THURSDAY, JUNE 1, 1916.

APPLE-GROWING FOR PROFIT.

The Apple: a Practical Treatise dealing with the Latest Modern Practices of Apple Culture. By A. E. Wilkinson. Pp. xii+492. (Boston and London: Ginn and Co., 1915.) Price 8*s.* 6*d.*

MR. WILKINSON'S monograph is a very good example of a type of book which is indigenous to the New World. Writers of such monographs look at their subject keenly and exclusively from its commercial aspect. They collect or recount from their experience every item of information the possession of which by a grower is calculated to make his proposition pay; with equal ruthlessness they exclude everything a knowledge of which does not appear likely to lead to monetary profit.

Thus the present work abounds in sound and useful information on every section of commercial apple-growing, yet it neither mentions nor describes any form of training other than that for the production of a "vase"-shaped (open-headed) or pyramidal standard. Espaliers, cordons, and the subtler forms of trained tree beloved of thrifty Frenchmen are ignored completely. The American apple-tree has, in truth, been standardised, and the form prescribed is the low standard. Dwarfing stocks are allowed—in the home garden. Similarly, admirable accounts are given of frost prevention by the use of "heaters," of picking, packing, grading, marketing, and advertising, yet the descriptions of the chief varieties of apple are so brief and unclassified that growers would have the greatest difficulty in naming an unknown variety which happened to come into their hands.

So long as information has a commercial bearing it may, however, be included, even though it lack precision. For example, colour appears to be a very important attribute of American apples, and accordingly the subject is considered with some thoroughness, and quite inconclusive experiments are cited, as, for example, those on the influence of manuring with potash salts on the production of colour. Science is trying hard to discover what determines coloration in fruit, and why the colour should show from year to year such remarkable variations in one and the same variety; but its efforts so far have been unsuccessful, and the information that science can give on this subject is scarcely worth the attention of the grower.

There is, however, another aspect of the American type of monograph well exemplified in this book which deserves nothing but praise and emulation. That is the resolute thoroughness with which fundamental problems are envisaged. For example, we in this country are content to recognise that certain varieties of apple do well in certain districts and badly in others. We may go so far as to make inquiry on the subject and publish the results—a work upon which the Fruit Committee of the Royal Horticultural Society is now engaged. The American does better than this. He endeavours to discover what are the soil requirements of different varieties of apple, and in this inquiry he is, apparently, so successful that he is able to speak of and describe a "Baldwin" soil, a "Northern Spy" soil, or a Rhode Island "Greening" soil.

So excellent are the brief introductory chapters on selection of site and adaptation of varieties to soil that we can imagine some strenuous urban American exclaiming on reading them: "Sure, I can grow apples," and forthwith setting out and growing them—perhaps successfully.

Needless to say, the chapters on spraying and on insect and other pests are well done. Lime-sulphur increases yearly in favour with American growers, and, indeed, the spraying schedule recommended by the College of Agriculture of Cornell University comprises four annual sprayings with lime-sulphur, to which, if insects are to be destroyed as well as parasitic fungi, arsenate of lead is added.

The subject of breeding is treated somewhat briefly; Mendelism is glanced at. The statement (p. 425), "A breeder cannot obtain wholly new characters in apples by making Mendelian combinations," requires elaboration if it is not to be misleading; and the list (p. 414) "showing both self-sterile and self-fertile varieties" appears to contain only shy, average, or prolific pollen-bearers. It is curious that little or no reference is made either to the history and origins of the apple nor to recent work, as, for example, that conducted by the Duke of Bedford and Mr. Spencer Pickering at Woburn on economical methods of planting.

The book is well written by the hand of an expert. It should meet with wide success in America, and should be read with attention by all interested in fruit-growing in this country.

F. K.

THERMODYNAMIC CHEMISTRY.

An Introduction to the Principles of Physical Chemistry from the Standpoint of Modern Atomistics and Thermodynamics. By Prof. E. W. Washburn. Pp. xxv+445. (New York: McGraw-Hill Book Co.; London: Hill Publishing Co., 1915.) Price 15*s.* net.

TEACHERS and students alike should be grateful to Prof. Washburn for supporting the use in physical chemistry of the differential and integral calculus, which he introduces freely in the work now under review. Students will be surprised when they see how little calculus they need, and how much that little will strengthen the grip they get of physical chemistry. The time required for acquiring the necessary knowledge of calculus is nothing compared with the time wasted in wading through the tedious mathematics involved in evading the calculus. It is not only a waste of time—it is also misleading—to subject a number of difficulties each to a separate treatment, as is done when no calculus is used, as if they were of several quite distinct kinds in cases where they might be ranked together and enfiladed in a single attack.

In the application of thermodynamics to chemistry a method of purely mathematical analysis may be adopted or the principle of the efficiency of the perfect thermodynamic engine may be applied directly to physico-chemical phenomena, as is done by Prof. Washburn, who, however, simplifies the usual procedure by devising a specially constructed engine.

The influence of a pressure-change on equilibrium receives practically no quantitative treatment in most text-books; in this work it receives more of the attention it deserves. The author discusses the effect of extra pressure not only when applied to all the phases, but also when applied to one phase only. This last we consider of great importance in elucidating so-called "osmotic pressure," which is a special case of what we may call one-phase pressure.

Under the treatment of the influence of a temperature-change on equilibrium we find no reference to Nernst's complete integration of the differential equation, though Nernst's modification of Trouton's rule is mentioned. On the other hand, there is an excellent account of specific heat, without, however, applying the quantum theory.

The chapters on electro-chemistry are decidedly good, but we should prefer, for teaching purposes, a different order. It would be better to have a special chapter for E.M.F., which, so far as possible, should be kept separate from Faraday's laws and conductivity. We hope that in future editions the author will deal more fully with potential differences at interfaces generally on account of their importance in the theory of colloids; and for the same reason there should be more about the mechanical forces at interfaces.

Equilibrium, especially in solutions, is treated with a thoroughness unusual in introductory text-books. Mention is made of many recent advances in physical chemistry, and valuable references to literature help to make up for the rather scanty account given of some sections of the subject. There are brief biographical footnotes, numerous cross-references, and problems for practice in calculation. The printer's errors are few and not at all serious.

This excellent work is well worthy of the earnest study of both teachers and students.

FRANCIS W. GRAY.

APPLIED MECHANICS.

(1) *Elementary Applied Mechanics*. By Prof. T. Alexander and Prof. A. W. Thomson. Third edition. Pp. xx+512. (London: Macmillan and Co., Ltd., 1916.) Price 15*s*. net.

(2) *Applied Mechanics: First Year*. By H. Aughtie. Pp. 184. (London: G. Routledge and Sons, Ltd., 1915.) Price 2*s*. net.

(3) *Textile Mechanics*. By W. Scott Taggart. Pp. vii+117. (London: G. Routledge and Sons, Ltd., 1915.) Price 2*s*. net.

(1) PROFS. ALEXANDER AND THOMSON'S "Elementary Applied Mechanics" is an excellent treatise—a development of a much smaller one which engineers knew thirty years ago. It follows chiefly the methods of Rankine, but with a larger use of graphic constructions. It is a feature that the graphic diagrams are to scale, and are, in fact, exercises worked out. Appended to each chapter are examples fully worked out. On the mathematical side and within its range the treatment is complete. On the practical side it is not quite so satisfactory. The data of weights, working stresses, etc., involved in any practical solution are very scantily given, and the considerations which lead a designer to modify purely theoretical results are little touched on. In this the authors differ from Rankine, who took so much trouble with the data that his values are still of authority after fifty years, and are sometimes quoted in this book. For instance, the one essential starting point in roof design is the magnitude and distribution of the wind pressure. The authors merely assume a wind at 45° with the rafter, on one side of the roof, with a normal component 25 per cent. greater than the weight of the roof at each joint. But the wind pressure has nothing to do with the weight of the roof, and its distribution is not that assumed.

The problem of rolling loads on bridges is treated fully and with originality. The bending-moment diagram of circular arcs is interesting and useful. The maximum moment for any section for any travelling loads is fully discussed. The moving model which draws the bending-moment curve for a trolley is very ingenious, but it seems to us more difficult to follow than the ordinary demonstration.

On the subject of earth pressure Rankine's frictional theory is followed, without reference to the reservations he himself makes or to the numerous investigations which have shown how in most ordinary cases, except for dry sand, it is not even a good approximation. For retaining walls the deviation of the centre of pressure from the centre of the joint is taken at 3/10ths of the width without any explanation. It is a critical point, and needs defence.

Long struts are treated well, but only by the use of the Gordon-Rankine formula. The authors say that Rankine proved Gordon's formula to be rational. This is disputable; it is really an interpolation formula between Euler's and that for short columns. The various formulæ which are more convenient in use, and are, in fact, largely used in design, are not referred to.

Arched ribs are treated by Levy's graphic method, and there is an interesting and original chapter on masonry arches, though, perhaps, the treatment is too abbreviated to be very useful. Curiously, reinforced arches, now so important and affording such excellent scope for scientific treatment, are not alluded to.

The treatise is excellently printed and illustrated, and will certainly be useful to students and engineers. It seems a defect that the book has only a table of contents and no index.

(2) This is a very elementary book, in which ordinary mechanics, kinematics of machines, and some problems in work and power are treated

largely descriptively and with the help of numerical illustrations and simple experiments. The printing and diagrams are clear. But one may be allowed to ask why here, as in many other books, the so-called laws of friction deduced for dry surfaces and low intensities of pressure are given without a hint that in most cases they are more disobeyed than obeyed? Also, is such a very roundabout way of finding the work of a fluid pressure (Fig. 121) really helpful to a student?

(3) Mr. Taggart's book is similar to the foregoing, but it is more specialised, the illustrations being taken from textile machinery. It is more original, therefore, and is likely to be of service to textile workers, both in explanation of the machines they use and in familiarising them with some of the technics of the industry.

OUR BOOKSHELF.

On the Relation of Imports to Exports: A Study of the Basis of a New National and Imperial Policy. By J. Taylor Peddie. Second edition (enlarged). Pp. xxiv + 148. (London: Longmans, Green and Co., 1916.) Price 5*s*. net.

MR. TAYLOR PEDDIE'S book is written in favour of what he calls National Economics. "National Economics," he says, "to be based on freedom of trade, must come under the heading of low tariff duties, for high tariff duties are protective." Now, if low tariffs do not protect, what is their object? In his third essay Mr. Taylor Peddie attempts to answer this question. "British manufacturers . . . will have to submit . . . to a heavy income tax and other heavy direct taxation. . . . Is it, then, an equality of rights that American manufacturers . . . should in future be allowed to enter into free competition with our own productions?" Mr. Taylor Peddie has, in fact, rediscovered, repainted, and reclothed that ancient figure of fun, the mid-nineteenth-century French Free Trade school's Scientific Tariff, and, with the true artist's "temperament," he has fallen deeply in love with it!

True, his tariffs lack something in scientific precision, for he has found a special magic in the figure 17½ per cent., and no duty must exceed that amount. But their achievements more than compensate for all purely academic desiderata. His "low tariffs," apparently, are to counterbalance the adverse balance of trade, although (p. 42) he assures us that Free Trade has not produced that adverse balance. His "low tariffs" are to have no effect on prices, but to restrict imports (without protecting), increase the national productive capacity, the revenues of the State, and the distribution of wages, and although not affecting prices (p. 39) we can sell cheaper (p. 40). Mr. Taylor Peddie is, indeed, to be congratulated on his perversely paradoxical panacea.

On p. 98 we are told that "we shall never be able to destroy German industrialism by allowing National Economic questions to be discussed in the abstract or as platitudes." If "National Economics" are really to be framed with the object of destroying industrialism, we are perhaps justified in hoping that they will quickly become what Mr. Taylor Peddie believes the history of political economy for the main part to be—"a record of absurd and justly exploded opinions." A. L.

A Manual on Explosives. By Albert R. J. Ramsey and H. Claude Weston. Pp. xi + 116. (London: George Routledge and Sons, Ltd., 1916.) Price 1*s*. net.

THIS little manual is intended to furnish to the munition worker, as well as to the general reader, concise information on the nature of explosives and on their manufacture, and further to emphasise the very important part which explosives play in the sphere of modern engineering. It is certainly an excellent little primer. Particularly good is the description of the manufacture of nitrocellulose, nitro-glycerin, and the modern high explosives, the text being illustrated by excellent diagrammatic representations of the various plants employed. The authors have shown considerable discretion in the allotment of space to the different explosives, but more might well have been devoted to propellants. Smokeless powders, other than cordite, scarcely receive mention. The description of the manufacture of cordite is very brief, and it is a pity the authors give only the composition of Mark I. cordite, which, through the serious erosion it produced in the guns, was superseded some years ago by M.D. cordite, containing less nitro-glycerin.

A short chapter is devoted to fuses and detonators, another to the application of explosives, some interesting examples of engineering applications being given. A valuable chapter is one on "Industrial Poisoning among Explosive Workers and its Prevention," in which the authors deal with the symptoms by which poisoning may be recognised, the general lines of first-aid treatment, and enumerate some of the simple precautions which should be adopted to minimise risk of poisoning. Such chemistry as is necessary to follow the various processes and relating to the composition of explosives is very clearly set out, and altogether the book admirably fulfils the intentions of the authors.

Yorkshire's Contribution to Science—with a Bibliography of Natural History Publications. By T. Sheppard. Pp. 233. (London: A. Brown and Sons, Ltd., 1916.) Price 5*s*. net.

THE object of this volume is to provide students of the natural history of Yorkshire with a guide to all sources of information likely to be of service to them. Many workers in biological and geological science will be grateful to Mr. Sheppard for the particulars he has brought together about Yorkshire periodical publications dealing with natural history, Yorkshire scientific magazines now extinct, and Yorkshire topographical and general magazines. The particulars concerning other British scientific journals and societies and the list of works of reference add to the completeness of the volume.

LETTERS TO THE EDITOR.

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

Meteorological Conditions of a Blizzard.

I AM glad to see Mr. Bostwick's protest against the current use of the word "blizzard," and agree with him that the British Isles, excluding mountains like Ben Nevis, cannot produce the conditions for a real blizzard.

There can be no comparison between the phenomenon as it occurs in North America and the polar regions and the very mild imitation commonly called a blizzard in the English daily Press. In most cases the latter consists of a mixture of snow and rain, perhaps not amounting to more than 0·10 in. in all, and a wind not exceeding a strong breeze.

The only approach to a blizzard in the S.E. of England during the last fifty years was on January 18, 1881. On that occasion the dry snow and the gale were present, but not the low temperature. Much inconvenience was caused by the drifts and stoppage of traffic, but hundreds of thousands of persons probably made their usual outdoor journeys on that day in their usual clothing without danger, a thing they could not have done had the third condition of a really low temperature been fulfilled.

W. H. DINES.

Benson, Wallingford.

Economic Work of the Geological Surveys.

THE note on Sir Robert Hadfield's address to a Committee of the Advisory Council for Scientific Research, given in NATURE for May 25 (vol. xcvii., p. 264), suggests that the speaker was ill-informed as to the recent history of the Geological Surveys of our islands. The activities of what Sir Robert Hadfield styles "the Geological Survey" have naturally been "restricted" as regards Ireland, since the Geological Survey of that country was placed under the Irish Department of Agriculture and Technical Instruction so far back as 1905. So soon as the need for more detailed information as to our mineral resources became apparent, through the pressure of military operations, the staff in Ireland was devoted to the preparation of a reference index to all known mines and mineral localities in the country, and the inquiries that are almost daily dealt with already show the utility of the material thus brought together.

The remark quoted from Sir Robert Hadfield's address as to the basis on which our knowledge of Irish minerals rests must surely refer to some officer in England. The Department of Agriculture in Ireland employs, in addition to the staff of its Geological Survey, an officer entitled the "Economic Geologist," possessed of special mining qualifications, whose advice is always at the service of those who may be desirous of developing mineral industry in the country. Surely the combined work of the Geological Surveys and of the mining officials already employed in the public service should obviate the creation of a new "Central Imperial Bureau." The deficiency of information has long been due to public ignorance of the value of the material brought together by public servants, an ignorance unhappily shared by many who pose as mine prospectors.

GRENVILLE A. J. COLE.

Geological Survey of Ireland,
14 Hume Street, Dublin, May 27.

ANTARCTIC PHYSIOGRAPHY.[1]

DR. GRIFFITH TAYLOR, physiographer to the Commonwealth of Australia, accompanied Capt. Scott's last Antarctic Expedition as its chief physiographer, and in this interesting volume he records his experiences, gives brief summaries of his observations and conclusions, and describes the daily life and incidents of the enterprise. His scientific results will be given more fully and connectedly in the special volumes on the work of the expedition. His narrative is mainly of interest as a preliminary statement of his conclusions, and for his racy account of the life of the expedition and pleasing picture of the good humour and happy comradeship between all its members.

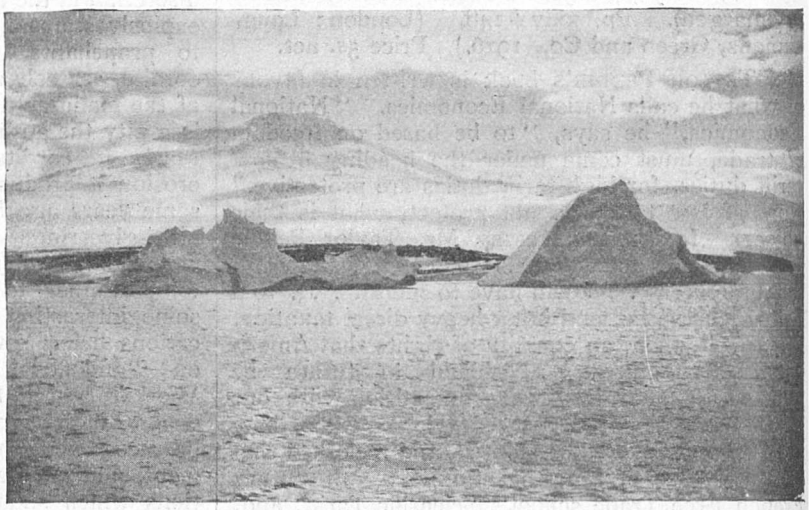

FIG. 1.—Photo from the ship of Cape Evans, January 26, 1911. The Tunnel Berg appears on the right. Behind is the dark line of the Ramp, and twelve miles away the cone of Erebus with a small steam cloud. From "With Scott: The Silver Lining."

Dr. Taylor's chief contributions to the history of the expedition are his accounts of the voyage from New Zealand to Macmurdo Sound, of the winter's life at the base there, and of the two expeditions under his command to the mainland on the western side of Macmurdo Sound. During his sledge journeys in that area he was able to supplement the observations of Ferrar, David, and Mawson, and by combining all the materials available has produced the most detailed map of any part of eastern Antarctica. It is an area of special interest, as the glaciers descend towards the coast through a series of remarkable valleys which notch the edge of the Antarctic plateau. Dr. Taylor's party followed the Ferrar Glacier

[1] "With Scott: The Silver Lining." By Dr. Griffith Taylor. Pp. xiv+464. (London: Smith, Elder, and Co., 1916.) Price 18s. net.

westward to an upper section, which has been named the Taylor Glacier. The origin of the glacier valleys has not yet been fully explained, but the solution of the problem may be furnished by the detailed geological and geographical information collected by Dr. Taylor and his comrades.

Dr. Taylor's special attraction to Antarctica was the opportunity of studying the physiography of an area where water action had been always either absent or relatively insignificant compared with glacial erosion. It is interesting to note that his Antarctic studies have led him to reduce the importance he had once assigned to ice erosion. He now attaches more importance to the shattering action of frost than to the actual erosive influence of glacier ice. The front of the Antarctic plateau which rises above the Ross Sea has been hollowed into the great rounded depressions known as corries or cirques; and these features have long been attributed by many glacialists to the direct excavating action of glaciers. Dr. Taylor, however, adopts the conclusion that they are essentially due to the action of frost. This explanation was first clearly advanced by Prof. Cole in 1895, and though long rejected it has been largely adopted in recent years. The indefiniteness of the characters used to distinguish glacial from water erosion is illustrated by some of Dr. Taylor's observations. Thus he figures a hill slope which appears to be an ordinary denudation curve; he attributes this catenary curve to glacial erosion, whereas probably most glacialists regard the opposite denudation curve, which is oversteepened at the end owing to the toe of the slope having been worn away, as the characteristic feature of glacial denudation.

One item in Dr. Taylor's physiographic nomenclature is open to regret, since he has followed a growing custom of adopting an ordinary German term with a special technical meaning. He uses the term "riegel" for a rock bar across a glaciated valley. In his first reference to the structure he calls it a bar or riegel; but afterwards he uses only the latter. The word "bar" is the recognised English term, and it is used in geography, and there seems no need to introduce a foreign word. German authors adopt the term "riegel" because it is the natural word for them to use in describing this structure; and there seems no more reason why British authors should call such a formation a riegel than why German geographers should call it a bar. It may be said that the term "bar" is ambiguous, and can only be understood by the context, but exactly the same objection applies to "riegel."

In reference to the general physiographic Antarctic problems, it is interesting to note that

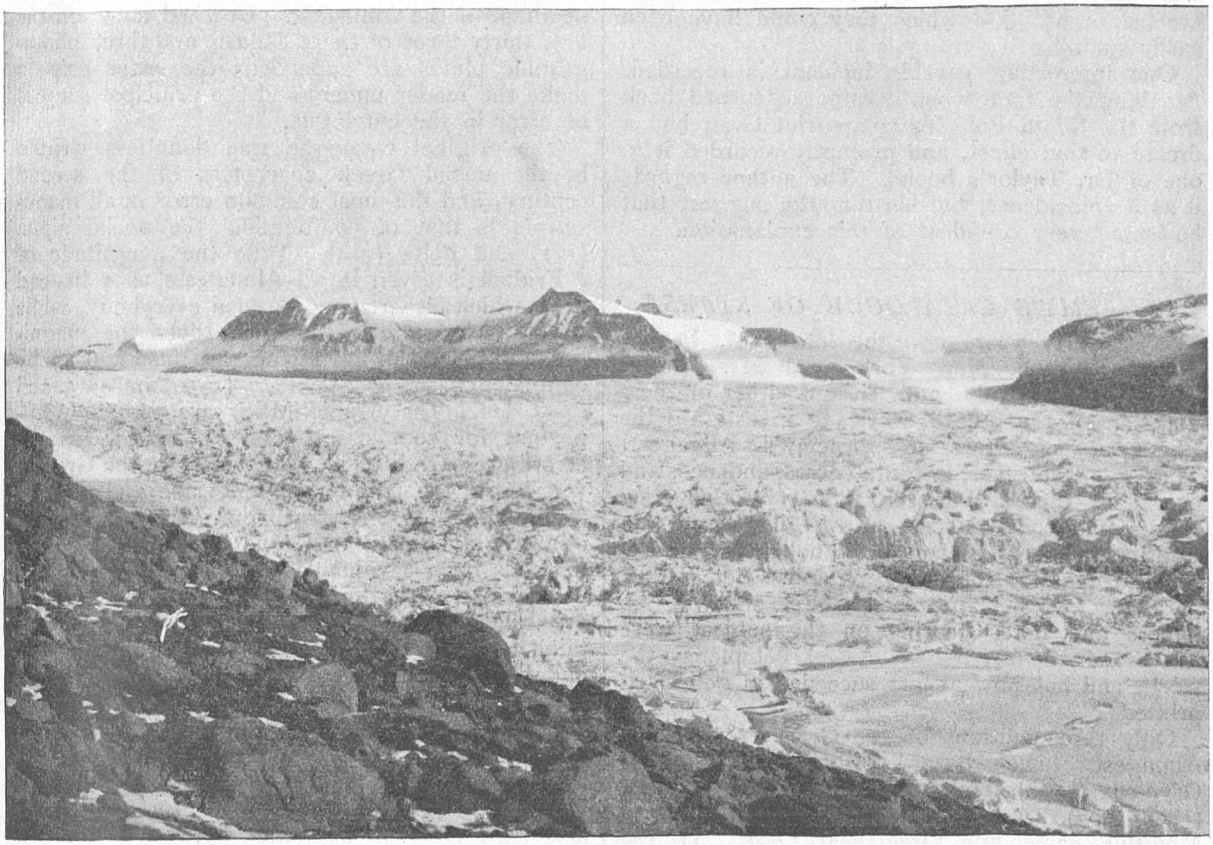

FIG. 2.—The field of crevasses (Skauk) at the root of Mackay Tongue, January 6, 1912. Behind are the faceted slopes of Mount Allan Thomson. Photo from the Flat Iron looking N.W. From "With Scott: The Silver Lining."

Dr. Taylor believes in the connection advocated by Filchner between the Ross and Weddell Seas. From the account of the researches by Dr. Simpson it appears not improbable that the most important of the scientific results of the expedition will be the additions to Antarctic meteorology.

The book is illustrated by numerous excellent photographs, including some by the expert Antarctic photographer, Mr. Ponting, and also many instructive and ingenious diagrammatic sketches by Dr. Taylor. He publishes a photograph of the *Discovery* Hut in which he lived for a month, and the title directs attention to one feature which shows that the hut was not built as designed; for it is raised on supports which were only to have been used if the hut had to be erected on ice into which they could have been easily sunk.

One interesting psychic incident is recorded. At about the time when Amundsen turned back from the South Pole his compatriot Gran had a dream to that effect, and promptly recorded it in one of Dr. Taylor's books. The author regards it as a coincidence, but his remarks suggest that he is not very confident of this explanation.

PTOLEMY'S CATALOGUE OF STARS.[1]

JUST forty years ago the late Prof. Peters, of Clinton, New York, and Mr. Knobel began independently, and without either of them knowing of the other's work, to investigate the Catalogue of Stars in Ptolemy's Almagest. They soon, however, got into correspondence, and eventually met in Paris in 1887. By that time Peters had collated most of the manuscripts in Continental libraries, and Mr. Knobel then undertook to examine those in England. Peters died in 1890, and in November, 1891, most of his papers and notes bearing on the subject were forwarded to Mr. Knobel, who completed the work, and has now at last suceeded in getting it printed.

Only three editions of the Greek text of the Almagest have been published, those of Grynæus (1538), Halma (1813–16), and Heiberg (1898–1903). A valuable German translation by Manitius came out three years ago. Of the Star Catalogue there have been several separate editions, the best of which is that of Baily (Mem. R. Astr. Soc., vol. xiii.). But from an astronomer's point of view no previous edition can compare with the one we are considering here, as this is founded on an examination of a great number of codices—Greek, Latin, and Arabic—and contains, besides, many other things for which astronomers looked in vain in the earlier editions.

The investigation of Peters differs from those hitherto made, as he began by calculating from Piazzi's star-places and Mädler-Bradley's proper motions the longitudes and latitudes of all Ptolemy's stars for the epoch A.D. 100, for the purpose of identifying the stars and getting an idea of the accuracy of the positions. This was done before Auwers had published his new reduction of Bradley's observations, and it would have been worth while to examine what difference the adoption of Auwers's proper motions would have made, though the main results of the investigation would doubtless not have been affected. The work also differs from all others in the number of codices consulted. In all, twenty-one Greek and eight Latin codices of the Almagest were examined, and also three Arabic codices of the Almagest, ten of Al Sûfi's Uranometry (the catalogue in which is that of Ptolemy, with a constant correction for precession), and one of Nasir-ed-din Al Tûsi's Compendium of the Almagest. Detailed notes on the first thirty-three of these codices and three photographic plates are appended; the latter help to make the reader understand the principal sources of error in the catalogue.

The original catalogue was doubtless written in the uncial Greek characters of the second century, and the most common error in all manuscripts is that of confounding the uncial alpha (=1) and delta (=4). Thus the magnitude of θ Eridani is given in all Almagests as 1 instead of 4, which hitherto has puzzled everybody, while the Bodleian Greek Almagest gives the magnitude of Sirius as 4. Errors are also caused by confusion between Λ and Λ (=30) or $\epsilon=5$ and $\theta=9$, etc. The Arabic MSS. are especially important for comparison with the Greek, as the errors are of a different kind. Unlike the Greeks, who wrote the minutes of longitude and latitude as fractions of a degree, the Arabs wrote the minutes in figures, and thus these two different methods form a valuable check one on the other.

The star-places finally adopted by the authors are given in three catalogues. The first contains for each star: Baily's number, the number and Latin description of the star from the Latin edition printed in 1528, the Flamsteed number and Bayer's letter, the longitude, latitude, and magnitude. The second catalogue repeats the last three items, and gives the longitude and latitude computed from Piazzi for the epoch A.D. 100, and the difference between these and Ptolemy's values; also the magnitude from the revised Harvard Photometry. The third catalogue gives Ptolemy's longitudes reduced by 2° 40′, being the difference which Ptolemy states he found between the longitudes of Hipparchus and those of his own time, and the latitudes unaltered; also the positions computed for 130 B.C. After a lengthy set of notes on various stars follow tables collating a number of codices as regards longitude, latitude, and magnitude.

Most writers have been of the opinion that Ptolemy's catalogue was nothing but that of Hipparchus, the longitudes being altered by adding 2° 40′ for precession. Peters had already published in 1877 a paper showing that modern star-places, reduced to A.D. 100 and compared with those of Ptolemy, gave a mean correction to his longitudes = +34·9′, making his epoch

[1] "Ptolemy's Catalogue of Stars. A Revision of the Almagest." By Dr. C. H. F. Peters and E. B. Knobel. Pp. 207. (Washington: Carnegie Institution, 1915.)

A.D. 58 instead of A.D. 138, the alleged epoch. The year A.D. 58 is 187 years after the epoch of Hipparchus, which gives the amount of precession = 2° 36′, agreeing closely with the difference of 2° 40′ found by Ptolemy. Mr. Knobel remarks that, as the correction could not represent positions observed in A.D. 138, this supports the view that the catalogue is simply that of Hipparchus, with a constant amount added to the longitudes.

But this conclusion is by no means certain, and was not accepted by Peters when he spoke on this subject at the Kiel meeting of the Astronomische Gesellschaft in 1887, less than three years before his death. According to the very short report in the *Vierteljahrsschrift* (xxii., p. 269), Peters said that the constant error of the longitudes might very well be due to systematic errors of Ptolemy's instruments or to faults of the method (comparison of sun and stars with the moon as an intermediary), neglect of refraction, etc. The equinoxes of Ptolemy should not be assumed to possess the accuracy required to justify the above conclusion, and it would, in fact, be remarkable if such accuracy had been attained. Peters added that stars with large proper motion, especially 40 Eridani, agreed far better with the places of the stars at the time of Ptolemy than with those at the time of Hipparchus. To these reasons for hesitating to adopt the usual conclusion we would add the common belief among the Arabs that Ptolemy had borrowed his whole catalogue from Menelaus, adding 25′ (41 years' precession at 36″) to the longitudes. This seems in itself a far more likely origin of the catalogue than that it should have been borrowed from one made 270 years earlier. But the problem of the origin of Ptolemy's catalogue is still unsolved.

J. L. E. D.

PROF. H. C. JONES.

THE announcement in NATURE of May 18 of the death of Prof. Harry Jones, of Johns Hopkins University, will be received by his many friends in this country with sincere regret, for his transparent honesty and sincerity, his enthusiastic nature, his kindliness, and his courtesy impressed all with whom he came in contact.

Harry Clary Jones was born in New London, Maryland, in 1865, and received his academic education in the famous university of his State. He graduated as A.B. in 1889 and as Ph.D. in 1892. The next two years he spent in Europe working in the laboratories of Ostwald, Arrhenius, and van't Hoff. Permeated with the ideas and theories associated with these names, Jones returned to America and proceeded to promulgate them with boundless energy and enthusiasm. He received an appointment on the teaching staff of Johns Hopkins University, and was in time promoted to the chair of physical chemistry. Jones was a tireless worker himself and inspired his numerous co-workers with an equal industry. During the last twenty years he published, alone and in conjunction with them, well above a hundred papers, many of them memoirs of considerable magnitude, and found time in addition to write six books (text-books and semi-popular works), several of which have passed through a number of editions.

The line of research to which he chiefly devoted himself was the study of the intimate nature of solutions. In the "ideal" solutions of van't Hoff the mutual influence of solvent and solute may be neglected. The main object of the investigations of Jones and his fellow-workers was to ascertain the nature and extent of this influence in actual solutions. For aqueous solutions Mendeléeff had advanced the hypothesis that the dissolved substance existed in the form of a hydrate or hydrates of definite composition. Jones modified and extended this idea and held that dissolved substances in general are combined with more or less of the solvent as a series of solvates. To test this "solvate theory of solution" his extensive experimental work was devised. He explained abnormally low freezing-points of concentrated solutions as due to a portion of the solvent having combined with the solute, so that the concentration in the remaining solvent was greater than that deduced from the composition of the solution, and showed that this abnormality in aqueous solutions was greatest for those substances which crystallise most readily with water of crystallisation. By the use of the grating spectroscope he showed that the absorption bands of solutions became broader (1) as the solution became more concentrated, (2) as the temperature was raised, (3) as dehydrating substances were added. In each case this would correspond to the production of simpler hydrates. He also showed that different absorption bands were obtained according to the solvent in which the salts investigated (chiefly those of neodymium, which give sharp absorption bands) were dissolved, pointing to the formation of different solvates. By means of the radiomicrometer he demonstrated finally that the water in concentrated solutions of non-absorbing salts showed a smaller absorption in the infra-red region than water itself.

Of his text-books the "Elements of Physical Chemistry" is deservedly the most successful, being written in an easy, readable style, which makes it popular with the student. In his "New Era in Chemistry" he described the progress of the science from 1887 onwards, and struck a personal note which adds to the interest and pleasure of perusal.

J. W.

NOTES.

THE Paris correspondent of the *Times* states that the Committee of the Senate appointed to consider the Daylight Saving Bill has reported against the measure on the ground that the economy intended to be realised is doubtful, and that the change would cause serious inconvenience.

IN the recent debate on the Air Board in the House of Lords several references were made to the scientific side of aeronautics. This aspect of the subject is not nearly so well known and appreciated as it should be

by the designers and constructors of our present aeroplanes. If the new Air Board succeeds in bringing about a better understanding between the practical designer and the scientific expert, and in enabling the results of scientific experiment and calculation to be used more widely in the actual production of aircraft, it will be doing a great service to the aeronautical industry. The proposal for the establishment of a separate Board of Inventions in connection with the Air Board seems to be a good one, provided that the Board consists of men who have sufficient technical knowledge to be able to discriminate between inventions of real use and the many "freak" inventions which now flood the country. A great deal of the time of scientific experts is now wasted in experimenting on inventions that should have been thrown out as obviously useless in the first place. The progress that has been made from the scientific point of view is very considerable. It is now possible to calculate with considerable accuracy the performance and stability of a new design from simple experiments on models in a wind tunnel. In the matter of scientific aeronautics we are well in advance of the enemy, except perhaps in connection with rigid airships. The chief necessity at the present time is that available scientific information should be used to the fullest advantage. It is only by the combination of scientific investigation with the practical experience of the pilot and the designer that the best results can be obtained, and the much-desired supremacy of the air definitely assured.

THE following officers of the Linnean Society for the ensuing year were elected at the annual meeting of the society on May 24:—*President*, Sir David Prain, C.M.G.; *Treasurer*, Mr. H. W. Monckton; *Secretaries*, Dr. B. Daydon Jackson, Mr. E. S. Goodrich, and Dr. A. B. Rendle.

WE regret to see the announcement of the death, on May 28, at seventy years of age, of Sir James F. Goodhart, consulting physician to Guy's Hospital and other institutions, and president of the Harveian Society of London in 1898.

THE fourth Wilbur Wright Memorial Lecture of the Aeronautical Society, on "The Life and Work of Wilbur Wright," will be delivered by Mr. Griffith Brewer at the Royal Society of Arts, on Tuesday, June 6, at 3 p.m. The Rt. Hon. Lord Montagu of Beaulieu will preside.

AT a meeting of the Institution of Mining Engineers, to be held at the rooms of the Geological Society, Burlington House, Piccadilly, W., on Thursday, June 8, Prof. F. W. Hardwick will deliver a lecture on "The History of the Safety-Lamp," in celebration of the centenary of its invention by George Stephenson and Sir Humphry Davy.

WE regret to announce the death, on May 17, at eighty-four years of age, of Mrs. Mary Everest Boole, widow of George Boole, the mathematician. Devoted to her husband and his memory, she was an original and rather paradoxical writer; for example, on the strength of her knowledge of the mathematical theory of envelopes, she wrote a sort of metaphysical essay about free will, etc., in terms of an envelope-theory. Like Henry Drummond, she mistook a picturesque analogy for a real explanation; but the book is better worth reading than many more orthodox productions.

GENERAL SIR DOUGLAS HAIG, Commander-in-Chief of the British Forces in France and Belgium, in his first despatch, dated May 19, and covering the period from December 19, 1915, makes the following appreciative reference to the assistance afforded by chemists attached to the forces:—"The valuable nature of the work performed by the officers of the Central Laboratory and the Chemical Advisers with the Armies in investigations into the nature of the gases and other new substances used in hostile attacks, and in devising and perfecting means of protecting our troops against them, is deserving of recognition. The efforts of these officers materially contributed to the failure of the Germans in their attack of December 19, 1915, as well as in the various gas attacks since made."

AMONG the representatives of applied science who have lost their lives in the present war some mention should be made of Capt. Paul Hammond. He was born in Brazil of British parentage, and was educated at Tonbridge School. He studied at the School of Mines at Freiberg, in Saxony, where he graduated as a mining engineer. He was for some time engaged in mineralogical survey work in the south of the State of São Paulo, and afterwards practised as a consulting mining engineer in London. Shortly after the outbreak of war he received a commission in the 8th Battn. of the East Lancashire Regiment, and was Acting Major when he was wounded at Foncquevillers. He died eight days later, on February 25 of the present year, aged thirty-one. His keenness and courage stood him in good stead in his short military career, while his cheerfulness and kindliness endeared him to all who knew him.

A REPORT has just been issued by the Committee appointed by the Home Secretary in March last to test experimentally the value of dry-powder fire-extinguishers in putting out fires such as are likely to be caused by bombs (Cd. 8250, price 1*d*.). These extinguishers generally contain as their main constituent sodium bicarbonate, the amount varying from 46 to 56 per cent. in the samples analysed. The particular make chosen for the fire experiments contained also approximately the same proportion of calcium carbonate, the total available carbon dioxide amounting to 12 or 13 per cent. The efficacy of the dry-powder preparations was compared with that of water applied (1) in buckets, and (2) in liquid extincteurs spraying a jet of water impregnated with carbon dioxide upon the fires. None of the agents employed had any material effect upon the combustion of the bomb itself. Water, however, was far more effective than the dry powder in preventing the spread of the fire, the wetting of the surrounding material confining the conflagration to the immediate neighbourhood of the bomb. The general conclusion arrived at was that by far the best extinguishing agent is a plentiful supply of water applied in the manner most convenient; the use of dry powder is to be deprecated as giving a misleading sense of security.

SOME interesting details of his recent explorations in Central Asia have been furnished by Sir Aurel Stein on his return to England. He followed a route hitherto unknown to the Pamirs across Darel and Tangier, and in this portion of his journey he was assisted by Pakhtum Wali, an exiled chief of Chitral, who has recently carved out for himself a new kingdom in this region, and desires the friendly support of the Government of India. At an old sand-buried site in the Talkamakan desert many ancient writings on wood in an early Indian language dating from the third century A.D. were found, and the old route by which the Chinese conveyed their silks to Central Asia and the Mediterranean was traced. On this road hundreds of copper coins and bronze arrow-heads, the débris of their caravans, were picked up. On another

part of the route the watch-towers erected by the Chinese to protect their western marches in Kansu against the Huns were examined. These travels involved more than 11,000 miles marching over mountain and desert, and Sir Aurel Stein gratefully acknowledges the kind treatment he received from the Russian officials. The explorer and the Indian Government, who organised the journey, are to be heartily congratulated on the successful completion of a task which will supply much new information on geography, history, art, and linguistics.

THE provisional programme of the eighty-sixth annual meeting of the British Association, to be held at Newcastle-upon-Tyne from Tuesday, September 5, to Saturday, September 9, under the presidency of Sir Arthur Evans, F.R.S., is about to be issued. The inaugural meeting will be held in the Town Hall on September 5, at 8.30 p.m., when the president will deliver an address to the association. Evening discourses will be delivered in the Town Hall on Thursday, September 7, by Prof. W. A. Bone, F.R.S., who will deal with some recent advances in combustion, and on Friday, September 8, by Dr. P. Chalmers Mitchell, F.R.S., on "Evolution and the War." The reception-room will be in the College of Medicine. Some of the section-rooms will be in the same building, and the remainder will be conveniently accessible from it. The following are the presidents of sections :— A (Mathematical and Physical Science), Dr. A. N. Whitehead, F.R.S.; B (Chemistry), Prof. G. G. Henderson; C (Geology), Prof. W. S. Boulton; D (Zoology), Prof. E. W. MacBride, F.R.S.; E (Geography), Mr. D. G. Hogarth; F (Economic Science and Statistics), Prof. A. W. Kirkaldy; G (Engineering), Mr. G. G. Stoney; H (Anthropology), Dr. R. R. Marett; I (Physiology), Prof. A. R. Cushny, F.R.S.; K (Botany), Dr. A. B. Rendle, F.R.S.; L (Educational Science), Rev. W. Temple; M (Agriculture), Dr. E. J. Russell.

A VERBATIM report has just been published (London: Harrison and Sons; price 6*d*.) of the proceedings of the conference on the Neglect of Science, of which an account was given in NATURE of May 11 (p. 230). The conference was successful in eliciting some noteworthy utterances from leading representatives of many departments of national activity, and was fortunate in securing Lord Rayleigh as the chairman. The chief claim of the first resolution was that science "should form part of the entrance examination of the Universities of Oxford and Cambridge, as well as of the newer universities." Lord Rayleigh is Chancellor of the University of Cambridge, which still makes, not science, but Greek an essential subject of entrance examinations; and the purpose of the meeting over which he presided was to urge the need for reform. It is of particular interest, therefore, to give Lord Rayleigh's views upon the supposed advantages of compulsory classical study for the average boy in a public school. "I believe it is true," he said, "there is a certain type of mind for which a classical education on more or less existing lines is perhaps the best thing that can be found; but when it comes to the majority of schoolboys, I think it is nothing less than an absurdity to talk about impressing them with the language and literature of the ancients. It is well known that such a result is not achieved with the average boy. I myself was an average boy, in classical matters anyhow, and I can speak from experience. I was not behind the average; but I know that the long years which I gave to classical work were to a very large extent thrown away, although I have no doubt I got something from it; but any idea of attaining to an appreciation of the language and literature of the Greeks, in my own case, and in the case of most of my friends, was mere moonshine. . . . You pretend to take a literary education by Greek, and you end by getting none at all. My own belief is that modern languages to a very large extent serve the purpose if properly taught and properly insisted upon, as they very frequently are not now."

THE death is announced of Prof. Paul Lemoult in tragic circumstances. Until the outbreak of war he occupied the chair of chemistry at the University of Lille, and was at the same time director of the School of Commerce of the North, and chief engineer to the chemical works of La Pallice, near La Rochelle. When Lille was occupied by the enemy some of the industries were transferred to the Lyons district, and under the direction of Prof. Lemoult a picric acid works was erected, which very soon was able to contribute substantially to the production of this explosive. On Monday, May 1, a fire broke out in the works, and very soon assumed serious proportions. Lemoult was soon on the spot, but, in spite of his efforts, the fire spread to the storehouse, which contained 150 tons of picric acid. The explosion which ensued destroyed the factory, and Lemoult lost his life. Paul Lemoult was born in 1871, and after passing through the Lyceum at Poitiers he was admitted to the Ecole Normale in 1891. He then entered the laboratory of Berthelot as *préparateur*. He obtained his doctorate in 1898 for a thesis on the polymerisation of cyanogen compounds, for which he obtained the Jérôme Ponti prize. He afterwards took a post at the celebrated colour factory of St. Denis, where he remained several years, when he was appointed to the University of Lille. His wide knowledge of technical matters was greatly valued by the industrial community among which he lived, and the confidence which he inspired led to his appointment as director of the School of Commerce of the North. He made several valuable contributions on organic chemistry to the *Comptes rendus* of the Paris Academy of Sciences.

IN 1879 the arrangements for the transport of the obelisk from Alexandria to New York were undertaken by the Government of the United States. The work was completed, and the obelisk was erected at New York in October, 1879. During the course of the operations Lieut.-Commander H. H. Gorringe, who was in command of the expedition, made a collection of Egyptian antiquities, which were removed to America, but after his death the collection was completely lost to sight, and has only recently been examined by Prof. S. A. B. Mercer, who gives an account of it in part ii. (1916) of *Ancient Egypt*. It turns out to be of exceptional interest, containing a number of fine terra-cotta figurines of Harpocrates and Isis, dating from the Roman period. The gems of the collection are a beautiful bronze figure of Ptolemy Lathyros, an excellent example of Ptolemaic art; a number of bronze figurines of the Roman period, and statues of Osiris, Sekhmet, Neith, and Isis of the twenty-sixth dynasty. In the same issue of *Ancient Egypt* Prof. C. G. Seligman describes a remarkable ivory comb of the prehistoric period, with a representation of the hippopotamus goddess, Taurt, which seems to be the earliest representation of this divinity, and indicates that her cult prevailed in a time earlier than is usually supposed.

THE visit of the British Association to Winnipeg in 1909 gave a welcome stimulus to ethnographic work in Canada, of which an account is given by Mr. A. C. Breton in *Man* for April. The Dominion Government has contributed liberally to this work by establishing an Anthropological Division of the Geological Survey,

with charge of the Victoria Memorial Museum at Ottawa as the centre of research, and it has already published a series of papers of exceptional value. Canada possesses at the present time no fewer than thirty museums equipped with anthropological departments, the most important being that at Ottawa. In this the complete Labrador Eskimo ethnological and archæological departments are of special interest. Toronto possesses the cranial collection of the late Sir D. Wilson, and a fine series of skeletons from mounds in Ontario and Manitoba, brought together by Prof. Montgomery. In the Provincial Museum in the same city are stored collections of Ontario skulls and a mass of stone implements brought from ancient sites in the province by the late Dr. David Boyle. A good example of a local museum is that of the Rocky Mountains Park at Banff, where Mr. Harlan Smith is in charge of fine collections from the tribes of that region. The Dominion Government deserves warm congratulations for the active interest it has shown in developing the study of the ethnology and archæology of the country.

THE *Annals of Tropical Medicine and Parasitology*, vol. x., No. 1, April, contains six papers. Dr. H. H. Scott deals with the vomiting sickness of Jamaica; Dr. G. Duncan Whyte with simplified diagnosis and treatment of ancylostomiasis; Dr. E. R. Armstrong with differential blood counts in malaria; Mr. H. F. Carter with three new African midges; Sir Leonard Rogers with the reduction of the alkalinity of the blood in cholera; and Dr. H. R. Carter, of U.S.A., with immunity to yellow fever. Dr. Scott, who is Government bacteriologist in Jamaica, after a long and careful study, concludes that vomiting sickness, so prevalent in that island, is due to poisoning by ackee fruit, *Blighia sapida*. There has been much difference of opinion as to the causation of this vomiting sickness, yellow fever and cerebro-spinal meningitis having been considered to be the cause of death in many of the cases in the past. Dr. Scott found in 1914–15 that ackees formed part of the last meal taken in health before the onset of the disease. Persons taking the "soup," or "pot-water," made with ackees in certain conditions, showed the most acute symptoms; the onset occurred in two hours, and death nearly always resulted. Unopened ackees, those picked from a decayed, bruised, or broken branch, those forced open unnaturally, and those with a soft spot are poisonous. Much of the poison is extracted by boiling with water. The affection is largely one of childhood. By experiment it was determined that intragastric administration of an extract, made by boiling unopened ackees with water, produced in three kittens and one pup the symptoms and pathological changes seen in cases of vomiting sickness. The pathological changes in man and experimental animals are described, and are well illustrated in two plates.

IN the *American Naturalist* for April Prof. T. Waterman discusses the evolution of the human chin. His main object is to demonstrate the fallacy of the contention of Dr. Robinson that the human "chin" has evolved as a consequence of the habit of articulate speech. Prof. Waterman's task is not difficult, but his essay serves a very useful purpose, and his facts are admirably marshalled. It might, however, have been pointed out that the evolution of the chin is due as much to the shortening of the facial portion of the skull as to the reduction of the teeth.

THE *Museum Journal* of Philadelphia for December has just reached us. Among other items of interest, it contains a very readable account of the Eskimo of Coronation Gulf, known also as the "Copper" Eskimo, from the fact that these people are largely dependent on this metal for their implements. It is among them that Stefansson found his "blond Eskimo." The clothing, weapons, and methods of hunting are described at length, but no description of the physical characters of these people is given. Copper appears to be the only native metal they possess, but they also use iron and brass, though only to a very limited extent. How, and whence, they obtain these is not stated.

MR. HALSEY BAGG, in the *American Naturalist* for April, records the results of his recent attempts to measure individual differences in behaviour in white mice, and therefrom to determine the degree to which kinds of conduct can be established in family lines by selection. His choice of white mice, in preference to man, he explains, was determined by the fact that in man the experimental method cannot be used. Mr. Bagg's test of alertness and educability was made through the medium of a maze ending in a food compartment. Altogether ninety mice were used, and each individual was passed through the maze seventeen times. There were no marked differences between the sexes in regard to this test of ability, but yellow mice proved inferior to white in this ordeal. The author found marked individual differences in behaviour, and discovers an apparent resemblance among individuals of the same litter.

AN interesting point in relation to the geographical distribution of British Mollusca will be found in the *Scottish Naturalist* for May. Therein Mr. Denison Roebuck reviews the history of a slug, *Limax tenellus*, found by the Rev. R. Godfrey, in the Rothiemurchus Forest in 1904, after it had been lost sight of for fifty-six years. Some were obtained from under stones, but the majority were taken from old pine branches covered with decayed pine needles and other rotten vegetation. This discovery of the nature of the habitat at once threw a flood of light upon the occurrence of the species, and showed that the reason it had so long escaped notice was due to this preference for aboriginal pine forests, an area conchologists had never thought of searching, from a belief that pine was inimical to molluscan life. The clue obtained, search was at once made on an extended scale, with the result that it has since been found in no fewer than six Scottish and eleven English counties, five of these forming a ring encircling London. But, more than this, it occurs in abundance in the pine forests of Switzerland, and it now remains to discover the intermediate stations on the mainland of Europe.

MESSRS. SHERRATT AND HUGHES, Manchester, have published a further account, by Mr. J. Arthur Hutton, of investigations into the salmon fisheries of the River Wye. Good statistics of the fish caught by rods and nets, and measurements and determinations of age are given, and the author deduces some very interesting results. The scarcity in very large spring and summer salmon (five and a half to six years old) indicates an apparent failure of the 1910 hatch, and this appears to be traceable to two causes:—(1) The exceptional drought and high temperature in the rivers in the summer of 1911, which probably encouraged coarse fish in competition with the early stages of salmon; (2) the marine conditions in 1912, the year when the parr hatched in 1910 would migrate to the sea. This was a season of high salinity in the sea, and of low autumn temperature. A further point brought out by Mr. Hutton is that Wye salmon have for some years been migrating and spawning earlier than usual. This is possibly an integrative effect of a series of exceptionally mild winters. The change is probably only temporary.

ORANGES and lemons in which the style is persistent up to maturity are known to occur at certain seasons and in certain localities, and various theories have been advanced to account for the fact, some writers suggesting that these forms are peculiarities of a distinct variety of the plant. In a note contributed to the *Atti dei Lincei*, xxv. (1), 3, R. Pirotta dissents from these views, and advances the theory that the persistence or otherwise of the style depends on the effects of weather in retarding or accelerating the processes of fertilisation and the ripening of the fruits.

OWING to the scarcity of dyestuffs resulting from the war, considerable interest attaches to the attempts to obtain and utilise new colouring matters. In this connection the *Atti dei Lincei*, xxv. (1), 5, contains an account of investigations by R. Lepetit and C. Carta Satta on the yellow substance extracted from the bark of *Pinus pinaster*. These researches, commenced ten years ago, show that this colouring matter furnishes tints of a beautiful yellow with mordants of alum, of an orange colour with tin, of a less bright yellow with chromium, dirty yellow with copper, and olive-brown with iron. It is thus identifiable with quercetin, and exists in the bark of the fir-tree in a state of complete combination with a tanno-glucoside.

THE report of the Botanic Gardens and Government Domains, Sydney, New South Wales, has just been received, and contains an interesting account of the various botanical activities undertaken under the direction of Mr. J. H. Maiden. In addition, the report includes a valuable contribution relating to the Arachnida, Myriapoda, and Insecta of the Botanic Gardens, by Mr. Rainbow, entomologist of the Australian Museum, and is on similar lines to the account of the mammals, birds, reptiles, fishes, and shells published in the report of the previous year. A long list is given of interesting plants introduced, or re-introduced, into the Gardens, and in the herbarium report we note that 2725 sheets have been added to the collection, many being additions to the flora of New South Wales.

THE report of the Agricultural Department and Experiment Station in the Virgin Islands for the year ended March, 1915, has recently reached us, and shows that considerable attention has been given to the cotton crop, especially with regard to establishing a local seed supply, and thus ensuring uniformity of crop and staple. Coconut planting in the islands is being encouraged, and nearly 3000 nuts were distributed during the year. An Onion Growers' Association has also been formed with every prospect of success. A similar association has been formed in Antigua, where conditions are also favourable for this crop. From the reports of the various islands, it is clear that the Imperial Department of Agriculture is making every effort to extend the scope and foster the progress of agriculture in the West Indies.

IN the course of the voyage of the *Carnegie* from New Zealand to South Georgia last December and January search was made for the Nimrod and Dougherty Islands in the South Pacific. The search in both cases was fruitless. In the *Geographical Review* for April (vol. i., No. 4), where an account of the search appears, it is suggested that the result of this work is to remove these islands, especially Dougherty Island, from the map. The writer is perhaps not aware that in 1909, on the homeward voyage of the *Nimrod*, with Sir E. H. Shackleton's Antarctic Expedition, Capt. J. K. Davis made a thorough search for these islands, and failed to find them. They were in consequence removed from the last edition of the Prince of Monaco's bathymetrical chart of the oceans. Without a doubt icebergs gave rise to the reports of the islands, for it is very difficult in certain conditions of light to distinguish some icebergs from land.

DURING the last year or two the *Geographical Journal* has been devoting some attention to articles on different regions, more or less affected by the war, each from the pen of an expert. In the issue for May, 1916 (vol. xlvii., No. 5), Prof. J. W. Gregory has a long article, illustrated with maps, on Cyrenaica. Prof. Gregory deals particularly with the economic possibilities of Cyrenaica and its future as a colony. Over this he is not enthusiastic, but at the same time is strongly opposed to the view that Cyrenaica is a useless desert. The climatic question is an important one, and Prof. Gregory holds that the evidence points to no change since classical times; nor will he admit that Turkish control has been altogether bad for the land. The change in the economic value of Cyrenaica since Roman times he holds is due mainly to competition by new lands, making the production of corn and wool less profitable, and to honey, a valuable product in the past, being superseded by sugar-cane and beetroot. The decline in the trans-Saharan trade, owing to its diversion to Nile and Niger routes, and the development of steam navigation on the Mediterranean have robbed the country of its position on several great trade routes.

IN connection with the *Daily Weather Report* the Meteorological Office has issued a revised edition of the quinquennial appendix, giving normal values for pressure, temperature, and bright sunshine. The values are extended to include the year 1915, and with the increased length of period are becoming of greater value. Pressure normals for the hour of the reports are now for ten years instead of five, while the normals for air temperature, rainfall, and bright sunshine are for thirty-five years, from 1881 to 1915. The values are given for the several months, and are issued in quarterly sheets. Normals for the current season show only slight differences of pressure, the values being relatively lower in the north and west than in the south and east. Temperature is rising briskly, and in the late spring and early summer the mean daily maximum is about 10° warmer in the south of England than in Scotland, and the mean night temperature shows an almost equally large difference. Rainfall is increasing somewhat at the English stations, while the duration of bright sunshine is at about its maximum.

ACCORDING to a short note in the *Atti dei Lincei*, xxv. (1), 5, containing the Proceedings for March 5, it would appear that piracy of mathematical discoveries was common in Italy in early times. In this note the writer, Prof. Gino Loria, discusses the claims of a work by Luca Pacioli (1445–1514), entitled "Divina Proportione," dealing with mensuration of plane and solid figures, and gives evidence in support of the view that the substance of this work was purloined from an unpublished manuscript by Pier della Francesca entitled "De corporibus regularibus." That Tartaglia's solution of the cubic equation should have become wrongly attributed to Cardan would appear to be the result of a practice of which Tartaglia himself was not altogether innocent. A second part of Prof. Gino Loria's communication deals with some interesting writings by Tommaso Ceva (1648–1737) and Guido Grandi (1671–1737) on the properties of certain curves traced on the surfaces of cones and cylinders. These investigations anticipate Monge's descriptive geometry, inasmuch as the method of projection was used in studying the curves in question. Ceva discussed the properties of the curve which pro-

jects into a spiral of Archimedes, and Grandi applied the same method to the curve of which the projection is an equiangular spiral.

THE October-November part and the December (1914) part of the *Journal de Physique*, which were published in the earlier part of May, complete vol. iv. of the journal. Amongst the longer papers contained in the two parts may be mentioned one by Prof. Marcel Brillouin on kinetic energy and absolute temperature in isotropic solids, the concluding portion of Prof. Seligman-Lui's paper on the mechanical interpretation of the law of gravitation, Prof. Gouré de Villemontée's paper on the propagation of electricity through paraffin oil, and Prof. E. Bouty's paper on some examples of the application of the method of closed cycles. In addition, there are shorter papers on the localisation of foreign bodies in the organism by radiographs, and on the recent determination of the latent heat of fusion of ice at the Bureau of Standards at Washington. The abstracts of papers published in other journals include a number in the *Philosophical Magazine*, *Journal de Chimie-physique*, *Annalen der Physik*, *Physikalische Zeitschrift*, and the *Zeitschrift für Physikalische Chemie*. The author index of the volume covers twenty, the analytical table of contents sixteen, and the volume 850 pages.

MR. A. L. PARSON has published a novel theory of the constitution of atoms based on a new conception of the structure of the electron ("A Magneton Theory of the Structure of the Atom," Smithsonian Miscellaneous Collections," vol. lxv., No. 11). Instead of the usual assumption that the electron possesses spherical symmetry, the author considers it to be a ring of negative electrification revolving with high speed. The diameter of the ring is supposed to be of the same order of magnitude as atomic diameters, and the tangential velocity of revolution to be about the velocity of light. The author points out that these assumptions are not inconsistent with the experiments on which our knowledge of the electron is based, and shows that they offer a mode of escape from certain well-known difficulties in all theories of atomic structure based on the usual assumptions of simple electrons. In the paper the application of the new conception to the explanation of the chemical and magnetic properties of the elements is discussed at considerable length, but it may be noted that all the considerations are only of a qualitative character, and do not provide any definite test of the adequacy of the theory. It should be added that no use is made of the recent valuable and extensive evidence as to the structure of atoms derived from the study of the phenomena of radio-activity and X-rays, and, indeed, it seems difficult to account for them on the new theory.

MR. F. C. THOMPSON, in a paper recently read before the Faraday Society, directs attention to the fact that, almost without exception, alloys which are of industrial utility consist of one or more solid solutions. The brasses, nearly all the bronzes, the nickel brasses, most coinage alloys, aluminium alloys for aeroplane and motor-car construction, fall within this category. The hardening of steel is due to the formation, and more or less complete preservation on quenching, of a solid solution. The special properties of the nickel and nickel chromium steels are due to the improvement conferred by the alloying element or elements which dissolve in the iron. The dominating characteristic of these alloys as compared with the pure metals from which they are made is "toughness," a combination of strength and ductility. As a result of his study of the matter, Mr. Thompson concludes that the remarkable hardness and high electrical resistivity of solid solutions of metals point strongly to the fact that they are caused by crystalline distortion similar to that which arises from cold work. This is explained on the theory that the process of crystallisation of such solutions causes an equalisation of the atomic volumes of the constituents. Elastic stresses are thus set up which, in their turn, increasing the resistance to further stresses, raise the hardness of the mass. Such a theory would lead to a parabolic curve expressing the relationship of the hardness to the concentration throughout the series, with a maximum at the composition of 50 atomic per cent. of each metal. The silver-gold series of alloys fits into this generalisation.

TECHNOLOGIC PAPER NO 68 of the U.S. Bureau of Standards deals with standardisation of automobile tyre fabric testing. The chief causes of variation in test results are due to different testing machines, dimensions of test specimens, moisture content of specimen at time of test, method of sampling, and lack of uniformity in the material. There is but little difference in the results for strips of 1 in. and 2 in. width, and the former width has advantages which indicate that preference should be given to it. The fabrics were supposed to contain twenty-three threads per inch, and the actual width of the specimens was fixed by counting twenty-three threads. The average strength of thirty tests on 1-in. specimens was 247 lb. Samples of cotton material increase in strength considerably when they have absorbed moisture from the atmosphere. It is best to dry the sample in such a way as to eliminate moisture effects entirely. There are only small differences in strength for specimens selected from different parts of the width of the fabric; samples should be cut from different parts, and the average result taken. Tests made in different machines show differences amounting to as much as 15·9 per cent. It is recommended that testing machines be calibrated at frequent and regular intervals.

OUR ASTRONOMICAL COLUMN.

LARGE DAYLIGHT FIREBALL ON MAY 20.—Mr. Denning writes:—"On May 20, at 8.8 p.m. (18 minutes after sunset, Greenwich), a splendid meteor was seen by a great many persons in the southern counties of England. The sky was clear everywhere, and the large green disc of the meteor created a vivid effect as it passed with a rather slow, apparent motion from N. to S. across the western heavens. Reports from fifty-six casual observers of the phenomenon have been received, and it appears from a preliminary discussion of the data that the object was directed from a radiant in Perseus situated in the N.N.W. sky at the time of the event. The height of the meteor was from about 75 to 27 miles along a course, slightly declining in height, of more than 200 miles. The position was from over the S.E. coast of Ireland to the English Channel, far south of Devonshire.

"The estimates of the observed duration of flight of the meteor are rather conflicting, but, taking a mean of what appear to be the best values, the real velocity was about 32 miles per second.

"This fine meteor adds another instance to the rather extensive list of similar objects which have made their apparitions in twilight. The hour following sunset is highly favourable in some respects to the production of these objects, though the prevailing daylight must naturally cause many of them to elude notice."

COMET 1916*b* (WOLF), 1916 ZK (PLANET).—From *Astronomische Nachrichten*, No. 4845, we learn that observations of the anomalous object 1916 ZK, discovered

by Wolf, were made at Vienna on April 6, 7, 22, and 27. On the latest date Dr. Palisa observed a sort of halo surrounding its image, and further remarked that the change of daily motion was not asteroidal in character. In America it has been observed at Yerkes (May 4) and at the U.S. Naval Observatory (May 6). It is shown on photographs taken at Bergedorf on April 29 and May 2; on the earlier date its magnitude was 13·2. According to observations by Prof. Wolf (April 30) the nebulosity was 15″ in diameter, and sharply defined towards the W.N.W., the nucleus being eccentrically placed in the same direction, thus presenting features justifying its classification with comets. The cometary character is emphasised by the Babelsberg observers, who state that it is immediately picked up as a comet. Observations, April 6–May 6, have been used by Prof. Berberich in an investigation of the orbit assuming motion approximately following a great circle, but no useful results had been obtained. The middle-place errors for a parabola (April 6 and 22, Vienna, and May 6, Babelsberg) are stated to be inadmissibly large. A provisional ephemeris based on hyperbolic elements (April 6, 22, and 30) represented fairly closely the Babelsberg observation of May 6.

The following orbit and ephemeris have been calculated, also by Prof. Berberich (*Astronomische Nachrichten*, Circular No. 508), by variation of the distance-ratios from the observations of April 6, 22, and May 6 referred to above:—Perihelion = 1917, June 15·916 G.M.T.; $\omega = 120^\circ\ 30'\ 19{\cdot}3''$; $\Omega = 183^\circ\ 15'\ 12{\cdot}6''$; $i = 25^\circ\ 35'\ 21{\cdot}9''$; log $q = 0{\cdot}227854$.

Ephemeris, Greenwich Midnight.

		R.A. h. m. s.		Decl. ° ′
June 1	...	12 29 7	...	+4 28·5
5	...	12 28 46	...	4 35·0
9	...	12 28 38	...	4 39·9
13	...	12 28 43	...	4 43·3
17	...	12 29 0	...	4 45·1

The orbit can still be somewhat uncertain, but the ephemeris should suffice very well for search. Perihelion passage, it should be noted, occurs in the middle of June of next year, so that comet 1916*b* promises to be under observation for a very extended period. At present the distance from the earth is increasing. On July 3 it will be, roughly, 0·44 astronomical unit—40 million miles—from both the earth and the sun.

A POSSIBLE NEW COMET.—The following message from Prof. Pickering was received on May 8 at Kiel: "Perrine cables bright object Thursday evening, nine to ten, moved ten degrees alpha Pavonis towards sun. Possibly comet" (*Astronomische Nachrichten*, No. 4845).

VENUS.—On June 3, two days after maximum brilliance, Venus will be in conjunction with the moon; the planet will be 1° 19′ N. Unless clouds prevail this configuration will afford an excellent opportunity of viewing the planet in full daylight without optical help. Although the crescent phase can now be distinguished with quite small hand telescopes, the most interesting phenomena of the phases—the more or less complete annulus seen at inferior conjunction with the sun (July 3) and the secondary light, "lumière cendrée"—are only to be seen with large instruments. As inferior conjunction occurs at 8h. G.M.T., English observers will be at a disadvantage. Recent work indicates that a period of sun-spot maximum is specially favourable for the development of luminous effects on the dark side of the planet, but there is a dearth of observations, and it is desirable that a close watch should be maintained.

METEOROLOGICAL AND MAGNETIC AUTOGRAPHS.[1]

COMPLAINT has been made from time to time of the essential dulness of year-books of tabular matter, although it is recognised that the statistics must be compiled diligently year by year in order to provide material for exhaustive discussion at some time in the future. It is, therefore, all the more gratifying to find in the Blue-book before us, published by the authority of the Meteorological Committee, and produced under the direction of Sir Napier Shaw, a definite attempt made to digest the magnetic data obtained in 1913 at Eskdalemuir, somewhat on lines suggested by Prof. Birkeland and also by Dr. Chree.

Mr. L. S. Richardson, who contributes this analysis of magnetic disturbances recorded at Eskdalemuir Observatory, of which he was appointed director in 1913, is also responsible for an appendix giving indirect comparisons by means of a standard set of portable magnetic instruments, between the standard instruments in use at Greenwich, Kew, Falmouth, Valencia, and Eskdalemuir in the United Kingdom, and also those at De Bilt (Utrecht), Potsdam, and Val Joyeux, the national magnetic observatories of Holland, Germany, and France, thus partially anticipating the comparisons made recently under the auspices of the Carnegie Institution.

Mr. Richardson gives two classes of magnetic disturbance, whereas Prof. Birkeland indicated three, but one of the three was an intermediate class, so perhaps, in general, two will be sufficient, the essential difference being that in one class the direction of the disturbance is constant and in the other variable. In connection with the well-known smoothness of the vertical force traces as compared with the other magnetograms, Mr. Richardson makes a suggestion worthy of attention. He says:—"The fact that the vertical component is perpendicular to two electrically-conducting shells, the earth's surface and the upper ionised air, may have an influence in reducing the amplitude of its oscillations. For an oscillating current forcibly maintained in either shell would induce a reverse current in the other shell; and at an observatory which was not more than a small arc of the earth's surface away from the currents, the reverse current, while partly neutralising the vertical force, would increase the horizontal component. For slower oscillations the induced current would be diminished by the electric resistance. The system is like a transformer with a short-circuited secondary coil. The vertical force is the main flux of the transformer. The horizontal components represent the magnetic leakage."

The magnetic data from Eskdalemuir form the principal part of the magnetic portion of the Year Book, the Kew data being given in much less detail, Valencia being unprovided with magnetographs, and Falmouth practically discontinued. Meteorology is represented by five stations, Aberdeen being the additional contributor, monthly means for each hour of the day being tabulated for temperature, pressure, and relative humidity of the air, for wind velocity, and rainfall, sunshine tables being added.

It is curious to note that the mean warmest hour at Falmouth is invariably 1 p.m., while at the other observatories it is generally 2 p.m. or 3 p.m. The arrangement of the tables is that, except for Eskdalemuir, the establishment of which is too recent for normals to have any significance, what is printed is a

[1] Meteorological Office. British Meteorological and Magnetic Year Book, 1913. Part iv., section 2. Hourly Values from Autographic Records. Pp. 97. (Edinburgh: H.M.S.O.; London: Meteorological Office, 1915. Price 5*s*

set of normal values and the departures for 1913. It is doubtful if this is more convenient than the old plan of publishing current values and departures from normal. A brief comparison between the extremes for Kew and Greenwich for 1913 indicates that there is less close agreement than might be expected, showing that for London as a whole one outlying station is totally inadequate. We notice the employment of the millibar in the pressure tables, and also of absolute temperatures, but neither of these is likely to popularise the work, but if the aim be uniformity we might suggest that a step in this direction might be made by adopting a uniform height above the ground for corresponding instruments, especially for the thermographs, which are all at different heights.

W. W. B.

RESEARCHES ON HOPS.

IN a contribution to these pages a couple of years ago (NATURE, April 23, 1914, vol. xciii., p. 199) it was pointed out that a good instance of that scientific attention which is paid by certain foreign countries to the study of economic plants could be seen in the monographic study of the hop which is being made by Dr. J. Schmidt, with his staff of chemists and botanists, at the Carlsberg Laboratory, Copenhagen. In that review the results were noted of Dr. Schmidt's investigations into the growth in length and rotational movement of the stem of the hop and their diurnal periodicity. We have now to hand the results of a number of further researches.[1]

Dr. O. Winge has investigated the pollination and fertilisation processes in *H. Lupulus and H. japonicus*. The paper deals fully with the cytological and nuclear phenomena, and is clearly illustrated by figures. Some interesting developmental points were observed in the study of a monœcious hop and of a sterile gynomorphous male. Experiments to produce a hybrid between *H. Lupulus* and *H. japonicus* failed; it may be observed here that the same negative results were obtained by the reviewer three years ago. Dr. Winge's investigations showed that the pollen of *H. japonicus* caused the ovary of *H. Lupulus* to swell almost to the normal size, resulting ultimately in a "fruit" of normal appearance. The hop strobile, too, developed its axis and stipules. Microscopical examination showed that as a rule fertilisation had taken place in the embryo-sac, and a small embryo was produced, which, however, never developed further. Dr. Winge thinks that it is perhaps possible that the pollen of Urtica may be able to produce "fruits" in the hops in hop-gardens, as was asserted by a practical man—a Bavarian hop-grower—in 1883.

Dr. H. Schjerning gives a full summary of his numerous researches dealing with the proteid substances of barley, both in the grain itself and during the brewing processes; for reasons of space, no further reference can be made to this here.

A new method for the quantitative determination of resins in hops is described by Messrs. O. Winge and J. P. H. Jensen. These investigators found that, contrary to what Hayduck has stated, the γ resin is of value to the brewer, since it gives a bitter taste to the wort and helps in the precipitation of the albumens. For the determination of the total resins in the hop the most satisfactory method was found to be that of extraction with cold ethyl ether and titration of the solution with 1/20 normal potassium hydroxide solution. By this method the lupulin content is obtained as a percentage of the dry weight of the hops; it has been employed not only for the valuation of the various varieties of hops grown in the experimental garden, but also in analyses of trade samples made by the laboratory in co-operation with various breweries. The relations between the bitterness of the α, β, and γ resins were found to be constant, and, respectively, as 10 : 7 : 4.

Dr. J. Schmidt has a very interesting paper on the aroma of hops. The author does not regard it as proved that the aroma present in a hop sample, when this is mixed with the wort for boiling, has any decisive influence on the flavour of the beer. This, it may be noted, is in opposition to the view held by brewing experts, and the further information on this subject which Dr. Schmidt promises will be awaited with interest. It is pointed out that the commercial varieties of cultivated hops are very probably not "true," since, being propagated by cuttings, there is always the danger that these may be taken occasionally from seedlings which have established themselves in the garden. To avoid the danger, Dr. Schmidt has used exclusively at his research station individuals raised by vegetative propagation from one plant. This group of individuals is termed a hop-clone—a clone-plant being any single plant belonging to the clone. In crossing experiments with two American varieties and Danish male hops, proof was obtained that the distinctive aroma of these American hops—which Dr. Schmidt calls "turpentine-like"—was transmitted to between half and three-quarters of the offspring plants, without regard to whether the hops (strobiles) themselves retained the appearance peculiar to those of the mother plant. It is to be hoped that Dr. Schmidt will be on his guard against attempting to ascertain the true nature of the aroma of a new seedling hop from the examination of the plant in its early years exclusively, since there is reason to believe that this may change with the age of the plant.

Dr. Schmidt also records the results of his investigations as to the amount of lupulin in plants raised by crossing, and also their time of flowering. It was found that the average lupulin content of the offspring shows (with rare exceptions) a decrease, due perhaps to the fact that the "wild" male plants used were genotypically of a low order as regards lupulin content; in every group, however, some few specimens—the extreme plus variates—occurred; a stock of any of these new varieties with increased lupulin-content can be raised for commercial use by vegetative propagation. Very similar results have been obtained at Wye College, Kent, in the breeding of new varieties of hops; Dr. Schmidt, referring to these, writes:—"Altogether, these two series of investigations carried out independently in England and Denmark respectively exhibit remarkable uniformity of results, and the discoveries thus made appear to promise well for the systematic improvement of hops."

E. S. S.

[1] "Comptes Rendus des Travaux du Laboratoire de Carlsberg," vol. xi. livr. 1–4 (1914–15).

"TROPISMS."

THE word "tropism," first used to indicate the growth-direction of plant-members under the influence of some stimulus, has during the last fifteen years become a favourite term among investigators of the behaviour of animals. Those interested in physiological terminology will find accounts of the various meanings attached by different writers to the word in two controversial articles by Mr. S. O. Mast (*Arch. f. Entwicklungsmechanik*, xli., 1914, pp. 251–263, and *Biol. Centralbl.*, xxxiv., 1914, pp. 641–674). He finds that the word is now "used in so many different senses that everyone finds it necessary to indicate in which sense he proposes to use it"; there-

fore the author suggests that it might advantageously be dropped in favour of such well-understood expressions as "reaction" or "orientation." It is satisfactory to find that he repudiates the endowment of the term "with mystical causal powers." By calling a reaction—say to light—a "tropism," one does nothing to explain it.

In his recent important work on the Foraminifera, Mr. E. Heron-Allen has directed attention to the purposeful behaviour shown by many of these Protozoa in the selection and arrangement of foreign materials worked into their tests. He sums up the evidence on this subject in a paper in the Journ. R. Microsc. Soc., vol. xvi., part 6, and concludes "that there appears to be no organism in the animal kingdom, however simple be its structure, which lives a life of its own independently of any other organism, which is not capable of developing functions and behaviour . . . which in the Metazoa might be called, and would properly be so called, Phenomena of Purpose and Intelligence."

Turning from protozoa to insects, Mr. F. M. Howlett publishes (Bull. Entom. Research, vi., part 3, 1915) some puzzling observations on the chemical reactions of fruit-flies. In the genus Dacus, the males and not the females of certain species are strongly attracted by different eugenol-compounds, the smell of which resembles that emitted by plants that also attract the male flies. The corresponding females do not apparently emit similar odours, nor were they seen to frequent the odoriferous plants. Of the possible explanations suggested by Mr. Howlett, the most probable therefore seems to be that the smells are characteristic of some food which is attractive to males only.

STUDIES IN MENDELISM.

AN important paper on the inheritance of the flowering time in peas and rice, by Yuzo Hoshino, has been published in the Journal of the College of Agriculture (Imp. Univ. Sapporo, Japan, vol. vi., part ix.). The author concludes that in peas the inheritance is governed by two pairs of Mendelian factors. In the one pair are lateness (dominant) and earliness (recessive); in the other pair are acceleration (dominant, hypostatic to lateness) and retardation (recessive, hypostatic to earliness). Gametic coupling between flowering time and flowering colour is also indicated, early red and late white flowers being equal in number and far fewer than early whites or late reds. The experiments on rice were not conclusive, but the author suggests that three pairs of Mendelian factors are probably concerned.

In the Proc. Amer. Phil. Soc. (vol. liv., No. 218) Bradley M. Davis discusses from the Mendelian point of view the mutation phenomena in Œnothera, and advises caution in accepting results based on breeding experiments where there is reasonable doubt as to the gametic purity of the parent "species."

The March number of the *Journal of Genetics* (vol. v., No. 3) contains several papers of interest. Misses C. Pellew and F. M. Durham find that from reciprocal crosses between *Primula verticillata* and *P. floribunda* plants resembling the female parent are generally obtained, these breeding true to type when self-fertilised. Occasionally the hybrids are of the *P. Kewensis* form, some partially sterile and others fertile. J. V. Eyre and G. Smith discuss some results from the cross-pollination of varieties of flax. W. Neilson Jones and Dr. M. Chevely Rayner contribute some important results from breeding experiments with two varieties of *Bryonia dioica*. The presence of waxy bloom on the ripe berry is a recessive character; the capacity to increase the number of vascular bundles in the stem beyond ten "behaves as a simple dominant to the absence of such capacity." The authors consider that their experiments "emphasise the need for caution in the subdivision of existing species without recourse to breeding tests." A supplement to Dr. L. Doncaster's well-known researches on the magpie moth (*Abraxas grossulariata*) is afforded by the Rev. J. M. Woodlock, who discovered near Dublin a new variety of the moth, resembling *lacticolor* in pattern, but behaving as a simple recessive to typical *grossulariata* without any sex-limiting complication. The typical *grossulariata* pattern depends, according to Father Woodlock, on two dominant characters; the absence of one results in the appearance of *lacticolor*, that of the other in the appearance of the new variety, which the reverend author—perhaps with some reminiscence of literary criticism—proposes to designate as "Q."

EFFECT OF TEMPERATURE ON SOILS.

THE effect of temperature on some of the most important physical processes in soils has been studied experimentally by Mr. George J. Bouyoucos, of Michigan Agricultural Experiment Station, and his results are published as Technical Bulletin No. 22. Very few problems of this kind have been worked out experimentally. Our knowledge is based almost entirely on deductions from the laws of surface tension, viscosity, and expansion as affected by temperature. It is not surprising that when put to the test of experiment, under the complicated conditions that obtain in soils, these deductions are found wanting. When one-half of a column of soil of uniform moisture content is kept at 20° or 40° C., and the other at 0° C., for eight hours, the percentage of water transferred from the warm to the cold soil increases in all types of soil with rise of moisture content until a certain water content is reached and then falls. The author terms the percentage of moisture at which this maximum transfer occurs, the thermal critical moisture content. The laws of capillarity and viscosity do not by themselves explain this result. Experiments on the movement of water vapour from warm to cold soil through an air space showed that such movement was insignificant under all conditions tested. The conclusion is drawn that the source of water as dew is not derived from the soil vapour, as commonly believed.

The translocation of water from a moist soil at 0° C. to a dry soil at 40° C. is very small. This has a most important bearing on the preservation of soil moisture by mulches. The study of the effect of temperature on the rate of percolation of water in soils showed that the rate of flow increases uniformly with rise of temperature only in the case of sand. In other soils, the rate of flow increases up to about 30°, and then falls. It is suggested that in the latter soils the swelling of colloidal matter closes the channels through which the water flowed. Although other reasons might be put forward to explain this effect, the author's hypothesis agrees with some of the known properties of colloids. Further, when the soil was tested at 20° C., then at 50° C., and again at 20° C., the two readings at 20° C. were not the same. This hysteresis effect is interesting.

The last section of the paper is devoted to the relation of temperature to soil aeration. The rate of flow of air through soil decreases with rise of temperature, and this effect is most marked in soils likely to contain colloidal matter, *e.g.* clays and peat. Although the author is, perhaps, rather too ready to assume that the views commonly held on many of the points arising from his work are inconsistent with his own deductions, this bulletin is a notable contribution to our knowledge of the dynamics of soils.

THE SEARCH FOR NEW COAL-FIELDS IN ENGLAND.[1]

THE search for concealed coal-fields was one of the subjects considered by two Royal Commissions appointed to consider our coal resources. Since the publication of the report of the second Commission, in 1905, much progress had been made both in locating new coalfields and in defining the areas in which concealed coal-fields could not exist. By "visible coal-fields" were meant those areas in which Coal Measures, with or without a covering of superficial materials, cropped out at the surface. These areas alone were shown as coal-fields on geological maps, and to them collieries were at first confined. As the geological knowledge of the country progressed it became clear that the Coal Measures might, and did in certain cases, pass under newer formations, and had been proved around the northern and western borders of the Kent coal-field and under London, and thence in a general north-westerly direction through Buckinghamshire, Oxfordshire, and Northamptonshire, towards Warwickshire and Leicestershire. The existence of this barren tract had been proved by a number of borings in and near London and in the counties named, but its limits had not been ascertained. On its north-eastern side rocks older than Coal Measures had been proved at Culford, Lowestoft, and Harwich, rendering the existence of coal under central and eastern Suffolk improbable, though there still remained unexplored a tract extending northwestward through Essex, Bedfordshire, and Rutland. On its south-western side there lay a great area of unexplored ground. The south coast, from Folkestone to Devonshire, and adjacent areas in Sussex, Hampshire, and Dorset, with parts of Devonshire, Somerset,

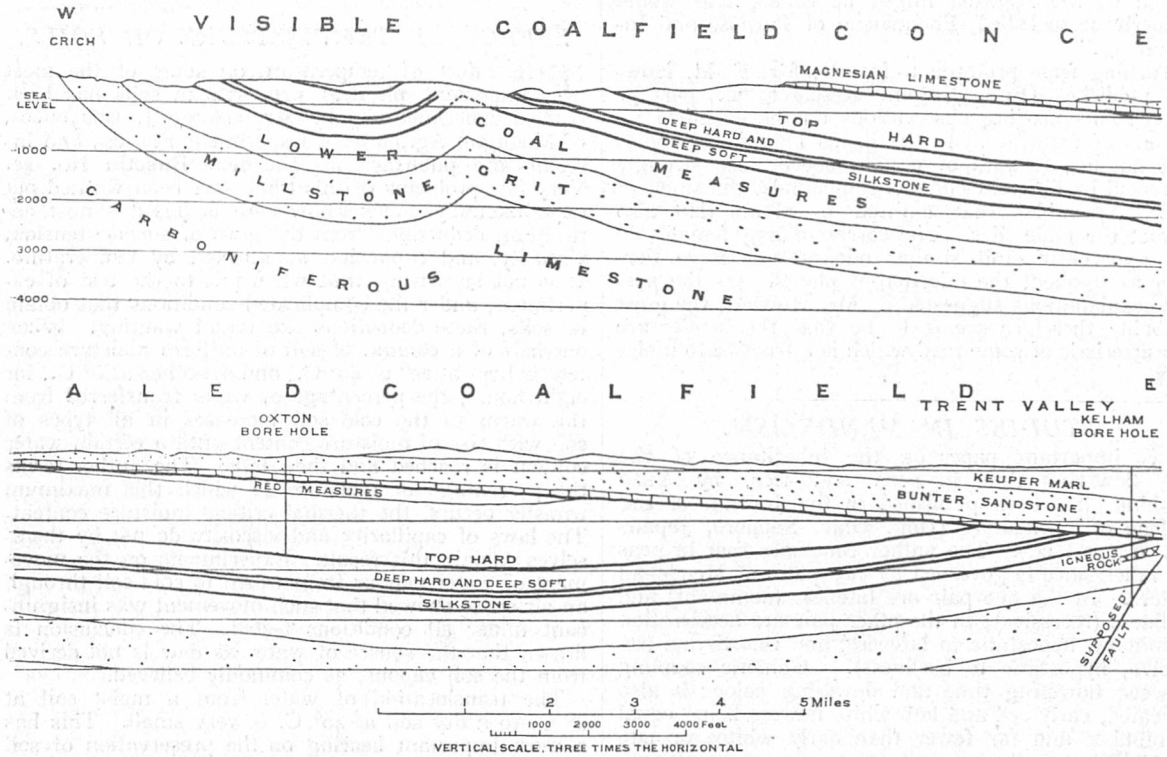

FIG. 1.—Section across the Nottinghamshire coal-field.

form "concealed coal-fields." A map was shown on which were distinguished (*a*) areas occupied by formations older than Coal Measures, (*b*) visible coal-fields, (*c*) areas occupied by formations newer than Coal Measures. On the last-named concealed coal-fields, so far as they had been found to exist, and the districts in which the absence of Coal Measures had been proved, were distinguished. Thus the visible coal-fields of Cumberland, Durham with Northumberland, Yorkshire with Nottinghamshire and Derbyshire, Staffordshire, Shropshire, Warwickshire, Leicestershire, and Somerset with Gloucestershire, were all bordered on one side or the other by concealed coal-fields, while in Kent a coal-field not associated with any visible outcrop had been proved to exist. In South Wales, however, there was no more than a trifling part of the coal-field concealed in the sense mentioned above.

On the other hand, the absence of Coal Measures and Wiltshire, were unproved in the sense that no boring had yet reached the base of the Secondary rocks. What these rocks rested upon it was impossible to say, but their thickness was likely to be great near the south coast.

Three examples were selected in order to illustrate the nature of the problems which arose in the search for concealed coal-fields.

The Nottinghamshire coal-field was illustrated by a section (Fig. 1) drawn from near Crich, in Derbyshire, to Kelham, near Newark-on-Trent. Commencing in the Carboniferous Limestone, the line of section crossed the visible coal-field in a distance of about 6½ miles. Thus far it was founded on observations made at the surface, but it then entered a region in which Permian (Magnesian) Limestone, Bunter Sandstone, Keuper Sandstone, and Keuper Marl in succession formed the surface of the ground. These formations lay unconformably upon the Coal Measures; they were inclined at a gentler angle, and had not been affected by the folds which had bent the Coal

[1] Abridged from a discourse delivered at the Royal Institution on Friday, March 17, by Dr. A. Strahan, F.R.S.

Measures into synclines and anticlines. It followed that the newer strata were not parallel to the older, and might rest upon any part of the Coal Measures, or even upon any older formation. Surface observations made upon the newer formations gave little clue to the structure of the Coal Measures; reliance had to be placed on boreholes, and on the identification of the specimens obtained from them. The section therefore had been drawn through a borehole at Oxton, and near the Annesley Colliery now working, to a borehole at Kelham.

The Oxton borehole was put down 7½ miles within the margin of the concealed coal-field, and proved that the base of the newer formations had descended eastwards 790 ft. in that distance—that is, at the rate of 1 in 50. The dip of the Coal Measures was rather steeper, and it seemed possible that the coal-field might extend an indefinite distance eastwards, though it might descend to an inaccessible depth.

The Kelham borehole was put down nearly ten miles east of the Oxton borehole, and proved that the eastward dip of the newer formations was maintained at the same gentle angle. At a depth of a little more than 1500 ft. it traversed a seam of coal, the identity of which was in doubt. At about 1700 ft. it passed through a dyke of igneous rock which was of no significance. More important was the fact that down to about 2400 ft. it was in strata which, by their character and fossils, could be identified as Lower Coal Measures, that below them it met little more than 200 ft. of Millstone Grit, and that it then entered Carboniferous Limestone.

The greater part of the Millstone Grit appeared to be cut out by a fault, but whatever explanation was adopted, and whatever the coal-seam might be—whether the Top Hard, as supposed by some, or the Silkstone, as appeared more likely—an eastward rise of the Coal Measures had been proved to exist. The deepest part of the concealed coal-field had been passed, and the eastern limit was in sight.

Similar explorations were being carried on across other parts of the concealed coal-field,[2] and the result had been to show that the eastern limit lay not far east of the valley of the Trent. Though not so large as appeared possible to the Commission of 1905, this extension was a notable addition to the visible coal-field, but its productiveness was still a matter of doubt. Observations on the thickness of coal-seams were difficult in boreholes, but so far the results had been disquieting.

As a second example, the Denbighshire concealed coal-field was selected. Here it was not so much the existence as the accessibility of the coal-seams which was in question, and the reason was found in a great development of upper measures, for the most part barren of good coal. The dip of the strata was much steeper than in Nottinghamshire, and would speedily carry the seams to an inaccessible depth. But the numerous faults tended on the whole to counteract the dip and to keep the seams within reach. The upper measures were distinguishable into three groups, and the recognition of these groups at their outcrops rendered possible estimates of depth to the productive measures below. The results of recent work had been to show that the outcrops were repeated—that is, that the counteraction of dip by faults was continued in the areas not yet proved by underground workings. Nothing was yet known of the area overlain by New Red Sandstone.

The Kent coal-field, the third example selected, was wholly concealed by a blanket of Tertiary and Secondary strata, with an average thickness of 1000 ft. towards the north, but increasing to upwards of 1700 ft. southwards. The structure of the Palæozoic

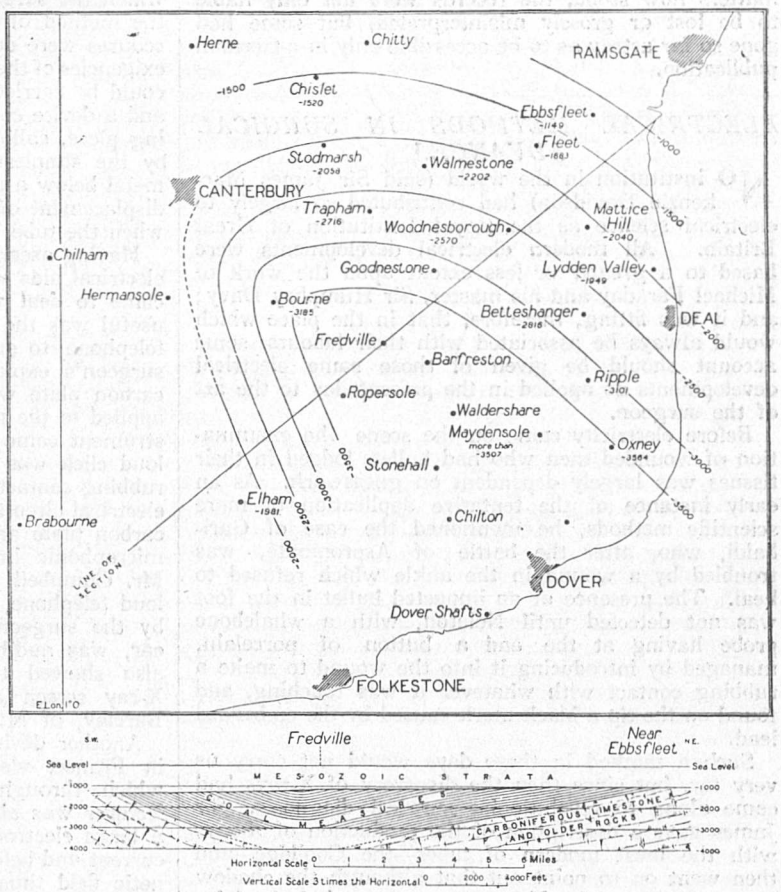

FIG. 2.—Contour-lines in the surface of the Carboniferous Limestone under Kent.

floor upon which this blanket rested had been ascertained by boring. It had been shown that the Coal Measures existed in a syncline formed in the Carboniferous Limestone (Fig. 2). The synclinal axis ranged a little west of north, and the trough became shallower in that direction. Southwards, on the other hand, it deepened and widened, in a manner which suggested that a large part of the coal-field would lie under the sea. The limestone-surface had been reached in so many borings that it had been possible to draw contour-lines upon it, ranging from 1000 ft. to 3500 ft. below sea-level (Fig. 2). These lines showed that the slope of the limestone-surface, though somewhat steeper on the eastern than on the western side of the trough, was generally gentle. The thickness of Coal Measures in part of the trough had been proved to exceed 2700 ft.

The relations of the Kent coal-field to those of the

[2] An account of the investigation as a whole appears in "The Concealed Coal-field of Yorkshire and Nottinghamshire" (*Mem. Geol. Survey*), 1913.

north of France, Belgium, and South Wales were illustrated by a map. It was shown that the line of intense disturbance on which the Continental coal-fields were situated was more likely to pass south of the Kent coal-field than through it, and that the coal-field occupied a position comparable in this respect to that of the newly discovered coal-field of La Campine. Whether the disturbed belt was continuous under the south of England and joined up with the Armorican folding of South Wales and Somerset could be proved by further borings, and in no other way.

The registration and correct interpretation of borings were matters of great importance. A recommendation made by the Royal Commission on Coal Supplies, that particulars should be collected and preserved in a Government office, had not led to any action. As matters now stood, the records were not only liable to be lost or grossly misinterpreted, but some had gone so far astray as to be accessible only in a German publication.

ELECTRICAL METHODS IN SURGICAL ADVANCE.[1]

NO institution in the world (said Sir James Mackenzie Davidson) had contributed so largely to electrical science as the Royal Institution of Great Britain. All modern electrical developments were based to a greater or less extent upon the work of Michael Faraday and his master, Sir Humphry Davy; and it was fitting, therefore, that in the place which would always be associated with their labours some account should be given of those same electrical developments as applied in the present day to the art of the surgeon.

Before electricity came on the scene the examination of wounded men who had bullets lodged in their tissues was largely dependent on guesswork. As an early instance of the tentative application of more scientific methods, he mentioned the case of Garibaldi, who, after the battle of Aspromonte, was troubled by a wound in the ankle which refused to heal. The presence of an impacted bullet in the foot was not detected until Nélaton, with a whalebone probe having at the end a button of porcelain, managed by introducing it into the wound to make a rubbing contact with whatever it was touching, and found on the tip a black mark caused by the embedded lead.

Such a method in these days would not carry us very far, but since then the discovery of X-rays had come along to revolutionise surgical diagnosis. Sir James gave a description of the production of X-rays with the most modern of tubes—the Coolidge—and then went on to point out that although the shadow picture produced by X-rays gave a good deal of information as to the relative densities of any interposed materials, it was not like an ordinary photograph from which the relative positions of objects could be inferred. It was a shadow of the object, and therefore might be very misleading. He showed on the screen two X-ray pictures of exactly the same subject, in which, however, the tube had occupied slightly different positions. In the one case a bullet appeared to be in the right lung, and in the other in the left. Something more was needed than the single X-ray photograph if any correct information as to the position of a foreign body was to be obtained.

There was, first, the stereoscopic method, and this he illustrated by having two little electric bulbs side by side, one of them surrounded by a green film of gelatine, and the other by a red film, each casting a shadow of an object—a cone of wire—from slightly different points of view. Spectacles consisting of red and of green lenses were distributed among the audience, and when the shadows were viewed through these they combined to give an impression of solidity, as though the actual object were being looked at instead of its shadow. With the spectacles reversed, the effect became a pseudo-stereoscopic one.

This was not precise enough, however, for the purpose of exact localisation, and in order to arrive at mathematical accuracy a different system was available. Here the lecturer gave a description of his own well-known cross-thread localising method, and the manner in which the geometrical conditions under which the two X-ray pictures were produced are reconstructed so as to interpret the various findings on the negative in the terms of exact measurements which the surgeon required to employ. It was really the method of similar triangles. If more rapid procedures were demanded, as they might well be by the exigencies of the present time, the same measurements could be carried out with a hand fluoroscope (shown) and a device consisting of scale, cross wires, and sliding piece, calibrated so as to enable one to determine by the simplest adjustment the depth of a piece of metal below a marked point on the skin by noting the displacement of the shadow on the illuminated screen when the tube was moved to a given distance.

Having ascertained the position of the bullet, other electrical aids were available for the surgeon when he came to deal with its extraction. One of the most useful was the telephone attachment, consisting of a telephone to one terminal of which was attached the surgeon's exploring instrument, and to the other a carbon plate which, moistened with salt water, was applied to the patient's skin. When the exploring instrument came into contact with embedded metals, a loud click was elicited, becoming a sharp rattle on a rubbing contact. A small current, generated when the electrical circuit was completed by contact between the carbon plate and the foreign body, accounted for the microphonic impression. Through the kindness of Mr. Campbell Swinton, who had installed a special loud telephone, the rattling sound, usually heard only by the surgeon when the receiver was close to his ear, was audible all over the theatre. The lecturer also showed the ingenious telephone forceps with X-ray screen attached, adapted by Captain A. E. Barclay, of Manchester.

Another device for the same purpose, largely used in France, was Prof. Bergonié's electromagnet, of which, through the kindness of Dr. Ettie Sayer, the lecturer was able to show an example. In this case a large electromagnet was excited by an alternating current and held over the suspected part. If the magnetic field thus created embraced the embedded projectile, a vibratory motion was induced in the latter, synchronising with the pulsing of the current. The surgeon palpated the part and became instantly aware of any vibration of the tissues which indicated the presence of the metal. The point of maximum vibration having been selected, he made an incision at that point, and then the magnet was again used and the incision deepened in accordance with the information it gave. The lecturer was able to repeat this action on a smaller scale with some pieces of high-explosive shell (lent to him by Dr. Menzies) placed in gelatine, and their vibrations when brought within the influence of the magnet were projected on the screen.

The lecturer concluded with a tribute to what he called the shadow-army (consisting of workers in all branches of war surgery), who followed the movements of the combatant army as exactly as in the experiments he had shown them the shadows on the screen followed every alteration in the position of the lamp.

[1] Abstract of a discourse delivered at the Royal Institution on May 5, by Sir James Mackenzie Davidson.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—On Tuesday, May 30, at a crowded special Degree Congregation, the degree of LL.D. was conferred by the Vice-Chancellor (Mr. Gilbert Barling) upon the Right Hon. W. M. Hughes, Premier of the Commonwealth of Australia. It was felt to be fitting that the University, which owes its foundation so largely to the great Colonial Secretary, should thus honour the distinguished representative of the Overseas Dominion which has taken the lead in the promotion of co-operation between science and industry in the Empire.

LONDON.—At a meeting of the Senate held on May 24 the following doctorates in science were conferred:—D.Sc. in geology, Mr. P. G. H. Boswell, an internal student, of the Imperial College (Royal College of Science), for a thesis entitled "The Stratigraphy and Petrology of the Lower Eocene Beds of East Anglia"; D.Sc. in psychology, Miss M. J. Reaney, an internal student of King's College, for a thesis entitled "The Psychology of the Organised Group Game."

OXFORD.—The Waynflete professor of chemistry (Prof. W. H. Perkin) gives notice that the new chemical laboratories in South Parks Road will be open for inspection by members of the University and their friends on Wednesday, June 7, from 4 to 6 p.m.

BY the will of the late Mr. J. Forte, his plantation "Bennetts," and the residue of his estate in Barbados, are left to Codrington College in that island. The value of the bequest is expected to be not less than 10,000*l*.

A PARTY of professors from French universities is visiting this country at the invitation of the British Government. Oxford was visited last week, and on Monday, May 29, the party was received at the University of London by Sir Alfred Pearce Gould, Vice-Chancellor of the University, and members of the Senate. On Tuesday, Mr. Henderson, President of the Board of Education, received the visitors at the offices of the Board, and welcomed them on behalf of the Government. During the day visits were paid to University College, Gower Street, and the East London College. King's College, London, was visited on Wednesday. Cambridge will be visited to-day, and the party will remain there until next Monday, after which visits will be paid to Manchester, Liverpool, Sheffield, Leeds, Glasgow, and Edinburgh. It is proposed to return to France on June 12.

THE relations between science and industry, on one hand, and science and the State, on the other, are being discussed in France as well as in the United Kingdom. In a paper by Prof. H. Le Chatelier, on science in its relations with economic development, in the *Comptes rendus* for May 1, we find ourselves held up as a model in some respects in these matters. Prof. Le Chatelier agrees that in France the general public ("*le grand public, c'est-à-dire le public incompétent*") believes in science, but he says that this is unfortunately not the case either with the public authorities or with the leaders of industry. In Germany any captain of industry is proud of the title of doctor of science; in France this would be ridiculed. In England such men esteem it an honour to preside over meetings of learned societies; in the United States leading manufacturers show their respect for science by gifts amounting already to many millions of pounds. France, also, has not established any institution corresponding to the Physikalisch-Technische Reichanstalt in Germany, the National Physical Laboratory in England, or the Bureau of Standards in the United States, though it has the Institut Pasteur. The too frequent absence of laboratories in connection with works is deplored. It is admitted that the faults are not altogether on the side of the manufacturers, as the source of scientific study is frequently not directed to a practical end, and might be described as intellectual gymnastics. This is a fault of the scheme of education, and it is pointed out by Prof. Le Chatelier that the Academy of Sciences has never been consulted on the question of the organisation of teaching.

SOCIETIES AND ACADEMIES.

DUBLIN.

Royal Dublin Society, May 23.—Dr. J. M. Purser in the chair.—Prof. W. **Brown**: Note on laminated magnets. When a compound magnet is built up of laminations the distance between the poles decreases as the cross-section grows from an oblong to a square, and when the section further increases from a square to an oblong the said distance then increases. The above result was found to hold whether the steel laminations were placed in contact or separated by slips of paper, but the minimum distance between the poles was, in the latter case, greater than in the former.

PARIS.

Academy of Sciences, May 15.—M. Camille Jordan in the chair.—G. **Lemoine**: The catalysis of hydrogen peroxide in heterogeneous media. Part iv. Experiments with carbon; conclusions. The three varieties of carbon used in these experiments—coconut charcoal, wood charcoal, and sugar charcoal—all acted as catalysers towards hydrogen peroxide, the first being the most energetic. There would appear to be a relation between the catalytic power and absorptive capacity for gases. The results given in the four papers are summarised.—H. **Le Chatelier** and F. **Bogitch**: The estimation of carbon by the Eggertz method. The effects of heat treatment of the steel, of nickel, manganese, and silicon have been examined.—P. **Duhem**: The electrical oscillations on a system of purely dielectric bodies.—C. **Guichard**: The C congruences of which one of the focal surfaces is a quadric.—M. Bergonié was elected a correspondant for the section of medicine and surgery in the place of the late M. Mosso.—J. K. de **Fériet**: An integral equation of the second species, admitting hyperspherical functions as fundamental solutions.—D. **Eginitis**: Observations of the comets 1915*a* (Mellish) and 1915*e* (Taylor) made at the Athens Observatory with the Doridis equatorial.—P. **Villey**: A stenographic machine for the blind.—A. **Colson**: The consequences of the assimilation of reversible solutions to saturated vapours.—C. **Raveau**: The complete expression of the heat of reversible solution in a volatile liquid.—L. C. **Maillard**: The formation of pyridine bases, starting with albuminoids. Remarks on a recent communication on the same subject by MM. A. Pictet and Tsan Quo Chou.—Mlle. R. **Hemmerlé**: Diphenylpyruvic acid.—J. **Bougault**: Phenyloxymaleic anhydride. This anhydride is obtained by the action of sulphuric acid upon α-cyanophenylpyruvic ester. It crystallises with one molecule of water, and hence possesses the same composition as phenyloxalacetic acid, but its reactions with alcohols and amines clearly distinguish it from the latter.—MM. J. and C. **Cotte**: The examination of a prehistoric paste. A chemical and microscopical examination of a coloured paste found on two fragments of bone in the eneolithic layers of the cavern of Adaouste.

—P. **Gaubert**: Circular polarisation produced by spherolites.—A. **Guébhard**: The age of the upper conglomerates of the region of Castellane (Basses-Alpes) in its relations with the alpine foldings.—Mlle. S. **Coëmme**: A new method of reproduction of the partitions of Ammonites.

BOOKS RECEIVED.

Bulletin of the Museum of Comparative Zoology at Harvard College. Vol. lx., No. 6. Results of the Yale Peruvian Expedition of 1911. The Arachnida. By R. V. Chamberlin. (Cambridge, Mass.)

Preliminary Report on the Botanical Results of the Danish Expedition to Siam (1899–1900). Flora of Koh Chang. By Johs. Schmidt. Part x. (Copenhagen: Bianco Luno.)

Annals of the Durban Museum. Vol. i., part 3. (Durban.) 5*s*. net.

Journal of the Royal Statistical Society. Vol. lxxix., part 2, March. (London.) 5*s*.

Transactions of the Royal Society of South Africa. Vol. v., part 4. Pp. 273–564. (Cape Town.) 12*s*. 6*d*.

Mentally Deficient Children: their Treatment and Training. By Drs. G. E. Shuttleworth and W. A. Potts. Fourth edition. Pp. xix+284. (London: H. K. Lewis and Co., Ltd.) 7*s*. 6*d*. net.

More Minor Horrors. By Dr. A. E. Shipley. Pp. xiv+163. (London: Smith, Elder and Co.) 1*s*. 6*d*. net.

Newsholme's School Hygiene: the Laws of Health in relation to School Life. By Dr. J. Kerr. Pp. 352. New edition. (London: G. Allen and Unwin, Ltd.) 4*s*. 6*d*. net.

The Forty-fourth Annual Report of the Board of Directors of the Zoological Society of Philadelphia. Pp. 53. (Philadelphia, Pa.)

A Generation of Religious Progress. Edited by G. Spiller. Pp. 151. (London: Watts and Co.) 1*s*. net.

A Senior Experimental Chemistry. By Dr. A. E. Dunstan and Dr. F. B. Thole. Pp. xiii+522. (London: Methuen and Co., Ltd.) 5*s*.

The Geology of the Lake District and the Scenery as Influenced by Geological Structure. By Dr. J. E. Marr. Pp. xii+220. (Cambridge: At the University Press.) 12*s*. net.

DIARY OF SOCIETIES.

THURSDAY, JUNE 1.

ROYAL SOCIETY, at 4.30.—The Transmission of Electric Waves around the Earth's Surface: Prof. H. M Macdonald.—A Critical Study of Spectral Series. IV. The Structure of Spark Spectra: Prof. W. M. Hicks.—Periodic Disturbance of Level arising from the Load of Neighbouring Oceanic Tides: K. Terazawa.—The Use of Partly Neutralised Mixtures of Acids as Hydrion Regulators: E. B. R. Prideaux.—The Fossil Floras of the Coal Measures of South Staffordshire: Dr. E. A. N. Arber.

ROYAL INSTITUTION, at 3.—Chamber Music and its Revival in England: Sir Alexander Mackenzie.

ROYAL SOCIETY OF ARTS, at 4.30.—The Work of the Imperial Institute for India: Prof. W. R. Dunstan.

LINNEAN SOCIETY, at 5.—New Types of Fossil Characeæ from the Purbeck Beds: Clement Reid and J. Groves.—The Structure of the Vertebral Column in the Anura Phaneroglossa and its Importance as a Basis of Classification: Prof. G. E. Nicholls.—Variation in Mnium: Prof. Julius MacLeod.—A New Species of Bennettites: Dr. Marie Stopes.

FRIDAY, JUNE 2.

ROYAL INSTITUTION, at 5.30.—La France dans l'Histoire comme Champion du Droit: Lieut. P. H. Loyson.

GEOLOGISTS' ASSOCIATION, at 7.—The Petrology of the North Sea Drift and Suffolk Brick-earths: Dr. P. G. H. Boswell.—Notes on Erosion Phenomena in Egypt: Mary S. Johnston.

SATURDAY, JUNE 3.

ROYAL INSTITUTION, at 3.—Folk-lore in the Old Testament: Sir J. G. Frazer.

MONDAY, JUNE 5.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Further Explorations in Central Asia: Sir Aurel Stein.

ARISTOTELIAN SOCIETY, at 8.—The Nature of Judgment: E. H. Strange.

SOCIETY OF CHEMICAL INDUSTRY, at 8.

VICTORIA INSTITUTE, at 4.30.—The Tides, with Special Reference to their Effects around the British Isles: Prof. E. Hull.

TUESDAY, JUNE 6.

ROYAL INSTITUTION, at 3.—Optical Research and Chemical Progress: Dr. T. M. Lowry.

ZOOLOGICAL SOCIETY, at 5.30.—*Discussion*: The Results Published in the "Biologia-Centrali-Americana," with Special Reference to the Zoogeographical Relations between America and Africa—Opened by Dr. F. Du Cane Godman, followed by Dr. A. Smith Woodward, Dr. H. Gadow, C. Tate Regan, R. I. Pocock, and Dr. C. W. Andrews.

RÖNTGEN SOCIETY, at 8.15.—Annual Meeting.—Homogeneity of Visible Radiation: Prof. J. W. Nicholson.

WEDNESDAY, JUNE 7.

SOCIETY OF PUBLIC ANALYSTS, at 8.—Determination of the Reichert and Polenske Figures of Butter and Margarine, using Small Quantities of the Fat: A. Douglas Heywood.—Potash and other Mineral Fertilisers and Constituents of Plants: R. R. Tatlock and R. T. Thomson.—Estimation of Acetone in the Presence of Ethyl Alcohol: Jitendranath Rakshit.

GEOLOGICAL SOCIETY, at 5.30.

ENTOMOLOGICAL SOCIETY, at 8.—Certain Forms of Acraed from Madagascar: A Reply to M. Oberthür: Dr. H. Eltringham.

THURSDAY, JUNE 8.

ROYAL SOCIETY, at 4.30.

ROYAL INSTITUTION, at 3.—Chamber Music and its Revival in England: Sir Alexander Mackenzie.

INSTITUTION OF MINING ENGINEERS, at 10.45 a.m.—The History of the Safety-Lamp: Prof. F. W. Hardwick.—The Health of Old Colliers: Dr. J. S. Haldane.—The Estimation of Moisture in Coal: T. F. Winmill.—(1) The Absorption of Oxygen by Coal. VIII. and IX.; (2) The Oxidation of Pyrites: T. F. Winmill.

OPTICAL SOCIETY, at 8.—Modern Technical Applications of Radium and other Luminous Substances: F. Harrison Glew.

FRIDAY, JUNE 9.

ROYAL INSTITUTION, at 5.30.—Eyesight and the War: Dr. E. Clarke.

ROYAL ASTRONOMICAL SOCIETY, at 5.

MALACOLOGICAL SOCIETY, at 8.—Note on *Erato guttula*, Sow.: J. R. le B. Tomlin.—An Undescribed Ammonoid from the Lower Greensand (Aptian) of Kent: G. C. Crick.—*Helix scytodes*: Prof. G. K. Gude.

SATURDAY, JUNE 10.

ROYAL INSTITUTION, at 3.—Folk-lore in the Old Testament: Sir J. G. Frazer.

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