J. Murray Dixon, of Smithland Rectory, Loughborough, he was born in 1885. His ambition, which showed itself when he was quite young, was to excel as an artist, and birds formed the favourite theme for his pencil. Though he modelled his work largely on that of Archibald Thorburn, for whom he entertained an immense admiration, he showed promise of developing a style of his own. He was especially keen on game-birds, but wildfowl of all kinds fascinated him, and he was never so happy as when tramping the hills of Scotland after grouse and deer. His many friends will read with pride the comments of his Colonel: "He was a brave and cool leader of men." He fell on April 9, when rallying his men for the attack on the German second line of trenches, shot down by machine-gun fire, to die of his wounds on the following day. By his death ornithology has lost a devoted disciple, but his work and his memory will ever be cherished among us.

THE appointment is announced of a Civil Aerial Transport Committee, to inquire into civil aerial communications after the war; the committee is constituted as follows:—Lord Northcliffe (chairman), Major Baird (deputy-chairman), the Duke of Atholl, Lord Montagu, Lord Sydenham, Mr. Balfour Browne, Mr. A. E. Berriman, Mr. G. B. Cockburn, Mr. G. Holt-Thomas, Mr. Claude Johnson, Mr. Joynson-Hicks, Mr. F. W. Lanchester, Lieut.-Col. M. O'Gorman, Major-Gen. Ruck, Mr. J. S. Siddeley, Mr. T. Sopwith, Mr. H. G. Wells, Mr. H. White-Smith, Mr. W. Tyson Wilson, Sir Laurence Guillemard, Col. J. W. Pringle, the Earl of Drogheda, Mr. G. E. A. Grindle, Mr. G. E. P. Murray, Sir Thomas Mackenzie, the Rt. Hon. W. P. Schreiner, and Capt. Vyvyan. Brig.-Gen. Brancker will represent the R.F.C. The Meteorological Office has also been asked to name a representative, and one or two additional names will be announced later. Mr. D. O. Malcolm will be the secretary of the committee, and the offices will be at Winchester House, St. James's Square.

As already announced, the annual congress of the South-Eastern Union of Scientific Societies is to be held this year in London, in the lecture hall and rooms of the Linnean Society, on June 6–9. Dr. William Martin, formerly general secretary of the union, is the president for the year, and will take for the subject of his address on June 6 "The Application of Scientific Method." Among the many interesting items in the programme of the congress, the following papers and addresses may be mentioned. On June 7 Dr. A. Smith Woodward, "Vertebrate Remains from London Excavations," and Mr. E. A. Martin, "Some Skulls and Jaws of Ancient Man, and his Implements." On June 7, too, members of the congress are invited to the Hooker lecture of the Linnean Society by Prof. F. O. Bower. On June 8 Prof. E. W. MacBride, "Are Acquired Characters Inherited?"; Dr. G. A. Boulenger, "Reptiles in Captivity"; and Dr. B. Daydon Jackson, "Notable Trees and Old Gardens of London." On June 9 Dr. J. S. Haldane,

"Abnormal Atmospheres and Means of Combating Them," and Prof G. S. Boulger, at the Chelsea Physic Garden, "The Associations of the Garden with the History of Botany." During the meeting there will be several visits to places of scientific interest. All subscriptions must be sent direct to the hon. general secretary, Mr. H. Norman Gray, 334 Commercial Road, London, E.1.

WE regret to record the death of Mr. Benjamin Hall Blyth on May 13, in his sixty-eighth year. An account of his career appears in *Engineering* for May 18, from which we take the following particulars. Mr. Blyth served his pupilage to civil engineering with Messrs. B. and E. Blyth in Edinburgh, and in 1871 became a member of the firm of Messrs. Blyth and Cunningham. The work undertaken by this firm grew very rapidly—between 1871 and 1877 Parliamentary plans for work estimated to cost 6,000,000*l.* passed through its hands. Mr. Blyth joined the Institution of Civil Engineers in 1877, became a member of the council in 1900, and was elected president in 1914. He was consulting engineer to the Caledonian, the North British, and the Great North of Scotland Railways. He was responsible for the two great stations, the Central in Glasgow and the Waverley in Edinburgh. Mr. Blyth was also engaged in dock enlargement and improvement at Grangemouth and at Methil; both these docks are fully equipped with the latest appliances for handling material. He was called upon to advise the leading corporations in Scotland, and was much in demand as an expert witness, both in Scotland and at Westminster. He contested East Lothian unsuccessfully three times. He was chairman of the Edinburgh and District Tramways Company, director of the National Bank of Scotland and of the Edinburgh Life Insurance Company, and governor of the Merchiston Castle Schools and of the Royal Hospital for Sick Children. He is survived by an only daughter.

BOTANICAL science has suffered a serious loss through the death of Ruth Holden, an American botanist of great promise. Miss Holden was born at Attleborough, Massachusetts, in 1890, and graduated M.A. of Harvard in 1912. She took up palæobotanical research under Prof. Jeffrey, of Harvard, and in 1913 came to this country as a travelling Harvard fellow in order to devote herself more particularly to the anatomical investigation of Mesozoic Conifers. She became a post-graduate student of Newnham College, and was afterwards elected to a fellowship. Impelled by her love of strenuous work and by her strong conviction of the justice of the cause of the Allies, Miss Holden temporarily relinquished her scientific career at the Cambridge Botany School and threw herself with characteristic energy into nursing. In December last she went to Russia with the first of the Millicent Fawcett medical units, and earned the unstinted praise of the administrator of the unit by her self-sacrificing work in Petrograd, Kazan, Galicia, and in various parts of Russia. After partially recovering from an attack of typhoid fever, she died from meningitis at Moscow on April 21. Miss Holden had published several papers on palæobotany, both in America and England, and shortly before her departure for Russia she completed an account of a new Cordaitalean genus from India. She was an exceptionally keen and able investigator, who endeared herself to all with whom she was associated by her outspoken candour, her sense of humour, and her wonderful power of overcoming difficulties, both in the way of fulfilment of her plans of scientific work and in surmounting obstacles which confronted her in her endeavours to obtain employment as an American citizen with a British medical unit.

MR. J. V. DUPRÉ, whose death we regret to record, had a distinguished scientific career, and did much valuable work in connection with explosives. After leaving Merchant Taylors School, he took the three years' course in engineering at the City and Guilds of London Technical College, South Kensington, and gained the college diploma. After leaving college he worked for about a year in the laboratory of the late Dr. A. Dupré, F.R.S., where he gained his first experience of explosive work, in which he evinced the greatest interest. He then obtained an entrance into Messrs. Vickers, Ltd., and went through their shops at Erith, afterwards working for six years in their drawing office at Westminster. During the whole of this time he lived with his brothers, then chemical advisers to the Explosives Department of the Home Office, having succeeded their father in this position, and thus kept in closest touch with explosive chemistry, practical and applied. He then went to Canada, where he worked as chemical assistant to Dr. Lynde, of the McGill University, at St. Anne's. Soon after the outbreak of war he obtained an appointment in connection with the Explosives Department of the Munitions Board, Canada, and superintended the erection and working of a number of explosives factories in various parts of Canada. In all this work he showed such a grasp of his subject that in October, 1916, he was appointed chief chemical adviser, and finally technical adviser also, posts he filled with the greatest success. During January of this year he had a serious breakdown owing to overwork, and on convalescence was sent by the board to Old Point, Comfort, Virginia, to recuperate, but caught a chill on the journey, which developed into rheumatic fever, and finally into pneumonia, which ended fatally on March 13.

FEW men were so well known in pharmaceutical circles, and few so highly respected, as Mr. Peter MacEwan, who died on May 16, in his sixty-first year, and for the past eighteen years had held the responsible post of editor of the *Chemist and Druggist*. Mr. MacEwan received his pharmaceutical training in Scotland, and evinced very early in his career a distinct inclination towards the scientific side of pharmacy. When only twenty-six years of age he was appointed secretary in Scotland of the Pharmaceutical Society, and in that capacity found time and scope for the development of his scientific tendencies and ability for organisation. After a comparatively short time he joined the editorial staff of the *Chemist and Druggist* in London, succeeding the late Mr. A. C. Wootton in 1899. He published numerous papers dealing chiefly with the chemical aspect of pharmaceutical problems, and also devoted much attention to pharmaceutical politics. His judgment was keen and accurate, and his criticisms of the prevailing policy were frequently advanced with remarkable vigour. There was scarcely a branch of pharmacy in which he did not possess some special knowledge, and, being one of the kindliest and most generous of men, an appeal to him for assistance in any subject was seldom made in vain. He was a constant attendant at pharmaceutical meetings, and his contributions to the discussions almost invariably threw new light on the subject under consideration. His health had been for some time indifferent, but his death, which was due to apoplexy, was sudden. The funeral, which took place on Saturday last at Marylebone Cemetery, Finchley, was attended by many well-known pharmacists, including the president and registrar of the Pharmaceutical Society, and also by representatives of other learned societies. By his death pharmacy has sustained a distinct loss, and his absence from pharmaceutical gatherings will be painfully felt.

WE are indebted to the *Lancet* for the following extracts from an obituary notice of Prof. Landouzy, whose death, on May 10, after a long illness, we announced last week. Louis T. J. Landouzy was born at Rheims in 1845, the son and grandson of medical men. Beginning his studies in the place of his birth, he went to Paris in 1867 to complete them, becoming hospital resident in 1870, and steadily ascending the professional ladder until his appointment as physician to the Hospital Laennec in 1890. Three years after this he accepted the chair of therapeutics at the faculty of medicine in Paris, bringing with it the membership of the Academy of Medicine. In 1907 he was chosen by the faculty to be its dean, and in 1912 he was elected a member of the Institute. His most recent honour was the award of a gold medal for his work on infectious diseases by the Ministry of the Interior. Landouzy had long become one of the familiar figures of contemporary medicine both in France and abroad. Endowed with a great capacity for work, associated with remarkable physical activity, he accomplished a very large amount of scientific work bearing on a variety of important questions. But it is in connection with tuberculosis that his name will be best remembered. In the struggle against tuberculosis as a social disease Landouzy was ever to the front. He was delegate to the several international congresses on tuberculosis, and at Washington in 1908 expressed the belief that the centenary of Pasteur would witness the final extinction of tuberculosis. If he had lived to complete it, his last work would have been devoted to the organisation of an anti-tuberculosis campaign in the Army and to the invaliding of the tuberculous soldier. He was present in London at the last International Medical Congress of 1913, when he read a paper on thermal treatment and spoke as the official delegate at the dinner given by Lord Beauchamp on behalf of the British Government.

DURING the winter months, as Mr. Miller Christy has stated in a recent paper (Quart. Journ. Roy. Meteor. Soc., vol. xlii., 1916, pp. 269, 275), the sound of gun-firing in Flanders and France is rarely heard in the south-east of England. The conditions are now becoming favourable to audibility. According to a correspondent of the *Times* (May 14), the air-waves resulting from the heavy bombardment of Zeebrugge on the morning of May 12 were heard and felt to an unusual degree at Dover, Deal, and other places on the south-east coast. Dover lies eighty miles to the west of Zeebrugge, and there was a light north-easterly wind at the time. Yet "residents in villages several miles inland were awakened by the noise, the houses on the higher ground especially feeling the vibration." We have also received an interesting letter from Dr. H. C. L. Morris, of Bognor, in which he states that the sound of distant gun-firing was heard at that place, while he was out of doors, from 11 to 11.30 p.m. on May 13. He describes the sound as "a continuous rapid vibratory percussion, coming up from the south-east. . . . The sounds varied in intensity, and as near as I could judge a hundred distinct reports were heard to the minute. There was a very light land breeze from the north-west at the time." The sound-waves evidently came from a very distant source, possibly from the neighbourhood of Arras, which is 160 miles from Bognor.

ON April 2, 1916, shortly after 2 p.m., a great explosion occurred in a munition factory at Faversham. Several references are made to this explosion in the descriptions of the East London explosion of January 19. The observations are all from places to the north of Faversham. The sound of the explosion was heard at Maldon (30 miles), Dunmow (45 miles), and Little Bardfield, near Braintree (49 miles)—all places in the silent zone of the East London explosion; also at Diss (75 miles) and Norwich (92 miles). The air-waves shook windows at Little Bardfield, Felsham (60 miles) and Elmswell (64 miles) near Bury St. Edmunds, and Newmarket (68 miles)—in the silent zone of the East London explosion; also at Ufford, near Woodbridge (60 miles), Diss, Wreningham (88 miles) and Haddiscoe (89 miles) near Norwich, Norwich, and near Aylsham (104 miles). There is no evidence of a silent zone in this explosion, but the number of observations summarised above is, of course, too small either to prove or to disprove its existence.

IT appears from the annual report of the Decimal Association for 1916, which has just been received, that considerable progress was made during the year in the movement for the decimalisation of the coinage and weights and measures. Numerous representative public bodies have passed resolutions in favour of the proposals; as, for example, the executive council of the County Councils Association, which has expressed the view that it is desirable in the interests of education, commerce, manufactures, and trade that the decimal system of coinage and weights and measures should be as speedily as possible brought into general use in the United Kingdom, and that the system should be introduced into the curricula of the various schools as a necessary part of arithmetic. In this connection it may be mentioned that the Incorporated Association of Headmasters has also invited its members to support the proposals, and that the Lancashire and Cheshire division of that body has formed a committee for the purpose of suggesting ways of discovering and overcoming existing objections to the introduction of the metric system. British consuls abroad have continually directed attention to the necessity of adopting the metric system, and to the loss of orders and contracts involved in the retention of our present weights and measures. The recommendations of the Dominions Royal Commission were very sympathetic as regards the metric system of weights and measures and decimal coinage. The Commission was of opinion that the termination of the war would bring with it an unequalled opportunity for securing this much-needed reform, and that the Imperial and Colonial Governments should then co-operate to establish throughout the Empire a uniform coinage based on the decimal system and uniform weights and measures based on the metric system.

THE Philadelphia Museum has recently acquired a collection of specimens of the arts and crafts of the Bagobo, a people inhabiting the mountains of Mandanao, between the crest of the range which culminates in the volcanic Mount Apo, the highest peak in the Philippines, and the waters at the western side of the head of the Gulf of Davao. This is described by Mr. R. W. Hall in the *Museum Journal*, vol. vii., No. 3, for September, 1916. In December, when Orion appears in the sky, there is a magical ceremony intended to promote the growth of rice, their staple food. Though the fact has been questioned, there seems little doubt that at this sowing rite a slave victim was bound and his body hacked in pieces by the celebrants. It does not appear that, as in the Khond rite described by Sir J. Frazer, the flesh was actually buried in the fields. But this was possibly part of the rite in its primitive form.

IN the *Indian Journal for Medical Research* for January (vol. iv., No. 3) Capt. Knowles and Capt. Cole publish a study of the entamœbic cysts of in-

testinal amœbæ of man. They point out that divergent views exist as to (*a*) the differentiation of species of intestinal amœbæ, (*b*) the pathogenicity of the different species, and (*c*) the differentiation of species when encysted. They state their principal conclusions as follows: *Entamoeba tetragena* is usually regarded as identical with *E. histolytica*, and our results confirm this view. *E. minuta* is usually regarded as the pre-cyst of *E. histolytica*, whereas we have found *minuta* forms associated with both *E. coli* and *E. histolytica*. Where the prevalent type of organism was *E. minuta* it was commonly in association with 8-nucleate cysts, and resembled *E. coli*. We believe that these "different species" are all one and the same organism. The paper is illustrated with two excellent coloured plates.

THE method of measuring a small electric current, as, for example, the ionisation current through a gas, by the rate of leak of the charge on an electrometer through a known high resistance, has proved so convenient that many experimenters will welcome a paper by Dr. W. F. G. Swann and Mr. S. J. Mauchly on a method of constructing a high resistance of the Bronson type, for which Ohm's law is applicable, which appears in the March number of *Terrestrial Magnetism and Atmospheric Electricity*. A small quantity of ionium, which was chosen as the most suitable radio-active material, is placed in a shallow depression in the upper face of a brass plate and covered with sheets of mica and silver foil. The plate rests on the bottom of the ionisation chamber, through the top of which an insulated tube carrying a circular electrode projects. Through this tube a rod passes which carries a smaller plate, and the distances of both plates above the ionium plate can be varied. The metal surfaces within the chamber are all silver-plated. When the upper plate is 4·6 cm. and the lower 1 cm. above the ionium plate, the resistance of the cell is constant up to a potential difference of 4 volts, owing to the usual decrease of conductivity being compensated by the action of the δ rays from the metal surfaces.

IN the adoption of any scheme which runs counter to habits and prejudices, and with which obvious advantages and disadvantages are connected, as in the substitution of "Summer Time" for the normal and uniform method of time reckoning, many suggestions will be made with the view of improving the mechanism and diminishing the inconveniences. M. Désortiaux, of Tulle, a retired French engineer, is early in the field with a pamphlet, "La Réforme rationnelle de l'heure" (Gauthier, Villars), urging some drastic proposals that seem calculated to make confusion worse confounded. He objects to the abrupt alteration of the clock-hands twice a year, involving sudden interruptions of time-reckoning, and recommends a number of small alterations, the maximum being seven minutes, which he thinks could be introduced imperceptibly and without dislocation of our habits, by arrangement with the railways and other public indicators of time. In each week of January the clock is to be advanced five minutes. On two days of each week in February, April, and May the clock will be accelerated six minutes, and in March seven minutes. In June there will be no alteration, and in the second half of the year there will be retardations of similar amount, to restore the clock time to normal condition in January. The alteration effected by these small increments is far more considerable than in the plan that has obtained legislative sanction. The accumulative effect at maximum is 3·57 hours, one object of the ingenious proposer being to make the watch indicate approximately the same hour at sunrise. This arrangement discloses one weakness of the plan. It takes no account of latitude, and though the author admits the necessity of agreement between countries that have conterminous borders, he does not consider that the inhabitants on the Belgian border would be differently affected from those on the Italian. Again, it is strange that one who clearly perceives the annoyance caused by the sudden change of an hour, with its tendency to disarrange transport services, can suppose that a long-suffering public would endure a series of irritating interruptions twice a week for many months of the year. But having sanctioned a tampering with the uniform record of time, many utterly impracticable methods will be proposed with the benevolent intention of reducing the inconvenience to a minimum.

IN the April issue of the *Quarterly Review* will be found a well-informed article by Prof. W. J. Ashley on German iron and steel treated from the point of view of its commercial as distinct from its technical development. The syndication movement in Germany began to achieve continuous and substantial success when in 1892 the pig-iron producers came together, and in 1893 the Westphalian Coal Syndicate was formed. This example was followed by various branches of the steel trade. These combinations began with a mere price agreement; then they had to apportion the sale; and afterwards they concentrated the marketing of their commodity in a common selling organisation. Prof. Ashley then traces the further development of these "cartels" and their amalgamation into the "Stahlwerksverband," the great Steel Syndicate, which has commanded the whole position ever since. In order effectively to regulate price it limits each of the constituent concerns to a prescribed quota of a defined total output and concentrates all the sales in a central office. The growing cost of plant makes it very difficult for new competitors to start up from outside. In Germany the experts consider that no new steel works can profitably be put down which have an output capacity of less than 400,000 tons. Finally, the system of bounties payable to home manufacturers in respect of their export trade is explained.

THE formation of "ground ice," or "anchor ice," at the bottom of running streams occurs sometimes in this country, and forms the subject of an article in *Engineering* for May 11, by Mr. J. MacAlister, assistant engineer at the Greenock Waterworks. Ground ice has been experienced at Greenock in the "Cut," an open aqueduct some five miles long and situated about 500 ft. above sea-level. The water has a velocity of about 3 ft. per second, and ice sometimes forms at the bottom, thereby raising the surface-level of the water. Careful watching is required, as the slabs of ice sometimes take up such positions during the process of release as lead to overflow of the water. Despite other theories, Mr. MacAlister is inclined to think that the formation of ground ice in this channel, which has a rough bottom, is due to the cooling of the whole mass of water and the ice first forming in the comparatively still water encountered in the lee of stones, etc. The process may be, and probably is, accelerated by radiation, as the portions of the aqueduct where the ice usually forms first are situated at comparatively open spaces, and have low banks. Towards the end of January this year, for the first time in the history of some of the reservoirs, the formation of ground ice was general throughout the Greenock Waterworks. The author describes the various measures taken to remove the consequent ice blockages.

OUR ASTRONOMICAL COLUMN.

TWO ECLIPSING VARIABLE STARS.—The eclipsing variables RV Ophiuchi and RZ Cassiopeiæ have recently been investigated in great detail by R. S. Dugan (Contrib. Princeton Observatory, No. 4). In RV Ophiuchi, which is of spectral type A, the brighter star is found to emit five times as much light as the other, though having only two-thirds the diameter of the fainter component. During the total eclipse at primary minimum the star is 2·03 mag. fainter than at maximum, while the loss during the annular secondary minimum amounts to 0·11 mag. On the supposition of equal masses, the densities of the brighter and fainter components are respectively 0·24 and 0·06. In RZ Cassiopeiæ, which is also of spectral type A, the eclipse at primary minimum is not total, only eight-tenths of the smaller brighter component being covered by the larger fainter component, the star then being 1·59 mag. fainter than at maximum. At secondary minimum the loss of light is 0·06 mag. The smaller star emits seven times as much light as the larger, and its surface brightness is twelve times as great. The distance between the centres is three and a half times the radius of the fainter star, and probably between five and six times the radius of the sun. The brighter component is from two and a half to six times as dense as the fainter.

The new elements for the occurrence of eclipses in the two stars are:—RV Ophiuchi, 1913, Feb. 9d. 19h. 33·4m.+3d. 16h. 29m. 27·75s. E−2m. sin 0·22° E; RZ Cassiopeiæ, 1906, May 24d. 10h. 6·0m.+1d. 4h. 41m. 9·6s. E+10m. sin (12°+0·068° E).

Mr. Dugan points out that every eclipsing variable which has been observed with sufficient care and persistence shows a measurable secondary minimum, indicating that the companion is always a luminous body.

NEW ZEALAND TIME SERVICE.—Mr. C. E. Adams, the Government Astronomer for New Zealand, has recently issued particulars of the new arrangements which have been made for time-signals at the Hector Observatory. Accurate time-signals are given by three electric lights mounted vertically on the observatory flagstaff; the lowest light is green, and is 30 ft. above the ground; the middle light is red, and is 36 ft. above the ground; the highest is white, and is 42 ft. above the ground. The green, red, and white lights are switched on at fifty minutes, ten minutes, and five minutes to the hour respectively, and the signal is given by extinguishing all three at the exact hour. The signal is given in this way at G.M.T. 20h., 21h., and 22h., corresponding to New Zealand civil mean time 19h. 30m., 20h. 30m., and 21h. 30m. Arrangements have also been made for providing time-signals by telephone, telegraph, or wireless telegraph.

STONYHURST COLLEGE OBSERVATORY REPORT.—The results of the astronomical, meteorological, and magnetical observations made at Stonyhurst College Observatory during 1916 have been issued in the usual form by the Rev. Father Sidgreaves. The various observations are conveniently tabulated, and interesting comparisons with previous records are given. The solar surface was observed on 215 days, and the mean disc area of the spots, in units of 1/50ooth of the visible surface, was found to be 4·52, as compared with 4·51 for 1915, 0·82 for 1914, and 0·04 for 1913. Detailed drawings of faculæ were made on twenty-nine days during the summer, and it is hoped that these may be of value for comparison with spectro-heliographic records in hydrogen and calcium light. The spectrum of *o* Ceti was photographed at the two maxima which occurred during the year. The duration of bright sunshine was 205 hours short of the yearly average.

CONTINUED AND SPECIALISED EDUCATION IN ENGLAND AND WALES.

THE Board of Education has taken advantage of the widespread interest in education awakened by the events of the war to consider in what measure, by a reconsideration and a revision of its regulations, it can encourage a much fuller development of further education in its various forms, especially in those which fall outside the sphere of the secondary school and of the university.

The Board has accordingly had under review the facilities for further education which, since and prior to the Education Act of 1902, including the results of the Technical Instruction Act of 1889, which was almost entirely responsible for the establishment of technical schools in the kingdom, have been provided by the local authorities, and it has accordingly issued a "Draft of Proposed Revised Regulations" upon which suggestions and criticism are invited. The draft embodies the experience and results of what in large measure is already to be found in successful operation, especially in the vigorous industrial centres of the North, where already in several of the large county boroughs there exists in full and successful activity the chief feature of the scheme set forth in appendix i. of the draft, entitled "A Suggested Plan for Further Education in a County Borough."

The draft gives an admirable *résumé*, especially in its four appendices, of the measures it is desirable to adopt to meet the educational necessities of not only the county boroughs, but also of other areas, such as the smaller towns and the urban and rural areas, and having regard to the different conditions, agricultural, industrial, and commercial, which prevail, including the provision of facilities "for disinterested studies making for wise living and good citizenship."

The draft foreshadows a more liberal policy on the part of the Board in respect of the administrative working of the measures for further education and of larger subsidies from the taxes. It is high time that the Board left a larger freedom in the hands of the local authorities by the removal, as it would appear is the intention of the Board, of many vexatious restrictions in their regulations, which entail a vast expenditure of time, both locally and centrally, upon the authorities out of all proportion to any advantage to be gained.

The proposed grant per *teacher*-hour instead of per *student*-hour is a most desirable reform, as is the substitution of inclusive and block grants in lieu of grant per student or per subject, and of much simpler methods of registration.

It is, moreover, a wise proposal that in the future the local education authority is to have full responsibility, as indeed the terms of the Act of 1902 require, for the educational efficiency and the proper and effective administration of all the facilities for further education within its area, whether rate-aided or not, and upon it is to devolve many matters of detail hitherto undertaken by the Board. Provisions are made whereby neighbouring local education authorities are encouraged to co-operate in certain educational measures so as to avoid waste of money and effort. The status and position of the larger and more advanced schools, as is now the case with a few, are to be more fully recognised by the Board under the new title of local colleges, and instead of being aided piecemeal in respect of the different courses of work undertaken by them, the colleges will be paid in regard of all their work by a block grant, and be recognised as "the centre and crowning limit of the local system of further education." The Board, it is of importance to note, "is fully satisfied that if any material advance is to be made it is only equitable that an increased

proportion of the cost, both of much old work and of new developments, should fall upon the grants."

The important changes set forth in the draft await, however, in their main proposals the close of the war, but having regard to the admitted fact that more than two millions of the adolescent population between thirteen and eighteen years of age cease to avail themselves of all opportunities of further education, no measures will be really effective for the future education of the young people until all exemptions from school up to at least fourteen years of age are removed and provision made for continued education within working hours until eighteen years of age. It is to be hoped, as the Board desires, that the experienced administrators of the various authorities and the teachers will give careful consideration to this important manifesto of the Board.

THE SUPPLY OF CEREALS.

THE recently published "Statistical Notes on the Cereals" (No. 5, March, 1917) issued by the International Institute of Agriculture must be regarded in the existing situation as a compilation of more than ordinary interest, representing as it does the most precise information obtainable as to the results of last season's corn harvests throughout the world. Preliminary estimates issued from time to time have pointed with lamentable uniformity to a serious shortage of corn supplies as compared with recent years, and the final record fully bears them out. Interest centres specially in the yield of cereals available for international trade, which excludes enemy countries, territories invaded by the enemy, and countries such as the uninvaded portions of Rumania and European Russia, export from which is prevented by the war. The total yield of wheat from all other sources shows a decline of 27·7 per cent. as compared with the excellent harvest of 1915, and 16·9 per cent. as compared with the average of the five seasons 1911–15. The rye crop shows corresponding deficiencies of 2·9 per cent. and 4·1 per cent.; barley, 9·9 per cent. and 4·1 per cent.; oats, 6·9 per cent. and 3·2 per cent.; and maize, 15·9 per cent. and 12·1 per cent. respectively. Taking wheat and rye together as the staple bread-corn crops, the total deficiency as compared with 1915–16 is 26·3 per cent., or 16·1 per cent. below the five-year average, whilst the total of the three "fodder-corn" crops shows corresponding deficiencies of 15·5 per cent. and 8·8 per cent. respectively. Now that all corn has become bread-corn the grand total is of interest, and this shows deficiencies of 19·6 per cent. and 11·4 per cent. respectively.

In order to get a true picture of the balance between production and consumption it is necessary, however, to bring further into the account the "carry-over" from previous seasons' crops, which fortunately in the case of wheat, oats, and maize was large. Even then, however, the available supplies fall short of estimated normal consumption for every crop except oats. In the case of wheat the whole supply of crop and reserve fails to meet normal consumption by roughly 2 per cent., whilst the total supplies of grain of all kinds show a deficiency below consumption requirements of fully 3 per cent. These deficiencies may appear to be small, but it must be remembered that they involve the entire consumption of the remainder left on hand from the superb crop of 1915 and leave absolutely no margin of insurance against a further unfavourable crop in the current season. When we make allowance further for the large quantities of corn which must have been lost on the high seas, it must be admitted that the case for a drastic reduction in cereal consumption has been proved beyond challenge.

TESTS FOR GLANDERS IN ARMY HORSES.

UNDER the title "The Value of the Intra-dermo Palpebral Method of Malleinisation," Major Hobday has recorded in the *Veterinary Journal* for December, 1916, his experience concerning the value of the palpebral test for glanders in horses, as employed in the French Army by Vet.-Major Lamarque, Prof. Douville, and M. Drouin. After a very extensive application of the test, he is very favourably impressed with it, claiming several advantages for it as compared with the subcutaneous test carried out in the region of the neck more widely resorted to in this country.

The chief advantages claimed are especially notable where large numbers of horses have to be speedily tested, and are summarised by Major Hobday as follows: (1) The greater convenience of transport (since the required dose is so much smaller); (2) the ease and rapidity of administration; (3) the great advantage of visibility (since swelling in the region of the eyelids is so much more perceptible than swelling in the subcutaneous region of the neck); (4) that the reaction is more violent and more rapid, and no time is wasted by taking temperatures, which is unnecessary; and (5) that the cost is less, owing to the smaller dose used.

For the test concentrated mallein is used, and two minims are injected with antiseptic precautions "intradermally in the under-eyelid, about the centre, but slightly inclined to the inner canthus." The eyes are inspected in about twenty-four hours, and again in about thirty-six or forty-eight hours, after injection. A positive reaction consists of a discharge of mucus from the inner canthus, and a characteristic swelling of one or both eyelids, closing up the orbit to a greater or less degree, and being excessively tender. The swelling, which persists for three or four days, extends downwards over the submaxillary region, and there may be a cording of the lymphatics extending to the submaxillary gland, which is swollen and tender. This test for glanders is undoubtedly of great value when large numbers of horses have to be speedily inspected, but whether it will prove as efficient or as generally trustworthy as the older subcutaneous test, in which the local reaction is accompanied by a thermal reaction which serves as a check, remains to be proved.

RHUBARB.

"IT is the interest of Mankind that all persons should be caution'd of advent'ring upon unknown herbs and plants to their prejudice." These words, written by John Ray more than two centuries ago, and quoted by his distinguished contemporary, John Evelyn, in his "Acetaria," are seasonable still, and, indeed, in view of the recent "advent'ring" with regard to rhubarb-leaves, have to-day a special significance and interest. Were our famous countryman of Stuart times living at this hour, it is quite conceivable that, great experimentalist as he was, and endowed with more than the usual share of the "interest of Mankind," he would have devoted himself with energy and skill to the solution of some of the problems that confront us now, and some pertinent remarks on the question of utilising rhubarb-leaves as a vegetable would have been likely to appear over his signature in the columns of the daily newspapers. Had he in such circumstances recommended them, we can well imagine that his recommendation would have been accompanied by a warning similar to that quoted above, or more cogent, and printed in large clarendon capitals or italics.

An appeal has been made to history to supply an authority for consuming rhubarb-leaves now, and some prominence has been given to the statement which reposes in some books of considerable authenticity that they were used as a pot-herb in Queen Elizabeth's time. If they really were so used, and even with perfect safety, and were then "considered to be superior to spinach or beet," it is poor comfort to offer to those who in 1917 are suffering the tortures of poisoning arising as a consequence of eating them. That numerous cases of more or less serious illness, and at least one fatality, as reported within the last few weeks in the daily Press, have followed the eating of rhubarb leaf-blades, is accepted as a fact which should leave no doubt in one's mind that they form to many people an unwholesome and even a dangerous food.

In inquiring into the use of rhubarb, mainly with the view of getting evidence from the records of the past as to the use of its leaves as a vegetable, and what were the opinions held regarding such a practice by those who have gone before, some notes which here and there may contain fragments of interesting and useful information have been accumulated, and may be worth putting on record in a collected form.

It is not intended to go far into the botany of rhubarb. The vexed question of the source, or sources, of medicinal rhubarb has led to much controversy. That does not concern us here. The rhubarb used for culinary purposes to-day appears to have originated from more than one species. Some writers attribute its origin to *Rheum Rhaponticum*, Linn., and there seems no reason to doubt that it was this species that was first used in this country for culinary purposes, as well as being the first grown in England for its medicinal root. Moreover, it was the first species introduced into cultivation here, and from early times has been known as English rhubarb. Another species believed to be the parent of culinary rhubarb is *R. undulatum*, Linn., introduced in 1734, while *R. hybridum*, Murr., which, according to Aiton, was introduced in 1763 by Dr. John Hope, F.R.S., who had a garden at Upton, West Ham, is claimed by some authors as the original source of the common garden rhubarb of to-day. All three, and probably other species, are involved in its parentage. For many years it has been cultivated in many varieties differing in size and colour of leaf-stalks, flavour, and in degree of earliness.

Evelyn did not appear to know the rhubarb plant. He does not allude to it in his "Acetaria." Nor can we get any evidence from other writers of his time to support the reiterated statement that *Rheum Rhaponticum* was introduced in 1573, and our investigations induce us to say that whatever else flourished in this country in Queen Elizabeth's reign no species of Rheum had any chance at all, for none was in the gardens of her day. Whatever delights and good times the Elizabethans had, they owed nothing to a dish of stewed rhubarb or a rhubarb-tart, and whatever bad times—whatever pains they endured—could not be laid to the charge of rhubarb-leaves in any form. The delights arising from the former were reserved for a much later, if not more fortunate, generation, and the tortures arising from the latter for our more immediate forefathers in some degree, but chiefly for ourselves.

We have suggested that the statement that rhubarb-leaves were used as a pot-herb in Queen Elizabeth's time cannot be trusted. It is apparently based on a mistake which originated out of a confusion of terms. John Gerard described and figured a certain plant in the first edition (1597) of his famous "Herball," under the name of *Hippolapathum sativum*, Patience, or Munkes (Monkes) Rubarbe, the last name "bicause as it should seeme some Monke or other have used the roote heereof in steede of Rubarbe." This, he says, "is an excellent holsome potherbe," but "it is not so pleasant to be eaten as either Beetes or Spinage." There is no doubt whatever that this plant is not a true rhubarb, but is a dock, and has been rightly referred by careful writers to *Rumex Patientia*, Linn., Herb Patience, a native of Southern Europe and the Orient. The name, "Monk's rhubarb," has also obtained currency in many works, including Syme's edition of "English Botany," for *Rumex alpinus*, Linn., a dock with large, roundish, radical leaves, found occasionally in this country, presumably as an escape from cultivation. This plant was known to Gerard, who included it in his "Herball" under the name of *Hippolapathum rotundifolium* (Bastarde Rubarbe), and he cultivated it in his garden in Holborn. Both these docks were evidently in gardens of the sixteenth century, and possibly long before, and were cultivated as pot-herbs, or the latter, according to Gerard, as a medicinal plant. Medicinal rhubarb was known to Gerard, but evidently only in the form of the dried root, which he figures. No evidence has been discovered to prove that any species of the true rhubarb (Rheum) was in cultivation in England before early in the seventeenth century, when John Parkinson, some time (probably not many years) before 1629, obtained a plant of what is now regarded as *Rheum Rhaponticum*, Linn. This he cultivated, and it is figured and described in the first edition of his "Paradisus Terrestris," 1629, under the name of *Rhaponticum verum seu potius Rhabarbarum verum*. Of it he wrote:—"I have a kinde of round leafed Dock growing in my Garden, which was sent me from beyond Sea by a worthy gentleman, Mr. Dr. Matth. Lister, one of the Kings Physitians, with this title, *Rhaponticum verum*, and first grew with me, before it was ever seen or known elsewhere in England." After some reference to the character and medicinal properties of the roots, he continued:—"The leaves have a fine acide taste. A syrrupe therefore made with the juice and sugar, cannot but be very effectuall in dejected appetites, and hot fits of agues; as also to helpe to open obstructions of the liver, as divers have often tryed, and found availeable by experience."

By some curious blunder Monk's rhubarb has also been identified with *Rheum Rhaponticum*; hence in many works it is stated that this plant was introduced in 1573, apparently on no better evidence than is supplied by the fact that Tusser included the name "rubarb" in his "Five Hundreth Points of Good Husbandry" of that date. In the edition of 1672 this name, without any qualification whatever, occurs in a list under the heading, "necessary herbs to grow in the Garden of Physick, not rehearsed before." This "rubarb" is probably *Rumex Patientia*, or *R. alpinus*—in "English Botany" it is represented as the latter. It is practically certain that it was not *Rheum Rhaponticum*.

It will be noticed that Parkinson refers to the fine acid taste of the leaves of the rhubarb which he cultivated. It is not clear whether he was alluding to the leaf-blade or leaf-stalk, but apparently he viewed this plant only as medicinal, and it seems impossible to determine the approximate date when rhubarb was first used for culinary purposes as we use it to-day. The practice of so using it was known to Philip Miller in 1752, for in the sixth edition of his "Gardeners' Dictionary" he wrote:—"This sort [*Rheum Rhaponticum*] is frequently cultivated in the gardens, and is call'd English Rhubarb. The roots of this enter as an ingredient into several compound medicines; and of late years, the footstalks of the leaves have been used for making of tarts in the spring of

the year, as these may be had before goosberries are large enough for that purpose. These footstalks must have their outer skin peel'd off, otherwise they will be very stringy: when this is done, the pulpy part will bake very tender, and almost as clear as the apricot; and having an agreeable acid flavour, is by many persons esteemed for this purpose."

Rheum Rhaponticum has been cultivated in the neighbourhood of Banbury, mainly for the sake of its root, since about the year 1777. W. Bigg, writing in 1846 (*Pharm. Journ.*, vol. vi., p. 75) on its cultivation there, said:—"Of the leaves, I believe no use is now made, except the use common to all vegetable offal—manuring. The leaf-stalks are now very partially sold for the table. In former years, the sale of the leaf-stalks formed a part of the trade, but it can scarcely be said to do so now. Wine has been occasionally made of them, but not to any important extent. . . . The leaves were some years ago in demand (I have reason to think) for the adulteration of tobacco, or the manufacture of cigars, but are not at present."

It is stated in *Loudon's Gardeners' Magazine*, vol. vii., 1831, p. 369, that poor people in the neighbourhood of Glasgow were in the habit of using rhubarb-leaves as a remedy for, or for the relief of, rheumatism. Heated leaves were applied to the parts affected.

If there was anything like a general appreciation of rhubarb as a substitute for fruit about the middle of the eighteenth century it must have declined so much in favour as to have been little used at the beginning of the nineteenth, for it is recorded that Mr. Joseph Myatt, of Deptford, about the year 1810, sent his two sons to the Borough Market with five bunches of rhubarb, and of these they succeeded in selling only three. But he persevered in his efforts to make a market for the vegetable, raised improved varieties, and before many years had elapsed rhubarb as a culinary plant was established in public favour. According to *Loudon's Gardeners' Magazine*, vol. iv., p 245, at the beginning of June, 1828, the demand for rhubarb in the Newcastle-upon-Tyne market was so considerable that 100 sticks sold for 5*s*. In 1831 (*loc. cit.*, vol. vii., p. 682) the culture of tart-rhubarb had increased so rapidly about Edinburgh that one grower for the market, who a few years before found great difficulty in selling forty or fifty dozens of bunches of stalks in a morning, sold from three to four hundred dozens of bunches. The common price of tart-rhubarb in the Edinburgh market at that time was 2*d*. a bunch of a dozen stalks, while in Glasgow the same quantity was sold for 3*d*.

We are informed that Myatt obtained his first roots from Isaac Oldaker, gardener to Sir Joseph Banks, and Oldaker had brought them from St. Petersburg, having been gardener to the Emperor of Russia. They represented a finer and earlier kind than those previously cultivated in English gardens.

Several papers in the Transactions of the Horticultural Society of London show that in the second and third decades of last century a great deal of attention was paid to the forcing and blanching of rhubarb. In 1824 Mr. James Smith, gardener at Hopetoun House, was awarded the society's silver medal for devising a simple, effectual, and economical mode of forcing the plant. It appears that the method of blanching was discovered by accident in the Chelsea Physic Garden in 1815 (Trans. Hort. Soc. Lond., vol. ii., p. 258).

It was long ago realised that the use of rhubarb as food was attended with some risk to health. Lindley ("Vegetable Kingdom," 1846, p. 503) remarked that oxalic acid is copiously formed in both docks and rhubarbs, and that the latter also contain an abundance of nitric and malic acids. While these give an agreeable taste to the stalks of rhubarb when cooked, he regarded them as being ill-suited to the digestion of some persons. The "Penny Cyclopædia," 1841, warned persons subject to calculous complaints against eating tarts made from rhubarb leaf-stalks, owing to the presence of oxalic acid, and that "the formation of the oxalate of lime, or mulberry calculus, may be the consequence of indulgence."

A note in the *Gardeners' Chronicle*, 1846, p. 5, by Alexander Forsyth, who was gardener to the Earl of Shrewsbury at Alton Towers, Staffordshire, has been recently referred to in newspapers as showing that rhubarb-leaves were in use about that time for culinary purposes. Forsyth wrote:—"We have been in the habit of eating the leaves of the rhubarb-plant for many years, and seeing that the fruit-stalks of this vegetable were counted as waste, I thought it very likely that they were the better part of the plant, and I now find that the pouches of unopened flowers bear the same relation to the leaves of rhubarb that cauliflowers do to cabbage-leaves, and may be obtained in great abundance, and that at a time (April) when all kinds of vegetables are valuable." He refers to using the young inflorescence, which he called Rhaflower, "as a boiled vegetable, to be used like broccoli." The meaning of his statement about eating the leaves of rhubarb was not clear then, but in a subsequent note (*Gardeners' Chronicle*, 1847, p. 325) there is no doubt at all that by leaves he meant the leaf-stalks, and not the blades, for he wrote:—"I have no experience in the eating of the leaves, and think them nauseous to the taste and unpleasant to the smell, and it seldom happens that any article is good for food when all the three senses of sight, taste, and smell reject it; it is not a good green colour. I tasted them boiled, and they did not appear to me to have one redeeming quality to keep them an instant from the dung-heap." In the latter note Forsyth again referred to eating the cooked flower-heads of rhubarb, and stated that he and others had done so without experiencing any ill-effects. But he directed attention to the fact that during the season (spring, 1847) there was a general complaint against the eating of the stalks of rhubarb-leaves, as violent relaxation had resulted. Another correspondent to the *Gardeners' Chronicle* (1847, p. 325) suggested that illness from eating rhubarb—apparently he meant the inflorescence—may have been due to the variety, and stated that a medical man whom he knew had a plant of rhubarb in his garden which was particularly early, and which, used in tarts, invariably caused illness in those who ate it, while other plants growing in the same bed, but which were a little later, were quite wholesome. The same effects had been observed for several years, until at length he destroyed the offending plant.

A reference to the *Gardeners' Chronicle* (1847, pp. 283, 341, 357) will show the varying results of eating the young inflorescence, producing no ill-effects in some cases and serious illness in others; and in the same journal (1847, p. 283) a case is recorded of a Chelsea woman who boiled rhubarb-leaves as a substitute for spinach, and all three of those who ate of the dish were attacked with sickness, one of them, a boy, being also afflicted with swellings about the mouth. An editorial comment on this runs as follows:—"We are not aware of any similar instances of serious consequences following the use of rhubarb, but it is by no means surprising that a plant which forms so much oxalic acid should be unsafe, and we recommend the subject to serious chemical inquiry. It is quite conceivable that the leaves should contain some principle which the stalks are deficient in, as indeed is proved by the different manner in which the juice of the leaf-stalks and leaves is affected by the

same reagents; but until there shall have been time for a careful inquiry into the organic products of these two parts we can only warn the public against employing for food any part of the rhubarb except that which experience shows to be harmless."

The Garden (1872, vol. i., p. 197) contains an extract from an American paper which shows that a woman residing between Oneida and Durhamville, New York, died from the effects of eating as greens the leaves of rhubarb, or pie-plant as it is known in the United States, her death taking place after three weeks of suffering. "The leaves are poisonous, and should never be eaten," concludes the paper's announcement of the fatality.

Judging from published statements (*Gardeners' Chronicle*, ser. 3, vol. xv., pp. 340, 353, 384, 400), there was a revival of interest in the question of eating rhubarb-leaves in 1899. One correspondent wrote (p. 384):—"Rhubarb-spinach has been for many years a favourite dish with us"; but the Secretary of the Massachusetts Horticultural Society communicated the following warning (p. 400).—"The *Gardeners' Chronicle* for May 27 is at hand this morning and the note on 'Rhubarb-leaves as a Vegetable' prompts me to say to you that instances have been known here where their use as 'greens' has caused fatal results owing to the excess of oxalic acid. A horticultural friend told me many years ago that he had raised many seedlings, some of which (I assume that the usual part was cooked in the usual way) caused vomiting as certainly as ipecacuanha."

A curious case is reported in the *Pharmaceutical Journal* (1901, vol. lxvi., p. 639) as follows:—"At an inquest held at Ashstead on Friday, May 3, concerning the death of John Lintott (thirty-nine), a scaffolder, it was stated that on the previous Monday deceased complained of violent pains and a doctor prescribed for him, having found that he was suffering from a gastric attack. After the doctor left the patient some cooked rhubarb-leaves were given to him as medicine, it being stated that the leaves were used as a vegetable in parts of Hampshire. The man died next day, and the doctor expressed the opinion that death was due to excessive vomiting, causing exhaustion, produced by eating rhubarb-leaves. The coroner expressed surprise at hearing that stewed rhubarb-leaves were used as a medicine or as a vegetable. A verdict was returned of 'Accidental death, caused by eating rhubarb-leaves.'"

In 1911, vol. lxxxvi., p. 8, the same journal contains the following, extracted from the *British Medical Journal* of December 31, 1910:—"The author [Dr. W. E. Burton] mentions two cases of rhubarb-poisoning to which he was called, the symptoms being similar in each case, and refers to the death from the use of rhubarb which was the subject of a coroner's inquest at Catford some weeks since. Rhubarb, although rightly regarded as a wholesome food and an excellent substitute for fruit, does not agree with everyone. It is possible that the presence of oxalates in the urine and the severe intestinal irritation indicate oxalic acid as being one of the agents responsible for the toxic action. Oxalic acid and oxalates, chrysophan, chrysophanic acid, and phaoretin are all found in rhubarb-root, and are of an irritating nature."

In a discussion on rhubarb-wine (*Gardeners' Chronicle*, 1853, p. 406), the observations of one writer seem to have especial interest as a possible explanation of the cause of the variable effects produced by eating rhubarb:—"However good the wine made from rhubarb may be, I take the liberty of advising your readers not to drink it. It is well known that the acidity of rhubarb-stalks is owing to the presence of an acid salt—the binoxalate of potash—a combination of the poison oxalic acid and the alkali potash. This salt does not exist in sufficient quantity in the rhubarb-stalks to produce its poisonous effects, and the same may be said of the wine. But there is another danger attending its use in the form of wine which ought not to be overlooked. All hard water contains lime, and when mixed with the juice of the rhubarb-stalks the binoxalate of potash is decomposed and an oxalate of lime is formed. Now this oxalate of lime is the constituent principle of the mulberry calculus, and there is a peculiar condition of the human body known to medical men as the oxalic diathesis, which depends upon the presence of this oxalate of lime in the blood (I use the word blood for obvious reasons). This oxalic diathesis has been proved by Dr. Golding Bird to be much more common than it was supposed before this gentleman brought the microscope to assist him in his pathological researches. Such being the case, it is obvious that any article of common use which contains this oxalate of lime, or even the oxalic acid or its salts, must be more or less injurious to health, more particularly to those in whom there exists a predisposition to assume the oxalic diathesis. It must be borne in mind that oxalic acid is formed in the human body by the decomposition of sugar, urea, etc., and the diathesis is not uncommon from this cause. If it is thus easily produced indirectly, *a fortiori* it is still more likely to arise from the direct means of rhubarb-wine. Therefore I say to your readers, eschew the doubtless very agreeable beverage which has entered, through the medium of your columns, into competition with genuine 'Sillery mousseaux.'"

The eminent physician and chemist, Dr. William Prout, F.R.S. (1785–1850), regarded rhubarb as likely to be a dangerous food owing to the large amount of oxalic acid present in the leaf-stalks. Having analysed wine made from the stalks, he considered it a most pernicious drink, and that its frequent use was likely to produce stone in the bladder. He expressed the opinion that an Act of Parliament ought to be passed, if necessary, to prevent the sale of so dangerous a poison (*Gardeners' Chronicle*, 1853, p. 438).

There is possibly something in the suggestion that the chemical composition of rhubarb varies to some extent according to the variety and also according to the soil on which it is grown. A writer in the *Gardeners' Chronicle* (1853, p. 357) stated that the amount of water present was less when the plants were grown on poorer soil, while the acid principle was more abundant.

Mr. Edward Solly, F.R.S., published in the Transactions of the Horticultural Society of London, ser. 2, vol. iii., 1848, pp. 35–92, the results of his experiments on the inorganic constituents of plants. Among the numerous plants on which he experimented were several rhubarbs. In the case of each of these he gives the respective amounts of water, organic matter, and inorganic matter found both in leaves and leaf-stalks. In every case, as he shows by figures, there was considerably less water present in the leaves than in the leaf-stalks, but in most cases almost double, in a few more than double, the amount, always very considerably more, of organic and inorganic matter was present in the former. It is therefore natural to assume from the results of his investigations that oxalic acid, or whatever is deleterious in the rhubarb-plant, is present in greater proportions in the leaf-blade than in the leaf-stalk.

It may be left to the discretion of those who chance to read this article to decide whether or not it is advisable to eat cooked rhubarb-leaves or rhubarb in any form. For at least a century the consumption every year of the leaf-stalks as a substitute for fruit has

been enormous. It is well known to be usually a wholesome, and certainly a useful, food. Compared with its extensive use, the cases of illness charged against it may be regarded as negligible. The inflorescence has also been tried, but evidently not very much, and with diverse results. The consumption of the leaf-blades has apparently never been general or considerable, by no means comparable with that of the leaf-stalks, but the baneful effects of doing so are relatively so marked that it may be said decisively that rhubarb leaf-blades cannot be recommended for general use as a food. While experiments in such matters are often necessary, and, if attended with caution, are desirable, carelessness in recommending them or in putting them into practice may place one in a less enviable position than those of whom it has been said, "Happy from such conceal'd, if still do lie, of roots and herbs the unwholsom luxury"; and the injudicious experiment in eating insufficiently tested articles of food may lead one to "discover their malignity in dangerous and dreadful symptoms."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The eighth Halley lecture will be delivered at the University Museum on Tuesday, June 12, at 5.30 p.m., by Prof. Arthur Schuster. The subject is "Terrestrial Magnetism: Past, Present, and Future."

On May 22 Congregation passed the preambles of a series of statutes reconstituting the boards of electors to various professorships, and establishing a committee for advanced studies.

The annual report of the visitors of the University Observatory has been presented to Convocation. In it the visitors express their sorrow at the death of the late Prof. Esson, who acted as secretary to the visitors during the whole forty-two years of the work of the observatory. Several lectures to military bodies have been given by the director (Prof. H. H. Turner), including lectures in France and in the camps on Salisbury Plain. Research has gone forward in spite of unavoidable drawbacks, and many papers have been published by members of the staff and others in the course of the year. These include valuable memoirs by Prof. Turner, Miss E. F. Bellamy, Miss M. A. Blagg (on Baxendell's "Variable Stars"), and Mr. R. J. Pocock.

MISS BOWEN COLTHURST has been appointed principal of the College of Agriculture, Holmes Chapel, Cheshire. The college is connected with the University of Manchester, and is fully equipped for thorough training in practical and scientific agriculture.

AN influential deputation of London members of Parliament and of the London County Council Education Committee and officials waited upon Mr. Fisher at the Board of Education on Tuesday to ask the Board for an increased grant for education purposes in London. In reply Mr. Fisher said he was prepared to recommend to the Treasury that an increased grant should be made. The grant would probably amount to something above 1,000,000*l.*, but it would be given on the distinct understanding that the money should be used for education purposes only, and not for relief of present rates.

THE Elementary Education Sub-Committee of the London County Council has had under consideration the following resolution passed by the Central Consultative Committee of Headmasters:—"That the time is now ripe for the compulsory introduction of the metric system." The sub-committee is of the opinion that the time has now arrived when, in order to obviate the waste of time which is caused in the schools by the present system of weights and measures, and to facilitate commercial transactions, his Majesty's Government should be asked to make the metric system compulsory. The Education Committee of the council is in agreement with these views, and has recommended:—"That the council is of opinion that the time has arrived for the compulsory introduction of the metric system; that a communication to this effect be conveyed to his Majesty's Government; and that the council be recommended accordingly."

A BOOKLET describing the facilities for study provided by the various departments of the Imperial College of Science and Technology can be obtained on application to the secretary of the college. The guide was drawn up in the first instance specially for headmasters and science masters of schools and for colleges. It has been re-issued to provide persons anxious to have information as to the industrial careers for young men to which the Imperial College is specially directing its attention. The number of posts of an industrial character, in which high scientific education is of great importance, is constantly increasing throughout the Empire, and the Imperial College should after the war attract an ever-increasing number of students. We have also received separate parts of the calendar of the Imperial College, giving complete prospectuses of the associated colleges of the Imperial College, namely, the City and Guilds (Engineering) College, the Royal College of Science, and the Royal School of Mines.

IN August of last year the London County Council resolved that, subject to the establishment at the Imperial College of Science and Technology of a department of technical optics under a separate head; to the Government grant to the college being increased in respect of such department; and to certain other conditions, the council's grants to the college be increased in respect to technical optics by an amount proportionate to the increase in the Government grant as 1:3; provided that the increase in the council's equipment grant shall not exceed 750*l.*, and that the increase in the council's maintenance grant shall not exceed 1000*l.* a year. The governing body of the Imperial College has now informed the council that it has adopted the recommendation of its Technical Optics Committee—which is also the Advisory Council for technical optics—that Mr. F. J. Cheshire be appointed director of the department of technical optics for a period of five years commencing June 1, 1917, at a salary of 1000*l.* a year. The Education Committee of the council, at a meeting held yesterday, recommended that this appointment be approved.

WE have received from the office of the *Field* and *Queen*, Breams Buildings, London, E.C.4, a copy of the English edition of "British Universities and the War: a Record and its Meaning," a little book compiled at the request of several correspondents in the United States who expressed the wish to have some permanent record of the response by the universities of the United Kingdom to the country's call for volunteers. The sixteen brief contributions by the vice-chancellors, principals, and masters representative of the various universities form an inspiring record of noble endeavour on the part of our university men; and to these unadorned statements of patriotic sacrifice and accomplishment Mr. Fisher, the President of the Board of Education, has contributed a gracefully appropriate preface. "No line," says Mr. Fisher, "can be drawn between student and teacher, between young and old. Many of the most brilliant teachers in the country have given their lives on the battlefield; many a bright star in the firmament of science has

been prematurely eclipsed." This generous estimate of the part men of science have taken in the war is noteworthy. "It has been a war of chemists, of engineers, of physicists, of doctors. The professor and lecturer, the research assistant, and the research student have suddenly become powerful assets to the nation. Whatever university you may choose to visit, you will find it to be the scene of delicate and recondite investigations, resulting here in a more deadly explosive, there in a stronger Army boot, or again in some improvement to the fast-advancing technique of aerial navigation." The brochure deserves to be widely read. Its price is 1s. net.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 10.—Sir J. J. Thomson, president, in the chair.—Sir Joseph **Larmor** and N. **Yamaga**: Permanent periodicity in sun-spots. A discussion of the more sharply marked phases of the curve of frequency of sun-spots, since 1750, led Newcomb, in 1901, to strong confirmation of the prevalent view, previously verified by Wolf and by Wolfer, that sun-spots are governed by some permanent periodic agency of period determined very closely by him as $11{\cdot}13 \pm 0{\cdot}02$ years, and more recent independent discussions, by Wolfer in 1902 and by Schuster in 1906, have led them to conclusions nearly identical. The form of this periodic component is here extracted by semi-graphical methods, such as are appropriate to a permanent unbroken period, and also provide a further check on the degree of validity of the result. The periodic feature is found to be strongly and definitely present, provided the records for the two sun-spot cycles from about 1776 to 1798, which would largely vitiate it, are rejected as untrustworthy, or else are almost wholly assigned to some strong but transient anomaly. The residue of the sun-spot curve, when this periodic part is removed, seems to be accidental and sporadic, showing no other permanent periodicity of comparable period. The periodogram analysis of Schuster had, in fact, already led him to the result that the record is not homogeneously constituted even in the wider sense appropriate to natural radiation. The Fourier series here determined for the periodic part is found to be composed of sines only within the limits of attainable accuracy; thus the graph of that part is made up of anti-symmetrical undulations, a feature which may form a clue to its physical origin in the sun.—Prof. G. W. O. **Howe**: The high-frequency resistance of multiple-stranded insulated wire. The conductors employed in radio-telegraphy are frequently made up of a large number of fine wires separately insulated and stranded or plaited together in such a way that every wire occupies in turn the same relative position in the multiple conductor. In this way the total current is forced to distribute itself equally between all the wires, even at high frequencies. The object of this is twofold, viz. to make the inductance independent of frequency and to reduce the resistance at high frequencies. It is shown in this paper that the second object is rarely achieved because of the eddy currents induced in the wires by the magnetic flux within the conductor. It is shown also that the loss due to this cause is so great that the effective resistance of the stranded conductor is in many cases, greater than that of the solid wire which could be put in its place. In the first part of the paper formulæ are deduced on the assumption that the eddy currents in the fine wires do not appreciably affect the distribution of magnetic flux within them. In the second part this assumption is not made and formulæ are deduced which take into account the screening effect of the eddy currents. It is proved, however, that the assumption is permissible in nearly all the cases considered. A number of tables are given showing the ratio of the high frequency to the continuous current resistances of straight and coiled conductors of different sizes made up of fine wires of three alternative diameters. These formulæ and tables enable one to see at once if any advantage is to be gained by using such a stranded conductor in any given case, and, if so, the best number of wires and space-factor to employ. The paper shows conclusively, however, that the extended use of such conductors in radio-telegraphy for the purpose of reducing the resistance has no scientific justification.

Physical Society, April 27.—Prof. C. V. Boys, president, in the chair.—Prof. J. A. **Fleming**: A note on the derivation of the general equation for wave motion in an elastic medium. The paper explains a simple method of arriving at the general differential equation for wave motion, viz.

$$\frac{d^2\phi}{dt^2} = c^2\left(\frac{d^2\phi}{dx^2} + \frac{d^2\phi}{dy^2} + \frac{d^2\phi}{dz^2}\right),$$

where c is the velocity of propagation of the wave. The method described may be epitomised by saying that the differential equation is obtained by equating the product of strain-acceleration $d^2\phi/dt^2$ and density to the static measure of the stress expressed as the space variation of the product of the elasticity and the strain slope $\left(e\frac{d\phi}{dr}\right)$, which is the proper measure of the stress at the point considered.—A. **Johnstone**: The effect of stretching on the thermal conductivity of wires. For all the wires used (copper, steel, nickel, aluminium, brass, zinc), stretching produced a slight increase in thermal conductivity. The most satisfactory experiments showed an increase of about 0·5 per cent. for a tension of about 0·7 of the elastic limit. After the tension was withdrawn the conductivity returned approximately to its original value.—Prof. H. **Chatley**: Cohesion (third paper). The objects of the paper are:—(*a*) To re-state and add further evidence in favour of an electrical theory of cohesion. (*b*) To provide tentative empirical formulæ for the expression of intermolecular forces. The author defines cohesion as the net attraction (*i.e.* balance of attraction over repulsion) between molecules which are relatively chemically saturated, at distances not greatly exceeding the molecular diameters, and the following formula is proposed for this attraction:—$f_2 = Gm^2/d^{(2+4d_0/d)}$, where G is the Newtonian constant of gravitation, m the molecular mass, d the molecular interval (centre to centre), and d_0 is the molecular diameter.

Royal Astronomical Society, May 11.—Major P. A. MacMahon, president, in the chair.—Dr. J. L. E. **Dreyer**: The origin of Ptolemy's Catalogue of Stars. For more than a century it had been the prevailing opinion that Ptolemy had borrowed all his star places from the catalogue of Hipparchus, merely adding a constant quantity to the longitudes to bring them up to his own epoch. It was contended that this opinion was ill-founded; that the catalogue of Hipparchus could not have contained more than 850 stars, so that Ptolemy could not have borrowed from Hipparchus the whole of his catalogue of 1025 stars. There appeared no reason for disbelieving Ptolemy's statement that he had himself made extensive observations of the fixed stars.—Dr. S. **Chapman**: (1) Convection and diffusion within giant stars. Prof. Eddington had shown that in a giant star of low density the temperature and pressure gradients towards the centre must be much less than formerly supposed, the influence of gravity being largely counteracted by radiation pres-

sure. An attempt is now made to determine the relative importance of convection and diffusion. Some of the heaviest elements appeared at high levels, not only in the sun, which is a dwarf star, but also in some of the giant stars. It is probable that convection extends to a considerable depth within the star, raising some of the heavier elements to the surface layer. (2) Thermal diffusion and the stars. It is found that the thermal effect is far outweighed by pressure diffusion, which tends to produce stratification into layers of increasingly heavy elements towards the centre. It is therefore probable that the presence of elements of widely different atomic weights in the solar atmosphere is mainly due to convection.—G. J. **Newbegin**: Solar prominences, 1916. Fewer observations than usual had been made, owing to the bad weather in January and December. The observations were plotted on a diagram, which was shown on the screen. A growth of activity all round the limb was indicated; even the polar regions were more filled up than in 1915, and the general brightness had increased. Dark absorption bands had been observed on thirty occasions.

Royal Meteorological Society, May 16.—Major H. G. Lyons, president, in the chair.—J. E. **Clark** and H. B. **Adames**: Report on the phenological observations for 1916. The year as a whole was rather warm, excessively wet, deficient in sunshine, and phenologically disastrous. This arose mainly from the peculiar distribution of wetness and warmth. January was dry in most parts, but February and March among the wettest on record, the precipitation largely as snow. February was colder than January, March than February, and in Ireland and England, S.W., April than January. Cold nights with frosts continued well into July, the former half of which and June were so disastrously cool that the mean was lower than in May, with a minimum of sunshine. Many days were cooler than many in January. The winter warmth developed abnormal premature growth, seriously damaged by the early spring-winter. The extreme wet of that time almost stopped farm and garden work; the cold nights later ruined much of the fruit crop, and the cold summer greatly lessened the quality of the harvest, being also largely responsible for the serious failure of the potato crop, combined with the most abnormal rainfall of the ripening-off and lifting time in late October and November. The tables largely reflect the above conditions, especially in the earliness of the hazel (two weeks), bringing it well into January (26th), perhaps for the first time; also the long range in date of the hazel, anemone, and blackthorn, averaging ninety-seven days compared with forty-six days for the late spring and early summer flowers, hawthorn, ox-eye, daisy, and dog-rose. This long range is due to colder districts giving dates after the cold spring break, and the earlier some records preceding it. A very important aspect has so far not been worked out, namely, the areas of equal date of appearance, which may be suitably denoted as isophainal zones. In Great Britain the earliest, before April 29, appears to include South-West Wales, Cornwall, Devon, a tongue stretching up from Hants to Worcestershire, East Sussex, Surrey, and Kent. All the rest south of the Mersey and Humber, except a large East Anglian area round the Wash, falls in the zone between 120 and 130 (May 9). The third zone to the 140 isophain covers the rest of England except Northumberland and Scotland bordering on the Solway. Northwards, dates later than May 19 prevail. In Ireland we get the 130 isophain from near Limerick to west of Dublin, and so on towards Newry, that of 140 passing from Clew Bay to Belfast Lough, with a southward bend round Lough Neagh.

PARIS.

Academy of Sciences, May 7.—M. d'Arsonval in the chair.—J. **Boussinesq**: The orientation of the principal pressures in the state of slip (by plane deformations) of a heavy sandy mass with a rectilinear upper profile.—General **Sebert**: Further observations concerning the possible influence of violent cannonades on the fall of rain. The Central Meteorological Bureau has continued to publish its bulletins throughout the war, but with a delay of one week. Observers on the connection between the weather and gun-fire should bear this fact in mind if they make use of the bulletins.—L. **Mangin**: *Chaetoceros criophilus*, a characteristic species of the Antarctic seas.—G. A. **Boulenger**: Batrachians connected with the genus Euproctus: their ethological and phylogenic relations.—M. **Balland**: Some experiments in bread-making in view of the continuation of the war. A study of the effects of mixing various proportions of barley, maize, rice, and other materials with wheaten flour for the preparation of bread. In case of necessity up to 10 per cent. to 15 per cent. of barley, oats, maize, rice, or manioc may be added to wheat flour, barley being preferable.—M. E. Fournier was elected a member of the section of geography and navigation, in succession to the late M. Guyou.—M. **Petrovitch**: Some remarkable numerical expressions.—B. **Jekhowsky**: The development in series of various algebraical expressions by means of Bessel's functions of several variables.—M. **Mesnager**: Solution of the problem of the thick rectangular plate, supported at its edges, and loaded with a single weight at its centre.—MM. **Fayet** and **Schaumasse**: Observations and provisional elements of the comet 1917*b* (Schaumasse). The observations were made on April 25, 26, and 27. On April 25 the comet appeared to be of 9·5 magnitude, showing a slight central condensation.—M. St. **Procopiu**: The concentration of electrolytes in the neighbourhood of the electrodes.—Ed. **Chauvenet**: The fluorides of zirconium and the zirconyl fluorides.—R. M. **Gabrié**: The commercial utilisation of fumaroles and hot springs. Calculations on the energy obtainable from steam jets issuing from the soil and from hot water of geysers.—J. de **Lapparent**: A Foraminifer from the chalk of the Alps and Pyrenees.—A. **Pezard**: Regression of the erectile organs, resulting from post-puberal castration in the Gallinaceæ.—Marie **Goldsmith**: The acquisition of a habit in the octopus.—E. **Kayser**: Contribution to the study of apiculate yeasts.—M. **Cazin**: Total heliotherapy in the treatment of men wounded in the war. An account of the results obtained by the sun treatment of wounded. Very favourable results have been obtained.—Ch. **Lambert**: A method of writing and reading easily accessible to the blind, and specially useful to blind persons who have lost the hands or forearms.—J. **Danysz**: Anti-luargol. Experiments are described proving that a preliminary injection of luargol provokes in the organism the formation of a precipitating antibody.—H. **Vincent**: The infection of wounds by the pyocyanic bacillus. Causes and treatment.

SYDNEY.

Linnean Society of New South Wales, March 28.—Dr. H. G. Chapman, president, in the chair.—R. J. **Tillyard**: The morphology of the caudal gills of the larvæ of zygopterid dragon-flies. Three main types of gills, according to the form of their cross-sections, are recognised—(*a*) the saccoid gill-type, presented by the Epallaginæ and the Protoneurinæ; (*b*) the Triquetroquadrate type, occurring only in the Calopteryginæ; and (*c*) the lamellar type characteristic of the Lestidæ and most Agrionidæ. There is also a reduced (non-functional) type, of which the gills of *Agrion asteliae*, Perkins (Hawaii), furnish a good example. Onto-

genetic and phylogenetic questions will be discussed in a later paper.—Dr. J. M. **Petrie**: The occurrence of hydrocyanic acid in plants. Part iii. treats of five indigenous and seven cultivated cyanogenetic plants. Detailed experiments were made with a number of Alocasias, and a description of the distribution of the glucosides in the different parts of the plants is given. —Dr. J. M. **Petrie**: The chemical investigation of some poisonous plants in the N.O. Solanaceæ. Part iv., the chemistry of the Duboisias. This important group of endemic plants includes the pituri-tree of Central Australia and the cork-tree of New South Wales. The former is the only nicotine plant known other than the Nicotianas; and the latter contains the atropine-group of alkaloids, including the new nor-hyoscyamine. A third species, resembling the cork-tree, was also found to contain the same constituents. A complete historical account is given of the numerous chemical researches on the first two of these plants; and the contradictory evidence has been settled definitely by new experimental data. The proximate composition of the plants is compared and the investigation of their alkaloids described.

PETROGRAD.

Academy of Sciences, February 1.—E. S. **Fedorov**: A new descriptive geometry.—N. **Kulagin**: The ovary of the elephant.—V. V. **Zalenskij**: The segmentation of the ovum of *Salpa bicaudata*. First period.—E. **Busch**: Ericaceæ (Arctostaphylos, Arctous, Vaccinium, Calluna) of Siberia and the Far East.—A. M. **Nikolïskij**: *Coluber* (*Vipera*) *sachalinensis*, Czar., and its history. —G. J. **Vereščagin**: The basins in the vicinity of Lake Baikal.—Vl. N. **Šnitnikov**: The reptiles of the province of Semiřečje.—N. M. **Krylov**: Application of the method of W. Ritz to a system of differential equations.

HISTORICAL AND PHILOLOGICAL SECTION, January 25. —P. A. **Falev**: Account of an expedition in Transcaucasia and to Azerbeidžan in the summer of 1916.— N. Ja. **Marr**: (1) The Georgian epic, "The Hero in the Panther's Skin," by Šota of Rustav, and a new problem touching ancient Georgian culture. (2) A source of new information concerning the history of the Caucasian peoples.—I Ju. **Kračkovskij**: Description of the collection of Korans brought by F. I. Uspenskij from Trebizond.

BOOKS RECEIVED.

A Pocket Handbook of Minerals. By Prof. G. M. Butler. Second edition. Pp. ix+311. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 11*s.* 6*d.* net.

British Universities and the War: a Record and its Meaning. Pp. xv+88. (London: *Field* and *Queen*.) 1*s.* net.

Actions Physiologiques et Dangers des Courants Electriques. By J. Rodet. Pp. 87. (Paris: Gauthier-Villars.) 3.25 francs.

Differential Calculus. By Prof. H. B. Phillips. Pp. v+162. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 5*s.* 6*d.* net.

Lessons in Pharmaceutical Latin and Prescription Writing and Interpretation. By H. C. Muldoon. Pp. vii+173. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 6*s.* net.

Studies in Primitive Looms. By H. Ling Roth. (Halifax: Bankfield Museum.) 2*s.*

Staying the Plague. By N. Bishop Harman. Pp. viii+120. (London: Methuen and Co., Ltd.) 1*s.* net.

Australasian Antarctic Expedition, 1911–14. Scientific Reports. Series C. Zoology and Botany. Vol. iv., part 1:—Mollusca. By C. Hedley. Pp. 80+9 plates. (Adelaide: R. E. E. Rogers.) 8*s.* 6*d.*

DIARY OF SOCIETIES.

THURSDAY, MAY 24.

ROYAL SOCIETY, at 4.30.—The Influence of Vibrations upon the Form of Certain Sponge-Spicules: Prof. A. Dendy and Prof. J. W. Nicholson.—The Lateral Vibrations of Bars of Variable Section: Prof. J. W. Nicholson.

ROYAL INSTITUTION, at 3.—The Chromosome Theory of Heredity and the Alternatives: Prof. W. Bateson.

ROYAL GEOGRAPHICAL SOCIETY, at 5.30.—The Resources and Future of British Columbia: Dr. J. F. Unstead.

LINNEAN SOCIETY, at 3.—Anniversary Meeting.

AERONAUTICAL INSTITUTE, at 8.—The Testing of Materials for Aeronautical Construction: Edgar A. Allcut.

INSTITUTION OF MINING AND METALLURGY, at 5.30.—Shall Great Britain and America Adopt the Metric System?: W. R. Ingalls.

FRIDAY, MAY 25.

ROYAL INSTITUTION, at 5.30.—Breathlessness: J. Barcroft.

PHYSICAL SOCIETY, at 5.—An Investigation of Radium Luminous Compound: C. C. Paterson, J. W. T. Walsh, and W. F. Higgins.—The Resistance to the Motion of a Lamina, Cylinder, or Sphere in a Rarefied Gas: F. J. W. Whipple.—The Effect of Stretching on the Thermal and Electrical Conductivities of Wires: Dr. C. H. Lees.

SATURDAY, MAY 26.

ROYAL INSTITUTION, at 3.—The Electrical Properties of Gases: Sir J. J. Thomson.

TUESDAY, MAY 29.

ROYAL INSTITUTION, at 3.—The Movement of Glaciers: Prof. W. W. Watts.

THURSDAY, MAY 31.

ROYAL INSTITUTION, at 3.—The Art of the Essayist: A. C. Benson.

FRIDAY, JUNE 1.

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