THURSDAY, DECEMBER 11, 1913.

THE NEW PHYSICAL CHEMISTRY.

Physikalische Chemie der homogenen und heterogenen Gasreaktionen. By Dr. Karl Jellinek. Pp. xiv+844. (Leipzig: S. Hirzel, 1913.) Price 30 marks.

THIS stout volume witnesses in a remarkable manner to certain recent developments in physical chemistry—developments which bid fair to mark the opening of a period of fundamental and fruitful research, comparable in importance only with the years following the enunciation of the laws of solution and of electrolytic dissociation. We refer, of course, to the third principle of thermodynamics due to Nernst, and to the theory of energy quanta, first deduced by Planck as an integral part of his radiation theory, and then later applied with great success by Einstein, Nernst, and Lindemann to the development of a theory of specific heats. The Nernst principle and the Planck theory are closely connected by the Boltzmann conception of entropy as a statistical and probability magnitude, and the changes which their introduction has already brought about in physical chemistry can be well appreciated by comparing Haber's "Thermodynamik technischer Gasreaktionen" (published in 1905) with the present book, which has been essentially written from the point of view of these new theories. The possibility of the prediction of the course and extent of a chemical reaction from purely thermal data, combined with a knowledge of certain physical constants, is now well within reach.

Dr. Jellinek has not himself been directly concerned in any of the advances with which he chiefly deals. He is, however, favourably known both as a former pupil of Nernst's, and as the author of some recently published elaborate and excellent physico-chemical investigations on hyposulphites. And although this volume contains no original work, it nevertheless deserves much praise as a very good exposition of the subject with which it deals.

We have, at the outset, a discussion of the first and second laws of thermodynamics. Gaseous equilibria are then carefully treated, using reversible cycles, as well as entropy and the thermodynamic potential functions. The Nernst theorem is introduced in connection with the indeterminate constants occurring in the integrated form of the reaction isochore equation, and also, again, in connection with the entropy conception. A consideration of entropy and the second law from the statistical point of view follows. Then comes a detailed treatment of the theory of radiation, culminating in a discussion of Planck's formula, and of the properties of his oscillators and resonators.

The next very interesting section contains much material previously unavailable in book form. It expounds a theory of specific heats founded on the assumption that molecules can be regarded as oscillating systems of definite frequencies, similar in properties to Planck's oscillators, and that their energy content can only change by means of definite energy quanta or units. The methods (compressibility, melting point, abnormal dispersion, selective emission, absorption and reflection, photo-electric effect) by which these frequencies can be determined are reviewed, and the excellent agreement between specific heats calculated on this basis and the experimental values shown. Other applications of the theory of quanta are considered (*e.g.*, that by Haber to the heat effect of a chemical reaction), and the section closes with an excellent discussion—in a sense the keystone of the whole book—of the close connection between the Nernst theorem and the theory of quanta. The name of Sackur is here prominent.

The author then deals with the experimental side of the foregoing subjects. The technique of radiation measurements (more particularly in the infra-red region) is described, and we are given reviews of the methods used for specific heat determinations (several of them, *e.g.*, the beautiful explosion method of Pier, developed in Nernst's laboratory) and for the investigation of gaseous equilibria. The section dealing with the kinetics of the subject is short, and, with the exception of the reaction-velocity theories of Krüger and of Trautz, contains little new. Finally come two brief but interesting sections dealing with the electrochemistry and photochemistry of gas reactions, in which the views and researches of Krüger, Haber, Warburg, Einstein, and others find a place.

The book is written with great enthusiasm, and the author is obviously well acquainted with the literature of his subject. Everything is admirably knit together and co-ordinated, and the latest publications are noted and given their place in the general scheme. The only criticism we feel inclined to make concerns, not the manner in which the author has done his work, but the advisability of doing it at all in the form he has chosen. His volume contains material for at least four or five books. Two of these have already been written by Planck and one by Haber, whilst his most interesting chapters deal with a subject at present in a state of very rapid development—a subject, moreover, on which we may perhaps shortly expect an authoritative pronouncement from Nernst himself. The author has further, from

want of space, been sometimes compelled to omit or skim over certain points in a very arbitrary fashion, at the same time using material which plainly interests him, but is less germane to the matter in hand. This is distinctly a fault in so all-comprehensive a book, and indicates that a more modest programme would have been better. There is no doubt, however, that he has essentially succeeded in giving unity to the subjects treated, and his volume, with the above qualifications, is strongly to be recommended. As to the wisdom of the choice of his particular point of view, there can be little doubt. Haber has been credited with the remark that the basis of physical chemistry in the future will be one part thermodynamics and three parts theories of radiation and quanta. And when one considers the manifold ways in which these theories have already been applied—to specific heats, photo-electric effect, Röntgen rays, γ-rays, radioactive changes, the emission of free electrons during chemical changes, thermoelectromotive force, electrical resistance, &c.—one will not feel inclined to dispute his prophecy. The growing importance of atomic and molecular mechanics in comparison with classical thermodynamics is undoubtedly the outstanding feature of physical chemistry at the present moment.

VETERINARY PHYSIOLOGY.

A Manual of Veterinary Physiology. Fourth edition. By Major-General F. Smith, C.B., C.M.G. Pp. xii+808; 259 illustrations. (London: Baillière, Tindall and Cox, 1912.) Price 18*s*. net.

AS pointed out by the author, this work is essentially a veterinary, and not a comparative, physiology, and an endeavour has been made to render it of service, not only to the student of theoretical veterinary physiology, but also to the clinician. Throughout the book the author has taken every opportunity of pointing out the clinical application of various physiological facts, and further indicating how various pathological conditions are purely derangements of physiological conditions.

The work as a whole is excellent, and this edition must rank as the standard text-book on the subject in English. If any sections of the book stand out from the others, they are probably those on "locomotion" and on "the foot." The chapter on the former is really a masterly exposition of the subject; all paces are carefully considered, and the text is made very easy to follow by means of several series of excellent notations. There is also a very interesting discussion on the influence of age on the capacity for work, and attention is directed to the apparent considerable difference between man and the horse in this respect.

There are some features, however, which call for criticism. On referring to the paragraph on blood platelets, the author says: "It is probable they are distinct elements." Other authorities, however, do not agree with this view, Buckmaster and others going so far as to state that there are no blood platelets in circulating blood. The question is dismissed too shortly in one small paragraph. On p. 152 the author refers to "broken-wind" in horses, and after admitting that the condition is one in which the lungs lose their power of elastic recoil, he states that "one of the fundamental errors in veterinary pathology is to attribute this condition to emphysema or asthma." Here we join issue with the author, and while agreeing that the condition is not asthma, would point out to him that a suitably prepared section of the lung of a broken-winded horse shows quite clearly that the loss of elastic recoil in a chronic case is due to the rupture of the vesicular walls, and is, in fact, "chronic vesicular emphysema."

A list of *corrigenda* has been inserted at the front of the book, but one mis-spelt word has been overlooked on p. 192, "attendi*h*g" appearing for "attending." There is also an exhaustive index and a list of authorities quoted in the text. The printing and binding and general make-up of the book are in Messrs. Baillière's usual good style.

POPULAR ASTRONOMY.

Astronomy. By G. F. Chambers. Pp. xxiv+335+cxxxv plates. (London: Hutchinson and Co., n.d.) Price 5*s*. net.

Daytime and Evening Exercises in Astronomy. For Schools and Colleges. By Dr. Sarah F. Whiting. Pp. xv+104. (Boston and London: Ginn and Co., n.d.) Price 3*s*. 6*d*.

The Ways of the Planets. By M. E. Martin. Pp. v+273+vi plates. (New York and London: Harper and Brothers, 1912.) Price 5*s*. net.

(1) IN this volume Mr. Chambers has aimed at giving the man of ordinary education—too often, alas, deficient of any precise ideas regarding the fundamental truths of the oldest of the sciences—a clear and simple insight into the astronomy of to-day; and he has accomplished his part of the task with characteristic success. Abstruse problems are not sprung upon the young astronomer, nor are they obviously evaded, but at all times is he encouraged to observe phenomena for himself, and thereby to grasp more thoroughly

the lucid explanations. Sun, moon, and planets; tides, time, and eclipses; meteors and comets, and then the constellations, stars, and nebulæ, with their spectroscopic characteristics, are all dealt with in turn. Nor is the practically-minded neophyte neglected, for he will find some useful hints as to how to obtain and house his instrument, with some idea of the probable cost, based on actual accomplishments. The beginner should find little to confuse, and much that will enlighten him, although in the very brief survey of astro-spectroscopy he may wonder what such terms as "minimum-deviation" (p. 303) mean, and it is to be hoped that he will proceed to make further inquiries into this most fascinating branch of the subject. The book is very well and profusely illustrated, some of the plates being in colour, and can be recommended as an excellent work for the serious beginner. In the copy under review the transposition of the top line on p. 24 to the top of p. 25 makes the text much simpler.

(2) While Mr. Chambers aims at curing ignorance, Dr. Whiting seeks to prevent it, and to this end has compiled a set of educative, practical exercises in astronomy. The general aim of the author has been to formulate a set of exercises, *e.g.*, the use of globes, plate-measuring, spectrum observing and plotting, the plotting of ephemerides, sunspot numbers, &c., such as could be performed in day-classes independently of local weather conditions. In the hands of an enthusiastic and imaginative teacher we can conceive that the book would be extremely useful, but we fear that in the hands of the ordinary student the exercises might easily tend to become more automatic than is desirable. Such an aim necessarily restricts the scope of the work it is possible to do, but in places, for example, in the exercise on spectroscopic work, we feel that the author has missed many opportunities where actual manipulation on the part of the student would add exceedingly to the interest and the educative influence of the work. Our experience with students is that the reduction of a spectrum taken by themselves is likely to awake far wider interests than is the copying, even in colour, of a chart from some text-book. The mere statement of "principles" relating to such matters as velocity- and pressure-shifts, and the action of a magnetic field on radiations, savours of "cram," and should, we think, find no place in such a book.

(3) This is a charming book, telling the novice all that it is necessary for him to know, first about the planets in general and then in particular, and telling him in such language that he should never have to pause for a single definition or explanation that is not in the text. For each planet the family features are compared or contrasted, the physical condition explained, with the points where definite explanation is not yet forthcoming set out in clear and moderate language, and the ephemeris for a number of the coming years is very carefully interpreted; thus we find that on August 5, 1914, Mercury will be at western elongation, and "favourable for viewing," while we shall have "splendidly brilliant oppositions" of Mars in July, 1939, and early October, 1941, respectively. The author makes one feel at home with the planets by giving a very full introduction to every member of the solar family, and where figures are necessary, she robs them of all their awe by her familiar and easily-employed standards, leaving the reader of ordinary intelligence with a very fair idea of their significance. There is some repetition of facts in the book, but the forms in which they are stated are ever new and always interesting. Such a book, for its fund of information, its ease of comprehension, and its delightful style, should be found in every school library and (astronomically) youthful circle.

WILLIAM E. ROLSTON.

OUR BOOKSHELF.

Flies in Relation to Disease. Non-Bloodsucking Flies. By Dr. G. S. Graham-Smith. Pp. xiv + 292 + xxiv plates. (Cambridge: University Press, 1913.) Price 10*s.* 6*d.* net.

THIS is just the book for students who either are, or are to be, occupied with questions of public health; it is careful, well-digested, precise, and clear. Dr. Graham-Smith has practical knowledge of the things that he writes about, having already published numerous experiments on the transmission of bacteria by flies. His book is freely illustrated by excellent plates and text-figures by Mr. Edwin Wilson.

The evidence which convicts the common house-fly of causing heavy mortality in military camps seems to be complete; the same insect is also strongly suspected of being a chief agent in spreading typhoid, summer-diarrhœa, and other infectious diseases of cities. Visible proofs are here given that house-flies deposit vomit or fæces wherever they settle, and this of itself shows how dangerous they may be when any disease propagated by microbes is prevalent. It is to be hoped that the disgust which chapter vii., on the habits of flies, is sure to excite may rouse our sanitary authorities to root-out the breeding-places of the "busy, curious, thirsty fly," which is at present treated with far too much indulgence. Dr. Graham-Smith's facts, handled by a newspaper writer not unversed in biological studies, might furnish telling articles, such as rendered good service in the campaign against *malarial* insect-infection, and in America (not as yet in England) against *bacterial* insect-infection as well. We

hope to see them deeply impressed on the public mind.

The instructive descriptions before us are accompanied by excellent figures; nevertheless we have a suggestion to make about the determination of the house-flies. Dr. Graham-Smith has eighteen species of house-frequenting Diptera to deal with (p. 15). Most of them present no serious difficulty, but students unpractised in entomology will find a few hard to distinguish. Would it not be well to lighten their labours by a discrimination-table, which would concentrate attention upon the decisive characters? A single character (*e.g.* the tubercle on the middle tibia of *Fannia scalaris*), is sometimes a certain mark of the species. Or the really decisive characters might be italicised. The student should afterwards compare his fly with the description in every point; identification is not the only purpose of descriptions.

Non-piercing strikes us as a neater phrase than *non-bloodsucking*.

The Ideals and Organisation of a Medical Society. By Dr. J. B. Hurry. Pp. 51. (London: J. and A. Churchill, 1913.) Price 2*s.* net.

THE name of Reading, at the present moment, is mostly associated with political excitement; but Reading has many interests, and, among them, it is the home of one of the best of all the provincial medical societies. Dr. Hurry has done well to write an account of the work, purposes, and constitution of a medical society. He is a good friend to Reading; he loves its history, its old buildings; he has made many gifts to the town; he has been, for years, its chief chronicler; and the Reading Pathological Society is an example of all that a medical society ought to be. Indeed, a good medical society is a very great help to a town. It raises the level of things; it promotes the spirit of science; it ensures the efficiency of the town's hospital; it is a bond of union among practitioners; it adds dignity, distinction, and modernity to their art, and friendship and ambition. The interchange of knowledge, the comparison of experiences, the criticism, the honourable competition, all tend to achievement. Of course, there are difficulties; the hard-worked doctor cannot easily find time to attend meetings or to prepare papers. Waste of time, repetition, overlapping of subjects, are to be avoided, but are not always easy of avoidance. But a good medical society, such as the Reading Pathological Society, is an excellent help to men in practice, and to the town in which they practise.

A Day in the Moon. By the Abbé Th. Moreux. Pp. viii + 199. (London: Hutchinson and Co., 1913.) Price 3*s.* 6*d.* net.

IN these pages the Abbé Moreux chats on the moon and all that is related to it, and the reader will find not only that the matter is displayed in a very readable form, but that he will have learnt numerous facts, and have had a very instructive lesson, by the time he has finished the volume. A day in the moon refers actually to a lunar day, and the reader is transported to the moon and treated as if he were an inhabitant of that body. The author in this way introduces him to the mountain ranges and craters, and other conspicuous high and low lands which are brought into view as the solar rays illuminate them. Here and there are brought in incidentally interesting side issues, such as the probable use of lenses before ever Galileo or the inventor, a certain Dutchman, came to re-invent and use them. Bringing the reader back to earth again, he introduces him to such themes as the tides, possible weather changes due to the moon, action of the moon on vegetation and organic life, and on men and animals, and finally concludes with a list of objects shown on a map of the moon, those to be studied on each day of a lunation, and the lunar elements. Numerous illustrations from photographs and the author's drawings accompany the text. The translator has done his work well, and has, in the form of footnotes, made many statements more clear to British readers, such as when references were made to the metric system of measurements, and to distances between French towns.

Recent Physical Research. An Account of some Recent Contributions to Experimental Physics. By D. Owen. Pp. iii + 156. (London: *The Electrician* Printing and Publishing Co., Ltd., n.d.) Price 3*s.* 6*d.* net.

A PUBLICATION dealing with some of the most important recent developments of physics is sure to be of use if written with sufficient knowledge and a pleasing style. This book has both those advantages. The subjects include positive rays (with Thomson's new method of chemical analysis), the magnetic work of Curie, Weiss, and Heusler, new theories of the aurora (Störmer and Birkeland), Brownian movements (Einstein and Perrin), the pressure of light, the narrowing gap between the longest heat-waves and the shortest electromagnetic waves (Rubens, Lebedef), and the application of the electron theory to metallic conduction. The blocks are particularly good. One could wish for rather fuller references, and for a fuller treatment of the modern radiation problem (on p. 106 Planck's and Wien's formulæ are presented without directing attention to the importance of the "action constant"). But in view of the limited space at the author's disposal, a large amount of new information is attractively displayed.

Lip-reading: Principles and Practice. A Handbook for Teachers and for Self-instruction. By Edward B. Nitchie. Pp. xiv + 324. (London: Methuen and Co., Ltd., n.d.) Price 5*s.* net.

THE hard-of-hearing will be able to study lip-reading from this book without the aid of a teacher, if such a course is found necessary. The book is arranged also for use, under a teacher's guidance, by the semi-mute and the congenitally deaf who have acquired speech and language. The first part of the book is explanatory and directive, and the second gives exercises for practice.

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.*]

The Structure of the Atom.

In a letter to this journal last week, Mr. Soddy has discussed the bearing of my theory of the nucleus atom on radio-active phenomena, and seems to be under the impression that I hold the view that the nucleus must consist entirely of positive electricity. As a matter of fact, I have not discussed in any detail the question of the constitution of the nucleus beyond the statement that it must have a resultant positive charge. There appears to me no doubt that the α particle does arise from the nucleus, and I have thought for some time that the evidence points to the conclusion that the β particle has a similar origin. This point has been discussed in some detail in a recent paper by Bohr (*Phil. Mag.*, September, 1913). The strongest evidence in support of this view is, to my mind, (1) that the β ray, like the α ray, transformations are independent of physical and chemical conditions, and (2) that the energy emitted in the form of β and γ rays by the transformation of an atom of radium C is much greater than could be expected to be stored up in the external electronic system. At the same time, I think it very likely that a considerable fraction of the β rays which are expelled from radio-active substances arise from the external electrons. This, however, is probably a secondary effect resulting from the primary expulsion of a β particle from the nucleus.

The original suggestion of van der Broek that the charge on the nucleus is equal to the atomic number and not to half the atomic weight seems to me very promising. This idea has already been used by Bohr in his theory of the constitution of atoms. The strongest and most convincing evidence in support of this hypothesis will be found in a paper by Moseley in *The Philosophical Magazine* of this month. He there shows that the frequency of the X radiations from a number of elements can be simply explained if the number of unit charges on the nucleus is equal to the atomic number. It would appear that the charge on the nucleus is the fundamental constant which determines the physical and chemical properties of the atom, while the atomic weight, although it approximately follows the order of the nucleus charge, is probably a complicated function of the latter depending on the detailed structure of the nucleus. E. RUTHERFORD.

Manchester, December 6, 1913.

The Reflection of X-Rays.

In view of the great interest of Prof. Bragg's and Messrs. Moseley and Darwin's researches on the distribution of the intensity of the primary radiation from X-ray tubes, it may be of interest to describe an alternate method which I have found very convenient (*Comptes rendus*, November 17, 1913).

As we know, the wave-length of the reflected ray is defined by the equation $n\lambda = 2d \sin\theta$, where n is a whole number, d the distance of two parallel planes, and θ the glancing angle. If one mounts a crystal with one face in the axis of an instrument that turns slowly and regularly, such as, for instance, a registering barometer, the angle changes gradually and continuously.

If, therefore, one lets a pencil of X-rays, emerging from a slit, be reflected from this face on to a photographic plate, one finds the true spectrum of the X-rays on the plate, supposing intensity of the primary beam to have remained constant. (This can be tested by moving another plate slowly before the primary beam during the exposure.)

The spectra thus obtained are exactly analogous to those obtained with a diffraction grating, and remind one strongly of the usual visual spectra containing continuous parts, bands, and lines.

So far I have only identified the doublet, 11° 17′ and 11° 38′, described by Messrs. Moseley and Darwin. The spectra contain also a number of bright lines about two octaves shorter than these, and the continuous spectrum is contained within about the same limits. These numbers may be used in the interpretations of diffraction Röntgen patterns, as they were obtained with tubes of the same hardness as those used for producing these latter.

The arrangement described above enables us to distinguish easily the spectra of different orders, as the interposition of an absorbing layer cuts out the soft rays, but does not weaken appreciably the hard rays of the second and higher orders.

It is convenient also for absorption experiments; thus a piece of platinum foil of 0·2 mm. thickness showed transparent bands. The exact measurements will be published shortly, as well as the result of some experiments I am engaged upon at present upon the effect of changing the temperature of the crystal.

MAURICE DE BROGLIE.

29, Rue Chateaubriand, Paris, December 1.

As W. L. Bragg first showed, when a beam of soft X-rays is incident on a cleavage plane of mica, a well-defined proportion of the beam suffers a reflection strictly in accordance with optical laws. In addition to this generally reflected beam, Bragg has shown that for certain angles of incidence, there occurs a kind of selective reflection due to reinforcement between beams incident at these angles on successive parallel layers of atoms.

Experiments I am completing seem to show that a generally reflected beam of rays on incidence at a second crystal surface again suffers optical reflection; but the degree of reflection is dependent on the orientation of this second reflector relative to the first.

The method is a photographic one. The second reflector is mounted on a suitably adapted goniometer, and the photographic plate is mounted immediately behind the crystal. The beam is a pencil 1·5 mm. in diameter. When the two reflectors are parallel the impression on the plate, due to the two reflections, is clear. But as the second reflector is rotated about an axis given by the reflected beam from the first and fixed reflector, the optically reflected radiation from the second reflector—other conditions remaining constant—diminishes very appreciably. As the angle between the reflectors is increased from 0° to 90°, the impression recorded on the photographic plate diminishes in intensity. For an angle of 20° it is still clear; for angles in the neighbourhood of 50° it is not always detectable; and for an angle of 90° it is very rarely detectable in the first stages of developing, and is then so faint that it never appears on the finished print.

These results, then, would show that the generally reflected beam of X-rays is appreciably polarised in a way exactly analogous to that of ordinary light. Owing to the rapidity with which the intensity of the generally reflected beam falls off with the angle of incidence of the primary beam, it has not been possible to work with any definiteness with angles of

incidence greater than about 78°, and this is unfortunately a considerably larger angle than the probable polarising angle. Experiments with incidence in the neighbourhood of 45° should prove peculiarly decisive, for whereas ordinary light cannot as a rule be completely polarised by reflection, the reflection of X-rays, which occurs at planes of atoms, is independent of any contamination of the exposed crystal surface, and polarisation, once established, should prove complete for radiation reflected at the polarising angle. The selectively reflected X-rays seem to show the same effects as does the generally reflected beam. Selectively reflected radiation is always detectable after the second reflection, but this seems due to the selectively reflected radiation produced at the second reflector by the unpolarised portion of the beam generally reflected at the first reflector.

The application of a theory of polarisation to explain the above results is interestingly supported by the fact that in the case of two reflections by parallel reflectors, the proportion of X-rays reflected at the second reflector is invariably greater than the proportion of rays reflected at the first; that is, the ratio of reflected radiation to incident radiation at the second reflector is always greater than the same ratio at the first reflector. This might be expected if vibrations perpendicular to the plane of incidence are to be reflected to a greater extent than those in the plane of incidence. The proportion of such vibrations is larger in the beam incident on the second reflector than in the original beam, and a greater proportion of radiation would be reflected at the second reflector than could be at the first. For the case of parallel reflectors and incidence of a primary beam on the first at the polarising angle, the reflection at the second should be complete. E. JACOT.

South African College, Cape Town,
November 14.

Residual Ionisation in Gases.

FROM observations made by Simpson and Wright, the writer, and others, it is now known that the ionisation in air confined in airtight clean zinc vessels is about 8 or 9 ions per c.c. per second when the observations are made on land where the soil contains only such minute traces of radio-active substances as are found in ordinary clays or loams.

On the other hand, when the observations are made on the ocean or on the surface of large bodies of water, such as Lake Ontario, the ionisation in the same air confined in the manner indicated above drops to about 4 ions per c.c. per second. This reduction in the number of ions per c.c. per second has been shown to be due to the absorption of the earth's penetrating radiation by the water of the ocean and by that of the lakes.

On a recent voyage from England to Canada, I thought it would be interesting to see what the drop in the ionisation would be when the air in a zinc vessel was replaced by hydrogen. The observations were made on the ss. *Megantic*, a vessel of about 14,000 tons burden. On this boat the ionisation in air confined in a Wulf electrometer made of zinc was found to be 4·65 ions per c.c. per second, while in hydrogen it was 1·8 ions per c.c. per second. On reaching Toronto the experiment was repeated in a building which was free from any radio-active impurity, and in this case the ionisation in air was found to be 8·8 ions per c.c. per second, while in hydrogen it was 2·0 ions per c.c. per second.

The ionisation of the air on land was therefore 4·15 ions per c.c. per second more than it was upon the steamship, while the ionisation in hydrogen on the land was only 0·2 ion per c.c. per second more than on the sea. From this it follows that the ionisation produced in air by the penetrating radiation at the surface of the earth at Toronto was about twenty times as much as that produced by the same radiation in hydrogen.

Since the residual ionisation in hydrogen on the ocean was nearly 40 per cent. of that in air, it is evident that the residual ionisation in these two gases could not have been due to a radiation of the type of the earth's penetrating rays. Experiments should therefore be directed to determining whether this residual effect in gases is due to the action of an easily absorbed radiation from the walls of the vessel in which the gases are confined, or whether it has its origin in a disruption of the molecules occurring either spontaneously or through the agency of collisions.

J. C. MCLENNAN.

The Physical Laboratory, University of Toronto,
November 13.

The Nile Flood of 1913.

FOR some years past the Meteorological Office of the Egyptian Survey Department, under the direction of Mr. J. I. Craig, has carried out researches on the question of the possibility of forecasting the Nile flood, and he has put forward the theory that the rain which falls in Abyssinia comes from the South Atlantic (see "England, Abyssinia, the South Atlantic: a Meteorological Triangle," Quarterly Journal Royal Meteorological Society, October).

There is much evidence to support this, and correlations have been established between the flood, and pressure and wind velocity at St. Helena, and pressure in South America. So far the best prediction which can be based on these correlations is for the mean height of the Nile at Halfa, between July 16 and August 15, that is, in normal years for the middle of the rising stage. The probable error of a prediction based on this is ±0·33 metre, whereas a prediction which assumes that the river will be normal in any given year would have a probable error of ±0·55 metre. This result is sufficiently encouraging to make further work promising, and the writer is pursuing the investigation.

The flood of this year has been the lowest of which there is authentic and complete record. Records of the maximum and minimum of the flood as recorded on the Roda Nilometer (Cairo) go back to very early times, but naturally the early ones are less trustworthy than those of more recent date. The following figures, taken from "Egyptian Irrigation," by Sir William Willcocks and Mr. J. I. Craig, give the lowest recorded floods in recent times:—

Period	Lowest maximum recorded on Roda Nilometer Metres	No. of years of period recorded
1701–1725 ...	17·35 ...	18
1726–1750 ...	18·58 ...	24
1751–1775 ...	18·08 ...	25
1776–1800 ...	15·49 (1) ...	
1801–1825 ...	13·14 (2) ...	3
1826–1850 ...	18·15 ...	25
1851–1875 ...	18·30 ...	25
1876–1900 ...	17·65 ...	25
1901–1913 ...	17·17 (1913) ...	13

(2) Is almost certainly an error of 10 pics. (the divisions on the gauge), and it seems very probable that (1) is also an error, as at the present day in the low stage the river is artificially kept at a level of about 15 metres by the Delta Barrage and the Aswan Dam, and the average level in the low stage before the Barrage became effective was about 13 metres.

During the last twenty-four years calculations of the discharge at Halfa have been made, and as the

result of these it appears in the period July to October, which is usually taken as the flood period, the discharge of 1913 is between 50 and 60 per cent. below the average. In early times the effect of such a flood would have been disastrous, but the recent raising of the Aswan Dam, the reservoir being filled to its full capacity for the first time this year, and the construction or strengthening of the four barrages on the Nile, have removed the possibility of extensive loss and enabled the deficiency, due to the late arrival of the flood, to be tided over.

There is no need to point out the importance to Egypt of a knowledge of the causes of the Nile flood, and of the value of a prediction which could be given with fair accuracy a month beforehand. The flood of this year having been so exceptional, there is every possibility that useful clues may be obtained to its detailed causes, and to further this object I should be glad to have copies of any meteorological observations made in Central and South Africa, and the South Atlantic in this and previous years.

H. E. HURST.

Meteorological Office, Survey Department,
Giza (Mudiria), Egypt.

Pianoforte Touch.

I DO not think that Prof. Bryan will find any difficulty in sounding a single note of the same loudness a sufficient number of times for the test suggested, if he eliminates, as I did, those which are perceptibly louder or softer than the average; and the task for the listener is a very different one from sipping blindfold coffee and tea, where the two different tastes persist for a long time, and soon become hopelessly superposed. Certainly the problem as to whether a difference is caused by the nature of the blow given to the strings cannot be solved by playing a succession of notes, instead of a single one, for such a succession at once introduces a number of other factors.

The instrument which I used was an Erard grand of the latest type. Such an instrument, owing to the fact that the hammer strikes the string twice for each blow on the keys, is specifically favourable for producing differences which might be impossible in other cases.

SPENCER PICKERING.

MR. PICKERING tells us that in his latest Erard piano "the hammer strikes the string twice for each blow on the keys." If this is really the case the statement will go a long way towards clearing up the theoretical difficulties which have arisen in the attempt to explain the possible production of variations of tone quality by differences of touch. It is very difficult to obtain any definite information regarding the action of pianoforte hammers. Both Helmholtz's and Kaufmann's theories are inadequate, and an investigation recently started with one of my pupils seems to show that the action is much more complex than is usually supposed. But inquiries in other directions have merely elicited the dogmatic statement that the whole object of the check action is to prevent the hammer striking the string twice. In my Collard horizontal piano of 1892 the arrangement of the check action is distinctly favourable to a multiple impact, for when the action is removed and the hammer projected into the air it certainly rebounds considerably. Granting such an action to take place, we are no longer thrown back on the vibrating-shaft theory as the only *possible* explanation. The extent to which such effects are or are not noticed must necessarily be a matter of personal opinion, although I hope shortly to repeat the experiment described by Mr. Pickering when I can obtain a music-roll cut with the necessary repetitions.

G. H. BRYAN.

Alfred Russel Wallace Memorials.

MAY we appeal through these columns to men of science, both here and abroad, to contribute to a fund which we are raising for the purpose of placing a suitable memorial to the late Dr. Alfred Russel Wallace in Westminster Abbey? We should like also to be able to offer to the Royal Society a posthumous portrait of the late distinguished naturalist, and Mr. J. Seymour Lucas, R.A., has consented to execute this work. It is further contemplated that a statue or bust should be offered to the trustees of the British Museum (Natural History) if the necessary fund is subscribed. In view of the great services to the cause of science rendered by Darwin's contemporary and colleague, the duty of handing down to posterity a memorial worthy of the man and his work obviously devolves upon those of the present generation who have in so many diverse ways benefited both by his teaching and by his example. The whole sum asked for to enable us to carry out all the objects which we have in view is comparatively modest, viz. 1100*l.*, and we hope that this amount will be reached. The preliminary list of subscribers is sufficiently weighty to convince us that in undertaking the organisation of this movement we have not only the sympathy of the scientific world, but also the approbation of leaders of thought and of culture in other spheres of activity. Thirty fellows of the Royal Society, including the present and past presidents, have already given their adherence, and among those representative of other interests will be found the names of Mr. Arthur Balfour, Lord Haldane, Dr. Warren, the president of Magdalen, and the Dean of Westminster. We have only to add that permission to place the memorial, which it is proposed should be in the form of a medallion with a suitable inscription, in Westminster Abbey, has been cordially given by the Dean and Chapter.

We shall be willing to receive and acknowledge subscriptions, but it will be most convenient if these are sent directly to the manager, Union of London and Smith's Bank, Holborn Circus, E.C., in the form of cheques made payable to the "Alfred Russel Wallace Memorial Fund."

RAPHAEL MELDOLA,
6 Brunswick Square, W.C.
EDWARD B. POULTON,
Wykeham House, Oxford.
JAMES MARCHANT,
(Secretary), 42 Great Russell Street, W.C.

THE family of the late Dr. Alfred Russel Wallace having invited me to arrange and edit a volume of letters and reminiscences, they would be thankful if those of your readers who have letters of reminiscences would kindly send them to me for this purpose. The letters would be safely and promptly returned.

Will provincial American, Colonial, and foreign newspapers kindly republish this letter?

JAMES MARCHANT.

Lochnagar, Edenbridge, Kent.

Distance of the Visible Horizon.

ABOUT forty years ago I learnt a formula which I have used ever since. It was $7x = 4y^2$; x = height of observer in feet, y = distance of horizon in miles. I do not now know where I found this formula, but it will be seen, if a few examples are worked out, that it agrees very closely with that given in your issue of November 20. At 1000 ft., for instance, the distances are 42 and 41·9 miles respectively.

R. LANGTON COLE.

Sutton, Surrey, November 30.

THE PROBLEM OF THE UNIVERSITY OF LONDON.

THE University of London problem is still unsolved. Within the memory of most of us there have been *three* Royal Commissions on the University, and some of us are beginning to think that the problem is insoluble.

It will be remembered that the present constitution of the University was based upon the report of the Gresham Commission in 1891. The recommendations of the Gresham Commission were not adopted fully and completely, but, from many important points of view, were modified by the terms embodied in the schedule to the Act of 1898. The Act of 1898, under which the University now works, and under which it became a teaching as well as an examining university, was frankly a compromise, and few who were intimately connected with university organisation anticipated that the compromise afforded a lasting, much less a permanent, solution.

The 1898 Act took effect in 1900, so that the University has been working under its present constitution for a period of thirteen years. It started on its new career as a teaching university with a list of "recognised" teachers that had been drawn up for it by the Statutory Commission. It had no real control over teaching, nor did it own or possess any teaching institution.

It was not until 1907 that the University became in any real sense of the word a "teaching university." This was brought about by the incorporation of University College. In order to aid and promote the aims of the reconstituted University, the old corporation of University College agreed to be dissolved, and to transfer its powers and property to the Senate of the University. By this means the University became possessed of land, buildings, and educational appliances of great value, and acquired a teaching staff of high distinction, and an academic organisation of proved efficiency and honourable tradition.

The step taken by University College was followed, so far as circumstances permitted, by King's College, which was incorporated in the University two-and-a-half years later. Since that time the development of the teaching side of the University has been rapid. It would have been *more* rapid, but for the hindrances of the present constitution. But for those hindrances, the Imperial College of Science and Technology, which was constituted about the same time as University College was incorporated in the University, would also, from the first, have been part and parcel of the University. As things stand, the Imperial College is only linked to the University by the slightest of all links—that which is implied by the style and title of a "school" of the University.

The rapid progress of the organisation of teaching and research, the desirability of incorporating the Imperial College, and the need for a constitution more adapted to university government than the present, led to the appointment of a new Royal Commission in 1910. The report of that Commission was issued last April. This report has been generally acclaimed by educational experts as setting forth in an admirable fashion the aims and needs of a university placed in a great city such as London.

The report contains detailed suggestions for the reconstitution of the University, and at the same time suggests far-reaching educational reforms, for which it will take many years to prepare. It is this blending of proposals that may be immediately effective with schemes that cannot mature for many years to come that makes the report leave in some respects a *doctrinaire* impression. It appears to us, therefore, that the President of the Board of Education has taken the only possible practicable step in the circumstances in appointing a departmental committee "to consult the bodies and persons concerned, and to recommend the specific arrangements and provisions which may be immediately adopted."

In a recent speech at the Mansion House, the Minister for Education laid down the principles upon which immediate action might, in his opinion, be taken. He has confirmed those principles in a letter dated November 12 addressed to the vice-chancellor of the University, and published in our issue of November 20. We agree with him in the view that the five principles he lays down are the *essential* principles. If they were once adopted, the main difficulties that at present exist would undoubtedly disappear. Under these principles, the supreme governing body of the University will be a senate, small in size, predominantly lay in composition, and in no way representative of special interests. Its supreme business will be to guide and direct the high policy of the University, especially so far as that is affected by finance. It will not be overloaded, as the present Senate is, with every imaginable detail. A reference to the agenda paper of the present Senate will show that it concerns itself with everything and anything, from the wages of a lift-boy up to the appointment of a university professor.

The composition of the Senate that is proposed would only be possible if it were assisted in its work by a number of well-organised bodies. Among these, the most important are the faculties, consisting in the main of the University professors and University readers, all of whom in future will be appointed by the University Senate. To these faculties will be committed very great powers. They will, of course, be subject to the general control of the Senate, and to the statutes and ordinances existing for the time being. Subject to those, the faculties will determine the courses of study, the subjects of study for degrees, and all the details of educational work. It is clear that if the faculties are to do their work effectively they must be composed of teachers of the highest rank, and those teachers must be able to meet frequently and easily. The more directly and completely those teachers are controlled by the

Senate, the more effective will be the unity of the University organisation.

This being the case, the Commission recommends a considerable extension of the policy of incorporation, to which we have referred already. It recommends the extension of the principle of incorporation to the Imperial College of Science and Technology to Bedford College, and possibly to the East London College. It recommends that the Birkbeck College be incorporated, and be made an "evening school" of the University; and further, that some (possibly three) of the medical schools become incorporated medical colleges.

The incorporated institutions will be the property of the University; they will be under its educational and financial control; but the property will be so vested as not to preclude the earmarking of capital or income by donors and benefactors for particular institutions or specific purposes. All institutions thus incorporated will be known as "constituent colleges." The details of management of such institutions will be in the hands of college committees or delegacies, as, under existing conditions, is the case at University and King's Colleges.

Such being the general programme of the Commission, it follows as a matter of necessity that "as much of the University work as possible, together with the University administration, should be concentrated in a central University quarter." This brief statement by the Minister of Education ought to do much to clear away the confusion raised by what has been called "The Battle of the Sites." The Minister's statement, taken in conjunction with the report of the Commission, makes it perfectly clear that a site that merely provides the administrative offices of the University will not, in any circumstances, meet the needs of the case. If administrative offices, and administrative offices *only*, are sought, then there is small reason for removing from the present quarters in the Imperial Institute. To move the administrative offices from there to some costly site on the south side of the river, as has been suggested, would be wasteful and futile. It would be wasteful because it would require a very large sum of money even to move the administrative offices from South Kensington to the south side of the river; it would be futile because, when the removal was achieved, the University administration would not be nearer to any teaching centre than it is now.

It has been suggested that the Government should be asked for Somerset House for University purposes; and this proposal has been reported upon favourably by the Higher Education sub-Committee of the London Education Committee. At the meeting of the latter Committee on November 26, a report was adopted asking that the London County Council should join with the Senate of the University in a deputation to the Government to set forth the advantages of Somerset House as a university centre. If Somerset House were given to the University, it would undoubtedly be possible to effect a much-needed extension to King's College, and to provide for the housing of the administrative offices; but it would accomplish little, if anything, more; and this would be done at enormous cost, because the whole of Somerset House would need to be gutted. It is almost inconceivable that permission would be given for the alteration of the elevation of this building. The University would again be put into a house built for other purposes, and bearing another name; and, instead of a university quarter, all that would be achieved would be the bringing together of the University administration and one of its constituent colleges.

The report of the Commission gives strong reason for the establishment of a university quarter; such a quarter should be large enough to comprise at least two of the main constituent colleges of the University. King's College is undoubtedly cramped for space, and needs room for expansion; its removal is advocated. University College, on the other hand, has fine and permanent buildings; it occupies a site approaching seven acres, while immediately to the south of it, and lying between it and the British Museum, there is an area of some nine acres—or, if roads be included, of some eleven acres—that could, it appears, be acquired for the development of the University. It has been suggested that here could be placed new buildings for King's College, for the administrative offices, for the great hall of the University, and for students' clubs and societies. Here, at least, could be the beginning of a "university quarter" in the real sense of the word, starting with an area of between fifteen and sixteen acres of land: here, too, are possibilities for expansion and development.

In these two colleges all the faculties except that of music are represented, and they may be appropriately associated in a University quarter. The scheme of the Commissioners provides also for the establishment of "constituent colleges" in other parts of London. The report suggests the incorporation of Bedford College and the East London College, and in a special way that of the Imperial College. With regard to this, there seems to be some doubt as to the practicability of the details of the scheme proposed. The Commission suggests the formation of a "committee for technology," which shall at the same time be the delegacy of the Imperial College and the coordinating authority for technology throughout the University; but there is a feeling that these two functions should be kept separate, and committed to different authorities. The idea of a committee, or council, for technology coordinating the technological work throughout the University, and keeping it in touch with the representatives of the great industries, is, however, a sound one.

In conclusion, then, it seems to us that the action of the Minister of Education should lead to a solution of this long-standing problem. It is time that it should be solved. We cannot think that the question of the external degree ought to be allowed to stand in the way of providing London with the University that the capital of

the Empire requires. It may be, and we are inclined to think that it is, necesary that the external degree should be continued and maintained. It ought to be easy to devise a machinery for doing this that is not inconsistent and incompatible with the ideals laid down by the Commissioners.

All those concerned in the work of higher education in London—and, indeed, in the country generally—should combine to help in this scheme. There must be give and take. The incorporation principle already adopted by University and King's Colleges was in itself a surrender of autonomy, and other institutons must be prepared to make similar sacrifices if the University is to be a reality. The Minister puts this point well when he says, "Some acquiescence or even sacrifice on individual points will be necessary for all concerned if a scheme worth having is to be carried out."

THE PLUMAGE BILL.

IN the great question of fauna preservation the newspaper-reading public is at present occupied with the section concerning birds. It is announced by the Royal Society for the Protection of Birds that Mr. Hobhouse will, when Parliament reassembles, bring forward a Bill for restricting the import of plumage into the United Kingdom, and that this Bill will be backed by the President of the Board of Trade and the Under Secretary for India. In its monthly journal, the aforesaid society publishes what purports to be the text of this Bill. It is a very mildly worded measure which will not satisfy root-and-branch reformers, for it exempts from supervision personal clothing worn or imported by individuals entering this country from abroad. Consequently—unless I totally misunderstand the drift of the Bill—worded, like all Bills, with as much legal obscurity as possible—a woman resolved to have headdresses and robes of forbidden plumage has only to purchase such abroad and stick it into her apparel or her hat, and she passes our Customs houses unchallenged. If my reading is correct, then the results of this Bill will be very slight in stopping the destruction of rare and beautiful wild birds in the British dominions and the colonial empires of France and Holland. But I agree with the R.S.P.B. in welcoming any legislation rather than none, as the thin end of the wedge. We must remember that the first anti-slave trade measure (fought and delayed for many years by spiritual ancestors of the type of plumage-trading firms) was a poor and ineffective thing. But as soon as its justification was grasped by the public it was reinforced by much more drastic legislation.

Mr. James Buckland is quite right to direct attention in vigorous language to the disgraceful amount of beautiful-bird destruction which is going on in Nipal. This quasi-independent Himalayan State has—unhappily—been placed by fate in charge of the most interesting faunistic region of Asia, a country not many years ago famous for the variety and superb beauty of its harmless bird life, notably its pheasants. Originally the Nipalese respected almost religiously the fauna of their native land, like most Indian peoples. But of late they have become infected with a truly British love of life-destruction. They are incited to this by the agents of the plumage trade at Calcutta and other places, and, of course, find it a lucrative business. As in all things but foreign relations we acknowledge the state of Nipal to be an absolutely independent kingdom, it is permitted to import and export goods through British India under its own Customs' seals, intact and unquestioned.

Consequently, though the laws of British India forbid on paper the export of wild birds' plumes or skins, the State of Nipal monthly exports from Calcutta to the feather markets of the world—principally London—thousands of bird skins. The Nipalese have nearly exterminated the Monal pheasant, the Tragopan, and several other gallinaceous marvels. The few people who know and protest on this side are told that Nipal is an independent state and cannot be coerced. But there is no need for coercion. We regulate with Nipal the arms traffic and the opium traffic, and we can easily add to the list of prohibited traffics that in the plumage of rare birds or the skins and trophies of rare mammals. The Nipalese Government, after all, is civilised and can easily be brought to understand that we make our request in the interests of Nipal itself. We have many ways of obliging and disobliging Nipal without resorting to "coercion" in what is really—rightly viewed—a matter of religion.

But of course the weakness of our case and cause is that the present Cabinet—and past Cabinets—and all our Government departments care little or nothing about fauna preservation. They, owing to the faulty education of their component personalities in the preceding century, are unable to view the question from its æsthetic as well as its economic point of view. Consequently few of our London-governed colonies have adequate bird-preservation regulations; while the whole attitude of British India and Burma towards its wonderful and fast-disappearing fauna is one of the scandals of the age. If it were not that the Native States of the Indian Empire have and enforce, so far as they dare, game preservation and bird preservation laws, the Indian peninsula would be now almost lacking in all the more noteworthy types of wild bird and beast. The game regulations drafted by the Viceroy-in-Council for British India were published last year by our own Zoological Society, and forthwith so laughed at for their inadequacy and old-fashioned "game-preserving" character, that they seemingly found their way into the waste-paper basket. At any rate, no far-reaching regulations for fauna preservation have since been published and put in force.

Let scientific men take a broad and lofty view of this question of fauna preservation. Why should any beasts or birds not actively harmful to man or man's interests be killed, except where

they are required to provide palatable food for hungry humanity? Why should any more ibexes, markhur, deer, wild sheep, antelope, bear, and such like wonders of creation be destroyed in India, at any rate till by increase in numbers they are prejudicial to the agriculturist? Why should they be killed merely to provide trophies for British officers or tourists, when their life-history is of profound interest and can be studied through the camera, and their presence in the landscape is a source of delight to the eye? Why, similarly, should *any* beautiful birds that are not harmful to crops be killed anywhere for the ridiculous purpose of adorning already-sufficiently-adorned woman? We would-be bird preservers do not object to the unlimited use of ostrich plumes, because such use is supported by the domestication of the ostrich; we do not include the eider duck on our prohibition lists because its down feathers can be obtained without killing the producer; we do not refuse to the trade or the lover of beautiful objects the plumage of several kinds of duck and pheasant, because such can be obtained without bringing these particular types of bird near to extinction. In short, there is enough plumage in quantity and variety to supply all the needs of milliners, dress-makers-and-wearers, upholsterers, and even the purveyors of artificial flies for fly-fishing, without trenching on the rare and specially marvellous birds of the world, or the birds that are of incalculable use as insect destroyers and guano producers.

The apologists of the trade in forbidden birds' skins, or the defenders of the unchecked slaughter of interesting mammals by the rifle, are of a sadly limited type of mentality, so limited that an educated naturalist is not on the same mental plane. Though he can easily parry their arguments, he cannot get them to understand his. But perhaps the foes of Mr. James Buckland who attend to harass him at his lectures are, together with their salesmen-colleagues at London auctions, remarkable beyond others of their class for their want of knowledge of the article they trade in and the local methods of their trade. They do not know for the most part the right name in English or Latin or the approximate habitat of the birds they deal in. As to how the skins are procured, they probably only know that they bought them in Antwerp, Paris, Havre, Amsterdam, Bordeaux, Marseilles, Trieste, Port Said, Calcutta, or Port-of-Spain. They have no knowledge of and no responsibility for the actual half-caste or native agents who do most of the killing or snaring. Occasionally, some specially important firm undertakes a commission for a rich curio-collecting client, and sends out an agent to some distant region to get into touch with the native hunters, but such a firm would scarcely take as much trouble over the bulk of its business—the supply of the millinery houses.

As an illustration of the foregoing remarks, I should like to insert a passage from the writings of Mr. W. Emery Stark, which appeared a few months ago in *The Times of Ceylon*:—

The Trade in Birds of Paradise.

The Papuans (of Dutch New Guinea) are engaged by the traders to act as "hunters." The season, which begins in April, lasts for six months, and for the remaining six months of every year the Papuan spends his time in paddling about, and his money in buying ornaments and luxuries. There is a regular and well-organised trade in birds of paradise. The centre of the trade is at Ternate, where the traders live, and from where they start every year in March for New Guinea. The traders are chiefly Chinese, but there are two or three Dutch trading companies. The Government issue licences for hunting at 25 guilders, or about 2*l.* a gun, and, in addition, the Government charge a heavy export duty on the birds. This year there were 4000 applications for licences, of which 1870 were granted, and one trading company alone secured 240 licences. The traders engage the natives as "hunters," paying the licence and finding guns and ammunition. Each "hunter" is expected to bring in for the season 20 skins of the "great bird of paradise" and 50 to 60 of the ordinary and less valuable sort. The former command at their first price from 1000 to 1200 guilders, or roughly 100*l.* per "corge," *i.e.* 20 birds. In the home market a "corge" realises from 150*l.* to 170*l.*, and a single bird of extra fine plumage has been known to fetch as much as 40*l.* or more. A rough calculation of the 1870 licences issued this year, show that they are likely to result in the production of about 200,000 skins.

I wish the Government had received a steadier backing in the matter of fauna-preservation from the Zoological Society and the British Ornithologists' Union. The attitude of the latter seems to be that so long as museum shelves are stuffed with specimens, birds may be in the landscape or not. The last thing I desire to do is to fetter the researches of professional science. But I would remind fellow ornithologists that it is not only the skin of the bird for classification that is needed, but still more the bones, the muscles, and the viscera, and the living creature itself. This is not the material supplied by the trade collector. Yet, as a concrete example, look at the remarkable deductions in biology which have followed the illustration of the cæca and intestinal tracts in birds and mammals by Dr. Chalmers Mitchell; or the work of A. H. Garrod and F. E. Beddard in myology and windpipes. It is this material which is wanted by the biologist more than an endless multiplication of empty skins—this and the life-study through the camera and the note-book; and all such food for systematists and expounders of the New Bible could be supplied by game-wardens and those who should be placed in control of the wild fauna of our dominions.

H. H. JOHNSTON.

Since the foregoing article was written, there has been placed in my hands a copy of a Government notice recently issued in Egypt—we may be sure not without Lord Kitchener's knowledge and approval—referring to the shooting of animals. Lord Kitchener is no sentimentalist; but alike in his reports and his acts he has continuously used his influence for the preservation of bird-life in Egypt.

NOTES.

THE council of the British Association, acting under authority of the general committee, has made the following grants out of the gift of 10,000*l.* made to the association for scientific purposes by Sir J. K. Caird at the Dundee meeting of the association last year:—(1) 500*l.* to the committee on radio-telegraphic investigations; (2) an annual grant of 100*l.* to the committee on seismological investigations, which is carrying on the work of the late Prof. John Milne, F.R.S.; (3) an annual grant of 100*l.* to the committee appointed to select and assist investigators to carry on work at the zoological station at Naples; (4) 250*l.* towards the cost of the magnetic re-survey of the British Isles, which has been undertaken by the Royal Society and the British Association in collaboration.

FOR the Australian meeting of the British Association in August next year, under the presidency of Prof. W. Bateson, F.R.S., the following presidents of sections have been appointed:—A (Mathematics and Physics), Prof. F. T. Trouton, F.R.S.; B (Chemistry), Prof. W. J. Pope, F.R.S.; C (Geology), Sir T. H. Holland, K.C.I.E., F.R.S.; D (Zoology), Prof. A. Dendy, F.R.S.; E (Geography), Sir C. P. Lucas, K.C.M.G.; F (Economics), Prof. E. C. K. Gonner; G (Engineering), Prof. E. G. Coker: H (Anthropology), Sir Everard im Thurn, K.C.M.G.; I (Physiology), Prof. C. J. Martin, F.R.S.; K (Botany), Prof. F. O. Bower, F.R.S.; L (Educational Science), Prof. J. Perry, F.R.S.; M (Agriculture), Mr. A. D. Hall, F.R.S.

SIR PHILIP WATTS, K.C.B., F.R.S., has received the Order of the Rising Sun (Second Class) from the Emperor of Japan.

THE Royal Society announces that the studentship on the foundation of the late Prof. Tyndall for scientific research on subjects tending to improve the conditions to which miners are subject has been awarded for the ensuing year to Mr. J. I. Graham, of Bentley Colliery, Doncaster, for an investigation into the cause of spontaneous combustion of coal, with special reference to gob-fires.

AT the annual general meeting of the Faraday Society, held on November 26, the following officers and council were elected to serve for the year 1913–14:—*President,* Sir Robert Hadfield, F.R.S.; *Vice-Presidents,* Dr. G. T. Beilby, F.R.S., Prof. K. Birkeland, W. R. Bousfield, K.C., Prof. Bertram Hopkinson, F.R.S., Prof. A. K. Huntington, Dr. T. Martin Lowry, and Alexander Siemens; *Treasurer,* Dr. F. Mollwo Perkin; *Council,* R. Belfield, Dr. H. Borns, W. R. Cooper, Prof. F. G. Donnan, F.R.S., Emil Hatschek, Dr. R. S. Hutton, Prof. A. W. Porter, F.R.S., E. H. Rayner, Dr. R. Seligman, and Maurice Solomon.

IT is proposed to establish a permanent memorial to the late Sir William White, K.C.B., F.R.S. The Institution of Civil Engineers, Institution of Mechanical Engineers, Institution of Naval Architects, Iron and Steel Institute, Royal Society of Arts, Institution of Engineers and Shipbuilders in Scotland, North-East Coast Institution of Engineers and Shipbuilders, Institute of Marine Engineers, and Institute of Metals, are supporting the scheme, and have invited their members to contribute. A general committee (under the chairmanship of Lord Brassey) has been formed representing the engineering profession, the Navy and Merchant Service, and some Government Departments. The form which the memorial is to take will depend upon the support which is given to the scheme. It is requested that all cheques be crossed "Coutts and Co.," and made payable to "The Sir William White Memorial Fund," and sent to Dr. J. H. T. Tudsbery (hon. treasurer), Institution of Civil Engineers, Great George Street, Westminster, S.W. The general committee is thoroughly representative, and includes the president of the Royal Society, and other well-known men of science. The fund already amounts to 1368*l.*

DR. R. T. GLAZEBROOK, director of the National Physical Laboratory, asks us to supplement the article on the British radium standard contributed to our columns last week by Prof. Rutherford, with a reference to the directions which have been issued for sending radium to the laboratory. In the case of radium it is necessary to be particularly careful as to its transmission. It is stated, therefore, in the circular describing the work undertaken by the laboratory, that anyone wishing to send radium for test must advise the laboratory of his intention at least one day previous to sending the specimen. The letter of advice should state approximately the value of the specimen and the method by which it is being sent. All communications and specimens should be addressed to the Director, the National Physical Laboratory, Teddington, Middlesex, and all packages containing specimens should be marked clearly, "R. Department." The laboratory takes no responsibility for the sample until it has actually arrived and a formal receipt acknowledging its arrival has been transmitted to the sender. Samples will be returned ordinarily by registered post, the sender being charged postage and registration fee.

IT has already been fully recognised that Capt. Scott's second Antarctic Expedition was better served in the department of photography than any of its predecessors. The public should therefore welcome the opportunity of inspecting some 150 enlargements of Mr. H. G. Ponting's exquisite photographs—and not the public alone, but those interested in zoology and the study of ice also. These photographs are on exhibition in the gallery of the Fine Art Society, 148 New Bond Street. Some of the ice photographs are of extraordinary beauty and interest, such as the illustration of pressure ridges (No. 81) and that of the cliffs of the Barne Glacier (No. 109). The studies of seals and penguins are wonderful, and must represent the result of infinite patience in securing them. Many of the photographs are known from lectures and the book of the expedition, but in their present form they allow of closer inspection and fuller appreciation. It need scarcely be said that the familiar figures of members of the expedition frequently appear, and add to the interest of the collection.

NEWS is to hand, through the Rome correspondent of *The Times*, of the successful initiation of the gravimetric, magnetic, meteorological, and aërological work of the Italian Expedition to the western Himalaya and Karakoram, under Dr. F. de Filippi. Preliminary observations were made and work done at the Royal Hydrographical Institute in Genoa, and, on arrival in India, at Simla and at Dehra Dun, the headquarters of the Indian Survey. The expedition has a wireless telegraphic equipment, and has already successfully made use of it for time signals, not only between Simla, Delhi, and Lahore, but also between Skardu, in Baltistan, and Lahore. This indicates the utility of this method for field work, even though the receiving station be situated near high mountains, and the determinations of differences of longitude based on these signals, together with latitude observations, will enable observations to be made for the deviation of the plumb-line. When the expedition is at work in districts previously unworked, these signals, if equally successful, will be of high value. The investigation of the upper atmosphere has been begun by means of balloons and theodolite observations on them. A station has been established on the Deosai plateau at a height of 14,000 ft., where pendulum and magnetic work will be done, and solar radiation investigated. Geological excursions are also being made. The expedition will winter, carrying on such work as is possible, at Skardu.

A SUMMARY of the weather for the past autumn, issued by the Meteorological Office, shows the peculiarities of the season. The mildness of the weather was the chief peculiarity, and the quiet character of the wind and absence of gales was very striking considering that the temperature was so persistently high, due solely to the prevalence of southerly and south-westerly winds from the Atlantic. The mean temperature for the whole period of the three months —September, October, and November—was 4° in excess of the average in the east of England and in the midland counties, and it was 2° or 3° in excess of the average in all other districts of the United Kingdom. The maximum temperature was 79° in the north-east and north-west of England, and in the midland counties, and the minimum temperature was 22° in the midland counties and in the east of Scotland. The rainfall was in excess of the average in Ireland and over England, except in the north-eastern and north-western districts. The largest rainfall was 14·71 in. in the north of Scotland, and the least fall in any district was 6·58 in. in the north-east of England. The highest percentage of rain was 129 per cent. of the average in the south of Ireland, and in the south-east of England the aggregate rainfall was 119 per cent. of the average. In the east of Scotland the rain was only 78 per cent. of the average, and in the west of Scotland 80 per cent. In the midland counties the rainfall was 110 per cent. of the average, and in the east of England 106 per cent. The rainy days were in excess of the average in England and Ireland. The duration of bright sunshine was generally in fair agreement with the normal. At Greenwich the mean temperature for the autumn was 54°, which is 3° above the average. There were seventy days out of ninety-one with the temperature above the average, and frost occurred on only one day. The bright sunshine was seventy hours more than the average.

THE annual general meeting of the Royal Agricultural Society of England was held on December 10 at the Royal Agricultural Hall, Islington. From the report of the council of the society presented on this occasion we notice that the work at the Woburn Experimental Station continues to expand. This has so far been recognised that a grant of 500*l*. was made during the year from the Development Fund in aid of the experimental and research work carried on. As regards the field experiments, in addition to those on continuous wheat barley, the rotation and green-manuring experiments have been further carried on, as well as work on varieties of oats, varieties of lucerne, clover, and grass mixtures, linseed, soya bean, &c. At the pot-culture station, in addition to a continuation of the work on lime and magnesia, the principal fresh research was on the action of copper, zinc, and manganese salts on the wheat plant, and of lithium salts on tomatoes. The practical demonstration of the eradication of wild onion by the growing of deep-rooting grasses and plants was clearly shown at Chelsing, Herts, the results of the system adopted being this year very marked. During the year 196 complete analyses, that is for purity and germinating capacity, and seventy-four rough analyses and comparisons of bulks with samples, were made. Eight prescriptions for mixtures for the formation of permanent pasture were drawn up, and three analyses of mixtures made. One of these mixtures, said to be a cheap one, was found to contain about 1 per cent. of seeds useful for the purpose, the remaining being weeds and the screenings of a wheat crop. The experiments which were begun at Woburn early in 1911 for the purpose of demonstrating that by means of isolation it is possible to rear healthy stock from tuberculous parents have been brought to a close. One of the experimental animals was killed in December last and the others in the course of the present year. After slaughter a searching post-mortem examination was made, but no evidence of tuberculosis was found in any case. A full account of the experiments will be published later.

PHYSICAL anthropologists are unwearied in their search for anatomical characteristics which may serve as tests of race. The last essay of this kind is that of Mme. Bertha de Vriese, under the title of "La signification morphologique de la rotule basée sur des recherches anthropologiques," published in *Bulletins et Mémoires de la Société d'Anthropolgie de Paris* (6th series, parts 3–4), in which the writer has collected numerous measurements of the patella among various races. The article commends itself as an important contribution to comparative anatomy.

IN the November issue of *Man* Mr. J. W. Scott Macfie describes a collection of curiously carved wooden staves from West Africa. They are used in the cult of Shongo, god of thunder and light-

ning. Childless women pray to Shongo for offspring, and when a son is born he is dedicated to the god. He is taken to the shrine, a ram is sacrificed, and the boy is given a staff, with directions to keep silent for a period which may extend to three months. Adults also carry these staves, and make a vow of silence for recovery of health. In the course of this rite, the patient pours the blood of a sacrificed ram on some stone celts, believed to be thunderbolts sent by Shongo. A smaller variety of staff is kept in houses to represent Shongo. Sacrifices are made before them, and thus they are regarded as Ju-ju, or sacred, and the owners are very unwilling to part with them.

PALÆOLITHIC natural history forms the title of an interesting article by Mr. R. I. Pocock in *The Field* of November 29. It is illustrated by reproductions of prehistoric sketches of various animals, together with photographs of their nearest existing representatives.

TO Mr. A. E. Cameron, the author, we are indebted for a copy of a paper, published in the September issue of the Transactions of the Entomological Society, on the life-history of *Lonchoea chorea*, a fly which, in the larval stage, does a certain amount of damage to diseased beet crops.

MR. W. JUNK, the well-known Berlin publisher, announces the issue of a reprint of H. Loew's "Die Europaeischen Bohr-Fliegen (Trypetidæ)," at a subscription price of 6*l*., to be raised after publication to 7*l*. 10*s*. Although this fine folio was originally published so long ago as 1862, it is still the basis of our knowledge of this family of Diptera. The reproduction of the photographs will, it is stated, be superior to that in the original edition, in which the prints have become faded and stained. In another circular the same firm directs attention to the "Coleopterorum Catalogues," of which fifty-five parts have been already issued.

THE very remarkable vertebrate fauna of the Permo-Carboniferous beds of north-central New Mexico forms the subject of a fully illustrated memoir by Messrs. Case, Williston, and Mehl, issued, as Publication No. 181, by the Carnegie Institution of Washington. The species from this horizon at present identified include a shark akin to Pleuracanthus, five amphibians, and ten reptiles of a low, although in some cases specialised, type. The most remarkable of the amphibian remains is a skull described as a new genus and species under the name of *Chenoprosopus milleri*, the generic designation referring to the curious superficial resemblance of the specimen to the skull of a goose. The genus is believed to belong to the temnospondylous amphibians, in spite of certain indications of affinity with reptiles. Among undoubted reptiles special interest attaches to the restoration of the skeleton of the pelycosaurian described by O. C. Marsh as *Ophiacodon mirus*, on account of the enormous size of the skull as compared with that of the trunk. According to the figures, the shoulder and pectoral girdles of this and certain allied forms present a striking resemblance to the corresponding elements of African anomodonts.

IN the course of a lecture on zoological gardens delivered before the Royal Society of Arts on November 27, Dr. Chalmers Mitchell, secretary of the Zoological Society directed attention to the tastes of the general public in regard to establishments of this nature, pointing out that much greater interest is taken in watching the gambols and other habits of well-known animals than in observing rare species, or in contrasting one species with another. This, of course, is only natural, and as the members of the public supply the greater part of the funds by which menageries are maintained, it is only right and proper that their tastes should be consulted and catered for. Not that the lecturer was by any means unmindful of the scientific value of menageries. On the contrary, he pointed out that such establishments afford practically the only means of obtaining a knowledge of the comparative psychology of animals—a subject of which we are still profoundly ignorant. "I have no doubt," he observed, "if we made use of the opportunities that menageries can afford, that we should find groups differing in structure equally different in natural disposition, in mental and emotional quality, in the power of forming new habits, in the quality of their intelligence." Attention was also directed to the improvement in the condition of menagerie animals, and their increased longevity, as the result of the open-air treatment, as contrasted with the old "cossetting" system; while a considerable portion of the discourse was devoted to a description of the new "Mappin Terraces," and the "Caird Insect House," and the advantages which will accrue to the menagerie as a popular resort when the former are in full working order.

THE first number of *The Indian Journal of Medical Research*, published in July of this year, consists of more than 200 pages, with fourteen plates, and contains a number of important contributions. First in order is a memoir by Capt. W. S. Patton and Capt. F. W. Craig on certain hæmatophagous flies of the genus Musca. These are congeners of our common English house-fly, and, like it, have the proboscis soft and not adapted for piercing. Being unable, therefore, to puncture the skin of man or animals, they obtain the food they require, namely blood, by associating themselves with common biting flies, such as Stomoxys, Tabanidæ, &c. When one of these biting flies has put its proboscis through the skin the Musca approaches it, and will endeavour to thrust its proboscis into the wound, and to oust the first occupant. Sometimes several crowd round the same biter, and when they have succeeded in dislodging it, or when it has completed its meal, they suck up the blood from the wound. It is possible that these flies may play a rôle, hitherto overlooked, in the transmission of disease. Four species, two of them new, are described in detail with the help of excellent figures drawn by Mrs. Patton.

MAJOR H. G. J. DE LOTBINIÈRE has contributed to *The Quarterly Review* for October (No. 437) a concise and valuable paper on the principal forest resources of the world and the steps which have been taken in Britain and elsewhere to provide for the future. He points out that before many years the timber cut in Russia—our main source of supply, and the only important reserve left to draw upon—will

exceed the annual growth, so that exports will decline; that in the majority of other timber-producing countries the forests are, or soon will be, insufficient to meet the rising demand for local consumption; and that the only forest reserves of coniferous timber as yet untouched are in regions difficult of access, in Siberia, British Columbia, and the Andes. The position so far as this country is concerned is serious, but not yet hopeless, for Britain is admirably adapted for timber-growing, though it will take years of industry to bring the soil back to forest conditions. The author makes a number of timely and practical suggestions regarding the lines on which a scheme of afforestation for suitable portions of the sixteen million acres of mountainous and heath land in Britain should be prepared, and strongly urges the necessity for immediate action.

THE Journal of the Department of Agriculture of South Australia contains, amongst many interesting articles, brief reviews of the proceedings of the agricultural bureau meetings. The bureau, which possesses more than 150 branches, is essentially carried on to provide facilities for papers on subjects of agricultural interest being read by the farmer members, and to encourage mutual help. Without wishing to imply that the English farmer is endowed with these attributes for imparting and receiving information, as is his Australian cousin, it would appear natural that he should be prepared to attach more importance to advice obtained from a practical man than from a stranger in the form of an agricultural adviser. The adoption of farmers' bureaus in this country might be productive of much good work by stimulating the practical man to compare and to analyse variations in practice and profitability and to arouse greater interest in the daily routine.

AN interesting article by Mr. A. O. Walker, on weather fallacies, is contained in *Symons's Meteorological Magazine* for October and November, from experience gained as an observer for more than forty years. The first subject of attack is the Meteorological Office weather forecasts, but the criticisms do not imply any censure of the staff of that office, but are written from an agricultural point of view. Selecting two or three of the author's remarks: during hay harvest, *e.g.* a farmer wants to know what the weather will be two or three days *after the hay is cut*. Thunderstorms will occur independently of calculations as to exact time and place, and neighbouring stations are differently affected. Monthly averages of rainfall are often misleading; at Ulcombe (near Maidstone) for the years 1900–9 February had the lowest average, 1·62 in., and October the highest, 3·10 in. But in 1900 the two months changed places: October 1·76 in., and February 3·75 in., the wettest month of the year. Monthly mean temperatures are also apt to mislead, as they give little idea of the intensity of cold or warm spells. It is a common belief that temperature falls as height increases, within such limits as, for example, are found in south England; it is generally true as regards day temperature, but not as to night temperature. This is shown by the greater immunity of tender shrubs half-way up a hill from injury by frost compared with those at the foot. Snow is believed by some to have a special fertilising effect, but all that can be said of it is that in times of severe frost it protects the roots of plants.

THE *Journal de Physique* for October contains a paper by M. R. Détrait describing his researches on the slipping of liquids at the surfaces of solids. The accuracy with which the flow of a liquid through a capillary tube can be represented by the fourth power of the radius is a sufficient guarantee that at the velocities usual in such tubes the slip, if it exists at all, is small. To put the question to a severe test, M. Détrait has compared the times of flow of equal volumes of water and petrol through tubes of glass, which both liquids wet, and through tubes of sulphur, which the petrol alone wets. The experiments show that there is a measurable slip of a liquid past a solid it does not wet, which in the case of water flowing in a sulphur capillary tube leads to an excess flow equivalent to an increase of radius of the tube by about one-thousandth of a millimetre.

THE nature of the gases liberated by the autolysis of different organs and tissues forms the subject of a paper by Mr. F. Traetta Mosca in the *Gazzetta Chimica Italiana* (vol. xliii., ii., 144). Striking differences are shown by the different tissues, pointing to wide differences of enzymic activity; the liver, kidneys, brain, and suprarenal capsules liberate mixtures of carbon dioxide, nitrogen, and hydrogen in different proportions, whilst the intestines give in addition carbon monoxide and oxygen; from the pancreas, spleen, lung, and heart it is remarkable that nitrogen alone is evolved. In the majority of other cases also the relatively high proportion of nitrogen and hydrogen is a striking phenomenon of the protein degradation; thus in the case of autolysing calves' brain, 71·6 per cent. of the gas evolved consists of nitrogen and 22·4 per cent. of hydrogen, whilst from the suprarenal capsules 40 per cent. of the gas is nitrogen and 50·4 per cent. hydrogen.

THE Department of Mines of New South Wales has issued a pamphlet on mercury or quicksilver in New South Wales, with notes on its occurrence in other colonies and countries (Mineral Resources, No. 7), by J. E. Carne. The occurrence of mercury, in the native state or in the form of cinnabar, has been indicated in some ten localities, but the quantities produced hitherto are very small, one of the most favourable localities having yielded only about 10 cwt. of metal to the company which attempted for a time to exploit it. The general reader will, however, find that much interesting information has been brought together in the present report with reference to the production of mercury in other countries. An account is given of the wonderful mines at Almaden, in Spain, which are known to have yielded some four million flasks, or 140,000 tons of metal, whilst the Californian mines have given about half this quantity. It is pointed out that wet-concentration has proved useless, in spite of the high density of the mineral, and that efficient working of the ordinary low-grade ores (yielding 0·5 to 2 per cent. of mercury) is only to be effected by careful attention to economical

working of the furnaces; the gases must escape at the lowest temperature which will retain the mercury as vapour, and the hot spent ore must be used to heat the air-supply of the furnaces. As illustrating the difficulty of retaining the metal, it is mentioned that at the New Almaden mine in California, 2000 flasks (135,000 lb.) of mercury were taken from the ground under one of the furnaces, the metal having penetrated 27 ft. to bedrock.

The Engineer for December 5 contains an account of the motor ship *Arum*, launched last week from the yard of the builders, Messrs. Swan, Hunter and Wigham Richardsons, Ltd. This vessel is an addition to the comparatively small number of motor ships of which both hull and engines have been built in this country. Her dimensions are 360 ft. length over all, by 47 ft. beam, by 27 ft. moulded depth; she is to carry about 5600 tons dead weight on a draught of 21 ft. 6 in. The main engines, built by the same firm, consist of a pair of four-cylinder two-cycle reversible Diesel engines, designed for 1150 brake-horse-power at 135 revolutions per minute; the speed will be about 10·5 knots. The vessel has been built to the order of Sir Marcus Samuel for the carrying of general cargo, and is to trade to the Persian Gulf. Oil from the Persian oil wells is to be employed, a favourable ten years' contract having been secured for the supply of Sir Marcus Samuel's fleet.

AN illustrated article in *Engineering* for December 5 on the channel steamer *Paris* gives some up-to-date information regarding the development of geared turbines. Absence of wear, freedom from noise, durability, and low frictional loss have been achieved. The loss due to transmission and reduction with double helical wheels is under 2 per cent., whereas in the hydraulic and electrical systems it is quite five times as great. It has been contended that the windage loss in the running idle of the astern turbines partly nullifies this advantage; as the astern turbines revolve in the vacuum of the condenser, the losses for them amount to only 0·5 per cent. Accounting also for the loss due to the thrust-block associated with geared turbines, the mechanical gearing gives an efficiency of about 97 per cent. as compared with about 90 per cent. in other systems. In the *Paris*, the power transmitted through two gear-wheels is 14,000 shaft-horse-power. It is but four years since the first use of such gearing, and to-day there are 435,450 horse-power completed or under construction.

THE 1913 issue of "The Year-Book of the Scientific and Learned Societies of Great Britain and Ireland" has been published by Messrs. Charles Griffin and Co., Ltd., at the price of 7*s*. 6*d*. It will be remembered this useful annual publication is compiled from official sources, and it is appropriately described on the title-page as a record of the work done in science, literature, and art during the session 1912–13 by numerous societies and Government institutions. We notice in the case of the British Association that though particulars are given of the meeting held at Dundee in September, 1912, no information about the Birmingham meeting of September last is included.

OUR ASTRONOMICAL COLUMN.

THE STRUCTURE OF THE UNIVERSE.—The November issue of *Scientia* contains an article by Prof. J. C. Kapteyn, entitled "On the Structure of the Universe," which should be read by all those who wish to obtain the most modern view of this most fascinating problem. It was Prof. Kapteyn who, in 1904, first determined the elements of the two star streams, and since then a great advance has been made in extending our knowledge in this direction. In the present article, and, it may be added, it is written in a very clear and concise manner, he places before the reader the general nature of the problem, and step by step he points out how the various researches of many observers are coordinated and brought to bear in concentrated form on the question of the structure of the universe. The subject being so vast, he confines himself here mainly to that portion concerned with star-streaming, and considers the questions, What has the discovery of star-streaming done, and, What does it promise to do for the solution of the problems (1) that of the distance, and (2) that of the history or evolution of the stellar system. Prof. Kapteyn utilises a modified form of Secchi's stellar classification, and states that there is much evidence to show that this classification is a natural one, and that the order of evolution is as follows:—The helium stars being those of recent birth, while we come to older and older stars in passing from the helium stars to the stars of the first, then to those of the second, and finally to those of the third type.

In speaking of the spectra of such groups of stars as the Hyades, Pleiades, Ursa Major group, &c., he says:—"The groups that do not now contain any helium stars must have contained them formerly in great numbers. Going back in time still further, these helium stars must have been generated from some other matter, probably nebulous matter. Therefore in a remote past the groups of the Hyades and Ursa Major must have been full of nebula. So far as I know there is no trace of nebulosity now. So there must have been an epoch in the past that nebulous matter was exhausted, had probably all gone to the formation of stars."

JOURNAL OF THE ROYAL ASTRONOMICAL SOCIETY OF CANADA.—In the September to October number of the Journal of the R.A.S. of Canada, Mr. H. B. Collier writes on meteorites, and after giving a brief summary of early falls, he refers in greater detail to the "Cape York" meteorites brought by Peary from Greenland, and to the "Williamette" meteorite found nineteen miles south of Portland, Oregon. A very excellent translation from *Ciel et Terre* of a most interesting article by G. van Biesbroeck on the astronomical works of Olaus Roemer, the discoverer of the velocity of the transmission of light, is printed. The fire at Copenhagen in 1728 destroyed most of Roemer's manuscripts, but a portfolio bearing the inscription "*Adversaria*," survived, and has recently been published by the Danish Society of Sciences. Valuable historical facts were contained in it, and are here described. The subject of the boundary survey between Canada and the United States east of the St. Lawrence is dealt with by Mr. T. Fawcett, and he describes the part Airy took in the arrangements for the carrying out of the necessary astronomical work which such a survey demanded. A description is also given of the methods employed on that occasion (1842) by the British and American parties.

NEW NEBULÆ AND VARIABLE STARS.—In No. 4697 of the *Astronomische Nachrichten*, Mr. C. R. D'Esterre describes an object the abnormal behaviour

of which marks it as one of exceptional interest. He describes it as a new variable star or nova, and its positions for two epochs were (1855), R.A. 22h. 56·3m., dec. +58° 52′; (1900), 22h. 58·1+59° 6·3′. The long period of brightness of the star and rapid decline suggest, as he says, that "we may be dealing with the later stages in the history of a nova." Two charts taken on September 3, 1911, and August 25, 1913, exhibit marked changes in its magnitude. The same writer directs attention to some new nebulæ in the region of I Cassiopeiæ. Dr. R. Furuhjelm, of the Helsingfors Observatory, describes two new variables, both of which have amplitudes of at least three magnitudes. He proposes to continue to observe these objects to secure correct determinations of their periods.

WATTS'S INDEX OF SPECTRA.—Yet another series of appendices to this most valuable compilation of wavelength data has been commenced by the publication of Appendix V. This part begins with the spectrum of the electric spark in air and extends to that of chlorine. The additions include measures of the spectra of the elements Aldebaranium, Cassiopeium, and Beryllium (band spectrum). Among spectra of compounds Olmsted's data for calcium hydride and Fowler's carbon oxide spectra find a place. Perhaps it is not too late to make the suggestion that the policy of giving, in the briefest possible manner, an indication of the contents of the papers referred to be extended to include all references in forthcoming appendices.

SECULAR DESICCATION OF THE EARTH.

ON Monday, December 8, Prof. J. W. Gregory read a paper before the Royal Geographical Society, entitled "Is the Earth Drying Up?" The question is naturally one to which a definite affirmative or negative answer cannot be given owing to the relatively short period during which exact scientific measurements of precipitation have been made. The evidence is principally archæological, botanical, and geological, supplemented for some countries by historic records of population. Prof. Gregory put before the society the views of different investigators, and subjected them to a critical examination, confining himself to changes in historical times, and making no pretence at dealing with the great changes of climate of geological epochs, other than to indicate the glaciers of north-west Europe as the probable cause of the moister Mediterranean climate of prehistoric times.

There are, roughly speaking, three forms of the desiccation theory. Prince Kropotkin maintains that there is a world-wide tendency towards drought. Prof. Ellsworth Huntington believes that the most important changes are pulsatory, the climate being now drier, now moister, but in the long run becoming generally drier. Mr. R. Thirlmere holds that the climate varies in great cycles, each of which may extend over 2000 years or more, and that we are at present in a cooling world. Prof. Gregory examined the evidence from different countries in its bearing on these theories, and showed the results of his examination on a map, from which it appears that there has probably been desiccation in historic times in Central Asia, Arabia, Mexico, and South America; increased precipitation in the United States of America, Greenland, Sweden, Roumania, and Nigeria, and no appreciable change in Palestine, northern Africa, China, Australia, and by the Caspian Sea. He deduces that, though there may be local variations, there is no progressive world-wide change to support the theory of a universal drought. *A priori* it might be affirmed that no appreciable universal change could occur without a corresponding considerable change in the distribution of land and water, or in the intensity of solar radiation. The changes in the former have been small in historic times, and though no direct evidence of solar intensity is available, the records of temperature and of plant life indicate that its fluctuations are probably confined to the short period variations found by the observers of the Smithsonian Astrophysical Observatory.

The strongest support for the desiccation theory is derived from Central Asia, where the evidence, though not conclusive, largely owing to the alternative explanation of blown sand, is sufficiently convincing to have won over the majority of the travellers who have visited that region. E. G.

ASTRONOMY IN SOUTH AFRICA.

A VERY interesting address was given by Dr. A. W. Roberts, as president of the South African Association for the Advancement of Science, at Lourenço Marques on July 7. Dr. Roberts dwelt for the main part on the progress made in astronomy by South African workers during the past century, but he claims pardon for omissions when such a large scope of work has to be considered. He sums up the work of astronomical science in late years as circling round three great problems, namely the distance of the stars, the movements of the stars, and the structure and evolution of the stars. These three lines, he points out, all converge in one great question, namely the constitution, history, and cosmography of the universe as a whole. In reading his address, which is published in *The South African Journal of Science* (vol. x., No. 2, October) one is struck by the great part that has been played by astronomers in South Africa. To use the president's own words:—"It was at the Cape that a sounding line was first thrown across the stellar space. It was at the Cape that the idea of stellar photography was born, grew up, and reached maturity. It was at the Cape, or perhaps by the results obtained at the Cape, that the first vision was got of those wonderful streams of stars that sweep majestically through our universe. It was at the Cape that the classical distance of the sun was reached . . . that the first accurate parallax of the moon, and, later on, its weight, was determined . . . that the most refined measures of stellar distance have been secured." Dr. Roberts tells the story of how—twenty years ago—he had in purpose the determination of the position of the solar apex from the proper motions in Stone's catalogue. "I went," he said, "over my postulates with Gill, and was vehemently assured I was basing my equations on wrong premises. 'How do you know that the stars move haphazard?' he demanded. I did not know! 'They may be moving in streams; the whole universe may be a big whirlpool!'" The record of the past work of South Africa in astronomy is great, and a high standard has been set for the present and future astronomers there.

THE ORIGIN OF ARGENTINE HORSES.

IN the *Anales* of the Buenos Aires Museum for 1912 (vol. xii.) Señor Cardoso adduced evidence to show that the story of the origin of Argentine horses from Spanish horses imported by Don Pedro de Mendoza in 1535 or 1536 is a myth, and that the former are really descended from the Pleistocene *Equus rectidens* and *E. curvidens*, and existed in the interior of the country at the time of the Spanish conquest. This opinion is disputed in the *Revue générale des Sciences* of October 15 by Dr. Trouessart, who points out that the statement of wild horses having been seen by Sebastian Cabot in 1531 is based on the figure of a

horse introduced by that navigator in a map of the world in the region now known as Argentina. This, it is urged, is no evidence at all, but merely an indication that the country was suitable for horses. Historical evidence is cited to prove that horses were unknown to the Indians of Mexico, Panama, Peru, and Brazil at the time of the visits of Columbus (1498 and 1502), and of the opening up of the country by his successors. It is then shown that there is a hiatus between the beds containing remains of *E. rectidens* and those with bones of modern horses, while it is argued that the ancient indigenous perissodactyles became extinct as the result of climatic and other physical changes. That the historical evidence in the case of the countries mentioned is decisive may be admitted, but the statements of Señor Cardoso with regard to the existence of large numbers of horses in Argentina in 1580 and the lack of fear of these animals exhibited by the Indians, as well as certain structural peculiarities alleged to be peculiar to Argentine horses and *E. rectidens*, are not referred to by Dr. Trouessart, who had not seen the original paper when writing his own article. A summary of Señor Cardoso's views will be found in *The Field* of July 20, 1912.

FRENCH HYDROLOGY.[1]

THE operations of the French Hydrological Service in the Alps have been so often the subject of notice in these columns that the issue of a fresh volume (tome vi.), bringing the record of results down to the end of the year 1911 for the service in the southern region, does not appear to call for more than passing notice. As is customary, the volume, which is mainly devoted to numerical tables of discharges and other statistical information, commences with a brief description of certain special features in regard to methods of gauging and their adaptation to local conditions. This is followed by a chapter of explanatory remarks on the longitudinal sections and levels contained in the annexe—a case of forty-three plates.

Somewhat fresher ground is opened out by the first volume relating to operations of the same service in the Pyrenees, and detailing the results obtained in the basin of the Adour. In a brief, but very effective, *résumé* of the circumstances which preceded and led up to the establishment of the hydrological service in the south-west, M. Tavernier, who is in charge of this section of the work, records that the hydrology of the Pyrenees has been in the past the subject of greater research and more numerous observations than that of the Alps; and he adds that, while the material thus accumulated is fairly plentiful, it has brought with it the attendant difficulty of its evaluation and coordination, so as to admit of its utilisation in connection with future operations, which are naturally destined to be of a more precise and systematic character. He narrates, in seven successive subsections, the progress of investigation and the nature of the observations made before the inauguration of the departmental service of the Ministry of Agriculture, dating back to a period anterior to the year 1850, and including the records of certain services specially formed, from time to time, to study the phenomena of floods.

When he comes to discuss the relative merits of the regimen of the watershed of the Pyrenees and that of the Provençal Alps, he has some interesting remarks to make on the importance of lakes, which may be rendered as follows:—

The true wealth of the Pyrenees is to be found in close proximity to the summits, where numerous lakes exist, and where artificial reservoirs can be formed. It is quite otherwise in the Provençal Alps, where lakes are scarcely to be found, and where reservoir basins are rare. The lakes of the Pyrenees replace advantageously the glaciers of the Alps, since, in the former case, the outflow can be regulated to meet requirements, whereas the discharges arising from the melting of glaciers are intermittent and irregular, often proving a source of inconvenience because they cannot be controlled.

The second volume of this series is purely statistical and diagrammatic, and deals with the results obtained in the basin of the Garonne down to the end of 1910.

B. C.

[1] Ministère de l'Agriculture: Direction générale des eaux et forêts. Service des grandes forces hydrauliques. (*a*) Région des Alpes: Compte rendu et résultats, Tome vi. et Annexe (nivellements), 1913. (*b*) Région du Sud-Ouest: Comptes rendus et résultats obtenus. Tomes 1 et 2, 1912.

ECONOMIC GEOLOGY OF PAPUA.[1]

THE Commonwealth of Australia has begun the issue of "The Bulletin of the Territory of Papua," of which the first number consists of a valuable report by Mr. J. E. Carne, of the Geological Survey of New South Wales, on the coal, petroleum, and copper ores of part of British New Guinea. Mr. Carne visited the district to the north of the Gulf of Papua in 1912 in order to investigate the value of the coal discovered on the Purari River near the northern foot of Mt. Favenc. The coal proved to be only a brown coal of Cainozoic age, and Mr. Carne regards it as of no present economic value. He visited the Vailala River to inspect a series of gas springs, of which the first was discovered by G. A. Thomas at Opa in 1911. Mr. Carne's samples from these gas springs have been analysed by Mr. Mingaye, who shows that they contain petroleum. The discharge of natural gas is in sufficient quantity to indicate the probable occurrence of considerable supplies of oil in the underlying beds, and Mr. Carne regards the geological conditions as so promising that he recommends the prospecting of the area by adequate boring.

In discussing the relations of this oilfield he gives a valuable summary of the present stage of development of the New Zealand oilfields, and the most recent information regarding the gas well at Roma, in Queensland, and of that at Grafton, in New South Wales. Mr. Carne also visited the Astrolabe copper field to the east-north-east of Port Moresby. Only three of the ore occurrences there were available for inspection at his visit, and mining in the field is at present dormant. Mr. Carne, however, regards the prospects of the field as encouraging, though no final opinion can be formed without further prospecting. His account of one or two of the mines indicate that there are considerable bodies of low-grade ores available. Mr. Carne's memoir contains full references to the earlier literature on the economic geology of the districts visited, and it forms a valuable contribution to the geology of New Guinea.

METEOROLOGY AND GEOPHYSICS AT THE BRITISH ASSOCIATION.

A MOST important contribution was made by Mr. J. I. Craig, who was unfortunately unable to be present at the meeting. The abnormal warmth of 1911 in Europe prompted Sir Edward Fry to ask in NATURE if the phenomenon was world-wide. Mr. Craig was able to reply for Egypt in the negative, inasmuch as the summer there had been cooler than usual, but he was struck by the definiteness of the opposition, and began to investigate the relation between temperatures in Egypt and south west England, based on values for the past thirty-four years. He found that the departures from the normal in the two

[1] J. E. Carne: Notes on the Occurrence of Coal, Petroleum, and Copper in Papua. Bulletin of the Territory of Papua, No. 1, 1913, viii. Pp. 116+xxix plates+3 sections+1 map.

countries were in opposite directions in all seasons, as indicated by the correlation coefficient, but the results were much more definite for the first and last quarters of the year, when the values of r were -0.72 and -0.43 respectively. Mr. Craig then proceeded to calculate the values of r between Egypt and other European stations, and by using the values found he drew *lines of equal correlation*. A little thought shows what a powerful method he has inaugurated for dealing with the problem of centres of action and for localising the centres in a definite manner. It will be for each country in the future to work out the monthly or seasonal iso-correlational lines with itself as base, and to use the charts obtained in determining what information will be useful to it in making its own seasonal forecasts.

Mr. E. Gold and Mr. F. J. W. Whipple showed some curves of frequency of temperature for Kew and Valencia Observatories, which exhibited a double maximum in the annual curve. Roughly speaking, the year may be divided as regards temperature into three seasons, winter, summer, and equinoctial, each season including four months. If the temperature of a particular day of the year were always the same in different years, we should get a relatively large number of warm days at the time of the summer maximum, when temperature changes but slowly from day to day and of cold days at the time of the winter minimum. Actually, the temperature of a particular day of the year varies considerably, and the result is that the temperatures occurring most frequently are not the extremes, but are closer to the mean, and it may happen that they meet and give one single temperature of most frequent occurrence if the annual variation is small enough compared with the variability of a particular day. It may be noted for places similar to Kew in their temperature variations, that in order to experience the largest number of days of temperature 60° F., say, it is necessary to select a place with a mean maximum temperature, either 4° or 5° above 60° F. or 4° or 5° below 60° F.

Dr. J. S. Owens discussed the conditions to be fulfilled by an approved method of measuring atmospheric pollution, and considered in turn nine different methods, none of which were entirely free from objection. One of the simplest, that of collecting the deposit from the atmosphere in a gauge of known area, has been adopted by the Committee for the Investigation of Atmospheric Pollution.

Dr. Vaughan Cornish described a simple method of determining the period of waves at sea by observing the interval between the times when a patch of spent foam is on the crest of successive waves. The method appears to be an excellent one, and ought to be brought to the notice of marine meteorologists, but it is desirable that observations should be made, in connection with the method, to determine what correction is necessary owing to the effect of wind on the foam.

Prof. H. H. Turner, in presenting the report of the seismological committee, referred to the great loss which seismology had sustained through the death of Prof. Milne, who had invariably given some account of the year's work and progress at the annual meeting of the association ever since the committee was formed nearly twenty years ago. Since his death the committee had had an anxious time; it was agreed that the work must be carried on, and the committee had decided that for the present it could not do better than arrange for the collection and discussion of records to be carried on at Shide so far as possible without alteration. Mr. J. J. Shaw, who gave a description of his instrument which was working in the basement of the building, had succeeded in making a satisfactory damping arrangement for the Milne seismograph; this removed the most serious objection which had been raised to the Milne instrument, and it was hoped that the network of stations reporting to Shide would be able to add a "damped" instrument to their equipment.

The Rev. H. V. Gill, S.J., read a paper on the distribution of earthquakes in space and time. He concluded that at least 60 per cent. of recorded earthquakes were associated with others in their neighbourhood.

The Rev. W. O'Leary, S.J., discussed the sources of disturbance of seismometers which are especially sensitive to convection currents. A statement that certain periodic variations were due to the beating of the waves on the west coast of Ireland was challenged by Dr. Vaughan Cornish, who pointed out that the resultant effect of the waves on an irregular coast-line would not have the wave-period; it would probably not be periodic at all.

The Rev. A. L. Cortie, S.J., discussed the connection between sun-spots and terrestrial magnetic disturbances, and suggested that the equatorial rays of the solar corona might represent the stream lines of the solar influence, active in magnetic storms.

Dr. S. Chapman gave an account of an investigation into the periodic variations of magnetic force, by which he sought to test and extend Schuster's suggestion that the changes are due to the motion of ionised air across the vertical magnetic field. He dealt particularly with variations of lunar period, and found that he got eight complex curves for different phases of the moon, which could be resolved into a semi-diurnal variation, and a diurnal variation of which the epoch changed during the month—a change which he attributed to variation in the ionisation of the upper atmosphere due to the variation in the solar-hour angle.

In a joint meeting with Section E, important geodetic questions were discussed. An account of this discussion is given in the report of the proceedings of Section E.

On Monday the meteorologists and other cosmical physicists met together for the annual "meteorological luncheon," and taking to heart Sir Joseph Larmor's comment on the results achieved at the Mount Wilson Solar Observatory, that "if the meteorologists were not careful we should soon know more about the sun's atmosphere than we did about the earth's," the meteorologists accorded the place of principal guest to Prof. Hale's representative, Mr. C. E. St. John, who promised to remember them at his mountain shrine.

GEOGRAPHY AT THE BRITISH ASSOCIATION.

AT the conclusion of the president's address in Section E (Geography), Dr. W. S. Bruce presented his newly completed map of Prince Charles Foreland, Spitsbergen—an island of about 250 square miles, half of which is below the 100-foot contour line and one-fifth covered by glaciers. The rest consists of mountains and huge moraines. The height of Saddle Mount was fixed at 1406 ft., and the Devil's Thumb at 2602 ft. On a later day he gave an account of the economic resources of Spitsbergen, chief among which is an excellent steam coal bordering a splendid harbour, at present mined chiefly by Americans. In view of negotiations from Russia for the purchase of these coal measures, lying only fifty-three hours by cruiser from our coasts, he urged the immediate annexation of the island by the British Government.

Mr. I. N. Dracopoli described his journey across

Jubaland to the Lorian Swamp, and Dr. C. A. Hill the exploration of the limestone caverns of Gaping Ghyll, in Yorkshire.

Friday morning was devoted to local geography. After Miss C. A. Simpson's paper, which dealt in detail with the physical and human circumstances of the Rugby district, Prof. W. W. Watts analysed in masterly fashion the geography of Shropshire. Contrasting the lowlands north and east of the Severn with the uplands of the south and west, he exhibited graphically the influence on rivers, roads, and place-names of the forested Edges and the wooded barrier of the Severn Gorge. The more immediate neighbourhood of Birmingham furnished material for three papers. Mr. P. E. Martineau showed how the Midland Plateau, an upland area of 1000 square miles, sharply limited to the south by a steep escarpment, had marked the meeting of the English invaders from the Humber with the Saxons from Wessex. Mr. W. H. Foxall traced the growth of the city from a market at the convergence of trackways; and Mr. H. Kay contrasted the Black Country, which owed to its varied minerals a population of 1,750,000, a density exceeded on an equal area only in London, with the historical scenery of its borderland.

On Monday, before Dr. Bruce's paper on Spitsbergen, Mr. C. B. Fawcett contributed an anthropogeographic study of fiord lands in relation with the physical conditions of Norway, the north-west coast of North America, and Magellanes. In each region a narrow strip of coast was backed by barren highlands; each had a damp climate unfavourable to agriculture, with an ice-free sea; in each, expansion took place along the waterways. Social development depended on skill in navigation, local and limited among the Magellanes, confined to dug-out canoes among the Amerinds, but highly developed where the Norsemen were in touch with the shipbuilding nations of Europe. Mr. A. G. Ogilvie investigated the origin and growth of two remarkable promontories which screen the Inverness Firth from the Moray Firth, partly through geological changes, partly through tidal and wind currents. Prof. J. W. Gregory gave a lantern lecture on Australia, in preparation for the coming visit of the Association to that continent.

On Tuesday morning the section divided into two parts, one joining with members of Section A to receive papers on geodesy, the other discussing natural regions of the world, the topic being introduced by Prof. A. J. Herbertson. In the latter the most interesting points arose in connection with the place of man in the region. Some speakers held that human interests formed the only satisfactory principle of division; others that the title "natural" excluded man from consideration; and others that man and his environment were so mutually interactive as to be indivisible in such relations.

At the joint meeting with Section A, Capt. H. S. L. Winterbotham, R.E., read a paper on the accuracy of the principal triangulation of the United Kingdom. He said that the work having been carried out in the years 1783 to 1853, the precision of the angular measurements was less than that of most of the continental work, which is of later date. The probable error of an observed angle as calculated from the triangular errors is 1·23″, as against 0·54″ for the mean of all national systems up to 1892. These facts had led to the expression of doubts whether the British work was sufficiently accurate for incorporation with the more modern European work. This question was discussed at the British Association meetings in 1906 and 1908, and in the latter year a letter was written on behalf of the Council of the Association to the President of the Board of Agriculture and Fisheries, suggesting the remeasurement of a small portion of the triangulation remote from the old bases. This has now been done, and there are available as checks six bases in the British Isles (including three measured before 1820 with steel chains), and also a connection across the Channel to the new French meridional arc. The greatest discrepancy found was 1/42000 between the new base at Lossiemouth and the new Paris base.

The accuracy of a triangulation depends not only on the precision of the angular measurements, but also on the "strength" of the figure. In this latter respect the British triangulation has a considerable advantage over most other work. In order to get a rough idea of how far this had compensated for the inferior angular measurements a comparison was made with seventy-seven pairs of bases in all parts of the world. On the assumption that the error generated varied as the square root of the distance from the base it was found that the mean discrepancy for 100 miles of triangulation was 0·0000044 in the logarithm, or 1/99000. Taking the six pairs of bases available for the British Isles, the mean discrepancy was 0·0000029 in the logarithm, or 1/152000. It would appear, therefore, that the principal triangulation is sufficiently accurate for incorporation with the more modern work on the continent, and that if funds became available for remeasuring the British arcs, they would be better employed for other geodetic work.

Capt. H. G. Lyons, F.R.S., read a short paper on the terms used in triangulation, directing attention to the great and confusing differences in the terms adopted. He recommended that the terms first order, second order, third order, and fourth order should be adopted, the order depending on the average triangular error. The discussion showed that the feeling of the meeting was very much in favour of the proposal, and the question was brought up at the meeting of the general committee, and finally referred to the council, with a view to the whole question being brought to the notice of those concerned. M. Ch. Lallemand, in the discussion, stated that the subject was being considered by the International Geodetic Association.

A paper by Mr. E. B. H. Wade, read by Mr. Keeling, gave particulars of some longitude observations in Egypt along a line Helwan–Dagsur to investigate the local attraction in that district. There is a difference in the local attraction between the places named of about 8″.

Mr. B. F. E. Keeling read a paper on the precision of field latitudes in Egypt. The latitudes were observed with a 10-inch Repsold theodolite. The probable error of a single night's observations worked out at about 0·1″, but the agreement between observations on different nights was not as good as this would indicate. To investigate this, a series of monthly observations for latitude were carried out in the grounds of the Helwan observatory, using a procedure identical with that followed in the field. The results were much less accordant than was to be expected from the individual probable errors. A comparison of the different monthly sets of observations (11 in all) gave a probable error for one set of 0·5″, and this would appear to be the correct probable error to assign to the field latitudes of the Egyptian Geodetic Survey.

It was pointed out in the discussion that as these discrepancies were not found at permanent observatories, they must either be due to some peculiarity in Egypt, or more probably to the methods and instruments employed. Among those who took part in the discussions were M. Ch. Lallemand, Col. C. F. Close, and Prof. H. H. Turner.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. F. Horton, of St. John's College, has been approved by the General Board of Studies for the degree of doctor of science.

Science announces that an anonymous gift of 20,000*l*. has been made to Wellesley College. The money was given towards the 200,000*l*. fund which the college is trying to raise as an endowment. The total amount obtained thus far is 90,600*l*.

AMONG the scientific lectures arranged for advanced students of the University of London during the spring term of 1914 are a course of four lectures on carbohydrate fermentation at King's College, by Prof. A. Harden, University professor of biochemistry, at 4.30 p.m., on Mondays, beginning on January 26; and a course of eight lectures on physiological effects of anæsthetics and narcotics, at Guy's Hospital, by Dr. M. S. Pembrey and Mr. J. H. Ryffel, at 4 p.m., on Thursdays, beginning on January 22. The lectures, which will be illustrated by experiments, are addressed to advanced students of the University and to others interested in the subjects. Admission is free, without ticket.

THE annual report for the session 1912–13 of the Royal Technical College, Glasgow, has now been circulated. The total number of individual students enrolled was 5069, of whom 610 were day students. The higher work of the college continues to grow in volume and in standard. The roll of students included 135 graduates of the four Scottish universities and of the Universities of Cambridge, London, Manchester, Allahabad, and Calcutta. The arrangements for the affiliation of the college to the University of Glasgow have been completed, and the ordinance of the University Court giving effect to the affiliation received the approval of his Majesty in Council on March 7, 1913. The report gives particulars of twenty-nine works and papers published during the session by members of the college. Details are supplied of the extensions and developments in the various departments of the college and of the continued interest shown by the manufacturers and merchants of the district in the work of the college.

THE Institute of Chemistry has issued in pamphlet form a full report of a conference of professors of chemistry held on October 17 last to consider the relation of the qualifications of the institute to those of other educational institutions; the general question of the training of professional chemists; and the work of the institute in matters of professional interest in all branches. The members of the conference included the officers and members of the council of the institute, the board of examiners, professors of chemistry in universities and colleges recognised for the training of candidates for the associateship of the institute, and in other well-known colleges and technical schools. The pamphlet contains a preliminary statement by the president of the institute, Prof. R. Meldola, submitted as a basis for discussion and circulated among members before the conference, notes received from members before the day of the conference, the report of the conference itself, and expressions of opinion since received. The symposium is of great interest to chemists as bringing together authoritative views on the training and qualifications of professional chemists.

ON Friday, December 5, the London Teachers' Association held a meeting to discuss a report to be made by its education committee on the child and the kinematograph. The report will be based on the personal observations of the members of the committee of visits to picture palaces, on the results of their experience with children, and on the written compositions of 1300 children of Standard III. and upwards on the picture palace. Mr. Albert Smith, chairman of the education committee, considered the subject as regards its moral, physical, and educational effects on the child. Its physical effect was to produce a great frequency of headaches and to increase the number of children demanding eye treatment; its effect on character building was bad; the educational aspect showed that the results in a child's mind was "utter, hopeless, desperate confusion." Two things were needed, an efficient film censorship for all films shown to children and the establishment of educational conditions so that teachers should control films to be used in school work. In Germany the drawbacks of the kinematograph were minimised by proper restrictions. Dr. Garnett said that the London County Council had postponed consideration of this matter for six months. He had doubts whether the kinematograph would be of use in the teaching of history, geography, and industries, but he certainly thought it was of considerable use in the teaching of science, on account of the time-control.

THE annual prize distribution of the Northampton Polytechnic, London, E.C., was held on Friday, December 5, when the prizes were distributed by Mr. Cyril S. Cobb, the chairman of the London County Council. In his report, the principal, after giving details of the work of the institute, referred particularly to the delay in the erection of the technical optics annexe and its serious effect upon the unique work of the polytechnic in this subject. Mr. Cobb, in his address to the students, expressed his regret at the scheme having been apparently pigeon-holed at the Education Office of the council, and promised to unearth it with a view to a definite answer being given to the requests of the governing body in view of the great importance, both to the metropolis and the nation, of carefully planned developments in technological education in optics. Mr. Cobb also dwelt upon the necessity for employers, the apprenticeship system being practically dead, giving facilities for their apprentices and younger workmen to attend technical classes, remarking that if such facilities were not given the time might not be far distant when attendance at such classes might be made compulsory. In the laboratories of the polytechnic an interesting scientific development in electric furnace work was the subject of a lecturette given by Mr. S. Field, the head of the technical chemistry department, with practical demonstrations by Mr. E. Kilburn Scott, another member of the staff, and the inventor of a new type of electric furnace. The furnace is a flame arc furnace, working at high voltages, the three arcs of a three-phase system being produced at the same point in one furnace. Air under pressure is blown, as usual, through the arc, and the nitrous oxide produced is absorbed in appropriate towers, but incidentally the furnace is so arranged that the waste heat of these products can be utilised for steam raising. A still more important feature of the furnace is that the arc can be started and stopped by means of discharges in an auxiliary circuit not part of the high-pressure power supply. This gives a very efficient and convenient form of control. Other and older tyes of electric furnaces were described, and, to some extent, demonstrated. Many interesting details of the work and equipment of the polytechnic were also on view, some of them involving novel features of both educational and scientific interest.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 4.—Sir William Crookes, O.M., president, in the chair.—Sir Francis **Darwin**: A method of studying transpiration. The method is to close the stomata by coating the surface of the leaf with vaseline or some other grease, and then to place the intercellular spaces in connection with the outer air by cutting the leaf into strips. It is found by experience that such leaves transpire at rates comparable to those observed in natural leaves, and that they appear to behave normally in relation to external influences. In the present paper the effect of the relative humidity of the air is considered.—Sir Francis **Darwin**: The effect of light on the transpiration of leaves. The object of the research was to get a general idea of the differences in transpiration produced by alternate periods of diffused light and darkness. The experiments were made on the laurel (*Prunus laurocerasus*) and the ivy (*Hedera helix*), either by weighing or with the potometer. The results proved variable, and only by taking an average of a considerable number of experiments were figures of any sort of value obtained. For Prunus the average transpiration-rates in light and darkness are as 132 : 100; for ivy the figures are 136 : 100.—Prof. J. B. **Farmer** and L. **Digby**: Dimensions of chromosomes considered in relation to phylogeny. It is not possible to maintain that the width of chromosomes is a feature constant for the large phyla of the animal kingdom, inasmuch as not only are there appreciable individual differences, but in closely related species, *e.g.* lobster and prawn, this difference amounts to at least 60 per cent.—J. H. **Mummery**: The process of calcification in enamel and dentine. Although much has been written on the calcification of teeth, the actual mode of deposition of the lime salts has been very little investigated. The author shows that both in dentine and enamel the lime salts are deposited in the globular form, despite the chemical composition of the finished tissues.—A. **Compton**: The optimum temperature of salicin hydrolysis by enzyme action is independent of the concentrations of substrate and enzyme. The optimum temperature of the enzyme in question is independent alike of the concentration of the substrate and of the concentration of the enzyme.—C. F. U. **Meek**: The ratio between spindle lengths in the spermatocyte metaphases of *Helix Pomatia*.—Dr. A. P. **Laurie**, W. F. P. **McLintock**, and F. D. **Miles**: Egyptian blue. The purpose of the research is to decide the exact conditions under which the blue, manufactured and used in Egypt from the fourth dynasty to classical times, is produced, and to clear up the doubts as to its nature and constitution. The results of the investigation are to confirm the conclusion come to by Fouqué that the blue is a double silicate consisting principally of calcium and copper, but in which these metals can be partially replaced by alkalies. When soda, lime, and copper carbonate are heated with an excess of sand, a green glass is formed round the quartz particles at about 800° C. At about 840° the double silicate begins to crystallise out of this magma, again completely dissolving to form a green glass at 890° C. The discovery of this compound by the Egyptians is doubtless due to their practice of glazing small articles carved out of sandstone with a green copper glaze.

Royal Meteorological Society, November 19.—Mr. C. J. P. Cave, president, in the chair.—W. H. **Dines**: The daily temperature change at great heights. When observations by means of registering balloons were first started in England in 1907, it was soon found that the effect of solar radiation upon the thermograph was a matter that must be reckoned with. To avoid the trouble, balloons were mostly sent up a little before sunset, and this policy continued until the meeting of the International Committee at Monaco in the spring of 1909. At that meeting the time of 7 a.m. was fixed for the international ascents, 7 a.m. being the time for which the morning weather chart is drawn. Since then, ascents have been made in England at the specified time, viz. 7 a.m., on the twenty-three specified days per annum. But other ascents have also been made on the international days and on days of special meteorological interest, such as the occurrence of thunder, or of a very high or very low barometer, and such ascents are mostly made in the evening. Some 200 good observations have been made in the British Isles, reaching to about 16 kilometres, concentrated into two nearly equal groups, one with its centre two hours after sunrise, and the other about a quarter of an hour after sunset. Mr. Dines has carefully discussed these records, and finds that above two kilometres and up to the isothermal column, the daily range of temperature, if it exists at all, does not exceed 2° C., and that the maximum is in the afternoon or evening.—H. **Harries**: The eddy winds of Gibraltar. The Rock rises to 1400 ft., and is very exceptionally situated at the entrance to the Mediterranean, and consequently gives rise to great eddies of wind. Mr. Harries on two visits to Gibraltar made some observations on these eddies at the summit signal station, 1310 ft., by means of small balloons and pieces of wadding and wool. As the observations were carried out under nearly calm and also very windy conditions the results are both curious and interesting, and may help to throw light on some of the atmospheric disturbances which are a source of trouble to aviators.

Linnean Society, November 20.—Prof. E. B. Poulton, F.R.S., president, in the chair.—H. J. **Elwes**: The travels of Sir Joseph Hooker in the Sikkim Himalaya. Hooker received in all 1100*l.* from Government, and the return was marvellous in comparison with that modest subsidy. The first year, 1849, was devoted to work to the westward, including a part of Nipal, as far as the Yangma valley, and ending in late autumn; the second year was spent in northward exploration as far as the Tibetan boundary at the Donkia pass. Besides the collection of a vast number of plants, Hooker observed the geology and meteorology of the country traversed, and plotted the map which was published in his "Himalayan Journals." A subordinate part was the despatch of more than 1000 packets of seeds to the elder Hooker, by whom they were distributed to many private gardens and nurseries, by which means European cultivators became possessed, amongst other things, of the Himalayan Rhododendrons. Of the literary results of these investigations may be mentioned the two volumes of the "Himalayan Journals," 1854, the splendid "Illustrations of Himalayan Plants," 1855, and the noble "Rhododendrons of the Sikkim Himalaya," brought out in 1849–51 by Sir William Hooker during his son's absence in India.

Zoological Society, November 25.—Prof. E. W. MacBride, F.R.S., vice-president, in the chair.—Orjan **Olsen**: A new Rorqual from the coast of South Africa. A detailed account was given of external characters, biology, and distribution.—Miss Marie V. **Lebour**: A new species of Trematodes of the genus Lechriorchis. The species was found in the body-cavity of a dark green snake (*Zamenis gemonensis*) that had died in the society's gardens.—T. H. **Withers**: Cirripede remains from the Cenomanian Chalk Marl in the neighbourhood of Cambridge. The greater number of the specimens are referred to two species of the family Pollicipedidæ, and add materially to our knowledge of the phylogeny of the pedunculated Cirripedes. Both

forms are remarkable for their advanced form of scutum, in which the umbo is subcentral, and show that the transition of the scutal umbo from an apical to a subcentral position was acquired independently by unrelated forms in distinct lines of development.—Dr. P. Chalmers **Mitchell**: The peroneal muscles in birds. The author had dissected these muscles in more than 300 birds, and believed that he was able to give a nearly exhaustive account of the varieties of form presented by these structures. The paper described the peroneal muscles in *Chauna chavaria*, and gave a systematic account of the conditions in the different avian groups which could all be represented as derivatives of the Chauna condition by loss of certain portions and increased development of other portions.

Royal Anthropological Institute, November 26.—Prof. A. Keith, F.R.S., president, in the chair.—M. Fr. de **Zeltner**: The Touareg. The Touareg inhabit a region from the 7th degree of W. longitude to the 6th degree of E. longitude, and the author had explored the whole of this territory from east to west, reaching as far north as Aoudéras, about 150 km. north of Agadez, the capital of Aïr. The main object of the author's expeditions in 1910–11–12 was the anthropological study of the southern Touareg, of whom he measured 145 individuals, three being women. He was able to discover that, despite a certain amount of intermixture, the race presented a great homogeneity, and that it differed distinctly from the neighbouring groups—negroes, Hausa, Peulh, and Moors. Its customs were exclusively feudal, and women played a very important rôle amongst the Touareg, while they were treated with but little consideration amongst their neighbours. Although the Touareg were warriors above everything, yet one could conclude that they were commencing to adapt themselves to a settled life. As their pillaging expeditions became from day to day more difficult, a number of them were beginning to devote themselves to agriculture, forcing their captives to work, and obtaining good results therefrom. Internally there was absolute tranquillity in the Touareg country.

December 2.—Prof. A. Keith, F.R.S., president, in the chair.—Dr. W. **Hildburgh**: Japanese minor magic connected with the propagation and infancy of children. The lecturer prefaced his paper by describing the kind of magic to be dealt with as principally non-professional, and performed by the ordinary man or woman as distinguished from the professional magician. Starting with various magical cures for, or means for avoiding, barrenness, Dr. Hildburgh showed how some of these depended upon the transference of the soul of a living or dead person to the barren woman, while others depended upon the simulation of a birth, or other mimetic means. Passing then to pregnancy, he discussed the magical means for assuring the safety of the unborn child by protecting it from the attacks of malignant demons and from the effects of inadvertent acts of the mother, and those for predicting its sex and for assuring that the sex should be as desired.

Faraday Society, November 26.—Mr. W. R. Bousfield, vice-president, in the chair.—E. **Vanstone**: The electrical conductivities of sodium amalgams.—A. C. **Rivett** and E. I. **Rosenblum**: The influence of a second solute on the solubility of *ortho*-phthalic acid.

Society of Chemical Industry, December 1.—Dr. W. R. Hodgkinson in the chair.—Dr. E. J. **Russel** and W. **Buddin**: The use of antiseptics in increasing the growth of crops in soil. The action of antiseptics on the soil is shown to be complex, but the most important for the present purpose is that the micro-organic population of the soil is very considerably simplified. The higher forms of life are killed when sufficient antiseptic is added, and the bacteria are greatly reduced in numbers. If the antiseptic is volatile or easily removed from the soil a remarkable result is obtained shortly after it has gone. The bacterial numbers do not remain low, but they begin to rise, and finally attain a level much exceeding that of the original soils. Simultaneously there is an increase in the rate of ammonia production in the soil; the evidence shows that this is the direct result of the increased numbers of bacteria. The increased ammonia production, however, does not set in if a large amount of ammonia and nitrate is already present in the soil. This increased production of ammonia induces a larger growth than in the untreated soils; antiseptics, therefore, tend to have the same action as nitrogenous fertilisers, and could be used to supplement them in practice. The antiseptics used should be destructive to disease organisms, pests, and organisms detrimental to the ammonia-producing bacteria, be capable of being removed from the soil either by volatilisation, oxidation, or decomposition, be convenient in application, and not be absorbed too readily by the soil, or proper distribution cannot take place. Of the various compounds tried during the last three years formaldehyde is the best; then comes pyridine, and then cresol, phenol, carbon disulphide, toluene, and others. None of these are so good as steam, but the subject is yet in its infancy, and there is no reason to doubt that suitable antiseptics will yet be found.

CAMBRIDGE.

Philosophical Society, November 17.—Dr. Shipley, president, in the chair.—Dr. **Doncaster**: A possible connection between abnormal sex-limited transmission and sterility. In a previous paper it was shown that the rare tortoiseshell male cat probably arises by a failure of the normal sex-limited transmission of the orange colour by the male. The present communication gives evidence that the tortoiseshell male exhibited is sterile. Two females of the moth *Abraxas grossulariata* in which the normal sex-limited transmission of the *grossulariata* pattern had failed were also sterile; it is therefore suggested that the sterility may be correlated with transmission of a character to a sex which does not normally receive it.—E. **Hindle**: The flight of the house-fly. The paper contains a description of experiments on the range of flight of the house-fly, conducted in Cambridge during the summer of 1912. The results obtained indicate that flies tend to travel either against or across the wind. The chief conditions favouring their dispersal are fine weather and a warm temperature. The maximum flight in thickly housed localities seems to be about a quarter of a mile, but in one case a single fly was recovered at a distance of 770 yards. It should be noted, however, that part of this distance was across open country.—H. H. **Brindley**: Sex proportions of *Forficula auricularia* in the Scilly Islands. In view of collections of the common earwig obtained from two of the islands in 1911 showing as considerable differences in the proportions of the sexes as had been previously observed in collections from various localities in England and Scotland (Proceedings, vol. xvi., part 8, 1912, p. 674), a visit was made to the Islands in August last year. Collections were made in all the five inhabited and seven of the uninhabited islands. There are great differences in the proportions of the sexes in the various islands. The range for different localities on a single island is not great. The evidence that the characters of the soil and vegetation show any relation with the sex propor

tions is very slight. The sex proportions in the Scilly Isles show very slight relation with the positions of the islands as regards each other.

MANCHESTER.

Literary and Philosophical Society, November 4.—Mr. Francis Nicholson, president, in the chair.—Prof. Edmund **Knecht** and Miss E. **Hibbert**: Note on some products isolated from soot. The authors gave an account of the laborious work involved in isolating definite organic compounds from soot collected from household chimneys round Manchester. Three of these were obtained, and were described. One such compound is an unsaturated solid hydrocarbon, cerotene, which was isolated in 1783 by König and Kiesow from hay, this being the only other known source. Another substance, obtained in the form of a pure yellow oil, appears to be of the nature of a higher alcohol, and a solid organic acid was also isolated.—Prof. H. C. H. **Carpenter**: The crystallising properties of electro-deposited iron. Specimens of electro-deposited iron sheet of a high degree of purity have been found to exhibit remarkable recrystallisation effects when heated above the Ac3 change, and then cooled below the Ar3 change. In this way relatively enormous crystals are formed in three seconds after cooling below Ar3. The coarse crystals are sometimes "equi-axed" and sometimes "radial." Frequently both types occur on the same specimen. There is no reason for thinking that they are constitutionally different, and they are most probably α iron. These crystallisation effects are only obtained when the thickness of the iron sheet or strip does not exceed a certain critical figure, which is between 0·011 and 0·012 of an inch. The coarse crystals once formed can only be destroyed either by mechanical work or by heating above Ac3 followed by quenching, or by very prolonged heating above Ac3 followed by ordinary cooling rates. The same heat treatment which produces coarse crystals in the electro-deposited iron refines wrought-iron and very mild steel that have been rendered coarsely crystalline by "close-annealing" between 700° and 800° C. On the other hand, annealing at 700° to 800° C. has no effect in coarsening the structure of the electro-deposited iron which has been refined by cold mechanical work. In these respects, therefore, the behaviour of electro-deposited iron is precisely the opposite of that of wrought-iron and mild steel.

EDINBURGH.

Royal Society, November 17.—Prof. J. Geikie, F.R.S., president, in the chair.—Dr. F. **Kidston** Fossil flora of the Westphalian Series of the South Staffordshire Coalfield. More than 150 species were described, some of them being recorded for the first time as British. A few new species were also described.—Prof. Margaret J. **Benson**: *Sphaerostoma ovale* (*Conostoma ovale et intermedium*, Williamson), a Lower Carboniferous Ovale from Pettycur, Fifeshire. The paper also contained the description of a seed referable to Pteridosfernis, and possibly belonging to *Heterangium Grievii*, Williamson.—Prof. C. R. **Marshall**: Studies on the pharmacological action of tetra-alkyl-ammonium compounds. I., The action of tetra-methyl-ammonium chloride. This substance produces paralysis of the myoneural junctions in mammals and frogs. In anæsthetised mammals the intravenous injection of certain doses causes temporary cessation of the respiration, which was found to be synchronous with the paralysis of the nerve-endings in the muscles of the anterior end of the body. The respiratory paralysis was also found to occur after division of both fifth cranial nerves, and therefore could not be due, as has been stated, to stimulation of the endings of these nerves. It was further shown that the effect was not synchronous with the action on the circulation.—Dr. T. **Muir**: The theory of bi-gradients from 1859 to 1880.

PARIS.

Academy of Sciences, December 1.—M. F. Guyon in the chair.—Paul **Appell**: The development of $(x-y)^{-1}$ in series proceeding according to the inverse of given polynomials.—M. **Righi** was elected a correspondant for the section of physics in the place of the late M. Bosscha, and M. **Grignard** a correspondant in the section of chemistry in the place of M. Sabatier, elected non-resident member.—André **Broca** and Ch. **Florian**: A practical level with a damped mercury bath. The movements of the sheet of mercury are deadened by covering with a thin layer of glycerol, the latter being covered by a sheet of plane glass. Numerous possible applications of the instrument are suggested.—Henri **Chrétien**: Statistical analysis of star clusters.—A. **Demoulin**: A characteristic property of the families of Lamé.—E. **Vessiot**: The reducibility of differential systems.—Serge **Bernstein**: Some asymptotic properties of polynomials.—F. **La Porte**: Modifications of the coast of Brittany between Penmarch and the Loire. Near Morbihan the coastline is the same as in 1821; elsewhere the coast-line has retreated, except at Carnac, where 80 to 100 metres have been gained from the sea.—A. **Korn**: The origin of terrestrial magnetism.—F. **Croze**: The peculiarities of the Zeeman phenomenon in the series spectra of oxygen and hydrogen.—A. **Cotton**, H. **Mouton**, and P. **Drapier**: The optical properties of a mixed liquid submitted simultaneously to an electric and a magnetic field.—G. **Ribaud**: The quantitative study of the absorption of light by the vapour of bromine in the ultra-violet. From the results of the experiments the kinetic theory of light absorption does not hold for the large bands; for five lines the theory is in good agreement with observation.—L. **Dunoyer**: An experiment in optical resonance on a gas in one dimension.—G. **Moreau**: Couples consisting of two flames. Two Bunsen flames burn vertically in contact, one containing the vapour of an alkaline salt. In each flame is a platinum electrode, from which, under conditions detailed in the paper, a current amounting to several microamperes can be obtained.—R. **Boulouch**: Systems of centred spherical diopters: ordinary stigmatism and aplanetism.—E. **Aries**: The laws of displacement of chemical equilibrium at constant temperature or at constant pressure.—P. Teilhard de **Chardin**: A formation of carboro-phosphate of lime of the Palæolithic age.—A. **Prunet**: The fungi which cause in France the disease (*piétin*) of cereals. This name is applied to diseases due to the attacks of three different species of fungi.—J. **Stoklasa** and V. **Zdornicky**: The influence of the radio-active emanations on vegetation. In small amounts, the radium emanations favour plant growth, but above a certain quantity the contrary effect is observed.—E. J. **Hirtz**: A new reaction in electrodiagnosis.—Philippe de **Vilmorin**: The hereditary characters of tailless and short-tailed dogs.—Y. **Manouélian**: Histological study of the destruction of the acini in the salivary glands in rabic animals.—Adrien **Lucet**: Experimental researches on coccidiosis of the domestic rabbit.—L. **Gaumont**: Contribution to the study of the black fly of the beet.—F. **Duchâček**: A supposed biochemical variation of the Bulgarian lactic bacillus. A criticism of some conclusions of Effront on the variation of the Bulgarian bacillus.—Auguste **Lumière** and Jean **Chevrotier**: A new culture medium very suitable for the development of the gonococcus.—C. **Bruyant**: The peat bogs of the massif of Mont Dore.—E. A. **Martel**: Experiments with fluorescein at great distances. In connection with the

use of dyestuffs with great tinctorial properties, such as fluorescein, in tracing the path of underground water-courses, it is shown that the dye need not be previously brought into solution if the water is flowing, and that very large quantities of the colouring matter must be employed if erroneous conclusions are to be avoided. One hundred kilos. of fluorescein were used in one successful experiment.

CALCUTTA.

Asiatic Society of Bengal, November 5.—H. B. **Preston**: A molluscan faunal list of the Lake of Tiberias with descriptions of new species. The paper deals in the first instance with a large collection made by Dr. Annandale at and near Tiberias in October, 1912. A remarkable feature of the molluscan fauna of the Lake of Tiberias is the thickness of the shells of most of its constituent species and the almost complete absence of thin-shelled forms. This is probably due to the large amount of mineral matter held in suspension in the water. The distribution of the different species is discussed under the heading of each, and several new species and varieties are described. With the exception of a species of Unio, these are for the most part minute shells.—R. H. **Whitehouse**: The Planarians of the Lake of Tiberias. Three species of Planaria were taken in the immediate vicinity of the Lake of Tiberias, from which no representative of the group has hitherto been identified specifically.—Dr. G. **Horváth**: Aquatic and semi-aquatic Rhynchota from the Lake of Tiberias and its immediate vicinity. The collection made includes seventy-nine specimens of aquatic and semi-aquatic Rhynchota, representing twenty-one species, of which three are new to science.—Dr. N. **Annandale**, J. C. **Brown**, and F. H. **Gravely**: The limestone caves of Burma and the Malay Peninsula. This paper is divided into three portions. The first is introductory and gives a general account of the caves of Burma and the Malay Peninsula, a history of the literature which has ground up around them since the early days of the eighteenth century, and particulars of their archæology and folklore. Part i. is by J. Coggin Brown, and deals with the geology of the cave-bearing limestones of Burma and the Malay Peninsula. The opinion is expressed that on thorough examination many of the limestone caves of Burma and the Malay Peninsula will be found to contain deposits with recent or subrecent fossil remains. Part ii. is by N. Annandale and F. H. Gravely, and consists of an account of the fauna of the caves. Although both blind and purblind species are included in the list, no animal as yet recorded from these caves has reached the height of specialisation sometimes developed by a cavernicolous existence; such, for example, as is found in the case of certain species from the caves of Europe and North America. An appendix contains notes by Ch. Duroiselle and B. B. Binyabinode on clay votive tablets from the caves.

BOOKS RECEIVED.

Studies in Career and Allied Subjects. Pathology. Vol. ii. Pp. vi+267+xxxii plates. Vol. iv. Contributions to the Anatomy and Development of the Salivary Glands in the Mammalia. Pp. v+364+c plates. (New York: The Columbia University Press.) Each 5 dollars net.

Les Inconnus de la Biologie déterministe. By A. de Gramont Lesparre. Pp. 297. (Paris: F. Alcan.) 5 francs.

Das Relativitätsprinzip. By L. Gilbert. Pp. 124. (Brackwede i.W.: Dr. W. Breitenbach.) 3 marks.

Einführung in die Tierpsychologie auf experimenteller und ethnologischer Grundlage. By G. Kafka. Erster Band. Die Sinne der Wirbellosen. Pp. xii+594. (Leipzig: J. A. Barth.) 18 marks.

Report of the Interstate Conference on Artesian Water. Sydney, 1912. Pp. xv+207+68; maps and plates. (Sydney: W. A. Gullick.)

Société Française de Physique. Recueil de Constantes Physiques. By Profs. H. Abraham and P. Sacerdote. Pp. xvi+753. (Paris: Gauthier-Villars.) 50 francs.

Proceedings of the Royal Irish Academy. Vol. xxxi. Clare Island Survey. Part 64. Foraminifera. By E. Heron-Allen and A. Earland. Pp. 188+13 plates. (Dublin: Hodges, Figgis and Co., Ltd.; London: Williams and Norgate.) 5*s*. 6*d*.

Annals of the Transvaal Museum. Vol iv., part 2. (Pretoria: Government Printing and Stationery Office.) 7*s*. 6*d*.

The Bodley Head Natural History. By E. D. Cuming. Vol. ii., British Birds. Passeres. Pp. 122. (London: J. Lane.) 2*s*. net.

Bulletin of the British Ornithologists' Club. No. cxc. (1) Guide to Selborne. (2) Synopsis of the Life of Gilbert White. By W. H. Mullens. Pp. 27. (London: Witherby and Co.) 2*s*. 6*d*. net.

A Pilgrimage of British Farming, 1910–12. By A. D. Hall. Pp. xiii+542. (London: J. Murray.) 5*s*. net.

Annals of the South African Museum. Vol. vii.; vol. xii., part 1. (Cape Town: South African Museum; London: West, Newman and Co.) 1*s*. and 14*s*.

Linne's Föreläsningar öfser Djurriket. Med Understöd of Svenska Staten för Uppsala Universitet. By E. Lönnberg. Pp. xiii+607. (Uppsala: A. B. Akademiska Bokhandeln; Berlin: R. Friedländer und Sohn.)

The Fungi which Cause Plant Disease. By Prof. F. L. Stevens. Pp. viii+754. (London: Macmillan and Co., Ltd.)

Quantitative Analysis by Electrolysis. By A. Classen, with the cooperation of H. Cloeren. Translated by W. T. Hall. Pp. xiv+308+2 plates. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd.) 10*s*. 6*d*. net.

Logging: the Principles and General Methods of Operation in the United States. By Prof. R. C. Bryant. Pp. xviii+590. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd.) 15*s*. net.

Outlines of Theoretical Chemistry. By Prof. F. H. Getman. Pp. xi+467. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd.) 15*s*. net.

Constructive Text-Book of Practical Mathematics. By H. W. Marsh. Vol ii., Technical Algebra. Part i. Pp. xvii+428. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd.) 8*s*. 6*d*. net.

Marsh's Mathematics Work-Book. Designed by H. W. Marsh. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd.) 3*s*. net.

Der Gerbstoffe: Botanisch-chemische Monographie der Tannide. By Dr. J. Dekker. Pp. xiii+636. (Berlin: Gebrüder Borntraeger.) 20 marks.

Prehistoric Times. By the late Rt. Hon. Lord Avebury. Seventh edition, thoroughly revised. Pp. 623. (London: Williams and Norgate.) 10*s*. 6*d*. net.

The British Journal Photographic Almanac, 1914. Edited by G. E. Brown. Pp. 1496. (London: H. Greenwood and Co.) 1*s*. 6*d*. net.

Traité de Géographie Physique. By Prof. E. de Martonne. Deux. édition. Pp. xi+922. (Paris: A. Colin.) 22 francs.

The Sampling and Assay of the Precious Metals. By E. A. Smith. Pp. xv+460. (London: C. Griffin and Co., Ltd.) 15*s*. net.

Photo-Electricity: the Liberation of Electrons by Light. By Dr. H. S. Allen. Pp. 219. (London: Longmans and Co.) 7s. 6d. net.

Modern Seismology. By G. W. Walker. Pp. xii+88+plates. (London: Longmans and Co.) 5s. net.

Heredity and Sex. By Prof. T. H. Morgan. Pp. ix+282. (London: Oxford University Press.) 7s. 6d. net.

The Life of the Mollusca. By B. B. Woodward. Pp. xi+158+xxxii plates. (London: Methuen and Co., Ltd.) 6s.

Ordnance Survey. Professional Papers. New series. No. 2, An Investigation into the Accuracy of the Principal Triangulation of the United Kingdom. By Capt. H. St. J. L. Winterbotham. Pp. 20+v plates. (London: H.M.S.O.; Wyman and Sons, Ltd.) 2s.

Rays of Positive Electricity and their Application to Chemical Analyses. By Sir J. J. Thomson. Pp. vi+132. (London: Longmans and Co.) 5s. net.

Plant Physiology. By Dr. L. Jost. Authorised English translation by R. J. Harvey Gibson. Supplement incorporating the alterations of the second edition of the German original. Pp. 168. (Oxford: Clarendon Press.) 2s. 6d. net.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 11.

ROYAL SOCIETY, at 4.30.—Intermittent Vision: A. Mallock.—Attempts to Observe the Production of Neon or Helium by Electrical Discharge: Hon. R. J. Strutt.—The Relations between the Crystal-symmetry of the Simpler Organic Compounds and their Molecular Constitution: W. Wahl.—The Selective Absorption of Ketones: Prof. G. G. Henderson and I. M. Heilbron.—Absolute Measurements of a Resistance by a Method based on that of Lorenz: F. E. Smith.—A Determination of the Electromotive Force of the Weston Normal Cell in Semi-absolute Volts. (With a Preface by Prof. H. L. Callendar, F.R.S.): A. N. Shaw.—Elastic Hysteresis in Steel: F. E. Rowett.—A Simple Form of Micro-balance for Determining the Densities of Small Quantities of Gases: F. W. Aston.—A Second Spectrum of Neon: T. R. Merton.

MATHEMATICAL SOCIETY, at 5.30.—The Linear Integral Equation: Prof. E. W. Holson.—Generalised Hermite Functions and their Connection with the Bessel Functions: H. E. J. Curzon.—Limiting Forms of Long Period Tides: J. Proudman.—The Number of Primes of Same Residuacity: Lieut.-Col. Cunningham.—Some Results on the Form Near Infinity of Real Continuous Solutions of a Certain Type of Second Order Differential Equations: R. H. Fowler.—The Potential of a Homogeneous Convex Body and the Direct Integration of the Potential of an Ellipsoid: S. Brodetsky.—The Dynamical Theory of the Tides in a Polar Basin: G. R. Goddsbrough.—Proof of the Complementary Theorem: Prof. J. C. Fields.

CONCRETE INSTITUTE, at 7.30.—Some Fallacies in Testing Cement: L. Gadd.

ROYAL SOCIETY OF ARTS, at 4.30.—The Cultivation and Manufacture of Indian Indigo: Prof W. P. Bloxam.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Continuation of Discussion on Dr. Klingenberg's Address on "Electricity Supply in Large Cities."

FRIDAY, DECEMBER 12.

ROYAL ASTRONOMICAL SOCIETY, at 5.—The "Kinetic Theory" of Star Clusters: J. H. Jeans.—Distribution of Sun-spots in Heliographic Latitude, 1874-1913: F. W. Maunder.—Results of Micrometer Measures of Double Stars made with the 28-inch Refractor at the Royal Observatory, Greenwich, in the Year 1912: Royal Observatory, Greenwich.—*Probable Papers*: An Explanation of Sun-spots, of the Fluctuations of the Moon's Motion, and some other Puzzles of the Solar System: H. H. Turner.—The Spectra of the Wolf-Rayet Stars: J. W. Nicholson.—The Equatorial Current of Jupiter: Rev. T. E. R. Phillips.

MALACOLOGICAL SOCIETY, at 8.—Descriptions of Various New Species of Mollusca: G. B. Sowerby.—Synonymy of the Family Veneridæ: A. J. Jukes-Browne.—Descriptions of New Species of Land and Marine Shells from the Montebello Islands, Western Australia: H. B. Preston.

ALCHEMICAL SOCIETY, at 8.15.—Alchemy in China: Prof. H. Chatley.

MONDAY, DECEMBER 15.

ROYAL SOCIETY OF ARTS, at 8.—The Measurement of Stresses in Materials and Structures: Prof. E. G. Coker.

TUESDAY, DECEMBER 16.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—A Rough Survey of the Tribes of Western Papua: W. Beaver.—The Nomenclature of Clans in the Pueblo Area: Miss B. Freire Marreco.—Arctic Hysteria in Northern Asia: Miss M. A. Czaplicka.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Further Explorations in the N.W. Amazons Valley: Dr. Hamilton Rice.

ROYAL STATISTICAL SOCIETY, at 5.—Cooperative Live Stock Insurance in England and Wales: Sir James Wilson.—Some Material for a Study of Trade Fluctuations: D. H. Robertson.—The Determination of Size of Family, and Incidence of Characters in Orders of Birth from Samples: M. Greenwood and G. Udny Yule.

ILLUMINATING ENGINEERING SOCIETY, at 8.—Some Problems in Daylight Illumination, with Special Reference to School Planning: P. J. Waldram

INSTITUTION OF CIVIL ENGINEERS at 8.—Cyclical Changes of Temperature in a Gas-engine Cylinder: Prof. E. G. Coker and W. A. Scoble.

WEDNESDAY, DECEMBER 17.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—The Great Rain Storm at Doncaster, September 17: R. C. Mossman and C. Salter.—Recent Studies of Snow in the United States: Dr. J. E. Church, Jun.—The Meteorological Conditions of an Ice-Sheet, and their Bearing on the Desiccation of the Globe: C. E. P. Brooks.

AËRONAUTICAL SOCIETY, at 8.30.—The Science of Fast Flying: C. T Weymann.

ROYAL SOCIETY OF ARTS, at 8.—The Channel Tunnel: A. Fell.

GEOLOGICAL SOCIETY, at 8.—Supplementary Note on the Discovery of a Palæolithic Human Skull and Mandible at Piltdown (Sussex): C. Dawson and Dr. A. Smith Woodward.

ROYAL MICROSCOPICAL SOCIETY, at 8.—The Binocular Microscopes of the Past and a New Form of the Instrument: Conrad Beck.

THURSDAY, DECEMBER 18.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Employment of Power in H.M. Post Office: H. C. Gunton.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—The Standardising of Colours and Symbols representing Geographical Data, especially on Small Scale Maps: Prof. A. J. Herbertson.

LINNEAN SOCIETY, at 8.—The Evolution of the Inflorescence: J. Parkin.—*Hypericum desetangsii*, Lamotte, a New British Plant: C. E. Salmon.—The Mouth-parts and Mechanism of Sucking in *Schizoneura lanigera*: J. Davidson.

INSTITUTION OF MINING AND METALLURGY, at 8.

FRIDAY, DECEMBER 19.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Mechanical Engineering Aspects of Road Construction: Col. R. E. B. Crompton.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Air-filtration and the Cooling and Ventilation of Electrical Machines: W. E. Gurry.

CONTENTS.

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

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.
Telegraphic Address: PHUSIS, LONDON.
Telephone Number: GERRARD 8830.