THURSDAY, DECEMBER 19, 1912.

PRODUCTION AND THE PUBLIC REVENUE.

Principles of Economics. Vol. ii. By Dr. N. G. Pierson. Translated from the Dutch by A. A. Wotzel. Pp. xxiii+645. (London: Macmillan and Co., Ltd., 1912.) Price 10*s.* net.

THERE is much to be said both for and against the method adopted by the late Dr. Pierson of treating Value in Exchange and Money first, and dealing afterwards with Production and Public Revenue in the volume before us. Certainly some of the treatment has been narrowed, because much that rightly belongs to production has found a place in the earlier chapters, but the author has dealt admirably with the remaining phases of the subject.

His opening chapter reminds us that to define production in an economic sense is far from easy. He holds that such production is confined to material goods, either taking the form of increasing them in quantity, or bringing them into a condition to afford greater utility. He refuses to admit any production of immaterial utilities within his definition, thus taking too little account of "productive powers." J. S. Mill, it may be remembered, talked of "utilities fixed and embodied in human beings," which included those qualities that make a man industrially efficient. A truer view, therefore, would hold that production, as understood in economics, includes the creation or preservation of such powers, whether the labour consist of training producers or restoring them, when sick, to full health and vigour. The narrower definition, however, has some advantage in clearness.

Production, as thus defined, is considered in relation to Self-Interest, Population, Protection, and Land Tenure. The author was fundamentally opposed to Socialism, but no blind adherent of *laissez-faire*. Its defects are well illustrated in connection with depressions and crises and the interest of the working classes, and a strong point is made of those influences which act ultimately and mainly for good, but only after causing serious losses to individuals. Such faults are further aggravated by a too rapid growth of population, and Dr. Pierson gives a powerful criticism of the principle of Malthus and a restatement of it in the light of modern conditions. The final chapter of this part contains an admirable historical and descriptive treatment of land tenure in different countries.

The revenue of the State is of three kinds, or four if loans may be regarded as a source of income of the same order as the others. These are, first, returns from public domains or enterprises run on business lines; secondly, fees paid for a "measurable special benefit," or service performed by the State, in cases where there is a "predominant public purpose" and profit-making is a secondary consideration; and, thirdly, taxes, or "compulsory contributions from the public funds," which do not consist of special payments for some service rendered. The latter naturally occupy most of the space, and are treated in two chapters on the pressure and regulation of taxation. It only remains to add that Mr. Wotzel's really admirable translation shows to the best advantage the many merits of the book. For whilst some of its views may or may not meet with acceptance, its force, lucidity, and suggestiveness will scarcely be called in question.

N. B. DEARLE.

CHEMICAL BOOKS AND TABLES.

(1) *Landolt-Börnstein physikalisch-chemische Tabellen.* Vierte Auflage. Herausgegeben von Dr. Richard Börnstein und Dr. Walther A. Roth. Pp. xvi+1313. (Berlin: Julius Springer, 1912.) Price 56 marks.

(2) *The Elements of Qualitative Chemical Analysis.* With special consideration of the application of the Laws of Equilibrium and of the Modern Theories of Solution. By Prof. J. Stieglitz. Parts i. and ii., Fundamental Principles and their Application. Pp. xi+312. Price 1.40 dollars. Parts iii. and iv., Laboratory Manual. Pp. viii+151. Price 1.20 dollars. (New York: The Century Co., 1911–12.)

(3) *A College Text-Book on Quantitative Analysis.* By Prof. H. R. Moody. Pp. vi+165. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1912.) Price 5*s.* 6*d.* net.

(4) *A Laboratory Manual in Chemistry.* By Prof. W. C. Morgan and Prof. J. A. Lyman. Pp. xiii+142. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1912.) Price 1*s.* 8*d.* net.

(5) *Elementary Chemical Theory and Calculations.* By Dr. J. Knox. Pp. vii+103. (London: Gurney and Jackson, 1912.) Price 2*s.* net.

(1) THE new edition of the Landolt-Börnstein tables has been very greatly enlarged and covers nearly 500 pages more than the previous edition. Almost every section of the tables has contributed to this increase: it is therefore impossible to direct attention to all the features which are characteristic of the new edition. There is, however, a marked development in the use of graphic methods which will be very widely welcomed. Thus the equilibrium-diagrams for

metallic alloys have been increased in number from 54 to 251, and a series of 149 equilibrium-diagrams for binary mixtures of fused salts, including many minerals, makes its appearance for the first time. The interval of eleven years which elapsed between previous editions of the tables has now been reduced to seven years only; this appears to be justified by the vast multiplication of numerical data, as illustrated, for instance, by the fact that the "Annual Tables" for 1910 cover more than 700 pages; but the issue of frequent editions, each of which renders the earlier ones obsolete, will tend to confine the tables more and more to the shelves of reference-libraries. The new edition is the first to be issued since the death of Prof. Landolt; it is, therefore, only fitting that a handsome portrait of the originator of the tables should appear as a frontispiece to the new volume.

(2) Complaint has frequently been made that qualitative analysis is liable to degenerate into an unintelligent use of specific tests. Prof. Stieglitz, in his two volumes on qualitative analysis, has removed the subject to the opposite pole by treating it from the point of view of the advanced student of physical chemistry. To the average student, this treatment would probably present considerable difficulty, unless he should be fortunate enough to attend Prof. Stieglitz's own lecture courses and hear his explanations at first hand. Under other conditions there might be some disadvantage in placing the book directly in the hands of the student; but nothing but good can accrue from the assimilation of the contents of the two volumes by teachers responsible for conducting classes in qualitative analysis; they will then be provided with authentic explanations of the more puzzling reactions, and can hand on to their students as much of the underlying theory as may be practicable or desirable. It may be noted that the author has used to some extent the novel scheme of qualitative analysis described by A. A. Noyes and Bray in the Journal of the American Chemical Society.

(3) In the "College Text-book of Quantitative Analysis" concise directions for each step of the analysis are given, with numbered references to "explanatory facts" which justify the procedure adopted. These play the part of footnotes, but are of sufficient importance to justify their appearance in full-sized type on the same page as the instructions for working. It is claimed that by this system the student is saved from the vast waste of time which results from mistakes which are made before the instructor has been able to give personal attention to each individual. By the use of these minute directions, the student at once gets into the habit of correct manipulation, accomplishes more in the same time, and, for a beginner, gets unusually good results. Although a few minor criticisms might be made, the procedure (which was tested with the help of manuscript copies of the book during five years before publication) appears to be thoroughly sound, and teachers would be well advised to examine the book and determine how far it conforms to their own requirements. The directions for gravimetric analysis are particularly good.

(4) The "Laboratory Manual" is intended to accompany the authors' "Chemistry, an Elementary Text-book." It is suggested that the book "will prove interesting to teachers who wish to present that kind of chemistry which appeals to students because of its intense human interest." This view is probably responsible for the introduction of mixtures of potassium chlorate and sugar and of cream of tartar and carbonate of soda into the earliest chapters. But it may be questioned whether any useful purpose can be served by attempting to make chemistry popular with boys by the help of fireworks; in any case, the treatment appears to be extremely scrappy and vastly inferior to courses, such as those based on the British Association syllabus, which are now coming so extensively into use in this country. In this instance, at least, any attempt to copy American methods would involve a retrograde step.

(5) In the "Elementary Chemical Theory and Calculations" numerical exercises are provided to illustrate the chief quantitative laws, of which a brief discussion is also given. There is an ample selection of examples, but many of these are somewhat widely removed from actual laboratory practice, as, for instance, where sodium is made to combine directly with bromine to give a quantitative yield of sodium bromide, or where exact numbers of grains of hydrogen are made to combine with other elements: the value of the book would have been increased greatly if more real and fewer fictitious examples had been given, and especially if use had been made of the vast array of exact analyses which have been accumulated in the course of a century's work in the determination of atomic and molecular weights. T. M. L.

BOTANICAL AND GARDENING BOOKS.

(1) *Nervation of Plants.* By F. G. Heath. Pp. vii + 187. (London: Williams & Norgate, 1912.) Price 3*s.* 6*d.* net.

(2) *Wild Flowers as They Grow.* Photographed in Colour Direct from Nature. By H. Essenhigh Corke. With descriptive text by G. Clarke Nuttall. Fourth Series. Pp. viii + 200. (London: Cassell & Co., Ltd., 1912.) Price 5*s.* net.

(3) *British Violets.* A Monograph. By Mrs. E. S. Gregory. With an introduction by

G. Claridge Druce. Pp. xxiii + 108. (Cambridge: W. Heffer & Sons, Ltd., 1912.) Price 6*s*. net.

(4) *The Rock Garden.* By Reginald Farrer. Pp. xi + 118 + 8 coloured plates. (London and Edinburgh: T. C. & E. C. Jack, n.d.) Price 1*s*. 6*d*. net. (Present-Day Gardening.)

(5) *Tulips.* By Rev. Joseph Jacob. Pp. xi + 116 + 8 coloured plates. (London and Edinburgh: T. C. & E. C. Jack, n.d.) Price 1*s*. 6*d*. net. (Present-Day Gardening.)

(1) THE author of this work has written much and pleasantly upon ferns and trees, but here he has ventured into a field with which he is unfamiliar. The natural sciences, unfortunately, lend themselves too readily to arrant book-making when *cacoëthes scribendi* gains the upper hand, but that affliction is no excuse for a bad book nowadays, when it is easy enough to get a sufficient first-hand acquaintance with the elements of botany to enable the compiler of "popular" works to read with understanding some of the many excellent botanical text-books published in recent years and, where necessary, translate or paraphrase their diction into easier language for the benefit of a wider audience.

The object of the present work is apparently—by inference from the somewhat jumbled arrangement of the chapters—to describe in simple style the anatomy and physiology of "the two great divisions of the vegetable kingdom called respectively endogenous and exogenous plants," as the author puts it. The first and longest chapter, describing the venation of leaves, omits everything that is really interesting—the relation between venation and the outline and composition of simple and compound leaves, leaf mosaics, etc.—though it is at any rate free from the blunders to be found on almost every page in the rest of the book. We are told that, in addition to protoplasm, there are "in all, no less than twelve substances found within the cells of plants," namely, "chlorophyll, dextrine, gum, lime, oil, phosphorus, resin, salts, silica, starch, sugar, and turpentine." This greatly simplifies the biochemistry of plants. The structure of the "exogenous" stem is also elucidated, for we learn that the pith serves for the conduction of water by capillarity, as also do the bast fibres; the pith, moreover, produces the spiral vessels at its periphery, these give rise to the woody zone (showing "annular rings"), and this in turn produces the cambium, the functions of which are shrouded in mystery and doubt. The author's favourite words are "mystery" and "mysterious," often used several times in a sentence and hundreds of times in the whole book.

(2) The plates in the fourth volume of "Wild Flowers as They Grow" fully maintain the high standard of excellence shown in the preceding volumes of the series; the blackthorn, guelder-rose, and white water-lily are exquisitely portrayed, and most of the other plants are extremely good, though some of the colours are scarcely true to nature. Some of the text-figures are, as in previous volumes, too small and poorly executed to be of much service in illustrating the floral mechanisms described in the text. The latter is perhaps too largely occupied with folklore and quotations from herbalists and poets; but more attention is paid to the biology of the plants dealt with than is usually the case in books of this class, and the author has taken care to refer to the available modern text-books for details of pollination and other biological adaptations. The author correctly describes the bird's-nest orchid as a saprophyte—it is too often stigmatised as parasitic in "popular" books—but he might have proceeded to explain the mycorhiza or symbiosis between the plant and its root-inhabiting fungus, which is not mentioned. Like its predecessors, this volume, attractively got up, pleasantly written, beautifully illustrated with coloured plates, and remarkably cheap withal, will command a wide circulation among the increasing circle of readers interested in wild flowers.

(3) Mrs. Gregory's monograph of the British violets, the outcome of her long-continued and careful study of these protean and difficult forms, illustrates the usual result of the intensive method in systematic botany. In Hooker's "Student's Flora," published in 1884, the British violets occupy two pages, with descriptions of six species and seven other forms (sub-species, varieties, hybrids); Mrs. Gregory describes twelve species and more than sixty varieties, forms, and hybrids. Such studies as this, though adding to the troubles of the average field botanist who is content with the simple "lumping" method and finds the larger genera of flowering plants difficult enough without the "splitting" which modern systematists have done with small genera like Viola or Fumaria, are invaluable and prepare the way for further work on variation, hybridisation, and ecology.

(4, 5) These two additional volumes in the excellent "Present-day Gardening" series are of unusual interest and value. Mr. Farrer's work on alpine plants fully deserves the eulogies paid by Prof. Farmer in his preface to this volume on "The Rock Garden," into which the author has packed an amazing amount of invaluable information and advice, such as will be more serviceable to the rock gardener than a score of the innumerable tomes already published on this branch of

horticulture. In his volume on "Tulips," Mr. Jacob has successfully surmounted the difficulties of the pioneer—for this is stated by the editor of the series to be the first book on the tulip published in English—and has produced a delightfully readable as well as practical treatise on this interesting genus and its cultivation in times past and present. F. CAVERS.

OUR BOOKSHELF.

Catalogue of the Serial Publications possessed by the Geological Commission of Cape Colony, the Royal Observatory, the Royal Society of South Africa, the South African Association for the Advancement of Science, the South African Museum, and the South African Public Library. With an Appendix containing a List of the Serials in the Bolus Herbarium of the South African College. Pp. 54. (Cape Town: South African Public Library.)

IN a "Foreword" to this work it is stated that "this list is the outcome of a suggestion first made by Dr. T. Muir, F.R.S., in NATURE." The list, which contains the names of about 1100 serials, must be of great service to workers in science in Cape Town; it is arranged in seven columns, the first containing the names of the serials and the remaining six references to the libraries in the following order: South African Library, South African Museum, Royal Observatory, Royal Society of South Africa, Geological Commission, and the South African Association for the Advancement of Science. There is also an appendix containing a list of the serials in the Bolus Herbarium of the South African College.

This arrangement is obviously applicable to cases in which only a small number of libraries are included, but it gives space to indicate the actual volumes which are accessible; thus, in the case of the Smithsonian Annual Reports the six columns have the following entries:—

| 1862–1909 (inc.) [=incomplete] | 1872–1909 (1874 missing) |
| 1856– | 1880–1910 | — | 1881–1909 (inc.) |

In the Royal Society's subject indexes, where there are references to nearly thirty British libraries (indicated by symbols), the serials which are incomplete are marked *i*, which gives a very small amount of information and must be regarded merely as a caution.

In the catalogue under notice there is only one case of a serial occurring in all the six libraries, and it is not surprising that this is the Transactions of the Royal Society of South Africa. It is well known that Dr. Muir has inveighed against the multiple sets of the same serials in neighbouring libraries, and has pointed out that it would be better for only one of the libraries to have a complete set of a serial, which would enable some in the vicinity to use their resources in obtaining serials not possessed by others, and his influence in this direction has probably been felt in South Africa.

Union lists of serials have already been prepared in many cities and countries, and we may congratulate the trustees of the South African Public Library in adding to their number.

The Mineralogy of the Rarer Metals: a Handbook for Prospectors. By Edward Cahen and W. O. Wootton, with a foreword by F. W. Harbord. Pp. xxviii+211. (London: Charles Griffin and Co., Ltd., 1912.) Price 6*s*. net.

THIS convenient and carefully prepared manual supplies a want that has long been felt. Many of the elementary substances, long regarded as merely chemical curiosities, are now finding useful and often extensive applications in the arts. In the manufacture of filaments for electric lamps, in the preparation of mantles for gas-lighting, in various cases in which hardness or infusibility are desiderata, and especially in the production of steels with special qualities, a large and ever-increasing number of the so-called "rare metals" are finding familiar uses.

The authors in this handy volume have compiled, from the best and latest sources of information, statements of the nature, uses, and properties of these various metals, together with an account of the characters, distribution, methods of detection, and commercial value (where this can be ascertained) of the various minerals which constitute the sources of these rare metals. In view of the ever-increasing demands for many of these metals, and the fact that some which have not yet found useful applications may do so in the future, the appearance of this manual is distinctly opportune. The information, though given in concentrated form, appears to be in nearly every case clear and sufficient; and the book cannot fail to be of very great service to prospectors and others, who are now no longer confined in their researches to seeking for sources of the hitherto limited classes of so-called "precious metals" and "useful metals."

Not the least valuable characteristic of the book is due to the fact that, in its printing and binding, the question of its suitability for being carried in the pocket, for use in the field, has been carefully provided for. Our satisfaction at the appearance of this valuable book is somewhat marred by the information we have received that science has lost a promising worker by the death, since the book was finished, of the author whose name stands second on the title-page. J. W. J.

Education and National Life. By Dr. Henry Dyer. Pp. 112. (London: Blackie and Son, Ltd., 1912.) Price 1*s*. net.

DR. DYER'S wide experience of educational affairs in this and other countries should ensure for him many attentive readers. The more important aspects of a question of vital national interest are handled in an inspiring manner, and the essays should prove of value and assistance to professional and business men who have no specialised knowledge of education.

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.]*

Reflection of Röntgen Radiation.

FOLLOWING the investigations of Laue, Friedrich, and Knipping, we were led to study the transmission of a narrow pencil of X-rays through rock salt, a crystal of simple cubic form. The results are of interest, for they show in a striking way a strong reflection from the internal crystallographic planes upon which the pencil fell at nearly grazing incidence. The pencil so reflected is of such intensity that the short exposure required to produce well-marked effects on a photographic plate is insufficient to give more than a trace of the most intense of the other pencils of radiation emerging from the crystal. A small cleaved fragment was placed with one pair of faces horizontal. Below this an X-ray tube was fixed to a stand capable of sliding in grooves along an arc of a vertical circle of which the centre was a point in the crystal and the plane was one of the three principal planes of the crystal. A narrow pencil of X-radiation could then be rotated in this plane approximately about the point of incidence on the crystal.

When the pencil was vertical it was, of course, perpendicular to one face, and parallel to the other two sets of mutually perpendicular principal planes in the crystal. A slight movement of the X-ray tube directed the pencil at nearly grazing incidence on one of the sets of vertical planes. The result was a well-marked spot on the photographic plate situated several centimetres above the crystal, on the same side of these crystallographic planes as the incident pencil. When the latter was made to rotate until it was incident on the other side of these planes, the emergent beam moved through the central direct image to the other side, being again on the same side of the crystallographic planes considered as the incident pencil. The angle turned through by the emerging beam was certainly within a very small possible error the same as that turned through by the incident pencil. We thus have very direct evidence of copious reflection near grazing incidence from cleavage planes within the crystal itself.

This suggested the probability of a similar reflection from the planes of cleavage of mica, and we proceeded to make a concave mirror of mica to test this. A letter from Mr. W. L. Bragg in NATURE of December 12, however, announces that this has just been accomplished. In our experiments with rock-salt the beam enters the crystal in a different manner, but the effect is undoubtedly similar. It is not a pure surface effect, but takes place in the body of the crystal. Whether all the photographic patterns obtainable by experiments like those of Laue, Friedrich, and Knipping are readily explained by reflection, as suggested by Mr. W. L. Bragg, our experiments do not yet permit us to say; but the results of observation of an isolated spot certainly can be accounted for by reflection from a large number of layers of atoms, parallel to one of the pairs of faces of the crystal.

Judging from recent experience we have had of the photographic action of X-rays, it appears probable that a beam reflected in such a way is of sufficient intensity to be detected and followed without any great difficulty by the ionisation method.

C. G. BARKLA.
G. H. MARTYN.

King's College, London, December 14.

Shinobu Hirota.

SHINOBU HIROTA, who returns to Japan at the end of this month, by his doctor's advice, came with me to this country in 1895, and within a week of his arrival the seismograph which he brought with him from Japan was at work at Shide. To convince those who had doubts as to the possibility of recording in Britain earthquakes which had originated even so far away as their antipodes, a second instrument was installed at Carisbrooke Castle. To look after this Hirota had, wet or fine, a daily walk of four miles. The fact that these two instruments gave similar records and also that from a single record we could tell the distance at which a megaseism had originated naturally attracted some attention. Directly it was shown that certain earth disturbances had interrupted cables, Colonies desirous of knowing the cause of these sudden isolations from the rest of the world set up seismographs.

This was the commencement of the British Association cooperation of seismological stations, now sixty in number. To bring this into being Hirota played an active part. He knows personally many of the directors, and has given instruction to their officers. In practical seismometry he has made many innovations, some of which will perhaps be looked upon as "mere dodges," but they have rendered instruments more sensitive. His multiplying levers made of grass stems gathered from "bents" give pointers exactly one-third the weight of their equivalent in aluminium, and yet twice, if not three times, as stiff. It was by using these that we got at Bidston, where Hirota went to set up an instrument, the first records of rock deformation due to tidal load.

In the workshop he is a good all-round workman, in the observatory and office he has kept most careful records, could calculate a chordal distance, make a zenithal projection or an observation for time, while for photographic work he holds a gold medal from the Photographic Society of the Isle of Wight. Above all this, his sharp eyes would find on a seismogram two records where at other stations only one had been discovered. In view of the great attention and large sums which have now been spent, particularly in foreign countries, on the new seismological departure, I feel myself justified in giving recognition to an assistant pioneer in these new studies. Illness carries him back to his native country, where I trust he will have a speedy recovery. His work is embodied in annual seismological reports of the last seventeen years, and twenty-six circulars giving the records received from observatories cooperating with the British Association. J. MILNE.

Shide, Newport, Isle of Wight.

The Self-testing of Dispersion Apparatus.

A SERIOUS inconvenience attaches to the standard method of testing a plane grating, echelon, or other dispersive apparatus, by crossing its dispersion with that of an auxiliary piece; for, unless the resolving power of the auxiliary dispersion is in some degree comparable with that of the piece to be tested, it is scarcely possible to identify ghosts which lie close to their primaries. When an extended research with crossed dispersions is in question, the case, in most laboratories, becomes even more difficult.

The difficulty, I think, may be removed by means of a simple and relatively inexpensive arrangement of two front-reflecting mirrors, so devised that the echelon (say) is crossed with its own dispersion. One of the mirror faces has one truly straight edge, at which the dihedral angle is 90° or less. This edge is in contact with the face of the second mirror, the

two mirrors being adjustably clamped together, so that they can be set exactly at right angles to one another. Now let them be placed so that their line of contact is inclined 45° to the horizon, while (in a roughly approximate sense) the vertical plane through that line of contact bisects *externally* the angle between the mirrors. Vertical lines imaged by successive reflection at the two mirrors will thus appear horizontal, and conversely.

In the case of an echelon grating, the train would bear a general resemblance to a Littrow spectroscope. The light would pass successively through a slit (shortened to a minute square), an objective, and an echelon, and after reflection at the mirrors would return through the echelon and objective, and be brought to a focus in the plane of the slit. For the full advantage of crossed dispersions to be thus realised, it is, of course, essential that the effective aperture of the echelon should be at least as high as it is wide, the width being measured parallel to the dispersion. In echelon gratings and Lummer-Gehrcke plates this generally holds good, though in many gratings the length of the rulings is insufficient for the corresponding condition to be satisfied.

The pair of mirrors described might be replaced by an accurately right-angled prism, with reflecting faces meeting in as sharp and clean a line as possible.

The suggested arrangement may be modified by allowing the beam to pass through a second objective and be brought to a focus in the usual way. A small right-angled prism can then be used to return the beam through the lenses and the echelon between them, and since the intersection of its reflecting faces should lie strictly in the plane of the first formed (singly dispersed) spectrum, it is easy to arrange so that this intersection, as finally viewed, is to one side of the useful field. In thise case the prism need not be accurately right-angled, nor indeed is any great demand made on its other optical qualities; it may be some set-off against this that four transmissions through object-glasses are involved.

If an echelon grating of reflecting type is to be crossed with its own dispersion, a method essentially similar to the last-mentioned modification can be used. The apparatus, as arranged for single dispersion, having been auto-collimated, the beam would in the present case be twice brought to a focus, and would in all pass four times through one and the same objective. C. V BURTON.

Boar's Hill, Oxford, December 7.

Petrifactions of the Earliest European Angiosperms.

UNTIL the three specimens from the English Aptian in the British Museum were recognised as Angiosperms and described in my paper (Phil. Trans. Roy. Soc., series B, vol. cciii., pp. 75–100, plates v–viii, and kindly reviewed in NATURE, August 22, p. 641), Angiosperms were supposed not to have existed in northern Europe at that early date. Those three specimens came from two different localities, which minimised the chances of error, but it is highly satisfactory to have to record the discovery of another specimen from a new locality.

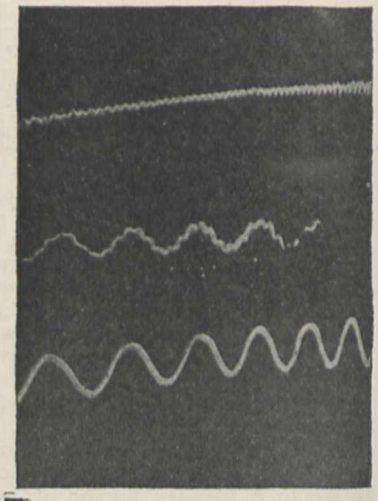
The new specimen is from the Lower Greensand of Kent, and belongs to the Maidstone Museum. While pursuing my study of the Lower Cretaceous flora I recently visited the Maidstone Museum, which has the best extant collection of Lower Greensand fossil plants from Mr. W. H. Bensted's famous Iguanodon Quarry. The collection includes a number of large pieces of silicified wood from other of the numerous quarries in the Lower Greensand in the district. All these I examined carefully, and the majority of pieces proved to be Gymnospermic, but one of the large bits of petrified wood arrested attention. Mr. Allchin, the present curator of the museum, generously allowed me to have sections cut from it, which prove the specimen to be a portion of the trunk of a large woody Angiosperm. A detailed and illustrated account of its anatomy will follow in due course, but it may be remarked here that its general characters differ from those of the three other described species from this horizon, and it certainly represents a new species and possibly a new genus.

As the question of the origin of Angiosperms is one in the forefront of controversy at present, and is one, moreover, about which we have so remarkably little evidence, the discovery of this, which is only the fourth specimen of Aptian Angiosperms yet obtained from northern Europe, is satisfactory in confirming the conclusions reached from the study of the three British Museum specimens. MARIE C. STOPES.

Smoke Trace of Compound Vibrations of Tuning-fork.

I READ with interest the note by Mr. F. H. Parker on upper partials of a tuning-fork, which appeared in NATURE of November 28, p. 361.

As an alternative to taking the first upper partial to be 6·6 times the frequency of the prime, or confirming the relation by separate traces, may I suggest the plan of making a trace of the vibration compounded of the two?



The accompanypanying print is from one corner of a smoke trace used by me at a popular lecture in 1901. One curve shows the fundamental (128 per second), another the first upper partial, while the centre curve of the three shows the form of vibration executed when the first upper partial is sounding, together with the prime. The three sounds may be heard by the audience, and the smoke traces of each obtained in their presence, and then projected by the lantern. The compound vibration is easily obtained by striking the fork on a hard surface, such as a counter, and so presents no difficulty whatever. The ratio of frequencies of first upper partial and prime for the rather slender fork in question is seen to be of the order 6·25. E. H. BARTON.

University College, Nottingham, December 7.

BREATH FIGURES.

AT intervals during the past year I have tried a good many experiments in the hope of throwing further light upon the origin of these figures, especially those due to the passage of a small blow-pipe flame, or of hot sulphuric acid, across the surface of a glass plate on which, before treatment, the breath deposits evenly. The even

deposit consists of a multitude of small lenses easily seen with a hand magnifier. In the track of the flame or sulphuric acid the lenses are larger, often passing into flat masses which, on evaporation, show the usual colours of thin plates. When the glass is seen against a dark ground, and is so held that regularly reflected light does not reach the eye, the general surface shows bright, while the track of the flame or acid is by comparison dark or black. It will be convenient thus to speak of the deposit as bright or dark—descriptive words implying no doubtful hypothesis. The question is what difference in the glass surface determines the two kinds of deposit.

In Aitken's view (Proc. Ed. Soc., p. 94, 1893; NATURE, June 15, 1911), the flame acts by the deposit of numerous fine particles constituting nuclei of aqueous condensation, and in like manner he attributes the effect of sulphuric (or hydro-fluoric) acid to a water-attracting residue remaining in spite of washing. On the other hand, I was disposed to refer the dark deposit to a greater degree of freedom from grease or other water-repelling contamination (NATURE, May 25, 1911), supposing that a clean surface of glass would everywhere attract moisture. It will be seen that the two views are sharply contrasted.

My first experiments were directed to improving the washing after hot sulphuric or hydrofluoric acid. It soon appeared that rinsing and soaking prolonged over twenty-four hours failed to abolish the dark track; but probably Mr. Aitken would not regard this as at all conclusive. It was more to the point that dilute sulphuric acid (1/10) left no track, even after perfunctory washing. Rather to my surprise, I found that even strong sulphuric acid fails if employed cold. A few drops were poured upon a glass (¼-plate photographic from which the film had been removed), and caused to form an elongated pool, say, half an inch wide. After standing level for about five minutes—longer than the time required for the treatment with hot acid—the plate was rapidly washed under the tap, soaked for a few minutes, and finally rinsed with distilled water, and dried over a spirit lamp. Examined when cold by breathing, the plate showed, indeed, the form of the pool, but mainly by the darkness of the *edge*. The interior was, perhaps, not quite indistinguishable from the ground on which the acid had not acted, but there was no approach to darkness. This experiment may, I suppose, be taken to prove that the action of the hot acid is not attributable to a residue remaining after the washing.

I have not found any other treatment which will produce a dark track without the aid of heat. Chromic acid, *aqua regia*, and strong potash are alike ineffective. These reagents do undoubtedly exercise a cleansing action, so that the result is not entirely in favour of the grease theory as ordinarily understood.

My son, Hon. R. J. Strutt, tried for me an experiment in which part of an ordinarily cleaned glass was exposed for three hours to a stream of strongly ozonised oxygen, the remainder being protected. On examination with the breath, the difference between the protected and unprotected parts was scarcely visible.

It has been mentioned that the edges of pools of strong cold sulphuric acid and of many other reagents impress themselves, even when there is little or no effect in the interior. To exhibit this action at its best, it is well to employ a minimum of liquid; otherwise a creeping of the edge during the time of contact may somewhat obscure it. The experiment succeeds about equally well even when distilled water from a wash-bottle is substituted for powerful reagents. On the grease theory the effect may be attributed to the cleansing action of a pure free surface, but other interpretations probably could be suggested.

Very dark deposits, showing under suitable illumination the colours of thin plates, may be obtained on freshly-blown bulbs of soft glass. It is convenient to fill the interior with water, to which a little ink may be added. From this observation no particular conclusion can be deduced, since the surface, though doubtless very clean, has been exposed to the blow-pipe flame. In my former communication, I mentioned that no satisfactory result was obtained when a glass plate was strongly heated *on the back* by a long Bunsen burner; but I am now able to bring forward a more successful experiment.

A test-tube of thin glass, about ½ inch in diameter, was cleaned internally until it gave an even bright deposit. The breath is introduced through a tube of smaller diameter, previously warmed slightly with the hand. The closed end of the test-tube was then heated in a gas flame urged with a foot blow-pipe until there were signs of incipient softening. After cooling, the breath deposit showed interesting features, best brought out by transmitted light under a magnifier. The greater part of the length showed, as before, the usual fine dew. As the closed end was approached the drops became gradually larger, until at about an inch from the end they disappeared, leaving the glass covered with a nearly uniform film. One advantage of the tube is that evaporation of dew, once formed, is slow, unless promoted by suction through the mouth-tube. As the film evaporated, the colours of thin plates were seen by reflected light. Since it is certain that the flame had no access to the internal surface, it seems proved that dark deposits can be obtained on surfaces treated by heat alone.

In some respects a tube of thin glass, open at *both* ends, is more convenient than the test-tube. It is easier to clean, and no auxiliary tube is required to introduce or abstract moisture. I have used one of 3/10 in. diameter. Heated locally over a simple spirit flame to a point *short of softening*, it exhibited similar effects. This easy experiment may be recommended to anyone interested in the subject.

One of the things that I have always felt as a difficulty is the comparative permanence of the dark tracts. On flat plates they may survive in some degree rubbing by the finger, with subse-

quent rinsing and wiping. Practically the easiest way to bring a plate back to its original condition is to rub it with soapy water. But even this does not fully succeed with the test-tube, probably on account of the less effective rubbing and wiping near the closed end. But what exactly is involved in rubbing and wiping? I ventured to suggest before that possibly grease may penetrate the glass somewhat. From such a situation it might not easily be removed, or, on the other hand, introduced.

There is another form of experiment from which I had hoped to reap decisive results. The interior of a mass of glass cannot be supposed to be greasy, so that a surface freshly obtained by fracture should be clean, and give the dark deposit. One difficulty is that the character of the deposit on the irregular surface is not so easily judged. My first trial on a piece of plate glass $\frac{3}{8}$ in. thick, broken into two pieces with a hammer, gave anomalous results. On part of each new surface the breath was deposited in thin laminæ capable of showing colours, but on another part the water masses were decidedly smaller, and the deposit could scarcely be classified as black. The black and less black parts of the two surfaces were those which had been contiguous before fracture. That there should be a well-marked difference in this respect between parts both inside a rather small piece of glass is very surprising. I have not again met with this anomaly; but further trials on thick glass have revealed deposits which may be considered dark, though I was not always satisfied that they were so dark as those obtained on flat surfaces with the blow-pipe or hot sulphuric acid. Similar experiments with similar results may be made upon the edges of ordinary glass plates (such as are used in photography), cut with a diamond. The breath deposit is best held pretty close to a candle-flame, and is examined with a magnifier.

In conclusion, I may refer to two other related matters in which my experience differs from that of Mr. Aitken. He mentions that with an alcohol flame he "could only succeed in getting very slight indications of any action." I do not at all understand this, as I have nearly always used an alcohol flame (with a mouth blow-pipe) and got black deposits. Thinking that perhaps the alcohol which I generally use was contaminated, I replaced it by pure alcohol, but without any perceptible difference in the results.

Again, I had instanced the visibility of a gas flame through a dewed plate as proving that part of the surface was uncovered. I have improved the experiment by using a curved tube through which to blow upon a glass plate already in position between the flame and the eye. I have not been able to find that the flame becomes invisible (with a well-defined outline) at any stage of the deposition of dew. Mr. Aitken mentions results pointing in the opposite direction. Doubtless, the highly localised light of the flame is favourable.

RAYLEIGH.

PALÆOLITHIC MAN.

THE fossil human skull and mandible to be described by Mr. Charles Dawson and Dr. Smith Woodward at the Geological Society as we go to press is the most important discovery of its kind hitherto made in England. The specimen was found in circumstances which seem to leave no doubt as to its geological age, and the characters it shows are themselves sufficient to denote its extreme antiquity. It was met with in a gravel which was deposited by the river Ouse near Piltdown Common, Fletching, Sussex, at a time when that river flowed at a level eighty feet above its present course.

Although the basin of the stream is now well within the Weald and far removed from the chalk, the gravel consists largely of iron-stained flints closely resembling those well known in gravel deposits on the downs, and among these there are many waterworn "eoliths" identical with those found on the chalk plateau near Ightham, Kent.

With the flints were discovered two fragments of the molar tooth of a Pliocene elephant, and a waterworn cusp of the molar of a Mastodon. The gravel is therefore partly made up of the remains of a Pliocene land-deposit. Teeth of hippopotamus, beaver, and horse, and part of the antler of a red deer were also found, with several unabraded typical early Palæolithic (Chellean) implements. The latter seem to determine the age of the gravel as Lower Pleistocene.

The human remains, which are in the same mineralised condition as the associated fragments of other mammals, comprise the greater part of the brain-case and one mandibular ramus which lacks the upper portion of the symphysis. The skull measures 190 mm. in length by 150 mm. in width at its widest part, and the bones are of nearly twice the normal thickness. Its brain capacity is about 1070 c.c. The forehead is much steeper than in the Neanderthal type, with only a feeble brow-ridge; and the back of the skull is remarkably low and broad, indicating an ape-shaped neck. The mandible, so far as preserved, is identical in form with that of a young chimpanzee, showing even the characteristically simian inwardly curved flange of bone at the lower border of the retreating symphysis. The two molars preserved are of the human pattern, but comparatively long and narrow.

At least one very low type of man with a high forehead was therefore in existence in western Europe long before the low-browed Neanderthal man became widely spread in this region. Dr. Smith Woodward accordingly inclines to the theory that the Neanderthal race was a degenerate offshoot of early man and probably became extinct, while surviving modern man may have arisen directly from the primitive source of which the Piltdown skull provides the first discovered evidence.

DR. C. THEODORE WILLIAMS, M.V.O.

WE record with regret the death of Dr. Charles Theodore Williams, on December 15, at the age of seventy-four years. He was the second son of Dr C. J. B. Williams, F.R.S., physician to University College Hospital and consulting physician to the Brompton Hospital. He was educated at Harrow and Pembroke College, Oxford, and afterwards studied medicine at St. George's Hospital and in Paris. He took the degree of M.A. in 1862, M.B. in 1864, and M.D. in 1869. In 1867 he was appointed assistant physician to the Brompton Hospital, and became full physician in 1871 and consulting physician in 1894.

Dr. Theodore Williams became a member of the Royal College of Physicians in 1865, and was elected a fellow in 1871, councillor 1891–93, and censor 1899–1900. He was an honorary fellow of Pembroke College, Oxford, and a member of the Athenæum Club. He was an active member of nearly all the London medical societies, and was president at various times of several of them. He was twice president of the Royal Meteorological Society. He was an honorary member of the Société Française d'Hygiène and of the American Climatological Society. He had the distinction of being elected one of the four presidents of the International Congress on Tuberculosis, held at Washington, the others being Koch, Landouzy, and Trudeau.

Dr. Theodore Williams had a large practice as a physician and a high reputation as a specialist in consumption, in which he had a very wide and varied experience. In collaboration with his father, he was the author of a work entitled "Pulmonary Consumption: its Modes of Arrest, Treatment and Duration," 1871. A second edition, revised and enlarged, being mainly rewritten by Dr. Theodore Williams, was published in 1887.

Dr. Theodore Williams was specially interested in the effects of climate in the treatment of pulmonary disease, and his first book, on the "Climate of the South of France," was published in 1867, when comparatively little was known of the Riviera as a health resort. In 1869 he visited Davos and examined many cases there, and reported very favourably on the results obtained by residence in the high altitudes. Later he incorporated his observations in his lectures on aerotherapeutics delivered before the Royal College of Physicians, 1893.

In 1911 he delivered the Harveian Oration before the Royal College of Physicians, choosing as his subject "Old and New Views on the Treatment of Consumption."

Dr. Theodore Williams was an active worker in the cause of prevention of consumption, and was one of the founders of the National Association, of which at the time of his death he was vice-chairman of the Council. He was one of the founders of the Queen Alexandra Sanatorium at Davos, and one of the most active workers in the establishment of the Brompton Sanatorium at Frinley and the King Edward VII. Sanatorium at Midhurst. For his work in connection with the latter, King Edward gave him the honour of the M.V.O.

He contributed many papers to the transactions of the medical societies and to the medical journals. In 1868 he married Mary, daughter of Dr. John Gwyn Jeffreys, F.R.S., a well-known authority on conchology. He is survived by his wife, whose bereavement has called forth general sympathy.

NOTES.

INFORMATION has been received at the Meteorological Office that the first prize of 2000 marks in the competition recently organised by the German Meteorological Society for the best discussion of the results of the international investigation of the upper air has been awarded to Mr. Ernest Gold, superintendent of statistics at the office, for his essay, entitled "The International Kite and Balloon Ascents."

MR. C. J. GAHAN, first class assistant in the department of zoology of the British Museum (Natural History), has been appointed to the newly created post of keeper of the department of entomology. Hitherto, for administrative purposes, there has been an entomological section of the department of zoology; in future there will be a special department of entomology under its own keeper.

PROF. JACQUES HADAMARD, professor of analytical and celestial mechanics at the Collège de France, and professor of mathematical analysis at the École Polytechnique, Paris, has been elected a member of the Paris Academy of Sciences in the section of geometry, in succession to the late Prof. Henri Poincaré.

THE death is announced, in his seventy-second year, of Mr. A. Beldam, first president of the Institute of Marine Engineers.

DR. WILLIAM J. HOWARTH, medical officer of the county of Kent, has been appointed medical officer of the City of London in succession to Dr. William Collingridge, who recently retired.

MR. E. J. LOOMIS, for fifty years an assistant in the American Nautical Almanack Office, died recently in Washington at the age of eighty-four. In 1889 he was a member of the United States eclipse expedition to the west coast of Africa. The list of his publications includes "Wayside Sketches," "An Eclipse Party in Africa," and "A Sunset Idyll and Other Poems." Mr. Loomis was the father of Mrs. Mabel Loomis Todd, who has collaborated with her husband, Prof. David Todd, of Amherst, in much of his astronomical work.

THE death is reported, in his sixty-second year, of Mr. Edwin Smith, an American astronomer and geodesist of repute. He had spent the greater part of his career in the service of the United States Coast and Geodetic Survey. In 1874 he was placed in charge of the United States Government expedition to observe the transit of Venus at Chatham Islands, in

the South Pacific, and in 1882 he was entrusted with a similar task at Auckland, N.Z. Later, he determined the force of gravity at Auckland, Sydney, Singapore, Tokyo, San Francisco, and Washington, by means of the three Kater pendulums of the Royal Society. He was a member of several scientific societies, and was one of the founders of the Cosmos Club at Washington.

WE are informed by the senior member of the department of botany at the Pennsylvania State College that Dr. William A. Buckhout, professor of botany and the senior professor at the college, died of heart disease on December 3. Dr. Buckhout was born in December, 1846, and was graduated from the Pennsylvania State College in 1868. In 1871 he became professor of botany and horticulture at that college. In the changes brought about in agricultural sciences during recent years he became professor of botany. For many years he was botanist of the Pennsylvania State Board of Agriculture. In 1888 he was appointed to the Pennsylvania State Forestry Commission, and was a prime mover in the State in creating and taking an active interest in forestry. He was author of papers on the chestnut as a fruit and food, the effect of smoke and gas on vegetation, a microscopic examination of State College water supply, forest fires, and others, and also of annual reports as State botanist.

WE gather from the report of the ninth season during which the Brent Valley Bird Sanctuary has been maintained, that the season 1912 was very successful. Nightingales bred as before; blackcap warblers increased largely in number; a nest of the marsh tit made a new record; and young wrynecks were reared for the first time. The work of the committee is spreading all over the country; the new nesting boxes, made from logs, which open at the top, are being very generally used, and a number of bird-lovers have found that they and feeding tables make excellent Christmas presents. The honorary secretary is Mrs. Wilfred Mark Webb, of Odstock, Hanwell, London, W.

THE fourth part of the Proceedings for 1912 of the Institute of Chemistry gives particulars of the progress which is being made towards the provision of new buildings for the institute. At an extraordinary general meeting of the institute, held on November 14 last, two resolutions were carried unanimously. One empowered the council to acquire from the Bedford Estate the site of 30 Russell Square, London, for a term of ninety-nine years, at a ground rent not exceeding 300*l.* per annum, one year at peppercorn rent. The other resolution gave the council power to apply the building fund and all future contributions to it to the erection and equipment of suitable buildings. The council finds that the original estimate of 15,000*l.* for the buildings will not allow of any undue elaboration in construction, or leave more than sufficient margin for adequate equipment. Of the 15,000*l.* required, 3932*l.* has still to be found. We notice, also, that the Public Appointments Committee of the institute has had under consideration the conditions attaching to chemical appointments under the Civil Service, and finds in some instances that the status of chemists employed is far from satisfactory. The Royal Commission on the Civil Service has invited the council to forward a statement for consideration.

THE International Congress of Medicine is to be held in London next August. It is expected that some 5000 medical men will be present as delegates. The congress assembles once in every four years, and is received in turn in all the capitals of Europe. It was last held in 1909 in Budapest. The congress will be presided over by Sir Thomas Barlow, president of the Royal College of Physicians. The general addresses to the full congress in the Albert Hall will be given by Prof. Chauffard, of Paris, on medicine; Prof. Paul Ehrlich, of Frankfurt, on pathology; Mr. John Burns, M.P., on public health; Prof. Harvey Cushing, of Harvard University, on surgery; and Mr. W. Bateson, F.R.S., on heredity. The subjects for discussion are mostly of professional interest, but some make a wider appeal, such as the psychology of crime, to be considered at a joint meeting of the Forensic Medicine and Psychiatry Sections. The causes of epidemic diseases and the effects of dust in producing diseases of the lungs are to be considered in the Section of Hygiene, the Forensic Medicine Section will discuss the causes and prevention of suicide, and the Tropical Medicine Section the subjects of plague and beri-beri.

WE have been favoured with a reprint of an article from *The Halifax Guardian* of November 30 in which Mr. W. B. Crump records his personal connection with the Belle Vue Museum, Halifax, and expresses his opinion on the present state and future prospects of that institution. The function of the museum, it appears, is considered to be educational, and the collections are therefore to a great extent of a general rather than a local character, but special attention is directed to certain slides prepared from the coal-balls of Beacon Hill, which are stated to have largely contributed, in the hands of Messrs. Williamson, Scott, and Spencer, to our knowledge of the mode of formation of the Coal Measures.

VOL. VIII. of the Records of the Indian Museum, the first part of which has just come to hand, is to be devoted to the zoological results of the Abor expedition of 1911–12. Mr. Stanley Kemp, it will be remembered, accompanied the expedition as naturalist, and it is his collections which form the subject of the volume. In the present issue Dr. Nelson Annandale describes eight tailless amphibians, three snakes, and one lizard as new. A considerable proportion of the amphibians were in the larval stage, and it is noticeable that many of the tadpoles, like those of the Darjiling district, possess special adaptations to prevent their being carried away by the strong currents of the streams they inhabit. Dr. Annandale also contributes an account of the few Porifera (sponges) obtained, while Captain W. H. Evans does the same for the Lepidoptera, Mr. F. H. Gravely for the Scolopendridæ, and Mr. C. A. Paiva for the Hymenoptera Anthophila (bees, wasps, &c.).

THE November number of *The American Museum Journal* contains a beautifully illustrated article by Mr. G. B. Sudworth on the present condition of the big-trees (Sequoia) of California. Thirty-one groups of these trees, covering areas ranging from less than an acre to ten square miles, and collectively occupying about fifty square miles, are known. Some of these tracts are in private hands, while others belong to the Federal Government, and it is urged that the splendid grove in North Calaveras should be acquired by Government. In the groves belonging to Government no felling, except when absolutely necessary, is permitted, but in those in private hands "lumbering" is carried on to a greater or less extent. The great danger to these trees is fire. The opinion has been expressed that the Sequoias are not reproducing themselves, and it seems that the seeds will not germinate in ground thickly covered with vegetable débris, or in deep shade. It is stated, however, that "wherever in the southern groves lumbering and fire have opened up the forest and exposed the mineral earth, an abundance of young big-trees is always found near seed-trees, unless, of course, fire has destroyed them."

PROF. H. MOLISCH has revised and enlarged his well-known work on luminosity in plants ("Leuchtende Pflanzen," Gustav Fischer, Jena, price 7.50 marks). Since the publication of the first edition (reviewed in NATURE, November 23, 1905) various writers—notably Prof. Molisch himself—have contributed to this interesting branch of plant physiology, and these scattered contributions are now brought together, with references to the literature of the subject. A large portion of the work is devoted to the phenomena of luminosity due to bacteria and fungi, though the various "phosphorescent" phenomena observed in animals and in the higher plants are discussed. Molisch concludes that the luminosity of plants (from which, of course, are excluded various cases of luminescence due to reflection of light brought to a focus by lens-shaped cells, and the like) is due to the production in the living cell of a substance ("photogen") which becomes luminous in the presence of water and free oxygen, and that this substance is either a protein or a phosphatid. The luminosity of the luminous bacteria and fungi differs from the various phosphorescent phenomena in animals in that the light is continuous during life, and not intermittent, though it may be due in all cases to a similar cause—the oxidation of photogenic substances by means of oxidising ferments.

The Journal of Agricultural Science (vol v., part 1) contains, amongst others, a paper by Mr. W. A. Davis on the estimation of potassium in fertilisers, soil extracts and plant ashes. It is shown that the perchlorate method, of which a modification is suggested, yields more accurate results than that in which platinum chloride is used, and has the additional advantages of (*a*) being more economical; (*b*) the results are not affected by the presence of barium, calcium, and magnesium chlorides and sodium phosphate; and (*c*) all uncertainty such as exists as to what value shall be taken for the atomic weight of platinum is avoided.

IN addition to the useful latest reports of ice given in the monthly meteorological charts of the North Atlantic Ocean issued by the Deutsche Seewarte, that for December contains the commencement of a series of air and sea temperature observations extracted from the log-books of Transatlantic steamers in the region of drift ice. The extracts, arranged according to groups, include (1) observations of great fluctuations of temperature; (2) ice encountered without much change of temperature; (3) great decrease of temperature indicating proximity of ice. During 1912 more than ordinary attention has been directed to the danger of ice, owing to the unusual extension of its distribution and to its density. In the case of fog the only means of detecting ice, in addition to a more careful outlook, is the observation of air and sea temperature, but it has been shown that such data are at times untrustworthy. The collection and publication of these extracts are, we consider with the Seewarte, of considerable utility, as affording data for a careful examination of the behaviour of temperature in the drift-ice region, independently of whether or not ice was actually met with.

THE report of the census of the island of Mauritius and its dependencies for 1911 has just been received. The population is practically stationary as compared with 1901, the slight decrease in the case of the main island being balanced by an almost equivalent increase in the dependencies. About 29 per cent. of the population are included under the term "general population," about 1 per cent. are Chinese, and the rest are included as Indo-Mauritians or other Indians; the latter class includes Indians born out of the colony, whom it is becoming increasingly difficult to distinguish from Indo-Mauritians. Fewer people are returned as engaged in industrial occupations; there has been an increase in the males who are agriculturists, and in the females who are domestics, but a decrease in the male domestics, in the general population, while the Indian population has become more definitely commercial and industrial at the expense of agriculture and domestic service. The report includes a map on the scale 1 in. = 1 mile, showing the geographical distribution of the people. The Census Commissioner has also published a study in Mauritian statistics which deals with "agricultural labour." This study necessarily refers almost exclusively to the sugar industry, and points out that the position of the Indian labourer is "one of unusual prosperity," since labour is scarce; sugar yields are abnormally high, and prices are remunerative.

A SUMMARY of the agricultural statistics for British India for the quinquennium ending with the season 1910–11 has just been issued by the Indian Government. The percentages of the area of British India for this and the preceding quinquennium show an approximately constant subdivision as follows:—Forest, 13 per cent.; not available for cultivation, 25 per cent.; culturable waste, 19 per cent.; current fallow, 7 per cent.; net area cropped, 36 per cent. Roughly 17 per cent. of the cropped area, which is sometimes cropped twice, is irrigated. About 90 per cent. of the cropped area is constantly devoted to food

grains, and includes 35 per cent. to rice, 10 per cent. to wheat. The acreage devoted to cane-sugar has remained steady at 1 per cent., but that devoted to cotton, which is about one-twentieth of the cropped area, shows an increase for the last quinquennium as compared with that which preceded it. Indigo culture has steadily declined during the ten years, until the acreage in the last season was but one-third of the acreage ten years previously; this decline has been most marked during the last five years in Madras, and least marked in Bengal. The acreage given up to opium has declined also within the five years to about two-thirds of that of the earlier period. The acreage devoted to coffee is also smaller, and those given up to tea and tobacco have been increased. Tables are given regarding the average yield per acre of certain crops in certain districts; these show that irrigated land gives an increased yield over unirrigated land for rice in Madras (20 per cent.), Punjab (40 per cent.), and for wheat in the United Provinces (45 per cent.), and in Bombay (100 per cent.).

WHEN ultra-violet light falls on an electro-positive metal, the metal emits negative electrons, and the phenomenon has received the name of the photo-electric effect. Two theories as to the mechanism by which the effect is brought about have been suggested at various times. The first regards the electrons of the metal as in harmonic oscillation and ascribes the emission to resonance due to the light frequency; the other, and in some respects the better, takes them as describing elliptic orbits like planets and regards the emission as due to conversion of the orbits into parabolas owing to the absorption of light. In the *Verhandlungen* of the German Physical Society for October 30, Dr. K. Herrmann shows that neither theory is in itself altogether satisfactory, and concludes that in all probability both causes are at work, resonance in the case of the selective effect, and the other in the normal effect.

A PAPER by Prof. Luigi Palazzo, extracted from vol. xxxii., part i., of the *Annali dell' Ufficio Centrale di Meteorologia e Geodinamica*, deals with magnetic observations made in 1908 and 1909 by Prof. Palazzo himself, and in 1907 to 1909 by an Italian surveying vessel, along the coast of Italian Somaliland and British East Africa. It includes a magnetic chart for the epoch January 1, 1909, giving lines of equal declination, inclination, and horizontal force for the coastal district from 6° N. latitude to a little south of the equator. The chart and an abbreviated account of the observational material also appear in monograph No. 17 relating to colonial affairs, published in September, 1912, by the Italian Foreign Office. In a preface to No. 4 of these same monographs, Prof. Palazzo advocates the establishment of a magnetic observatory in Tripoli. This proposal, he says, met with considerable encouragement at a meeting of the International Magnetic Commission, held in 1910, in Berlin, and recent political events would seem to favour its realisation.

MESSRS. BURROUGHS, WELLCOME AND CO. have sent us the 1913 edition of their photographic exposure record and diary, which is, as usual, neat and handy. There are many photographers to whom this little pocket-book is most necessary, and they will no doubt be glad to hear of this early issue, for does it not comprise a useful gift to a photographic friend? The concentrated and high standard of excellence of the contents of this diary in former years does not leave much room for any great additions or alterations in the present issue, but where possible, such as in the tables of film plate and paper speeds, the most recent data have been inserted. The pocket-book, as usual, includes that excellent and easily worked exposure calculator which may be regarded as the main feature of the issue, a feature of great value to those who are acquainted with it. Three separate diaries are issued, namely for the northern hemisphere and tropics, southern hemisphere and tropics, and for the United States of America, and all are got up in their tasteful style for the reasonable sum of 1*s*.

UNDER the title "Kreislaufvorgänge in der Erdgeschichte," Mr. Gustav Fischer, of Jena, has published (price 1.50 marks, pp. 39) an address by Prof. Gottlob Linck delivered before the University of Jena in June last. It is an interesting review, based on the most recent results, of the probable course of the formation of the earth and its atmosphere, dealing more particularly with the reasons for the present proportion of oxygen and nitrogen in the air, the composition of sea-water, and the origin of limestone rocks. The principal cyclic changes, both organic and inorganic, which occur under present terrestrial conditions are discussed, and a prophetic glance thrown on the future course of the world's history. Although the subject is highly speculative, it is treated with due regard to quantitative calculation and the most trustworthy geochemical data are employed. One noteworthy suggestion put forward is that by the progressive oxidation of the ferrous iron in the eruptive rocks the atmosphere will be gradually depleted of its oxygen, until insufficient remains to support the present existing forms of life.

A RIFLE-BARREL is very sensitive to transverse stress, and vibrations are produced in it by the explosion of the charge, by the friction between the bullet and the barrel, and by the reaction between the bullet and the rifling. Mr. Francis Carnegie has read a paper at the Institution of Civil Engineers on December 3 giving an account of his experiments on these vibrations and drawing conclusions therefrom. In the case of a 0·303 in. Mark III. Lee-Enfield rifle, the natural vibration of the barrel was first found by removing all its attachments. The attachments were then added one after another and the effect of each on the vibrations examined by photographic means. The position on the vibration curve at which the bullet leaves the muzzle is discussed, and the author favours the point of maximum displacement, as being likely to obtain a much less scattered group on the target. Experiments were also made with different designs of barrel, and it was found that the exterior shape of the barrel materially affected the vibrations. Experiments with different pitches of rifling indicate marked effects on the vibrations, but the results do not establish definite

conclusions. The nature of breeching-up of barrel and body, whether abnormally tight or loose, makes a considerable difference; correct breeching-up must be enforced if regular and consistent shooting is to be maintained. Alterations in the muzzle velocity make but little difference in the general characteristic of the vibration curve for any given rifle.

WITH reference to the American milk depôts or stations mentioned in the article on tuberculosis and the milk supply in NATURE of November 7 (p. 281), Mr. Wilfred Buckley writes to point out that the milk supplied is not certified milk in the sense in which the term is here understood, but is an "inspected" or "controlled" milk, which can be delivered at these stations at a cost of about 5*d*. per English quart.

THE Cambridge University Press has recently taken over the publication of *The Biochemical Journal*, which has now become the property and the official organ of the Biochemical Society. The journal, which will be isued from six to eight times a year, will be under the editorship of Prof. W. M. Bayliss, F.R.S., and Dr. A. Harden, F.R.S.

THE Royal Insurance Company, Ltd., of Liverpool, has issued a sixth edition of its handy little publication, "Rules of Golf." The rules as now printed were approved by the Royal and Ancient Golf Club of St. Andrews at its autumn meeting on September 24 last. The alterations of rules and the new features decided upon at that meeting are clearly set out. The manager of the Royal Insurance Company will, so long as the stock lasts, forward a copy of the book free on application.

MESSRS. E. T. NEWTON AND SON, LTD., of Camborne, Cornwall, have issued a new list of scientific and mathematical instruments manufactured by them. Special attention is devoted to instruments required by the surveyor in the various branches of his work, and the catalogue provides well-illustrated particulars of a variety of patterns of theodolites and accessories.

MESSRS. J. M. DENT AND SONS, LTD., have added to their series of scientific primers, published at the price of 1*s*. net, one on astronomy, by the Astronomer Royal, Dr. F. W. Dyson, F.R.S. This primer is a condensation of Dr. Dyson's "Astronomy: a Handy Manual for Students and Others," which was reviewed in our issue for September 29, 1910 (vol lxxxiv., p. 393). It is devoted almost entirely to the bodies in the solar system, the chapter devoted to the stars occupying only six pages.

HAZELL'S Annual for 1913 is the twenty-eighth issue of this useful and handy work of reference, which deals with everyday topics and activities. An interesting section of the book is called "The March of Science," and provides a brief account of the Dundee meeting of the British Association, condensed summaries of the work done and progress made in the various branches of science, short descriptions of recent great engineering schemes and of aërial navigation in 1912, as well as particulars of the various scientific societies.

OUR ASTRONOMICAL COLUMN.

SUN-SPOTS.—During the past week a large group of sun-spots has been visible on the solar disc. First seen on the eastern limb on December 12, the group was nearly central on December 17, its length being about one-tenth of the solar diameter; on the latter date a second, smaller group appeared in the N.W. quadrant.

THE INTERNATIONAL TIME CONFERENCE.—This important conference, referred to in our issue of October 31, duly met at the Paris Observatory, under the presidency of M. Bigourdan, and was divided into four separate commissions, each charged with the discussion of an important group of questions affecting the general problem.

From *The Observatory* (No. 455) we learn that, among other points, the conference agreed to use Greenwich time universally, to send out signals at exact hours, and to arrange that there shall be no overlapping; an agreement as to the most suitable wave-length to employ in the transmission of the signals by wireless telegraphy was also arrived at.

The States represented at the conference were Austria, Belgium, Brazil, France, Great Britain, Greece, Holland, Italy, Monaco, Portugal, Russia, Spain, Sweden, Switzerland, and the United States, and it is to be proposed to them that a "Commission Internationale de l'Heure," with an executive bureau in Paris, shall be established. Among other functions the bureau will endeavour to secure uniformity at the different stations, and will compare the various signals received with the object of improving their general accuracy. Nine "sending" stations, distributed round the globe, have been selected, and the times for each to send out its signals have been arranged; it is proposed to inaugurate the general scheme on July 1, 1913. The question of the perturbation of radio-telegraphic signals by atmospheric agents is, we learn, to be especially studied at a powerful station now being constructed at Laeken.

ELEMENTS AND EPHEMERIS FOR COMET 1912*c* (BORRELLY).—From recent observations made by Prof. Strömgren, a corrected set of elements for comet 1912*c* has been calculated by Prof. Kobold, and is published, with a daily ephemeris extending to January 6, 1913, in No. 4616 of the *Astronomische Nachrichten*. According to the ephemeris the comet is now (December 19) some 8′ east of β Aquarii, and is moving slowly in a direction east of south. Its calculated magnitude is 10·4, but Prof. Strömgren's observations show it to be extraordinarily faint; the following is an extract from the ephemeris:—

Ephemeris for 12h. (M.T. Berlin).

1912	α	δ	log r	log Δ	Mag.
	h. m.	° ′			
Dec. 21 ...	20 34·7 ...	−6 35·1 ...	0·1693 ...	0·3160 ...	10·4
25 ...	20 40·8 ...	−7 55·4 ...	0·1811 ...	0·3363 ...	10·6
29 ...	20 46 6 ...	−9 6·8 ...	0·1928 ...	0·3550 ...	10·7

THE INFLUENCE OF SPECTRUM ANALYSIS ON COSMICAL PROBLEMS.—A very interesting lecture, by Prof. Max Wolf, on the influence that spectrum analysis has exercised in the solution of cosmical problems is reprinted in an abstract from the *Zeitschrift für Elektrochemie*, No. 12.

The subjects briefly discussed by Prof. Wolf are far too numerous even to mention here, but they include the cosmical application of the Doppler and Zeeman effects, the determination of the gaseous character of some nebulæ by Huggins, the Lockyer-Janssen daylight observation of prominences in 1868, the progressive successes of Hale and Deslandres in the photography of the sun's upper atmospheric layers

while the sun is not eclipsed, the observation of the helium (D_3) line in the chromosphere by Lockyer, twenty-five years before the element was discovered terrestrially, and even the very recent work of Dr. Nicholson in the theoretical construction of such spectra as those of the unknown cosmical elements nebulium and coronium. This brief enumeration will serve to show that Dr. Wolf's paper is not only comprehensive, but also up to date, and should be read by all interested in astrophysics.

ELEMENTS OF RECENTLY DISCOVERED MINOR PLANETS.—In No. 4607 of the *Astronomische Nachrichten*, Dr. Cohn gives the elements and permanent numbers of eighteen minor planets discovered during 1911–12. Four of these have been identified with older discoveries to which no numbers had been allotted, and eleven of the "discoveries" made during 1911 have since been identified with planets previously included in the official records. The total number thus included, as shown by the present list, is 732.

THE PHYSICAL SOCIETY'S EXHIBITION.

THE eighth annual exhibition of physical apparatus under the auspices of the Physical Society of London was held on Tuesday, December 17, at the Imperial College of Science, and attracted the usual large attendance. At both the afternoon and evening sessions a short discourse was given by Mr. S. G. Brown on "Some Methods of Magnifying Feeble Signalling Currents." The lecturer described several instruments designed by himself for magnifying the currents received through Atlantic cables, by the use of which largely increased speed of signalling had been made possible. The most interesting of these was one in which the original signalling current moves a thermo-electric junction into and out of a small flame, the thermo-electric current thus produced being twenty-seven times that of the signalling current. The magnifying power is approximately constant for all currents, an advantage over the ordinary form of relay in which the current of the local circuit is constant and is merely made or broken by the signalling current. Other mechanical methods of achieving the same result were also described.

Exhibits of apparatus were shown by some thirty firms of manufacturers. The principal exhibit of the Cambridge Scientific Instrument Co. was a complete cardiograph outfit, composed of an Einthoven string galvanometer, projection apparatus, camera with moving plate or continuous paper for cases where long records are necessary, and a switchboard by which the standardisation of the galvanometer, compensation for skin currents, and measurements of body resistance could be quickly made. By an auxiliary apparatus, records of the heart sounds could also be obtained. Another of their exhibits was a Wilson cloud apparatus for showing the path of α particles or X rays by the condensation of water upon the ions. Messrs. J. J. Griffin and Sons had an interesting exhibition of motor-gyrostats with models for illustrating the Schlick method of steadying ships, and the gyrostatic mono-rail car. Mr. C. V. Boys's rainbow cup for showing the colours of thin films was also exhibited in action. In addition to the usual laboratory instruments, Messrs. Gambrell Bros. exhibited a new convection radiometer by Mr. F. W. Jordon for measuring small, steady rates of evolution or absorption of heat. The convection current of gas produced by the source of heat deflects two very light suspended mica vanes, the deflection being shown in the usual way by a mirror. The Marconi Co. exhibited instruments for use in wireless telegraphy, including a portable knapsack receiving and transmitting set for communicating across distances of fifteen miles. The Helsby Wireless Telegraph Co. showed a vibration-proof detector and a rotary quenched spark discharger.

Microscopes for ultra-microscopic and for metallurgical work were exhibited by Messrs. R. and J. Beck, Messrs. E. Leitz, and Messrs. Carl Zeiss. The last firm also had an example of its projection apparatus at work. The principal exhibits of Messrs. Alexander Wright and Co. consisted of various forms of Dr. Leonard Levy's apparatus for the examination of mine air according to the provisions of the Coal Mines Act of 1911. They also exhibited some good examples of palladium and platinum plating on metals and gold plating on glass.

Messrs. Kelvin and James White, Ltd., exhibited a compass for use on aeroplanes. It was of the floating type, and said to be entirely unaffected by the vibrations of the engines. A Fullarton vibrometer for obtaining the frequency and intensity of vibrations produced by any form of machinery was also shown. It consists of a vibrating reed which can be adjusted to the frequency of the vibration to be measured, the intensity being shown by the amplitude of the vibration of the reed. An Aitken portable dust counter for quickly estimating the number of dust particles in the air, based on the method of condensation of moisture on them, was exhibited by the same firm. Mr. R. W. Paul had a large exhibit of electrical measuring instruments, including several new types. Among them was a string galvanometer somewhat similar to the Einthoven, but with the string in a horizontal position. The Irwin optiphone was shown in use. This is an instrument for magnifying the motion of a vibrating body, such as the diaphragm of a telephone, the wave-form of the motion being obtained by the revolving mirror method.

Messrs. A. Gallenkamp showed some cheap electric furnaces and various laboratory apparatus for heat experiments, including a student's optical bench for radiant heat experiments. They also exhibited a sensitive flame for working at the low pressure of an ordinary gas supply, designed by Prof. S. P. Thompson. The Westminster Engineering Co. exhibited a small useful projection arc lamp for photographic work and optical lanterns. Resistance testing sets were shown by Messrs. Crompton and Co., Evershed and Vignoles, and Nalder Bros., and a large range of switchboard instruments was exhibited by the Weston Co.

RIVERS, GLACIERS, AND THE ICE-AGE.

BRUNO DIETRICH, of Potsdam, has made a geographical study of the Moselle valley ("Morphologie des Moselgebietes zwischen Trier und Alf," *Verhandl. des naturhist. Vereins der preuss. Rheinlande*, 1911, for 1910, p. 83). Basing his description on the geological structure and history of the district, he shows how the valley has been cut in a pre-Miocene surface of denudation. The meanders that arose on this fairly even surface are now traced as winding ravines (p. 120), owing to the elevation of the country and the consequent lowering of the base-level of the Moselle. The tributaries of the left bank, however, are held to have been incapable of forming such large meanders as are now seen in the forms of their ravines. At present they wander somewhat aimlessly in the flat land of their floors, now cutting back one valley-wall, now the other. Their valley-flats (*Talauen*) are attributed to lateral erosion at a time when the land remained stationary for a time (p. 130), and we gather that these flats have become per-

petuated during the general lowering of the valley-floors. For those who do not know the details of the ground, the argument seems to require further development, since it may be urged that the large meanders arose when the tributaries received much more water from the drainage of the plateau, while the *Talauen* represent the natural consequence of the diminution in volume of the streams. The "misfit" of a small meandering streamlet in a widely meandering valley reminds us of the conditions of the Altmühl valley, near Eichstätt, which is believed at one time to have held the Danube. An interesting account is given (p. 164) of the changes that have taken place where the Moselle traverses the sunken area of Wittlich. This depression is attributed to Middle Cainozoic earth-movements, and its form has become moulded by the Moselle and its tributaries, which have removed an immense amount of the yielding Permian strata and have left courses illustrating dry loops and river-capture.

E. C. Andrews, in his "Corrasion by Gravity Streams" (Proc. Roy. Soc. N.S. Wales, vol. xliii., p. 204), has urged that running water may work out a hollow in a valley-floor wherever its velocity is increased, as occurs in a constriction of the valley. The greater the velocity, the steeper will be the heads of these hollows, and a series of steps may thus arise in the floor, comparable to those found in valleys that have been filled by ice. Andrews compares the receding heads of the waterfall-regions or torrent-regions with the cirques (p. 282) of glaciated lands; the only cirques considered by him, however, are those that lie at valley-heads. He urges that rivers in flood-time effect so abnormal an amount of denudation that their normal action may be left out of count in considering the formation of their valleys. Similarly, the glacial epoch gave rise to ice-floods, beside which anything that we see now is insignificant (p. 274). Glaciers are considered as a type of "gravity-stream," and the author's studies in Australasia, California, and Scotland, while they do not bring him to any very new conclusions, lead to a pronounced advocacy of the importance of glacial erosion. In vol xliv., p. 262, Andrews illustrates the formation of steps and *roches moutonnées* by plucking action in the Yosemite valley. We do not know why (p. 292) he writes the extraordinary words, "lee seites" and "stoss seites," when he has used the convenient adjectives "down-stream" and "up-stream" in his previous paper. Here, again, cirques are regarded, not as arising independently on an upland by the corroding action of frost, but merely as the faces of steps formed beneath an ice-flood (p. 305), which have retreated upstream to their present positions on divides. In vol. xlv., p. 116, the author discusses "Erosion and its Significance," and points out that where two peneplane surfaces in association are separated by youthful topography, tectonic movements must have produced the difference of level. The flood-question is again discussed.

P. Morin, of Montluçon, reviews "Le problème de l'érosion glaciaire" in the *Revue générale des Sciences* for 1911, p. 762. He shows how the rock-ridges in the centre of some glaciated valley-floors, which are quoted by Brunhes as evidence of the inefficiency of the ice, may arise from a union of glaciers along arêtes which they have not been able to remove. Others represent the central parts of rock-barriers that lay athwart the ice-flow, the more rapid erosion by frost action and plucking on the margins of the glacier having excavated their ends more rapidly. The paper is agreeably illustrated, and sections are given on a true scale of the floors of glaciers descending from Mt. Blanc.

The late Prof. R. S. Tarr, who made a special province of Alaska, gave a general account of its glacial features in *Science* for February 16, 1912. The burden of sediment in the streams flowing from the glacier-margins led him naturally to ask (p. 250), "Can there be any doubt but that the glacier which protects the rock against the atmospheric agencies must attack it with equal or even greater vigour?" We may, perhaps, refer back to his excellently illustrated paper on "Some Phenomena of the Glacier Margins in the Yakutat Bay Region, Alaska" (*Zeitschrift für Gletscherkunde*, Bd. iii., p. 81), which has enabled many of us to compare outwash-features with those traceable in the British Isles. The results of glacial advance over old deposits are also clearly indicated (p. 102), and a warning is given against interpreting layers of vegetation interbedded with glacial detritus as evidence of an interglacial epoch. "A slight forward motion may well have pushed a broken ice-margin out into the fringing forest," as it did before the author's eyes in the Malaspina region in 1906.

O. D. von Engeln, of Cornell University (*ibid.*, Bd. vi., p. 104), records the results of observations made in Alaska on "Glacier Drainage and Wastage" during two expeditions led by Prof. Tarr. Much interest attaches to the forcing up of marginal streams against the valley-sides (p. 128) when a glacier increases in width; rock-gorges are then cut, parallel to the sides, which may easily again run dry. It is shown (p. 142) how denudation is rapid in an ice-filled valley, even if we neglect the erosive action of the ice, since the removal of the material copiously avalanched from the valley-walls leaves the surfaces continuously open to attack.

G. W. Lamplugh has published in the Proceedings of the Yorkshire Geological Society (Leeds, vol. xvii., p. 216) an important paper on the shelly moraine pushed up by the Sefström Glacier from the sea-floor in Spitsbergen in 1896. The illustrations selected are of exceptional beauty, apart from their geological value as Arctic landscapes.

W. von Lozinski usefully discusses "Die periglaziale Facies der mechanischen Verwitterung" (*Naturwissenschaftliche Wochenschrift*, October 8, 1911). The traces of widespread weathering by frost are destined to disappear as the conditions of the Ice age recede from us. The breaking up of rock-surfaces into block-detritus by frost must have occurred on an enormous scale as glacial conditions spread, and the material thus loosened provided the abundant erratics that were carried by the ice-invasion into the lowlands. Similar block-formations arose as the ice retreated, and also in unglaciated lands subject to its chilling influence; these detrital masses of local origin cumber the surface of large parts of Europe at the present day.

R. A. Daly (*Amer. Journ. Sci.*, vol. xxx., p. 297) publishes a characteristically speculative but suggestive paper on "Pleistocene Glaciation and the Coral-reef Problem," in which he represents the existing reefs as arising on a plateau of marine denudation, which was formed when the sea-level was lowered by the abstraction of its waters to form continental ice.

Those who wish to follow the course or courses of opinion on the origin of Ice ages will find a good review and a new cosmic suggestion in Fr. Nölke's paper, "Die Entstehung der Eiszeiten" (*Deutsche geographische Blätter*, Bd. xxxii., p. 1.). The passage of the sun through a heat-absorbing nebular aggregate is invoked. Ach. Grégoire (*Bull. Soc. Belge de Géologie*, tome xxiii., p. 154) believes that the elevation of a sea-floor to form a continent brings

up a mass of cold rock as against one that has long felt the influence of the sun; hence unusual precipitation follows on the new land-surface, and an Ice age sets in. Stanislas Meunier ("Les Théories Glaciaires," *Revue des Idées*, 1910, p. 207) affirms, as usual, that no general and contemporaneous refrigeration has been proved; but he also asserts that the scratches of stones in boulder-clay are produced by the infiltration of rain and consequent settling of the mass. M. Yokoyama ("Climatic Changes in Japan since the Pliocene Epoch," Journ. Coll. Sci., Tokyo, vol. xxxii., 1911, part v.) cannot accept the evolution of carbon dioxide as a cause of warmer climates, since in Japan the output must have been considerable during glacial times. He prefers, from local palæontological evidence, to account for the difficulties by a shifting of the poles. This is, of course, seriously opposed by the evidence of contemporaneous world-wide refrigeration. R. Speight ("The Post-glacial Climate of Canterbury," Trans. New Zealand Inst., vol. xliii., 1911, p. 408) finds no local cause in New Zealand to account for the succession of climates that he records, a moist climate following the glacial, and modified steppe conditions preceding those of the present day. The author points out that the sequence is so similar to that in Europe as to suggest some cause that affected the whole earth, though changes in the grouping of land and water in the southern hemisphere might account for the former conditions in New Zealand.

G. A. J. C.

THE WORK OF THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT, CHARLOTTENBURG, IN 1911.

THE following notes describe some of the more important researches, &c., undertaken at the above institution during 1911. They are compiled from the annual report of the Reichsanstalt, appearing in *Zeitschrift für Instrumentenkunde*, April, May, and June, 1912.

The comparison of platinum resistance thermometers with various gas thermometers has been completed between 0° and 450° C. It was found that the hydrogen thermometer and the helium thermometer of constant volume with an initial pressure of 620 mm. mercury indicated about 0·1° higher at 450° C. than the nitrogen thermometer under the same conditions. With the accuracy attained, the hydrogen scale may be at once identified with the ideal scale, since, according to Berthelot, these only differ by about 0·01° at 450° C. in the present case. The data for the following fixed points, which were determined afresh, refer to the ideal gas scale :—

Freezing points		Boiling points	
Tin	231·8$_3$°	Naphthalin ...	217·9°
Cadmium ...	320·9$_2$°	Benzophenon...	305·8$_9$°
Zinc	419·4$_0$°	Sulphur ...	444·5$_1$°

In connection with an investigation of the mean specific heat of gases at high pressures, the specific heat of air between 20° and 100° C. at 1 and 11 atmospheres was measured with a new calorimeter. It was found that when the pressure was increased from 1 to 11 atmospheres the specific heat increased by about 2·1 per cent. This result must not, however, be considered as final at present.

The investigation into the specific heat at constant pressure of air by the Callendar and Barnes continuous-flow method was concluded. The values found for the specific heat at constant pressure of carbonic-acid-free air under atmospheric pressure are given below. The method gives the results direct in electrical measure (watt-seconds); and the values converted into heat units (Cal.$_{15°}$) are also given.

Temperature °C.	c_p In electrical measure	c_p In calories
+ 20	1·009 ...	0·240$_8$
− 78	1·019 ...	0·243$_2$
-183	1·058 ...	0·252$_5$

The experiments were extended to carbonic acid gas, oxygen, and nitrogen. For the pure, dry gases, at atmospheric pressure and 20° C., the following results were found in electrical and in heat units respectively :—

Carbonic acid gas	c_p=0·846 and 0·202	respectively.
Oxygen	c_p=0·917 „ 0·219	„
Nitrogen	c_p=1·041 „ 0·249	„

For carbonic acid gas at −78° C. and atmospheric pressure the respective results were, c_p=0·76$_8$ and 0·183. The decrease in specific heat of CO_2 between +20° C. and −78° C. is, when calculated per degree, only slightly less than that between +100° C. and +20° C. determined by Swan.

Specific Heat of Water between 0° *and* 100° *C.*—A precise determination of the calorie in electrical units on a trustworthy basis appears very desirable. The bases of the measurement, viz. the unit of resistance, the e.m.f. of the standard cell and the temperature scale, have now been fixed internationally to such a degree of certainty as to appear to render possible a determination of the calorie in international watt-seconds to within 1 part in 10,000. This research was commenced at room temperature, and a description of the various apparatus and of the experimental arrangements is given in the report. No results are, however, recorded.

Weston Normal Cells.—A number of these were constructed, using new mercurous sulphate preparations, with the view of seeing whether all freshly precipitated samples yielded the same e.m.f. as the older preparations, and for the purpose of discovering whether the method of washing the precipitated mercurous sulphate had any influence on the e.m.f. of the cell. The results show that the method of washing has no appreciable influence on the e.m.f. Other extensive investigations were undertaken on Weston cells, and the general results arrived at indicate that both the reproducibility and constancy of the cell can be guaranteed internationally to within a few parts in 100,000.

In connection with some experiments on resistance thermometers, it was found that the differences shown between fused silica platinum resistance thermometers and the ordinary type may be ascribed to a reaction of the quartz glass on the platinum—probably of a chemical nature. Experiments were also made with the view of comparing the behaviour of the quartz glass resistance thermometer at the highest temperatures at which it can be used with the ordinary resistance thermometer. Full details of these experiments are given.

Electrolysis of Glass.—The investigation of the badly conducting layers discovered by Warburg in the electrolysis at 300°–350° C. gave the following result :—

Platinum or graphite anodes are not soluble in glass. On electrolysis, a layer of high resistance occurs at these anodes, sodium migrating from the glass to the kathode and oxygen to the anode. With mercury as anode, quantitative migration takes place. The metals lead, bismuth, antimony, tin, iron, and copper, when oxide-free, appear to migrate quantita-

tively into the glass. Anodes of lead oxide or copper oxide are insoluble, and exhibit the same phenomena as platinum or graphite anodes.

Among other investigations, either completed or in course of progress, the following may be mentioned:—Anode rays, the Doppler spectrum in canal rays, determination of the constant *c* of the law of black-body radiation, the thermal expansion of metals at high temperatures, electrolytic valvular action, influence of chemical composition and heat treatment on the magnetic and electric properties of iron alloys.

E. S. HODGSON.

AWARD OF BEIT MEMORIAL FELLOWSHIPS.

THE trustees of the Beit Memorial Fellowships for medical research have elected the following to fellowships. Each fellowship is of the annual value of 250*l.*, payable quarterly in advance. The usual tenure is for three years, but the trustees have power in exceptional cases to grant an extension for one year. The general character of the research which each fellow proposes to follow, and the place of research, are indicated.

Dr. Ida Smedley, the processes involved in the formation of fat in the organism (the Lister Institute of Preventive Medicine). Dr. R. A. Chisolm: An investigation into the production of experimental nephritis by various methods, and the problems arising therefrom (the Pathological Department, Guy's Hospital). Dr. D. V. Cow: (1) Investigation of the diuretic action of certain tissue extracts, especially of an extract obtained from the intestinal mucous membrane; (2) investigations of certain bacterial diseases with the object of ascertaining any possible beneficent action thereon of organic compounds of a non-toxic nature (the Pharmacological Laboratory, Cambridge). Miss Elsie J. Dalyell: Investigation of gastro-enteric diseases in infants, with reference to etiology (bacteriological research), influence of diet (chemical and bacteriological research), vaccine therapy as a protective and curative measure (Lister Institute of Preventive Medicine). Dr. C. Funk: An investigation into the nature of the so-called deficiency diseases (beri-beri, scurvy, &c.), with special reference to the chemical nature and physiological properties of the substances concerned in their etiology and prevention (the Lister Institute of Preventive Medicine).

Prof. A. B. Macallum: Problems in metabolism in disease, especially those concerned with the formation of urea, ammonia compounds, and uric acid and their excretion (Prof. Fredrik von Müller's Laboratory, Munich). Dr. J. McIntosh: Certain problems concerning the immunity of syphilis (Bacteriological Laboratory, London Hospital Medical College). Dr. S. W. Patterson: (1) Questions concerned with diabetes, especially the fate of lævulose in the normal and diabetic organism; (2) later, to investigate the toxæmias of intestinal origin, especially the influence of different forms of diet on the production of poisonous products, amine derivatives of amino-acids, &c. (Institute of Physiology, University College, London). Miss Helen L. M. Pixell: The life-histories of parasitic protozoa (the Protozoology Laboratory, Bedford College, and the Lister Institute of Preventive Medicine). Dr. H. L. H. Schütze: Studies concerned with the modern absorption theory of the union between bacillary antigen and the antibodies of the blood serum (the Lister Institute of Preventive Medicine).

All correspondence relating to the fellowships should be addressed to the honorary secretary, Beit Memorial Fellowships for Medical Research, 35 Clarges Street, Piccadilly, W.

ZOOLOGY AT THE BRITISH ASSOCIATION.

SECTION D, which was largely attended, presented a very full and varied programme, and the interest in the meetings of the section was well sustained throughout.

A lantern lecture, of a semi-popular nature, was given by Mr. F. Balfour Browne, on the life-history of a water-beetle. After describing his methods of keeping and rearing water-beetles, he proceeded to detail the life-history of a type of each of the two groups of water-beetles, taking *Dytiscus lapponicus* as a type of the group Hydradophaga, and *Hydrocharis caraboides* as a type of the group Palpicornia. The former, which has a very restricted distribution in the British Islands (N.W. Ireland and W. Scotland), being apparently a remnant of the fauna which in earlier and colder times occupied this area, seems to be the first species of the genus the life-history of which has been followed in detail. Mr. Balfour Browne gave an account of the egg-laying habits, the development of the larva and its escape from the egg by means of a pair of small spines on the head, the scraping of which against the shell ultimately ruptures it, and allows the larva to wriggle out. He stated that the larva, in addition to sucking the juices of its prey, from time to time reverses the action of its pharyngeal pump, so as to pour digestive juice into the prey (*e.g.* an insect larva), so that all the soft parts are dissolved and a thin pellicle of chitin only remains. He showed how the larva, after it is full grown and leaves the water, builds the pupal cell, and he referred to the winter habits of the perfect insect. He then compared the life-histories of Hydrocharis and Dytiscus, and pointed out how each type has adopted different means to attain the same end, and that it was just such differences which enabled each species to hold its own in its particular community in the great struggle for existence.

Foraminifera.

Messrs. Heron-Allen and Earland maintained that the life-history of Saccammina, as described by Rhumbler, was a composite sketch, and involved three separate organisms: (1) the early phases were stages of *Crithionina mamilla*, a sessile rhizopod, which, although often associated with *S. sphaerica*, has a wide distribution apart from that species; (2) the next phase was really *Psammosphaera fusca*, an extremely variable species, occurring both free and sessile, always without a general aperture, and found under conditions of depth, &c., in which Saccammina never exists; (3) the "Saccammina" stages, described by Rhumbler, which represent the complete life-cycle of *S. sphaerica*. Early shell-bearing stages of this species differ from the adult only in their smaller size, somewhat less finished exterior, and in the form of the general aperture, which is at first a mere fissure. The nipple-like protuberance, on which the aperture of the adult is placed, gradually develops later.

The Isle of Wight Disease of Bees.

Dr. H. B. Fantham gave an account of the causal organism of this disease—a minute microsporidian parasite, *Nosema apis*—which was discovered by Dr. Annie Porter and himself. The organism is, in the main, a parasite of the alimentary tract of the bee. Spores of the parasite, swallowed by the bee, give rise each to an amœbula, which enters an epithelial cell of the gut, becomes rounded, grows and feeds for a time, and then begins to multiply by various types of binary fission, producing clusters or chains, each individual of which is ultimately uninucleate. The presence of these parasites causes derangement of the bee's digestive processes, and may be fatal.

The second phase of the life-cycle (sporogony) leads to the formation of pansporoblasts, each of which becomes converted into a spore, which serves for the transference of the parasite to a new host. The symptoms of this disease, which has been termed microsporidiosis, vary; inability to fly, crawling, dislocation of the wings, abdominal distension, and "dry dysentery," followed by early death, may be noted. Warm weather favours the bee, damp aids the parasite. The method of infection is contaminative. Hives, comb, honey, and pollen from comb, bees' drinking places, flowers, water from foliage, and dew near infected hives have been observed to contain spores. Some bees can adapt themselves somewhat to the parasite, which forms crops of spores within them, and these bees act as reservoirs of the disease.

Preventive measures seem to be of most value in treating this disease. The only certain destructive agent for Nosema spores is fire. All dead bees should be burned, old combs and hives untreated by a painter's lamp are to be avoided, and it should be remembered that old wax is not sterilised by being merely melted. Weak stocks of bees should not be united, and great care should be exercised in importing bees from other places in the British Isles or from abroad. Provision of abundant honey and pure water supply, together with scrupulous clealiness of the hive and its surroundings, are great aids in the prevention of microsporidiosis.

Prof. Minchin directed attention to the fact that hereditary infection of bees by *N. apis* had not been found to take place, whereas the allied parasite (*N. bombycis*) of silkworms penetrated the ovary, and entered the eggs, so that the next generation was born infected. The latter parasite was able thus to tide over the winter. Hereditary infection of bees with *N. apis* was not necessary to enable the parasite to tide over the winter, for it can pass the winter in hibernating adult bees.

A Sessile Ctenophore.

Dr. Th. Mortensen gave an account of a sessile Ctenophore—*Tjalfiella tristoma*—found attached to the stems of Umbellula taken off west Greenland. This Ctenophore is compressed, elongated in the transverse plane, and has lost its costæ. The apical organ is rudimentary, being—as a static organ—of no use in a sessile organism. The tentacles are simple, and there is a branching canal system, as in Cœloplana and Ctenoplana. The animal is viviparous; its eggs develop in brood-chambers on the sides of the body, giving rise to cydippiform young, which swim, for a short time, by means of their well-developed costæ, then become attached by the mouth and at once begin to assume the adult form. Tjalfiella is closely related to Cœloplana, and especially to Ctenoplana, and Dr. Mortensen held that its anatomy and development support the Selenka-Lang theory of the origin of Polyclad Turbellaria from Ctenophores.

Mr. E. S. Goodrich expressed himself as unwilling to accept the view that Polyclads were derived from Ctenophores. But even if these two groups were related, they must have diverged in remote time, and it seemed to him inconceivable that their common ancestor should be still extant. Prof. Dendy did not share this view.

Papers on Helminthology.

Dr. W. Nicoll gave a *résumé* of recent progress in helminthology. He directed attention to the use of internal instead of external features as the basis of specific diagnosis, and to the correlation between habit and systematic position, which is clearly brought out by the new method of classification. He noted the great importance of the discovery that infection by Ankylostoma and Schistosomum takes place through the unbroken skin. Turning to morphological questions, he directed attention to the so-called "shell-gland" of Trematodes, pointing out that recent researches have shown that the shell-substance is secreted by the "yolk-glands," and that the function of the "shell-gland" remains unknown. Of interest also is the discovery of the existence of a communication between the intestine and the excretory vesicle in certain digenetic Trematodes.

Mr. J. W. Chaloner has investigated a disease of trout in Loch Morar, due to a larval Bothriocephalid (plerocercoid larva), found encysted in the wall of the intestine and adjacent organs, the cyst-wall being formed by the tissues of the trout. The larvæ varied in length from ¼ to 8 in. The birds of the loch were examined, and, in an adult merganser, a Diphyllobothrium—possibly the adult of the larva described—was found. All the merganser were found to be infected with the larval and adult sexual form of *Schistocephalus gasterostei*, obtained from the sticklebacks, which form a large part of the food of these birds.

Papers on Polychaeta.

Prof. W. C. M'Intosh directed attention to the close structural resemblances between the genus Filograna, which has an operculum for closing the tube, and Salmacina, which has no operculum. It was shown that the presence or absence of an operculum was not a point on which great dependence could be placed, since in the north—Shetland, Moray Firth, St. Andrews—amidst vast swarms of those devoid of opercula, a few occurred with them. Further, it was shown that the opercula are exceedingly variable in development, and that when they are absent the tips of the branchial filaments show great susceptibility to growths of a more or less conspicuous character; especially is this the case in Neapolitan specimens. The branchial pinnæ are variable in length according to the age or surroundings of the specimen, and the bristle-tufts of the anterior region likewise vary from five to ten pairs; yet, throughout the whole series of those with or without opercula, the structure of the bristles is precisely the same. Both forms are gemmiparous. After examining numerous examples and noting the plasticity of the organs, Prof. M'Intosh said he would prefer to refer all the forms to one species of the genus Filograna.

Mr. F. A. Potts gave an account of the habits of a new species of Phyllochætopterus, found living in shallow water off Vancouver Island. It lives in creeping tubes of translucent material, which generally possess several openings, each situated at the end of a branch of the main tube. In nearly all tubes more than one individual is present, sometimes as many as six. The tube is constructed, in the first place, by a single individual, which is formed from a fertilised egg; this worm propagates itself by autotomy, the posterior part becoming detached and regenerating an anterior region. Modification and branching of the tube occur to suit the increasing population. Circulation of water in the tube is maintained by the movement of cilia on the median segments and by undulatory movements of the abdomen.

Mr. Potts also described the formation, in Trypanosyllis sp., of reproductive buds, to the number of one to two hundred, from a patch of tissue extending over the ventral surface of the last one or two segments. Ectoderm and mesoderm alone take part in the formation of these buds; there is an entire absence of alimentary canal. In *T. gemmipara*, from the N.W. Pacific, bud-formation is accompanied by the rapid addition to the stock of a tail of forty to fifty

segments, which, unlike the buds, contains a prolongation of the alimentary canal of the stock, and, like the buds, develops generative products. In the earliest stage of proliferation observed, the body-cavity near the region of proliferation was filled with leucocytes, which also migrated into the cushion of mesoblast present immediately within the thickened ectoderm. Mr. Potts suggested that these leucocytes served a nutritive function, and also that they gave rise to the greater number of the mesoblast cells, from which are formed the gonads, cœlomic epithelium, and connective-tissue. The muscular and nervous systems of the bud grow out from those of the stock.

Dr. Cresswell Shearer traced the development of the mesoderm and the head kidneys of Pomatoceros, which he found to follow the same course as in Eupomatus (see Q.J.M.S., vol. lvi., 1911, pp. 568–585).

Papers on Echinoderms.

Dr. J. F. Gemmill described the development of the starfish *Asterias rubens*. The eggs were artificially fertilised in April at the Millport Marine Biological Station, and, at an early stage of segmentation, were taken to the University of Glasgow, and kept there in small aquaria provided with a simple "convection current" system of internal circulation. Metamorphosis took place in seven or eight weeks. The chief features of the bipinnaria and brachiolaria larvæ were described, as were also several interesting cases of double hydrocœl. Dr. Gemmill concluded that the epigastric and hypogastric cœloms correspond on the whole with one another and with the right and left body-cœloms of Balanoglossus, while the dorsal sac, which pulsates subrhythmically, is the homologue of the "pericardial vesicle."

Prof. E. W. MacBride gave an account of his studies, made at Millport, on the development of *Echinocardium cordatum*, the larvæ of which he was able, by feeding on the diatom Nitschia, to rear until they metamorphosed into young heart-urchins, which took place about eighteen to twenty-three days after fertilisation. The egg segments rapidly and forms an ellipsoidal blastula, which escapes from the egg-membrane. This becomes converted into a gastrula, which bears anteriorly a tuft of specially long cilia. Soon the formation of the skeleton and the arms of the larva is initiated. The cœlom arises as an unpaired vesicle nipped off from the apex of the archenteron, and becomes divided into right and left halves. Both right and left cœlomic vesicles send out prolongations which become pore-canals, and open to the exterior, but subsequently the two pores merge in a single median pore from which right and left pore-canals diverge. Prof. MacBride traced the metamorphosis of the larva, and pointed out that the mouth of the young Spatangoid is surrounded by five plates, from each of which springs an inwardly directed spine, the rhythmical movements of which suggest that they represent the teeth of the regular Echinoids.

Mr. H. M. Fuchs described work done at Plymouth on the hybridisation of species of Echinus. Three species—*E. acutus*, *esculentus*, and *miliaris*—were used in the experiments, and the early and variable larval characters were discarded in favour of more definite features developed by the later plutei. The late plutus of *E. miliaris* has no posterior epaulettes, but has a pair of green pigment masses on the anterior epaulettes; the late plutei of *E. acutus* and *E. esculentus* possess a pair of posterior epaulettes, but lack the green pigment. In 1909, 1910, and 1911 it was found that the inheritance of these characters in reciprocal hybrids between *E. miliaris* and *E. esculentus* or *E. acutus* was invariably maternal. During the spring and summer of this year the experiments have been repeated, and it has been found that the inheritance is different from that of previous years. All cultures of the crosses *E. esculentus* ♀ × *E. miliaris* ♂ and *E. acutus* ♀ × *E. miliaris* ♂ have been maternal, as previously, with one exception. In that case some of the larvæ possessed posterior epaulettes, some lacked them, and some had an epaulette on one side only. The crosses in which *E. miliaris* was the female parent were this year obtained only with difficulty, and, with one exception, they showed a purely paternal inheritance, *i.e.* an exact reversal from the condition of former years. The exception mentioned was the only case in which a large percentage of the eggs developed; the resulting larvæ were some of the paternal and others of the maternal type. No parallel seems to be known for this reversal of inheritance, the cause of which is unknown, but Mr. Fuchs suggested that it was due to a condition of the parents and not to the environment of the larvæ.

Miss Jordan Lloyd described methods of raising parthenogenetic larvæ of *Echinus esculentus*. The method found most successful consisted in treating the unfertilised eggs first with butyric acid to cause membrane-formation (Loeb's method), and then with tannic acid and ammonia in a mixture of sea water and cane sugar (Delage's method). In this way as many as 90 per cent. of the eggs have produced blastulæ, and the larvæ were vigorous and grew for the first three weeks as rapidly as larvæ from fertilised eggs. A few of the larvæ completed their metamorphosis, but the young urchins have not been kept alive more than a few days.

A New Parasitic Copepod.

Prof. H. F. E. Jungersen described *Chordeuma obesum*, a new parasite copepod found enclosed in a membranous capsule formed by the host—*Astronyx loveni*. Sometimes these cysts are extremely numerous, and in these cases the gonads of the host seem not to develop. A cyst which encloses a ripe female contains also its eggs and brood, and usually also a male and empty spermatophores. Embryonic development and most of the post-embryonic metamorphoses occur inside the cyst. Cyclopiform larvæ are liberated from the cyst, and either settle in the same host, thus augmenting the stock of parasites, or leave by way of the bursal apertures to infect other Astronyx, which they enter through the corresponding openings. In both cases the larva fixes itself by its hooked maxillæ, and causes the production of a cyst. The larval cuticle is cast off and the adult form assumed. The adult female is about 5 mm. long and sausage-shaped. Eyes, mandibles, and maxillulæ are wanting. The mouth leads through the pharynx and narrow œsophagus into a capacious stomach, but there is no intestine and no anus. The adult male is not more than 2 mm. long, subcylindrical in form, and has fundamentally the same structure as the female. The nauplius larva has the typical three pairs of appendages, but eyes are wanting, as in all later stages. There are three metanauplius phases followed by the cyclops stage, which is liberated from the maternal cyst. Prof. Jungersen stated that he could not at present indicate the systematic position of this new parasite.

The Luminous Cells of Pyrosoma and Cyclosalpa.

Prof. Ch. Julin detailed the histological characters of the luminous cells of *Pyrosoma giganteum*. Each of these cells contains a closely convoluted tube, the wall of which is achromophile and is traversed by an achromophile reticulum, on the knots of which are

numerous granules of nuclein, an albuminous substance rich in phosphorus. The tube is entirely immersed in a small amount of liquid, which fills the remainder of the cell. Prof. Julin then passed to consider the lateral luminous organs of *Cyclosalpa pinnata*, in which the cells are smaller than in Pyrosoma. In the substance of the cell lies a convoluted tube, frequently found to be broken up into vesicles. The tube is traversed by a reticulum bearing many nuclein granules.

Prof. Minchin suggested that the luminous particles, being formed in cytoplasm, might be volutin and not chromatin, and that the tube in the cell might be a schizomycete commensal or parasite.

An Hermaphrodite Amphioxus.

Mr. Goodrich described, and exhibited sections of, an hermaphrodite specimen of Amphioxus, found at Naples in the summer of 1911. It is an adult ripe male with twenty-five gonads on each side. All these are typical testes containing spermatozoa only, with the exception of the ninth gonad on the left side, which contains ova only, and is a typical ovary. This appears to be the first instance of hermaphroditism described in the Cephalochordata.

Scottish Sea Fisheries, 1898–1912.

Prof. W. C. M'Intosh held that a careful perusal of various statistical returns does not lead to pessimistic views of our fisheries, but rather bears out his views as to the safety of the supply of food-fishes. The herring, cod, haddock, plaice, lemon dab, sole, and turbot have been in turn the subject of gloomy forebodings, but the speaker maintained that not one of these was on the road to extinction or even to serious diminution.

Prof. Ewart pointed out that the appliances now used in fishing were more efficient than those in use fifteen years ago, but, as the take of fish had not increased in proportion, it seemed as if fish were less abundant than formerly.

Dr. Petersen remarked that, until statistics were available for the whole of the North Sea, the problem could not be fully discussed.

Reissner's Fibre and the Subcommissural Organ in the Vertebrate Brain.

Prof. Dendy described the subcommissural organ as a groove, or pair of grooves, lined by elongated, ciliated, epithelial cells, and situated beneath the posterior commissure. From these cells originate a large number of slender fibrils—probably elongated cilia—united together to form Reissner's fibre, which extends, as a highly elastic, tightly stretched thread, backwards through the brain-cavities and central canal of the spinal cord to the extreme end of the latter, where it is attached to a plug of connective-tissue lying in the *sinus terminalis*. Reissner's fibre and the subcommissural organ are well developed in all the great vertebrate groups from cyclostomes to primates. Prof. Nicholls's recent researches have shown that Reissner's fibre is not nervous (as it was believed to be by Sargent). Prof. Dendy has suggested that the subcommissural organ might be a kind of intra-cerebral sense-organ, concerned, with Reissner's fibre, in automatically regulating the flexure of the long axis of the body. Prof. Nicholls's recent experiments on fishes support this view, and further support is derived from the fact that in man, with his erect posture and but slightly flexible vertebral column, the subcommissural organ is reduced to a mere vestige—the mesocœlic recess—and Reissner's fibre is probably absent.

Papers on Birds.

Miss Laura Florence, who has examined the crops of about 1800 birds, belonging to ninety-five species, chiefly from agricultural land in the north-east of Scotland, with the view of finding which were injurious and which beneficial, gave a summary of her results. She emphasised the need for examining large numbers from different areas, and throughout the year, if trustworthy information is to be forthcoming. In some cases the verdict given by previous investigators has been confirmed, *e.g.* as to the injuriousness of the house sparrow, wood pigeon, and carrion crow, and as to the beneficial activity of the hedge sparrow, fieldfare, lapwing, and plovers. On the other hand, there are several cases in which the results up to the present do not confirm previous opinions, *e.g.* the diet of the black-headed gull and the common gull shows a striking resemblance to that of the useful lapwing.

Mr. A. Landsborough Thomson contributed a note on the method of bird-marking—by a light metal foot ring with inscription—applied by the Aberdeen University inquiry, which has already yielded interesting facts, *e.g.* records of an English-bred swallow returning to the breeding place the following summer, a Scottish-bred swallow returning to its birthplace the following summer, a Scottish-bred song-thrush migrating to Portugal in its first autumn, &c.

The Development of the Thymus.

Prof. J. P. Hill communicated a *résumé* of observations by Miss E. A. Fraser and himself on the development of the thymus, thyroid, and epithelial bodies in the marsupial *Trichosurus vulpecula*, and emphasised the following points—(1) the origin of the superficial cervical thymus, in major part at least, from the ectoderm of the cervical sinus; (2) the derivation of thymus iii. from the ventral as well as the entire caudal wall of cleft iii., thus affording a transition, as regards mode of origin, between thymus iii. of the lizard and that of Eutheria; (3) the presence of a well-developed thymus iv., a feature characteristic (so far as is known) of marsupials alone amongst the mammals; and (4) the lack of any topographical relationship of the epithelial bodies to the thyroid.

Fat-tailed Sheep.

Prof. J. C. Ewart discussed the origin of fat-tailed sheep. He considered it probable that, as the large inland seas common in Central Asia in prehistoric times dried up, domesticated sheep, to have a chance of surviving, found it necessary to store up fat as a means of providing nourishment during the long, dry season. In some cases fat was deposited to form fat-rumped races, in others to form fat-tailed races. Those individuals which, by increasing the number and length of the tail vertebræ, provided most accommodation for fat would, in the struggle for existence, have the best chance of surviving, as the aridity in Central Asia increased. Prof. Ewart considered it extremely probable that the long-tailed European breeds, instead of inheriting their long tails from an extinct long-tailed wild ancestor, as used to be assumed, are indebted for their long and apparently useless caudal appendages to fat-tailed ancestors. Evidence in support of this view is afforded by the fact that the fat in the tail gradually disappears when a sheep of the Afghan type is removed from the arid deserts of Central Asia to Western Europe, where green food is available throughout the year.

Survey of the Fresh-water Fauna of India.

In his account of the survey of the fresh-water fauna of India, which is now being carried out by the Indian Museum, Dr. N. Annandale laid great

stress on the importance of the fauna of any country being worked out in that country, and on the association of a study of the biology of a group with taxonomic research on that group. The recent liberal policy of the trustees of the museum, and the generosity of the Indian Government, had resulted in the acquisition of first-class zoological laboratories, and an excellent collection of zoological literature. He directed attention to the considerable number of zoologists now working in India, and to the zealous cooperation of numerous correspondents and collectors in different parts of the country. His paper was illustrated by photographs of the Indian Museum and its laboratories, and of species in the fresh-water fauna of special interest from a biological or taxonomic point of view, *e.g. Trygon fluviatilis*; Hislopia, *Pectinatella burmanica*, and other Polyzoa; fresh-water sponges and their gemmules; and a new Temnocephalid.

Zoological Results of the Scottish National Antarctic Expedition.

Dr. W. S. Bruce pointed out that the *Scotia* was fitted out especially for deep-sea work in high southern latitudes within the limits of pack ice. The result was a large collection of animals in the region of the Weddell Sea, from the surface down to a depth of 2000 fathoms. Altogether eighteen new genera and 263 new species have been found in the collections up to the present, particularly striking being the large percentage of new species from great depths, *e.g.* of sixty species of Echinoderms forty-four are new. The collections do not lend any support to the bipolarity theory.

Plankton of Lough Neagh.

Dr. W. J. Dakin and Miss M. Latarche presented a summary of their work on the plankton of Lough Neagh. Both the phyto- and zoo-plankton are made up of Arctic and central European species existing side by side. The authors do not accept the Wesenberg Lund-Ostwald theory—that seasonal variations in planktonic organisms are due wholly to changes in the viscosity of the water; such changes appear to be due chiefly to direct action of the temperature and the food supply. *Mysis relicta* was found in great abundance at the surface of the lough at midnight, whereas in daylight it was absent or rare.

Biological Science and the Pearling Industry.

Dr. H. Lyster Jameson reviewed the scientific work which has been done up to the present with the view of rendering the pearl and mother-of-pearl producing industries more profitable, and stated that, so far as he knew, the Japanese "culture-pearl" enterprise was the only instance of the application of biological knowledge to the improvement of this industry which had proved an unqualified business success. He suggested that there should be some organising machinery which would bring to bear on this and similar problems all available specialist opinion.

Prof. L. Rhumbler discussed the relation of the mechanics of the cell to the mechanics of development, and showed, by some examples, how the study of the dynamic properties of cells, already established by the study of cell-mechanics, is able to elucidate physically, in a simple manner, whole series of phenomena exhibited by the behaviour of embryonic cell-complexes. Dr. C. J. Bond discussed the method by which the individual organism becomes adapted to new environmental stimuli by use-acquirement, and the dependence of use-acquirements on variation and selection of intracellular units. Dr. J. Wilson held that the "presence-and-absence theory" of inheritance was unsound. Prof. R. J. Anderson gave a paper on "speech" in animals, and notes on the skull of a grampus. These last five papers do not lend themselves to the purposes of a summary.

In the laboratories adjacent to the meeting-room there was an exhibition of interesting specimens:—Antarctic fauna (Dr. W. S. Bruce); Leduc's osmotic growths (Mr. Deane Butcher); molluscan histology and development of cartilage in young plaice (Dr. Dakin); sexual dimorphism in butterflies (Dr. F. A. Dixey), Foraminifera (Messrs. Earland and Heron-Allen); aërating and larva-hatching apparatus, and records showing the use of Aristotle's lantern in the locomotion of Echinus (Dr. Gemmill and Mr. Elmhirst); preserved specimens of Crustacea, &c., in which the articulations were flexible (Dr. Loir); apparatus for the "valuation" of the sea (Dr. C. G. J. Petersen); invertebrates from the Pacific coast of North America (Miss Pixell); Rotifera (Mr. C. F. Rousselet); specimens and drawings illustrating the diversity of size, form, and colour in Alcyonaria (Prof. J. A. Thomson), and nesting-boxes (Mr. W. M. Webb).

J. H. ASHWORTH.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The vacancy in the Waynflete professorship of chemistry has been filled by the appointment of Dr. W. H. Perkin, F.R.S., professor of organic chemistry in the University of Manchester. Dr. Perkin has been admitted as a Fellow of Magdalen College.

Sir William Schlich, F.R.S., has offered to make over to the University a sum of 690*l.* 18*s.* 8*d.* as a contribution towards a fund for the permanent endowment of the professorship of forestry. On December 14 the offer was gratefully accepted by Convocation. Attention may be directed to the fact that the delegates for forestry propose to appoint a research officer to investigate diseases of trees, for a term of two years, at a salary of 400*l.* a year, besides travelling expenses. The research officer will begin work on February 1, 1913, or as soon after that date as may be possible. He will work in connection with the Oxford School of Forestry.

DR. T. MARTIN LOWRY has been appointed lecturer on chemistry at Guy's Hospital Medical School.

BY the will of Mr. R. J. Montgomery the sum of 5000*l.* is left to the Board of Dublin University and the Royal College of Surgeons, Ireland, for a "Mary Louisa Montgomery Lectureship" in ophthalmology, to be held alternately by the said boards for a period of five years, the lectureship for the first five years after his death being held by Dublin University.

MR. EDWIN TATE, J.P., has given to the Battersea Polytechnic the sum of 7000*l.*, the interest upon 5000*l.* of this sum to be utilised for scholarships, and the interest upon the remaining 2000*l.* to be devoted to the purchase of books for the Tate Library, which was also generously given by the same donor. The gift is another instance of the interest which the Tate family has always shown to the Battersea Polytechnic.

THE Royal Commissioners of the 1851 Exhibition acting on the recommendation of the Council of the Institution of Naval Architects, have appointed Mr. P. Y. Brimblecombe, late of Armstrong College, Newcastle-on-Tyne, to the post-graduate scholarship in naval architecture, 1913 (of the value of 200*l.* per annum, and tenable for two years), for the purpose of carrying out a course of research work in naval architecture at the Armstrong College.

IT is understood by *The Times* that the Royal Naval College, Osborne, is to be rebuilt permanently on the present site at a cost of 200,000*l*., and that the work will be begun almost immediately. A little time ago a committee of Admiralty officials, including the Director of Works, visited Christ's Hospital for the purpose of inspecting the new buildings there, and it was then stated to be likely that somewhat similar building plans were in preparation for a new college at Osborne.

A CONFERENCE week of educational associations will be held in the University of London, South Kensington, London, S.W., from January 6 to 11. Sir Henry Miers, F.R.S., Principal of the University, and Dr. M. E. Sadler, Vice-Chancellor of the University of Leeds, will speak at the opening meeting, to which members of all the associations are invited. Thirteen educational associations, including the Geographical Association and the Association of Teachers of Domestic Subjects, are taking part. We notice that the presidential address to the Geographical Association will be delivered on January 9 by Prof. E. J. Garwood, who will speak on Arctic glaciers and glaciated features of Britain.

THE annual meeting of the Mathematical Association will be held on Wednesday, January 8, 1913, at the London Day Training College, Southampton Row, London, W.C. At the morning meeting an address will be delivered by the president, Prof. E. W. Hobson, F.R.S., and there will be papers on map projections, by Mr. E. M. Langley, and the income and prospects of the mathematical specialist, by Prof. G. H. Bryan, F.R.S. After the election of president and other officers of the council, in the afternoon, the papers will be "Intuition," by Mr. G. St. L. Carson; "The Advisability of Including some Instruction on the History of Mathematics in the School Course," by Miss M. E. Barwell; and "The Teaching of the Scholarship Candidate in Secondary Schools," by Dr. W. P. Milne. There will also be an exhibition of scientific apparatus and books. Mr. E. M. Langley will exhibit the set of mathematical plastographs (designed and drawn by Mr. F. G. Smith) which were shown by him at the International Congress, and also some folding-paper and other models connected with the study of solid geometry.

THE London County Council has arranged to hold its annual conference of teachers on three days, January 2–4 next, at Birkbeck College, Bream's Buildings, Chancery Lane, London, E.C. The morning meetings will commence at 11 a.m., and those in the afternoon at 2 p.m. Addresses will be delivered at the first meeting on the Montessori method of education, at the second on reading and writing, at the third on "attention," and at the fourth on school hygiene, when Prof. Leonard E. Hill, F.R.S., will speak on open air and exercise. The last two meetings will be devoted to descriptions of educational experiments in schools. Application for tickets of admission, for which no charge is made, should be sent to the Chief Inspector, London County Council Education Offices, Victoria Embankment, London, W.C. The North of England Conference will meet on January 2–4 in Nottingham, at the University College. During the conference two united sessions will be held; the first, on January 3, will hear papers read by the Bishop of Lincoln, on the function of university education in civic life, and by Mr. P. E. Matheson on the educational outlook. At the second united session Sir William Mather will speak on the co-operation of employers and education authorities, and Mr. George Cadbury on the educational responsibilities of the employer. Other subjects of educational interest will be dealt with in sectional meetings, for which a very varied programme has been provided.

A MEETING of the Junior Institution of Engineers was held on December 11, when the president, Sir A. Trevor Dawson, gave an address, taking for his subject, "Staff Officers in Industrial Works: their Scientific and Practical Training and Duties." The demand now, he said, is for well-trained youths having experience of materials, mechanical methods, and men. There is a national need for more highly trained engineers—men combining scientific and practical knowledge, and having experience of materials, methods, and men, to serve on the staff of works. Engineering is a profession which constantly extends its boundaries. It is recognised, for instance, that the advent of an oil turbine—the most desired of all prime movers—was delayed largely by the absence of a metal for the blades which would stand the temperature of the gas impinging on them. This and other examples prove the need for wider technical training and sympathies. In all departments of applied mechanics there is need, too, for the creative mind, for inventive and adaptive genius. Is it not obvious, he said later, that if we are to maintain our position as a great industrial nation there must be advance in the science and practice of engineering? Other States adopt methods for assisting industry by helping to train men capable to take staff appointments in industrial factories. It is true that our great technical institutions are not excelled in any country in the world, and it is creditable also that our great City companies and many private endowments have assisted many men to prosecute their engineering studies at such institutions. Yet the results have proved unsatisfactory, alike from the point of view of the student and the nation. The absence of practical training, of early contact with the workshop, deprives those students in most cases of an indispensable part of their preparation for future industrial work, and interferes with their finding a suitable vocation after their college course has been completed.

SOCIETIES AND ACADEMIES.

LONDON.

Linnean Society, November 21.—Prof. E. B. Poulton, F.R.S., president, in the chair.—Dr. A. B. **Rendle**: Mr. P. A. Talbot's collection of plants from Southern Nigeria.—Rev. George **Henslow**: Vegetable mechanics. The object of this paper is to show that plants respond to gravity, strains, and stresses, in order to resist them and so secure stability.—Miss Nellie **Bancroft**: Some Indian Jurassic Gymnosperms. The fossil plants under consideration are of Liassic age, and come from Amrapara in the Rajmahal Hills in Bengal. The types represented are Gymnospermous, and include examples of *Brachyphyllum mamillare*, *Benstedtia*, coniferous wood, small bilateral seeds, and Cycadean stems, leaves, and fructifications. The structural evidence obtained, in conjunction with the external morphology of the specimens, supports the already accepted idea of a uniform Mesozoic flora.

December 5.—Prof. E. B. Poulton, F.R.S., president, in the chair.—E. J. **Bedford**: Notes on two orchids new to east Sussex. Further notes on several rarer species of the Orchidaceæ. The author is engaged in obtaining a series of photographs of the British wild orchids, his intention being to secure photographs of every possible species *in situ*, as well as at closer quarters at home, when arranged against a plain background. During the season of 1911 he was fortunate enough to obtain two species not hitherto recorded for east

Sussex. The first of these was the brown-veined orchid, *Orchis purpurea*, found in the Ouse district, near Lewes, in the month of May, by Mr. Herbert Jenner, of Lewes. This interesting find was the prelude of another of perhaps even greater interest, for in the month of June the author found a specimen of the rare lizard orchid, *Orchis hircina*, in the Cuckmere district near Eastbourne. The author's collection of photographs at present consists of thirty-three species and varieties out of a possible forty-four.—Prof. W. A. **Herdman**: Spolia Runiana, I., the Hebridean Diazona described as "Syntethys," and other rare or interesting animals obtained on the cruise of the S.Y. *Runa* in 1912. The chief forms discussed were:—(1) The giant sea-pen, *Funiculina quadrangularis*; (2) the pelagic Tunicate, *Doliolum tritonis*; and (3) the large green compound ascidian, described by Forbes and Goodsir in 1851 as *Syntethys hebridicus*, but now shown to be the same as *Diazona violacea*, Savigny, from the Mediterranean.

Physical Society, November 22.—Prof. C. H. Lees, F.R.S., vice-president, in the chair.—Prof. E. G. **Coker**: a column-testing machine. The conditions of fixture of the ends of columns, and the large influence this has upon their strength, generally make it necessary to use special testing machines for these members, in which the end plates applying the load are accurately parallel, and remain so during a test. If only rough measurements of the load are required this offers no serious difficulty, but accurate measurement involves elaborate mechanical devices, some of which are briefly referred to in the paper. This difficulty is overcome in a simple manner by supporting one pressure plate by two or more annular diaphragms spaced at considerable intervals, and clamped at their outer edges to a fixed casing in such a manner that only one degree of freedom is possible. This construction is carried out in the machine described in the paper.—C. E. **Larard**: The law of plastic flow of a ductile material and the phenomena of elastic and plastic strains. The author gave an account of the twisting to destruction at a uniform angular velocity of a cylindrical steel specimen 3 in. diameter, and of his deductions from the experimental data. The following deductions were made:—(1) The rate of increase of the torque with the time varies inversely as the time. (2) The acceleration of the torque velocity which is negative or, as it may be called, the deceleration, varies therefore inversely as the square of the time. (3) The variables, time t, and torque T, are connected by the compound interest law. More exactly $t+t_0=ae^{bT}$, where t_0 is a time constant. Corresponding results in terms of the angle of torsion θ and T obviously followed, since $\theta=\omega t$, where ω is the angular rate of straining. The author next proceeded to summarise certain other conclusions he has formed as a result of many experiments extending over five years, illustrating his arguments by means of original diagrams, but reserving the full account for later publication.—C. E. **Larard**: Kinematograph illustrations of the twisting and breaking of large wrought-iron and steel specimens. The tests illustrated the Northampton Institute testing machine in operation, showing torsion tests on the following:—(1) A piece of mild steel, 2½ in. diameter. (2) A piece of wrought-iron of the same dimensions. (3) A wrought-iron shaft, 2½ in. square. (4) A rectangular bar of steel, 3½ in. by 1½ in. (5) A steel tube, 3½ in. diameter, with the wall ⅜ in. thick. (6) A tension test showing the development of the Lüder lines.

Zoological Society, November 26.—Dr. A. Smith Woodward, F.R.S., vice-president, in the chair.—E. S. **Goodrich**: The structure of bone in fishes: a contribution to palæohistology. A microscopic examination of the bone of the Actinopterygian fishes showed that in those groups which are provided with lepidosteoid ganoid scales (Amioidei [Protospondyli] and Lepidosteoidei [Aetheospondyli]) the characteristic lepidosteoid histological structure extended throughout the endoskeleton as well as the dermal bones. No other fishes are known to have this lepidosteoid structure, either in the scales or in the skeleton.—G. W. **Smith** and Dr. E. H. J. **Schuster**: Land crayfishes of Australia. This paper dealt with the Engæus, a group of Victorian and Tasmanian crayfishes, which have forsaken the water and excavate burrows in damp soil. In certain mining districts on the west coast of Australia they do much damage to the artificial water-courses by riddling through the banks and dams and causing them to collapse. Although the tunnel leading to the heart of the burrow is free from water, there is always water in the circular chambers at the end where the crayfish lives. In a former paper it was suggested that these crayfishes of the genus Engæus are derived from the genus Parachæraps, which has spread from Western Australia into the desert regions of the centre, and is now found in all parts of continental Australia; but conclusive evidence is brought forward in this paper to show that Engæus is derived from the south-eastern and Tasmanian genus Astacopsis, and that its superficial resemblance to Parachæraps is due to convergence owing to similar habits.—Dr. C. L. **Boulenger**: The Myzostomida collected by Mr. Cyril Crossland in the Red Sea in 1905.—Hon. P. A. **Methuen**: Description of a new Amphipod, belonging to the family Talitridæ, obtained in the Woodbush district of northern Transvaal.—B. F. **Cummings**: Some points in the anatomy of the mouth-parts of the Mallophaga.

Geological Society, December 4.—Dr. Aubrey Strahan, F.R.S., president, in the chair.—J. E. **Marr**: The Lower Palæozoic rocks of the Cautley district (Yorkshire). The succession in this district is clearer than in the Lake District, and it is suggested that it be adopted as the type sequence for the Ashgillian beds of the north of England.—E. S. **Cobbold**: (1) The trilobite fauna of the Comley Breccia-bed (Shropshire). A trilobitic fauna from the matrix of a breccia of Middle Cambrian age, found near Comley Brook, is described. The fossils indicate an horizon that is probably equivalent to a part of the Paradoxides-tessini zone of Scandinavia. As they are distinct from those of the Quarry-Ridge Grits of Comley, which are also basal but rest upon Lower Cambrian limestones, the inference is drawn that the two deposits are separated by a distinct interval of Cambrian time. (2) Two species of Paradoxides from Neve's Castle (Shropshire). Portions of two species of Paradoxides, collected in 1892 by Mr. J. Rhodes, are figured. These are referred to *P. hicksi*, Salter, and to a new variety of *P. bohemicus*, Bœck. Species of Agnostus, Ptychoparia (Liostracus), Agraulos, Hyolithus, and Acrotreta occur in the same rock-fragments, but are not sufficiently well preserved for specific determination.

Mathematical Society, December 12.—Prof. A. E. H. Love, president, in the chair.—Dr. H. F. **Baker** (retiring president): Presidential address on recent advances in the theory of surfaces.—H. E. J. **Curzon**: A connection between the functions of Hermite and those of Legendre.—G. H. **Hardy**: An extension of a theorem on oscillating series.—H. R. **Hassé**: The equations of the theory of electrons transformed relative to a system in accelerated motion.—E. W. **Hobson**: The convergence of series of orthogonal functions.—J. **McDonnell**: Mersenne's primes.—L. J. **Mordell**: The diophantine equation $y^2=x^3+k$.—

W. H **Young**: (1) Derivatives and their primitive functions. (2) Functions and their associated sets of points.

Royal Astronomical Society, December 13.—Dr. F. W. Dyson, F.R.S., president, in the chair.—Prof. H. H. **Turner**: Note on a new similarity between the variations of S Persei and of sun-spots. Prof. Schuster had shown that besides the well-known eleven-year period of sun-spots there are several other periods, viz. 4·77, 8·17, and perhaps one of 13·45 years; these seemed to be submultiples of a master period of 33⅜ years. Prof. Turner had previously found a similar association of periodicities in the light curve of S Persei, which showed three independent periods, corresponding to sun-spot periods of 8·17, 11·13, and 33·38 years. The subject had now been more fully investigated, and satisfactory accordances obtained. In the discussion Prof. Schuster spoke of the sun-spot periods as 4·8, 13·5, 11, 8·3, and 48 years. Mr. Maunder and Father Cortie both doubted if these periods (with the exception of the 11-year) were more than mere arithmetical periods, having no real existence.—C. R. **d'Esterre**: Note on some observations of the region around the star clusters H v 33, 34 Persei. A series of photographs were taken with a 15-in. reflector with a view to answer the question, "What happens from night to night amongst the minute stars which form the general background of the Milky Way?" This led to the special selection of the well-known clusters in Perseus. The photographs were shown on the screen, and the results, in the discovery of new and variable stars, were described.—F. J. M. **Stratton**: Preliminary note on the later spectrum of Nova Geminorum, No. 2. Photographs shown on the screen gave the spectrum of the star—then of the eighth magnitude—and comparison spectrum on the same plate.—Prof. A. **Fowler**: Observations of the principal and other series of lines in the spectrum of hydrogen. The principal and sharp series of lines of hydrogen were observed by passing a strong discharge through a mixture of hydrogen and helium. Four members of the principal and three of the sharp series were identified, and their wave-lengths determined. They were found in satisfactory agreement with the corresponding lines in nebulæ and bright-line stars, &c. A second principal series was discovered, the first line of which was at wave-length 3203·30, the lines converging to the same limit as the first principal series.

DUBLIN.

Royal Dublin Society, November 26.—Mr. R. Lloyd Praeger in the chair.—Prof. J. **Wilson**: Unsound Mendelian developments, especially as regards the presence and absence theory. The purpose of the paper was to show that the presence and absence theory is unsound, that it leads to erroneous results, and that ordinary Mendelian formulæ suffice to deal with phenomena to which that theory has been applied. The theory originated in a misapprehension of experimental data. It was taken that when rose and single combs, and pea and single were mated, and the second crosses were rose and single, on one hand, and pea and single on the other in the ratio 3 : 1, the rose and pea combs were each the result of only one factor for each. It is shown in the paper that at least two factors are concerned in the production of roseness, on one hand, and peaness on the other, and that each of these two kinds of comb carries the results of at least four factors. The theory, as usually stated, is open to two interpretations. The usual interpretation is that a dominant factor is the cause of the dominant character, while the absence of the dominant factor is the cause of the recessive character. A cause which is absent is thus stated to have effect. But the absence of the dominant factor is really the cause of the absence of the dominant character, not the cause of the presence of the recessive.—A. L. **Fletcher**: A refined method of obtaining sublimates. The paper was a preliminary communication on an improved method of dry analysis. A support of electric arc carbon is enclosed in a sublimation chamber with removable silica or porcelain cover-plates, and is heated electrically. The advantages are the high temperature range possible and the facility with which high temperature work may be carried on in atmospheres other than air with the production of distinctive sublimates. The sublimation of certain substances on to existing deposits of iodine produces distinctive iodides on contact. A table was appended containing descriptions of sublimates obtained upon glass in air in sulphuretted hydrogen and on the iodine plate. It is possible to obtain, amongst others, deposits from vanadium, chromium, manganese, and iron.—A. L. **Fletcher**: The melting points of minerals. A short discussion of the principle of the meldometer was followed by a description of the methods followed in calibration. The facilities presented by the meldometer in the examination of very small quantities of substances were pointed out. Such are colour change, chemical change, reactions, fluxes. A table of the approximate melting points and behaviour at high temperatures of sixty of the rarer minerals was exhibited, together with a comparison of fusion temperatures arrived at on the meldometer and by non-subjective methods.

EDINBURGH.

Royal Society, December 2.—Sir William Turner, K.C.B., president, in the chair.—Sir William **Turner**: The right whale of the North Atlantic, *Balaena biscayensis*, its skeleton described and compared with that of the Greenland right whale, *Balaena mysticetus*. The description was based upon a specimen which had been presented to the Royal Scottish Museum by the manager of the sealing station on the west coast of Harris. This species of whale had been captured by Basque fishermen as early as the thirteenth century. It was believed to have become extinct during the eighteenth century, but in 1854 a specimen was caught off San Sebastian in Spain. Anatomical features showed that it was identical with *Balaena australis*, the whale of the Antarctic seas. As it is quite unknown in intermediate regions, it formed a good example of what has been called bipolarity.—Prof. A. H. **Gibson**: The loss of energy at oblique impact of two confined streams of water. The loss was shown to be expressible in the form aV^2+bv^2, where V and v are the speeds of water in the main pipe and the inlet pipe respectively. The coefficients a and b, which are constant for any one pair of pipes, depend on the areas of section and on the angle at which the one pipe meets the other. It was found that the loss was least for a particular combination of area and angle.—Dr. J. **Ritchie**: The hydroid zoophytes collected by the British Antarctic expedition of Sir E. Shackleton, 1908.—Prof. D. **Hepburn**: Observations on the anatomy of the Weddell seal (Scottish National Antarctic expedition). Part IV. The brain. Among other results it was found that the adult brain has preserved and presents an early embryonic stage in which the lateral limbs of the fissure of Sylvius are held wide open by the failure of the opercula to conceal the insula.—Dr. H. A. **Haig**: The central nervous system of the Weddell seal (Scottish National Antarctic expedition). The general conclusion come to was that, both in its anatomy and in its histology, the Weddell seal showed some features which were retrogressive, and others which placed it at a much higher stage from the point of view of evolution.

PARIS.

Academy of Sciences, December 9.—M. Lippmann in the chair.—E. **Bouty**: An attempt at the determination of the dielectric cohesion of a rare gas with small quantities of material. An exact determination of the dielectric cohesion of a gas requires at least 200 c.c. of the material. An apparatus capable of dealing with as little as 5 c.c. of gas has been constructed. It requires empirical calibration with gases of known dielectric cohesion, and experiments have been carried out with neon, helium, and argon. The apparatus will prove useful in following the stages of purification of a rare gas.—L. **Maquenne** and E. **Demoussy**: The use of a manometer in the study of the respiration of plants. A description of a closed water manometer, independent of the barometric pressure, applicable to the qualitative study of plant respiration.—A. **Righi**: A new experiment on ionomagnetic rotations.—M. **Décombe**: The dissipation and discontinuity of energy.—J. **Taffanel** and H. **Dautriche**: The propagation of the explosive wave in solids.—M. **Lémeray**: A theorem of M. Einstein. The author shows that the total energy radiated by a symmetrical radiator is the same, whether it is displaced or not relatively to the observer. This result is not in accord with the conclusions of Einstein.—G. **Reboul**: The influence of the geometric form of solid bodies on the chemical actions which they undergo at low pressures. Details of experiments proving that copper when attacked by sulphur compounds at pressures of the order of 0·1 mm. in a manner depending on its geometrical form. The attack commences on those portions of the metal where the curvature is greatest.—R. **Swyngedauw**: The relation of the longitudinal ampere-turns to the moment of commutation in continuous-current dynamos.—A. **Cotton**: The optical properties of a liquid submitted to the simultaneous action of two electrical and magnetic fields, and on molecular symmetry. Attention is directed to the valuable results which would be obtained by a study of the optical properties of a liquid submitted simultaneously to the action of powerful magnetic and electrostatic fields. The chief difficulty would be the construction of the very large electromagnet necessary for such a study.—Pierre **Weiss** and Auguste **Piccard**: The magnetisation of water and of oxygen. The exact value of the coefficient of magnetisation of water has been determined by two independent methods with concordant results. The mean value is $\chi = -0{\cdot}7193.10^{-6}$ at 20° C., with a temperature coefficient of +0·00013 in the neighbourhood of 20° C.—R. **Fortrat**: A new measurement of the magnetic decomposition of the lines of the second secondary series of zinc, and the quantitative verification of Preston's law.—Ch. **Féry** and M. **Drecq**: The diffusive power of platinum black and Stefan's coefficient. The method described gave a value of 0·82 for the coefficient of absorption of platinum black. From this, platinum black would not appear to be superior to lamp-black for use in absolute measurements of radiation.—M. **Tournier**: A method of measuring very great resistances. An electrometric method for resistances of the order of a megohm.—Jean **Meunier**: Some new forms of gaseous combustion in vortices and their analogy with the appearance of certain astronomical phenomena.—Ch. **Boulanger** and G. **Urbain**: The theory of the efflorescence of the saline hydrates.—A. **Colani**: The action of acids upon uranous oxide. The action of sulphuric and hydrochloric acids upon uranous oxide was found to depend very largely on the mode of preparation of the latter.—E. E. **Blaise**: Syntheses by means of mixed organo-zinc compounds. α-Polychloroketones. The constitution of ordinary trichloracetone.—J. B. **Senderens** and Jean **Aboulenc**: The esterification of the cyclanols by the aromatic acids. The catalytic esterification of the cyclanols, in presence of sulphuric acid, gives as good results with aromatic acids as with acids of the fatty series, provided that the carboxyl group is not directly united to the nucleus.—Raymond **Hamet**: The abnormal structure of the stem of *Rochea coccinea*.—L. **Blaringhem** and A. **Prévot**: Hybrids of wild and domestic guinea-pigs.—Raoul **Dupuy**: Contribution to the treatment of backward children by associated endocrinian extracts.—R. **Anthony** and L. **Gain**: The development of the skeleton of the wing in the penguin.—A. **Gruvel**: The anatomy of *Xenobalanus globicipitis*.—E. **Sollaud**: A new pœcilogonic variety of *Palaemonetes varians*.—E. **Fauré-Fremiet**: The action of the X-rays on the segmentation of the egg of *Ascaris megalocephala*.

NEW SOUTH WALES.

Linnean Society, September 25.—Mr. W. W. Froggatt, president, in the chair.—Cuthbert **Hall**: The Eucalypts of the Parramatta district, with description of a new species. Twenty-four species of Eucalypts are to be found in the area. Five are restricted mainly to the Hawkesbury Sandstone area, ten to the deep clay of the Wianamatta Shale Series, six to thin layers of clay overlying sandstone, two are uniformly distributed, and one grows in swampy ground. One species, which seems hitherto to have been confused with *E. tereticornis*, is described as new.—R. J. **Tillyard**: Some Australian Anisoptera (Neuroptera: Odonata), with descriptions of new species. The new species described are all distinct forms, including a new species of the genus Synthemis, from West Australia, a peculiar Austrogomphus, and a large Petalura. A study is made of the allied forms *Austroaeschna parvistigma*, Selys, and var. *multipunctata*, Martin, the conclusion being that these are distinct species.—R. T. **Baker**: Two unrecorded Myrtaceous plants from New South Wales. A Eucalypt collected at Black Mountain, New England district (C. F. Laseron), and a tea-tree (Melaleuca) from swamps on the Lawrence Road near Casino (L. G. Irby), are described as new. The former is locally considered to be a hybrid between the silver-top stringybark (*E. laevopinea*) and *E. stellulata*; in botanical sequence it may be placed between the stringybarks and the gums or smooth-barked Eucalypts. The Melaleuca finds its place in Mr. Bentham's Series v. (Spicifloræ) of the genus, next to *M. styphelioides*, Sm.

BOOKS RECEIVED.

Forty-first Annual Report of the Local Government Board, 1911–12. Supplement containing the Report of the Medical Officer for 1911–12. Pp. lxxx+366. (London: H.M.S.O.; Wyman and Sons, Ltd.) 3*s.* 8*d.*

A Laboratory Manual of Alternating Currents. By Prof. J. H. Morecroft. Pp. viii+247. (London: Longmans and Co.) 7*s.* 6*d.* net.

The Theory of Evolution in the Light of Facts. By K. Frank. With a chapter on Ant Guests and Termite Guests, by P. E. Wasmann. Translated from the German by C. T. Druery. Pp. xii+241. (London: Kegan Paul and Co., Ltd.) 5*s.* net.

Hazell's Annual for 1913. Edited by H. Hall. Pp. cxi+592. (London: Hazell, Ltd.) 3*s.* 6*d.* net.

Geometrical Optics. By A. S. Percival. Pp. vii+132. (London: Longmans and Co.) 4*s.* 6*d.* net.

God and the Universe. By G. W. de Tunzelmann. Pp. 256. (London: S.P.C.K.) 4*s.*

Outlines of the History of Psychology. By Prof. M. Dessoir. Authorised translation by D. Fisher. Pp. xxix+278. (London: Macmillan and Co., Ltd.) 7s. net.

Crops and Methods for Soil Improvement. By A. Agee. Pp. xv+246. (London: Macmillan and Co., Ltd.) 5s. 6d. net.

Monumental Java. By J. F. Scheltema. Pp. xviii+302+xl plates. (London: Macmillan and Co., Ltd.) 12s. 6d. net.

The Principia, or the First Principles of Natural Things. To which are added the Minor Principia and Summary of the Principia. By E. Swedenborg. Translated from the Latin by I. Tansley. Vol i., pp. cv+545; vol. ii., pp. xxi+669. (London: The Swedenborg Society.)

Cambridge County Geographies:—Linlithgowshire. By T. S. Muir. Pp. viii+142+2 maps. Rutland. By G. Phillips. Pp. x+171+2 maps. (Cambridge University Press.) 1s. 6d. each.

Problèmes d'Analyse Mathématique. By Prof. E. Fabry. Pp. ii+460. (Paris: A. Hermann et Fils.) 12 francs.

Leçons sur l'Intégration des Équations Différentielles aux Dérivées. By Prof. M. V. Volterra. Pp. ii+3+iv+83. (Paris: A. Hermann et Fils.) 6 francs.

Experimental Researches on the Specific Gravity and the Displacement of Some Saline Solutions. By J. Y. Buchanan. Pp. 227. (Edinburgh: Neill and Co., Ltd.) 7s. 6d. net.

Makers of British Botany. A Collection of Biographies by Living Botanists. Edited by F. W. Oliver. Pp. iv+332+xxvi plates. (Cambridge University Press.) 9s. net.

Changes in Bodily Form of Descendants of Immigrants. By Prof. F. Boas. Pp. xii+573. (New York: Columbia University Press; London: H. Frowde.) 7s. 6d. net.

The Writers' and Artists' Year-Book, 1913. Edited by G. E. Mitton. Pp. vii+147. (London: A. and C. Black.) 1s. net.

Who's Who, 1913. Pp. xxx+2226. (London: A. and C. Black.) 15s. net.

Books that Count. Edited by W. F. Gray. Pp. xx+315+lviii. (London: A. and C. Black.) 5s. net.

The Englishwoman's Year Book and Directory, 1913. Edited by G. E. Mitton. Pp. xxxi+412. (London: A. and C. Black.) 2s. 6d. net.

Einleitung in die Experimentalphysik: Gleichgewicht und Bewegung. By R. Börnstein. Pp. iv+118. (Leipzig: B. G. Teubner.) 1.25 marks.

Das Auge und die Brille. By Dr. M. von Rohr. Pp. vi+100+plate. (Leipzig: B. G. Teubner.) 1.25 marks.

School Gardening, with a Guide to Horticulture. By A. Hosking. Pp. xi+326. (London: W. B. Clive.) 3s. 6d.

A Barometer Manual for the Use of Seamen. Seventh edition. Pp. 83. (London: H.M.S.O.; Wyman and Sons, Ltd.) 6d.

Meteorological Office. Hourly Values from Autographic Records: Geophysical Section, 1911. Pp. 89. (London: H.M.S.O., Meteorological Office.) 5s.

Highways and Byways in Somerset. By E. Hutton. Pp. xviii+419. (London: Macmillan and Co., Ltd.) 5s. net.

Annals of the South African Museum. Vol. x., part iv., pp. 75–128; vol. x., part v., pp. 129–176+16 plates. (London: West, Newman and Co.) 2s. 6d. and 18s. respectively.

Records of the Geological Survey of India. Vol. xlii., part iii., 1912. Pp. 133–230. (Calcutta and London: Kegan Paul and Co., Ltd.) 1 rupee.

The Story of a Hare. By J. C. Tregarthen. Pp. xi+199+plates. (London: J. Murray.) 6s. net.

Vorlesungen über vergleichende Anatomie. 2 Lief. By Prof. O. Bütschli. Pp. iv+401–644. (Leipzig: W. Engelmann.) 9 marks.

Guide to the Materials for American History, to 1783, in the Public Record Office of Great Britain. Vol i., The State Papers. By Prof. C. M. Andrews. Pp. xi+346. (Washington: Carnegie Institution.)

The Crinoids of the Indian Ocean. By A. H. Clark. Pp. iii+325. (Calcutta: Indian Museum.) 20 rupees.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 19.

LINNEAN SOCIETY, at 8.—Experiments on the Pollination of our Hardy Fruits: C. Hooper.—The Morphology and Histology of Piper Betle, Linn: H. M. Chibber.—Some New British Plants: G. Claridge Druce.—Wild Rice, Annual and Perennial: Dr. Otto Stape.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Work of the International Electrotechnical Commission: Dr. S. P. Thompson.

INSTITUTION OF MINING AND METALLURGY, at 8.—The Dressing of Tin Ores in Cornwall: W. Fischer Wilkinson.—Notes on the Direct Volumetric Determination of Tin: H. J. B. Rawlins.—Notes on the Valuation of Nigerian Tin Concentrate: R. T. Hancock.

FRIDAY, DECEMBER 20.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—*Further Discussion*: Vapour-Compression Refrigerating Machines: J. Wemyss Anderson.—A Contribution to the Theory of Refrigerating Machines: J. H. Grindley.

CONTENTS.

	PAGE
Production and the Public Revenue. By **N. B. Dearle**	431
Chemical Books and Tables. By **T. M. L.**	432
Botanical and Gardening Books. By **Dr. F. Cavers**	432
Our Bookshelf	434
Letters to the Editor:—	
Reflection of Röntgen Radiation.—**Prof. C. G. Barkla, F.R.S.; G. H. Martyn**	435
Shinobu Hirota.—**Prof. J. Milne, F.R.S.**	435
The Self-testing of Dispersion Apparatus.—**Dr. C. V. Burton**	435
Petrifactions of the Earliest European Angiosperms.—**Dr. Marie C. Stopes**	436
Smoke Trace of Compound Vibrations of Tuning-fork. (*Illustrated.*)—**Prof. E. H. Barton**	436
Breath Figures. By **Lord Rayleigh, O.M., F.R.S.**	436
Palæolithic Man	438
Dr. C. Theodore Williams, M.V.O.	439
Notes	439
Our Astronomical Column:—	
Sun-spots	443
The International Time Conference	443
Elements and Ephemeris for Comet 1912*c* (Borrelly)	443
The Influence of Spectrum Analysis on Cosmical Problems	443
Elements of Recently Discovered Minor Planets	444
The Physical Society's Exhibition	444
Rivers, Glaciers, and the Ice-age. By **G. A. J. C.**	444
The Work of the Physikalisch-technische Reichsanstalt, Charlottenburg, in 1911. By **E. S. Hodgson**	446
Award of Beit Memorial Fellowships	447
Zoology at the British Association. By **Dr. J. H. Ashworth**	447
University and Educational Intelligence	451
Societies and Academies	452
Books Received	455
Diary of Societies	456

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