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Royal Society Publications and Meetings.

In his presidential address to the Royal Society on Nov. 30, Sir Ernest Rutherford referred to certain defects in the publications and in the meetings of the Society. It appears that the scientific communications made to the Society are important enough to demand publication, and so numerous that the *Proceedings* have considerably increased in volume, at any rate in the Physical or 'A' series. The sales, however, though they too have increased, still remain insufficient to cover the cost of printing. Thus the defect of the publications is formulated by the president as a lack of funds, and he appeals for further endowment.

It should be remembered that very many of the Society's publications are sent out partly as gifts, partly in exchange for other publications, and the value of the latter at least should be set against the pecuniary deficit. But, making all allowances, we conclude that the Royal Society has no more success with its publications than have many other scientific societies. From numerous quarters the complaint arises that papers cannot be published, that societies cannot find the money, or that editors and authors have to pay from their own pockets. On the other hand, we see some of our societies in an apparently flourishing condition and many scientific journals produced here in a manner that does not suggest lack of public support, while the number of new scientific periodicals that has sprung up in Germany since the War can scarcely be due to an excess of altruism on the part of German publishers. We can see only two possible reasons for this curious contrast: the failures must be due either to a lack of business management or to the simple fact that the goods are not wanted. In these days the appreciation of even the most abstract science is so widespread, and the number of scientific workers and institutions so enormously increased, that there certainly ought to be a demand for the publications of the premier scientific society, so long as they are reasonably up to standard. If this be conceded, an inquiry into business methods becomes the natural suggestion.

If, however, the papers presented to the Royal Society do not appeal strongly enough to the outside world when published, still less do they appeal to the fellows when they come up for reading and discussion. The president's remarks on this subject are almost pathetic. He says: "While special lectures and discussions, and some of the ordinary meetings, are in general well attended, there are occasions when important and interesting

papers are read before a very small audience. Quite apart from the painful impression left on the presiding officers, the sparse attendance has inevitably a discouraging effect on the reader of the paper, particularly, as is often the case, if he has come from a distance and spent much time and trouble in order to present the subject matter of his paper in an interesting way."

Sir Ernest merely repeats a very old complaint when he speaks of the "sparse attendance" and "discouraging" lack of interest. To some extent this is a natural consequence of the constitution of the Royal Society. It differs from the other learned societies of the metropolis in two points: its members represent all branches of science, and each member is a distinguished specialist in his own branch. Now it is generally, if not universally, true that the more a man knows of one subject, the less does he know of other subjects. The number of fellows capable of appreciating an advanced paper on any special theme is necessarily a small minority. The reader of a paper to the Zoological or Geological Society may be sure of an audience of fifty or sixty (as a rule the numbers are far more), and the discussions are only checked by want of time. At the Royal Society the same reader would get about one-tenth, simply because he has far less than one-tenth the number of fellow-workers to draw upon. If it be suggested that outside visitors would be welcome, one reply is that few besides those who have retired from active work can attend a meeting so early as 4.30 P.M.

In view of the necessary composition of any probable audience, there are two improvements still feasible. First of all, the author should remember that if in any society his audience must *ex hypothesi* know less about his subject than he does himself, in the Royal Society the general level of knowledge will be far lower. The less knowledge he assumes in his audience the more successful will his exposition be. "I know that I know, but all the same tell me as if I didn't know." Lack of knowledge does not, of course, imply lack of intelligence. It is generally the youngest authors that are most difficult to follow, and a little friendly advice from the officers might induce them to condescend to the level of an F.R.S. In a society like the Royal, even more than in other societies, the audience is less interested in detail than in the general conclusion, and above all the reader should bring out the relation of his bit of work to the broad concepts of the science. If any readers find that they have too little to say in these aspects, they may perhaps withdraw their claims for time and printer's ink.

This leads to the subject matter. It is perhaps inevitable that the meetings, and still more the *Proceedings*, should have become a convenient platform for the pupils of fellows of the Society who happen to be distinguished professors. The work produced is doubtless valuable, but is it of such prime importance as to attract a number of busy men of mature age to Burlington House on a winter afternoon? However this may be, there is no doubt that the Society has turned into a publishing body for a limited number of the physical sciences. Indeed, Sir Ernest Rutherford seems almost to glory in the fact, much as Sir Charles Sherrington might take pride in the thought that series 'B' consists so disproportionately of physiological papers. The Royal Society may be performing a charitable act in publishing work that has no other outlet, and yet this does not seem to be quite the proper function of a leading, co-ordinating, organising body. Let it publish these contributions if nobody objects, but there is no necessity for them to be read; even at present a considerable proportion of the papers is taken as read.

Sir Ernest Rutherford thinks that the meetings would be better if only more fellows would attend. He seems to us to over-estimate the number of those having special knowledge of selected subject matter, and it may be inquired whether this specialisation of the meetings is really on the right lines. The Royal Society is the one place where students in all the sciences can meet, and its gatherings should make the most of this. The physicist can help the biologist; the chemist can help the geologist. The subjects of discussion should be such as call for this many-sided help and criticism, or they should be of such broad and general nature so as to transcend the limits of specialisation. After all, the average fellow of the Royal Society does wish to learn something of the researches of the other fellows; he only asks that they should present their results in a form intelligible to him.

There is far more promise in the president's invitation to fellows to give demonstrations before the meeting. Informal talks on exhibits have successfully brightened the meetings of other societies, and are more likely to loosen the tongues of authorities with a reputation to lose, especially when combined with tea and coffee. Our only fear is that the fellows will succumb to the enhanced attractions of the tea-room and never reach the meeting-room at all.

Anthropology of the Westernmost Orient.

Ritual and Belief in Morocco. By Edward Westermarck. In 2 vols. Vol. 1. Pp. xxxii + 608. Vol. 2. Pp. xvii + 629. (London: Macmillan and Co., Ltd., 1926.) 50*s*. net.

PROF. WESTERMARCK, by the publication of his first masterpiece in 1891, gained a world-wide reputation as a historian of human marriage and a leading sociologist, a reputation later on increased by his analysis of "Moral Ideas," in which he established himself as a psychologist and a philosopher of the first magnitude. His merits as a master of inductive method and as a ruthless critic of insidious fallacies, are rivalled only by his power of building sound theories on the bedrock of biology and of our knowledge of human nature. The fame gained by his theoretical work has ever since eclipsed Westermarck's other equally astonishing achievement as a first-hand student of the savage or barbarous tribes of the Maghrib—the extreme west of the Oriental World. Westermarck's great learning somehow suggests the library, and his philosophic detachment and literary charm, a comfortable study in some ancient university cloister; and it is difficult to imagine him in the saddle, climbing inaccessible mule tracks in the Great Atlas; or as a daring ethnographic explorer of the Rîf, braving dangers so real that at times he had to be declared outside consular responsibility and the protection of civilised government.

No better field-work exists, however, than that of Westermarck in Morocco. It was done with a greater expenditure of care and time than any other specialised anthropological research; it has brought to fruition Westermarck's comprehensive learning and special grasp of sociology; it revealed his exceptional linguistic talents and his ability to mix with people of other race and culture.

Westermarck in the course of more than two decades, between 1898 and 1926, spent altogether the equivalent of seven years among the various Berber and Arab tribes of Morocco. He has investigated native life and culture through the medium of their own language, living among them, frequently forming ties of personal friendship with the hospitable Shereefs and lordly Sheikhs. The present two volumes embody perhaps the most important and attractive results of Westermarck's research. For although his "Marriage Ceremonies in Morocco" (1914) is as learned and as valuable as the present book, and his numerous monographs are indispensable for the specialist, the strange beliefs and rites of the Berber hillmen and the nomads of the desert will be more interesting to the general reader.

These two volumes, though primarily a model of method and scholarship, read like a novel of Marmaduke Pickthall or the "Arabian Nights." In fact it is perhaps the best companion and commentary to any oriental classic. Take, for example, the jinn, the special race of spiritual beings who constantly play pranks on men and women. Any of us who still retain our childish delight in Oriental literature are well acquainted with them, but we have never known their real nature. In the present book Westermarck for the first time gives us their genealogy, their natural history, and many wise hints as to how to deal with them. Their origin, their Asiatic and local antecedents, their true sociological nature—contradicting Robertson-Smith's totemic explanation—are given in a special chapter, for Westermarck is always careful to keep theory apart from statement of fact. And then we learn all there is to be known about them from Moroccan folk-lore, the opinions of the Koran, the comments of the learned and the scribe, and above all the stories current among the people. This popular belief impresses us with its freshness and imaginative power, with the flavour of the wonderful and miraculous, which prove that the Thousand and One Nights are not yet at an end, unless they be extinguished by the cold light of civilisation recently poured into Westermarck's Morocco by machine gun and aeroplane. Happily, though these beliefs will undoubtedly soon die, their ghosts will remain in the stories preserved for us in this book. These stories show us jinn consorting with pedlars in the market-place, leading young scribes astray and entering into love intrigues with man or woman—for there are female as well as male jinn. The spirits become so ubiquitous that we are glad to find in a special chapter exact prophylactic measures against them and remedies for the troubles which they cause.

The long chapter on the evil eye appeals no less to the antiquarian's imagination than to the interest of the sociologist. One of the oldest superstitions of the Mediterranean basin which still survives in the behaviour of civilised man, whether of Latin, Berber or Semitic race, is here described again with a fullness of detail and theoretical insight which defies comparison. A wealth of descriptive data, collected at first hand, is given, and then a comparative treatment of the problem, an analysis of the belief, and a number of interesting sidelights on its cultural influences. A description of the imprint of the evil eye upon decorative art,

given with many interesting illustrations, will remain among one of the most illuminating contributions to comparative folk-lore.

The anatomy of swearing and cursing will be of great value to all those interested in the subject. There is no doubt that a European will feel stricken by the poverty of his own language, more especially, perhaps, the Anglo-Saxon, whose repertoire, since the good days of Shakespeare and the buccaneers, has been gradually depleted by puritanic superstition and mid-Victorian prudery. The dilettante will therefore find impressive data in the long lists and full comments given with scientific calm and candour. He might be shocked by finding at the outset such a simple expression as "God damn you," somewhat more elaborated in the explicit "God damn your grandfather and the grandfather of your grandfather, and the grandfather of him who will not curse your grandfather," but by the time he arrives at the end of the chapter he will find these expressions pale and lacking in vigour.

Witchcraft and the practices of transference of evil give us a good insight into native belief, with its raw flavour of savagery mingled with certain dramatic reminiscences of medieval Europe. The beliefs and customs referring to animals are narrated, with the repressed but powerful sense of humour so characteristic of Westermarck's style and mind, and make this chapter as amusing as "Æsop's Fables"; while for the psychology of the relationship between man and beast, important for anthropologists in connexion with totemism, this chapter is of the greatest value. The long and excellent descriptions of the ritual of the dead, the beliefs and practices connected with agriculture, the account of the yearly round, following the solemn festive days of the Mohammedan calendar, can only be mentioned here.

Two subjects have yet to be commented upon as of especial interest to the student of man; one of them is the 'Ar or "transference of conditional curses," a remarkable universal phenomenon first discovered and named by Westermarck. The data given and the interpretation of them illuminate the problem of taboo—the cornerstone of primitive law and primitive religion. Westermarck's comments on the covenant among primitive Semites and his criticism of Robertson Smith will be of value to those interested in the Bible, the Jews, and the learned Scottish historian.

The second subject of outstanding importance is the Moorish doctrine of "holiness" or "blessed virtue," the *baraka*, which corresponds to the famous *mana* of the Melanesians, the Iroquian *orenda*, the Siouan *wakan*, the Algonquian *manitu*, and the Malagasy *hasina*. This type of religious conception has been made a pivotal point in modern comparative study of religion, especially through the contributions of Dr. Marett of Oxford. Westermarck's account of the *baraka* far surpasses, in accuracy, thoroughness, and sociological depth, the data we possess from any other area, and it is bound to influence future theories of primitive religion. What Westermarck has to say on magic and religion in his introductory chapter ought to be read and considered by all the students of the subject; for it is the result not only of much impartial thought but also of direct experience with a people who, while remaining in barbarism as regards some aspects of culture, were able to produce among themselves individuals singularly well able to analyse their own belief and that of their fellow tribesmen.

To the student of Semitic language and culture, to the scholar interested in the traces of the Carthaginian, Roman, and Hellenistic influence in North-West Africa, to the general anthropologist and the sociologist interested in culture at the level of higher barbarism, these two volumes will be an inexhaustible source of information and delight.

B. MALINOWSKI.

The Story of Radio-Communication.

History of Radio Telegraphy and Telephony. Written and Illustrated by G. G. Blake. Pp. xix + 425. (London: Chapman and Hall, Ltd., 1926.) 25*s*. net.

THE time for writing a history of 'wireless' has scarcely come yet, but it is well that somebody should collect data and sift material for this arduous enterprise. Mr. Blake has done this diligently and conscientiously, and the result is a compilation, or more properly speaking a *thesaurus*, from which future historians may glean with confidence.

The development of wireless has shown a steady evolution enlivened by spurts of discovery. The main dates of these spurts—a biologist might call them 'sports'—are approximately the following:

1864. Clerk Maxwell predicts ether waves.
1888. Hertz demonstrates ether waves experimentally.
1889. Lodge discovers the coherer and the principle of tuning.
1897. Marconi's long-distance radio-telegraphy.
1907. Lee de Forest invents the triode valve.
1915. First trans-Atlantic radiotelephony.
1920. Broadcasting.

These dates form a useful scaffolding for the historian, but it is surprising how much detail has been almost forgotten. Mr. Blake recalls the fact that it was Mahlon Loomis, an American dentist, who signalled from one mountain top to another by means of kites and atmospheric electricity. Another significant anticipation was the transmission of spark signals over a distance of 100 feet by Prof. Elihu Thomson in 1875, twelve years before Hertz. Nor is it generally realised that it was von Bezold who discovered that electrical impulses are reflected from the insulated end of a conductor and are capable of producing nodes and antinodes at different points on the wire. This was in 1870, eighteen years before Hertz, and twenty years before Lecher.

The chapter on detectors recalls many forgotten incidents of wireless development. We find a description of positive point electrolytic detectors of Ferrie, Fessenden, Vreeland, Schloemilch, Shoemaker, and Reich, all of which have been superseded by the various crystal detectors of which Dunwoody's carborundum detector was the first. An interesting chapter is devoted to the photophone and allied methods of signalling by short waves of the order of light waves. Here the author gives full credit to that brilliant German experimenter, Ernst Ruhmer, whose name, by the way, he spells Rühmer, a very prevalent mistake probably due to over-correction.[1]

Dealing with spark generators of high-frequency currents, the author gives an interesting account of the 'airblast' spark gaps of Löwenstein, Massie, Fleming, Richardson, and Shaw, and the rotary disc dischargers of Lodge and Chambers.

The most valuable chapter of all is the one on the thermionic valve. Here the author's prodigious industry comes into full play. The subject is one which he evidently has much at heart, and he seems to have followed the development of the valve through all its stages, both practically and theoretically, for we owe to him several beautiful models showing the action of the valve.

The feature which will appeal most strongly to those who wish to find their way through the maze of wireless inventions and discoveries is the list of references, which occupies fifty pages. The references are to books, periodicals, and patent specifications, and cover about fifty years.

We are accustomed nowadays to a flood of wireless literature liberally sprinkled with illustrations, which are, in effect, advertisements of certain brands of wireless instruments. Mr. Blake's book is refreshingly different. Most of the two hundred or so illustrations have been drawn by himself, and drawn in a manner which will command the respect of the most advanced electrical draughtsmen. Many of these drawings have been prepared to illustrate half-forgotten principles. Any of these might suddenly become of importance. So rapid, and even precipitate, has been wireless progress that many valuable ideas are in danger of being swallowed up and engulfed in the thronging crowd of new things. Mr. Blake's book has rescued many a pearl from being thrown on the scrap heap.

E. E. F. D'A.

[1] The linguistic principle of over-correction may be stated as follows: *The consciousness of a prevalent fault or omission in using a language leads to correction or replacement in places where it is not justified.* The most familiar illustration is the unjustifiable reappearance of 'h's' in southern England, but we may also quote the insertion of non-existent accents in French words; and some writers make the mistake of aspirating consonants (for example, bhoy) or modifying vowels ('same' for 'seem') in places where no Irishman would do so. The Germans make similar mistakes. Having been told that the final 'd' of hand is soft instead of hard as in German, they also show a tendency to soften the final consonant in such words as 'boot' and 'book.'

The Borderland of Physical Chemistry and Physiology.

Physikalische Chemie der Zelle und der Gewebe. Von Prof. Dr. Rudolf Höber. Sechste, neubearbeitete Auflage. Pp. xvi + 955. (Leipzig: Wilhelm Engelmann, 1926.) 42 gold marks.

IN his exacting task of elucidating the nature of living processes, the physiologist wisely draws on his colleagues in other branches of science for all the help they can give him. With the aid of the organic chemist, for example, he has already learnt how to isolate, analyse, and synthesise such fundamentally important substances as adrenaline and thyroxine: every day he likewise applies the technique and theories of the organic chemist to further his knowledge of that marvellous sequence of co-ordinated chemical reactions which constitutes metabolism.

The relations between the physiologist and physical chemist have been, perhaps, of an even more intimate nature. Physiology, seeing that it consists so largely of interchanges of matter and energy between semi-fluid cells and their fluid environments, offers signal opportunities for the application of theories of solution, mass action, surface chemistry, and so forth. So pressing, indeed, have been the needs of the physiologist, that in some cases he has not had the patience to await the necessary developments in pure physical chemistry, but has taken the law, or rather the laws, into his own hands, and laid the foundation stones of such developments himself. One need only

recall that the first precise measurements of osmotic pressure were made, not for chemical but for physiological purposes, by a botanist, Pfeffer: and that in more recent times Sir William Hardy, stimulated alike by the needs of biology and chemistry, has proved himself a pioneer not only in the field of colloidal chemistry, but also in the understanding of a subject which bulks largely in the mind of the physical chemist of to-day, namely, that of molecular orientation at interfaces. At the present time, the harvest reaped by this fruitful liaison appears to be not only maintained but also to be increasing, as is indeed shown by the work of A. V. Hill, Höber, Michaelis, and others. For that reason we cannot but extend a very cordial welcome to the latest edition of the most comprehensive treatise on the subject in existence—Höber's 'Physikalische Chemie der Zelle und der Gewebe."

Höber's book consists of two main divisions. Of these, Part 1 deals with such portions of "the physical chemistry of homogeneous and heterogeneous systems" as are considered applicable to physiology, and hence includes chapters on osmotic pressure and diffusion, the ionic theory of solutions, measurement of hydrogen ion concentrations, surface phenomena, colloid chemistry and enzymes. Unlike some writers, Höber shows himself equally at home both in the theoretical and practical application of these subjects. The theoretical treatment is almost invariably sound, if not always quite up-to-date, and is so continuously and ingeniously interwoven with physiological applications that even the heart of the most biologically inclined reader must at times be softened. A physiologist should not fail to be more interested, for example, in the nature of osmotic membranes, when he learns so vividly from Chap. i. that it was from the structure of the single plant cell that Pfeffer drew a leading hint as how to construct a really semi-permeable membrane. No less stimulating are the detailed discussions of the ionic theory of salt solubility (especially in connexion with uric acid and the solubility of its salts in the body fluids), and the comparison of suspensoid and hydrophile colloids, together with the application of this knowledge to the colloidal behaviour of living cells. Chap. vi., on enzymes, is perhaps the weakest in the book, but this can be readily excused by the German reader, who has access to the massive text-books of Euler and Oppenheimer.

It is to be hoped, however, that in future editions more attention will be given to the theory of ionic activity and its physiological successes, and that the fundamental work of Langmuir and Adam on molecular orientation in thin films will receive more than the passing notice accorded in Chap. iv. of the present edition. A statement and appraisement of the divergent views on protein ionisation held by the respective schools of Pauli, Sørensen, and Loeb would also be welcome.

Part 2 deals directly with the physical chemistry of cells and tissues and contains chapters on the body fluids, the osmotic properties and permeability of cells and tissues, narcotics, the physiological action of single electrolytes and ion combinations, electrical processes at physiological interfaces, absorption and secretion, and physical chemistry of matter and energy exchanges. Here the author reaches his zenith, both as regards his powers of exposition and his usefulness to the reader. Each topic is summarised in a manner which is at once comprehensive, lucid, and well arranged, and though the discussions may be inferior in stimulating power to those of Bayliss in his "Principles of General Physiology," yet they contain much of great value in the way of criticism and suggestiveness.

It is difficult to select for special commendation from much that is good: but we venture to think that the treatment of cell permeability, Hofmeister ion series, antagonistic and co-operative action of different cations, and the recent work on kidney function will be found to be of the greatest value to the student, both on account of the intrinsic merits of these summaries and of their inaccessibility elsewhere. In each case the reader is left with the impression that he has now got a really first-hand grip of the topic in question—possibly a dangerous delusion, but one of great help to him if he has to lecture on the subject.

The last chapter, on the physical chemistry of matter and energy exchange, is in some ways the most fascinating, but is certainly the least complete. In further editions it is to be hoped that the sections on the temperature coefficients of vital processes and the action of light in biology may be expanded so as to include the recent interesting work on these subjects. But the most urgent need, in the opinion of the reviewer, is that some industrious and competent linguist should prepare an English translation of "Höber" and so render him more easy of approach by that growing group of scientific workers who are attracted to the borderland of physical chemistry and biology.

In conclusion it should be noted that Höber takes up no philosophical position in regard to the ultimate nature of life: he does not lay down that all living processes are reducible to the same

conceptual shorthand as physics and chemistry, nor does he deny it. He is content to indicate the great achievements already to the credit of this powerful shorthand, and to leave his readers in a mood of optimistic agnosticism as to the future. If ever there comes a limit to the extent to which physico-chemical interpretations of life can be pushed, that limit will surely be very much nearer to the ultimate goal of biology than anything that has yet been reached. Such is the impression derived from reading Höber's book; such, indeed, is the policy which directs and stimulates the majority of modern physiological research.

F. J. W. R.

Rheumatism and Gout.

Aspects of Rheumatism and Gout: their Pathogeny, Prevention and Control. By Llewellyn Jones Llewellyn. Pp. xiii+295. (London: William Heinemann (Medical Books), Ltd., 1927.) 10*s.* net.

IN "Aspects of Rheumatism and Gout," Dr. Llewellyn, who has written much on these spa diseases, has collected the material of a number of his addresses and essays, many of them previously published, dealing with their pathogeny, prevention, and control, into an eminently readable and suggestive whole. In the foreword the plan of the work is outlined, and this is followed by a disquisition on diathesis, a subject which Sir Archibald Garrod has, since this volume appeared, treated in the Huxley lecture at Charing Cross Hospital; the rise, eclipse, and revival of the diathetic conception are sketched, and diathesis is regarded as a synonym for chemical individuality.

The diathesis of acute rheumatism or rheumatic fever is characterised by an inborn tendency to a want of the normal endocrine-autonomic balance which is manifested by instability of the functions of the skin and is essentially an inherent deficiency in the power of organic regulation. Similarly, in rheumatoid or atrophic arthritis, in osteo-arthritis and gout, the author finds evidence of this endocrine-autonomic imbalance, and further concludes that infections, if and when responsible for arthritis, act not directly but indirectly—the intermediary mechanism being instability or defect of the neuro-endocrine system. As bearing on this view, the geographical correspondence in the incidence of goitre and of acute rheumatism and cardiac disease, which is so prominent in Bristol, is brought out. Later on, the resemblance of acute rheumatism to serum sickness, or the symptoms following injection of horse serum, is pointed out, and the view that infection causes the instability of the neuro-endocrine system, which is the exciting cause of the joint symptoms, is again suggested. In considering the prevention of acute rheumatism and heart disease, the importance of supervision in the pre-rheumatic phase is emphasised.

The relation of oral sepsis and arthritis, which has been so much in the limelight, is dealt with in considerable detail, and gout, on which the author wrote a book some seven years ago (1920), is described as a hereditary condition of hypersensitiveness to proteins and analogous to asthma, the remarkable food idiosyncrasies of the gouty being brought forward to enforce the argument. It would thus appear that the gout-producing factor in alcoholic liquors is not the alcohol, but some protein such as hordein in beer and yeast cells in wine. A chapter is devoted to the common ailment lumbago, or pain in the back, and the difficulties in diagnosis are dealt with in chapters on the pitfalls in connexion with sciatica and arthritis. In conclusion, it should be said that the author's method of presenting his subject matter and style of writing add an attraction to the interest of these common diseases.

Our Bookshelf.

Colloids: a Textbook. By Prof. H. R. Kruyt. Translated from the Manuscript by Prof. H. S. van Klooster. Pp. xi+262. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1927.) 17*s.* 6*d.* net.

THE author says in his preface that his purpose has been to write a text-book or, in other words, "to offer a main line of orientation to students who wish to become acquainted with the general trend of Colloid Chemistry or who desire to undertake research in this particular branch of Chemistry." The work may certainly be said to accomplish this purpose and to have solved the fundamental problem of text-book writing—that of selection from an enormous mass of material—with complete success.

A general introduction begins with a brief description of colloidal systems, gives in less than forty pages a clear and concise account of boundary phenomena, and concludes with a description of the electrical conditions at interfaces. The second part, the largest of the book, is devoted to suspensoid sols; a number of important generalisations from the vast mass of data on charge, flocculation, etc., are developed very clearly. The third part, dealing with emulsoid sols, departs more markedly than the rest of the work from traditional lines. The author takes as a type of this class the agar sol, which is certainly to be preferred to gelatin, and shows that its stability is a function of two factors, hydration

and electric charge; if either of these separately is reduced, the sol alters its character but remains stable. The author is inclined to deal somewhat lightly with the anomalous viscosity of emulsoids, which have occupied both Freundlich's and Ostwald's laboratories considerably during recent years, but perhaps this is one of the simplifications made in the interests of the beginner; it is, however, certainly incorrect to say that a linear relationship between viscosity and concentration holds in agar, gum arabic, or starch sols, except at the very low concentrations and comparatively high temperatures at which the author and his students have chiefly examined them. In sols like those of india-rubber or cellulose nitrate it does not hold even at concentrations between 0·1 and 0·5 per cent. The remainder of Part 3 is devoted to protein sols, osmotic phenomena, and gels; though brief, these chapters are extremely lucid and instructive, and the reviewer has been struck particularly by the presentation and critical examination of Loeb's views. A short fourth part deals briefly with special cases of interest, such as soaps and emulsions.

The translation is idiomatic and nowhere leaves the reader in doubt about the author's meaning. The book is excellently printed and illustrated.

E. H.

Eruptive Rocks: their Genesis, Composition, Classification, and their Relation to Ore-Deposits; with a Chapter on Meteorites. By Prof. S. J. Shand. Pp. xx+360. (London: Thomas Murby and Co.; New York: D. Van Nostrand Co., 1927.) 20*s*. net.

PROF. SHAND'S interesting and original book is, as he says in the preface, the outcome of three insistent wishes: first, to clean up the "jungle of rock names"; second, to make the results and conclusions of petrology intelligible to "matter-of-fact people like physicists and chemists" (we did not know before that petrologists were less matter-of-fact than physicists and chemists); and third, to "bring theory and practice together to save petrology from the reproach of being an academic study of little use in life." Prof. Shand has produced an admirably stimulating work, but we are not sure he has achieved the above aims. The classification of igneous rocks he has devised is based upon a sound plan, just as Esperanto is, but it may fail for the same reason that artificial languages fail, because it is too clean-cut and logical, and has not grown up with the science. He does not clean up the jungle of rock names; on the contrary, he adds to the undergrowth a number of new terms with the aid of the overworked prefixes and suffixes, per-, sub-, meta-, -oid, and the like.

The most successful part of the book, indeed, is not the classification, but the exposition of physico-chemical principles as applied to the crystallisation of natural magmas. This occupies the first five chapters, entitled "Eruptive or Igneous Rocks," "The Fixed Constituents of Igneous Rocks," "The Fugitive Constituents of Magmas," "The Magma and its Walls," and "The Freezing of the Magma." Chaps. vi. to xiv. discuss classification in general, Prof. Shand's own system and nomenclature, and descriptions of igneous rocks in relation to this system. The book concludes with chapters on meteorites and eruptive ore deposits.

In describing the rocks assigned to various divisions of his classification, Prof. Shand has made a valuable survey of recent igneous petrography. The description of each main group is appropriately prefaced with a section on its geology, a feature often neglected in petrographical treatises. This book forms a very notable addition to petrological literature.

Second Experimental Report to the Atmospheric Corrosion Research Committee (British Non-Ferrous Metals Research Association): a Discussion held by the Faraday Society, 30th March 1927. By Dr. W. H. J. Vernon. Pp. ii+113-204. (London: The Faraday Society, 1927.) 8*s*. 6*d*. net.

IT is quite impossible in a short survey to give any real indication of the amount of valuable information contained in this report. Systematic investigations on the indoor atmospheric corrosion of copper, brass, aluminium, lead, and zinc are recorded, whilst in the case of copper, brass, and zinc, outdoor exposure has also been examined.

Weight increment–time curves are given, and the value of the protective coating formed in some cases is revealed. The effect of oxide films on brass upon its subsequent corrosion in a polluted atmosphere is indicated. Exposure of zinc over a period of three years shows that, in an indoor unsaturated atmosphere, a straight line relationship holds except for the first twenty-four hours.

An outstanding feature of the report is the portion giving detailed analyses of the outdoor corrosion products, the proportions of sulphate, sulphide, carbonate, and oxides being determined. The corrosion product is shown to be less easily eroded in some cases than others. The deposit on copper is the most tenacious and that on zinc the least. In the latter case some 90 per cent. of the deposit is removed by weathering during outdoor exposure.

The influence of alloying impurities in the metals is not very appreciable during indoor exposure, but in certain cases it is very pronounced during outdoor exposure; thus arsenical copper and, to a lesser extent, copper containing nickel, is more resistant to attack than H.C. copper.

Some laboratory experiments upon the atmospheric corrosion of iron are included in the report. Solid suspended impurities in the atmosphere are shown to be responsible for the corrosion of iron in an atmosphere of low relative humidity. Screening the metal by preventing the access of such solid particles inhibits the corrosion. The influence of rust upon the subsequent corrosion of iron in an unsaturated atmosphere is also demonstrated.

In conclusion; the report embodies the results of a research covering a wide range and carried out with a patience and accuracy which can only be described as classical.

W. S. PATTERSON.

The Mollier Steam Tables and Diagrams extended to the Critical Pressure. By Prof. Dr. Richard Mollier. English edition adapted and amplified from the third German edition by Dr. H. Moss. Pp. xvi + 53. (London: Sir Isaac Pitman and Sons, Ltd., 1927.) 7*s*. 6*d*. net.

RESEARCH is being conducted in order to obtain accurate knowledge of the physical properties of steam in the regions of high pressure and high superheat, but meantime the rapid development of the use of steam at high pressures and temperatures has accentuated the need for this information. To meet this temporary want, Dr. Mollier has extended his tables of 1906, modifying the characteristic equation adopted in the calculations, in order to obtain results which agree consistently with all available data.

The form of equation, that recommended by Prof. Callender, has been retained, but an additional term has been found a necessary refinement at pressures above 30 atmospheres. The method of testing this modified equation for reliability is briefly described. It is considered satisfactory for all conditions except for steam in the neighbourhood of saturation over a small range above 150 atmospheres, and the values in this range are obtained by reasonable extrapolation. The upper limits of the tables are the critical pressure and 500° C. They are in a convenient form with notes on their practical application. A table of coefficients intended to facilitate calculation and two large scale H. Φ charts are also included. Up to about 30 atmospheres, the values agree closely with previously published results, but in the higher pressure regions the differences are considerable and clearly justify the investigation. Although the book is only intended to have an ephemeral utility, it is a valuable contribution and should be highly appreciated by those interested in high temperature steam. L. M. D.

Les plateaux du Jura central : étude morphogénique. Par Dr. Georges Chabot. (Publications de la Faculté des Lettres de l'Université de Strasbourg, Fascicule 41.) Pp. 350 + 4 planches. (Paris: Société d'Édition Les Belles Lettres; London: Oxford University Press, 1927.) 12*s*. 6*d*. net.

THE plateaux of the Central Jura are believed to be dislocated fragments of a Tertiary peneplain which have been caught up between the folded ranges. The author correlates this peneplain with that of the Swabian and Franconian Jura, and concludes that the plateaux are "relics of the tabular Jura within the folded Jura." His demonstration would have been more easily followed if it had been accompanied by more adequate maps and sections.

Some interesting chapters deal with the karst phenomena of the plateaux which are compared with the classic region of Illyria. The differences due to local climatic conditions, composition of the rocks, and geological history are clearly and convincingly discussed. The rainfall of the Jura is such as to encourage vegetable growth and continuous chemical action, with the consequent greater accumulation of residual soil. The folded limestones are thin and alternate with impermeable beds: hence there is considerable run-off as well as constant infiltration. Changing climatic conditions in northern Europe have in the past sometimes promoted, sometimes retarded the characteristic processes of erosion. All these things impart to the karst of the Jura a somewhat hybrid character which is reflected in the peculiarities of the dry valleys, lapiés, dolines, and closed basins of the plateaux. This section of the book is worthy of the closest study.

Magnolias. By J. G. Millais. Pp. viii + 251 + 34 plates. (London: Longmans, Green and Co., Ltd., 1927.) 32*s*. net.

THIS book, which is well printed and handsomely illustrated, is a handbook to the cultivation of magnolias. The author is an enthusiast, with a great love and knowledge of gardening, and he pleads "for a big move in the planting of Magnolias throughout our islands so as to make England in April as lovely as Japan in cherry time." About forty species of Magnolia are known in the wild state, some deciduous, others evergreen, and all remarkable for their large and beautiful flowers. Not all are hardy, but in Sussex at least twenty species grow in the open air. One of these flowers in March, another in October, and other species in the months between.

The duration of the flowering season is remarkable, and Mr. Millais urges that "Magnolias should be planted freely, since no other genus but Rhododendron will give so long a succession of beautiful flowers, without cultivation, expense, or effort on our part."

The greater part of the text is devoted to an elaborate account of all the species and hybrids, giving in each case a clear botanical description, with notes on cultivation and on remarkable specimens in well-known gardens. A key to the genus by Mr. Dendy, of Kew, and a special chapter on the magnolias of Yunnan in China by the intrepid explorer, G. Forrest, add to the interest of the book. Another useful chapter gives an alphabetical list of the names and synonyms that have been applied to the species and hybrids.

How a Tree Grows. By Sir William Somerville. Pp. iv + 212. (London: Oxford University Press, 1927.) 10*s*. net.

THIS is an elementary treatise on forest botany, based on lectures given to students of forestry at Oxford. It is written in an easy style, and may be perused with pleasure by working foresters, gardeners, landowners, and others interested in growing trees and in the production and sale of timber. The book is well illustrated with more than a hundred diagrams and figures. Many subjects besides that indicated by the title are briefly but clearly dealt with, such as buds, leaves, stipules, seeds, seedlings, fall of the leaf, mycorrhiza, ascent and descent of sap, etc. Most attention is paid, however, to the structure and properties of wood and to the identification of timbers. A good index is provided.

Letters to the Editor.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

A Contribution to the Piltdown Problem.

SINCE the discovery of the fragments of the Piltdown skull in 1912, there has been considerable difference of opinion with regard to the manner in which the skull should be reconstructed, and as a necessary consequence of this, with regard to the extent of its cranial capacity.

Estimates of this have ranged from Smith Woodward's original figure of 1070 c.c. (see NATURE, vol. 92, p. 197; 1913) to his latest estimate of about 1300 c.c., a figure which is approved of by Elliot Smith (see NATURE, vol. 109, p. 726; 1922). Keith, on the other hand, at one time estimated its capacity at just above 1500 c.c., by measuring the amount of water displaced by the endocranial cast taken from one of

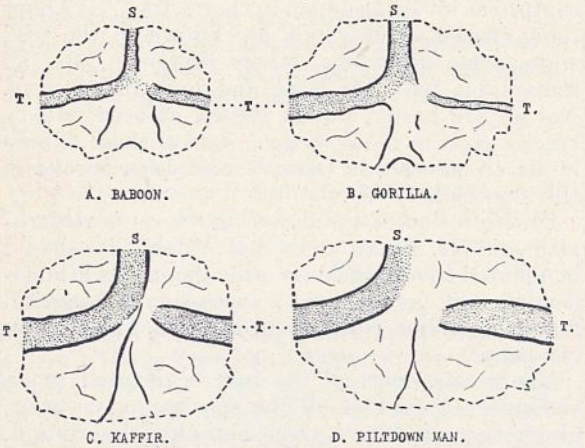

FIG. 1.—The stippled areas in the above drawings represent the arrangement and proportions of the venous sinus grooves (transverse sulci) on the internal aspect of the occipital bones of the skulls of: A. A baboon with a cranial capacity of 168 c.c.; B. A gorilla with a cranial capacity of 527 c.c.; C. A Kaffir with a cranial capacity of 1380 c.c.; and D. Piltdown man with a cranial capacity of 1415 c.c., estimated from the width of the transverse sulci (T.).

his reconstructions (NATURE, vol. 92, p. 197; 1913), but his most recent view, derived from an application of Lee's formula to one of his reconstructions, appears to be that the cranial capacity is about 1400 c.c. ("The Antiquity of Man," by Sir Arthur Keith, vol. 2, 1925). All these estimations were determined from different types of reconstruction, the accuracy of which is disputed, and so far there has not seemed to be any other way of arriving at an estimate of the cranial capacity, and in this way helping to decide whether the higher or the lower estimates are more likely to be correct.

On examining the endocranial aspect of Mr. Barlow's casts of the Piltdown bones, one is struck by the large size and clearness of outline of the grooves for the middle meningeal vessels on the parietal fragments, and of the transverse sulci, that is to say, the grooves for the transverse venous blood sinuses on the occipital fragment. Now the large size of these grooves and of their corresponding blood-vessels does not appear to have been sufficiently emphasised as an indication of the size of the brain-case, for they seem in themselves to suggest a moderately large brain cavity. That the size of the transverse sulci is correlated with the capacity of the cranium in a definite manner is clear from Fig. 1, inasmuch as these sulci are much narrower in a baboon than in a gorilla, and narrower in a gorilla than in man. This is what one would expect, seeing that these sulci lodge the veins, which convey practically all the venous blood returning from the brain. Larger channels are therefore needed for the larger amount of blood returning from larger brains.

A number of observations have therefore been taken on a small group of human skulls to test the degree of correlation between the width of the sulci and the cranial capacity, with the view of arriving at a means of determining the cranial capacity from the width of the sulci.

Average width of right and left sulci.	Cranial capacity.	Average width of right and left sulci.	Cranial capacity.
12·30 mm.	1300 c.c.	16·80 mm.	1370 c.c.
14·18	1436	17·26	1360
14·70	1320	17·33	1270
14·95	1130	17·80	1406
15·24	1615	18·10	1445
15·38	1410	18·20	1380
15·40	1250	18·30	1450
15·45	1280	18·35	1385
15·60	1290	18·45	1315
15·60	1270	19·40	1420
15·92	1450	19·48	1285
16·23	1170	19·50	1550
16·29	1380	19·52	1315
16·30	1350	19·75	1475
16·42	1320	20·70	1580
16·50	1266	21·00	1665

The coefficient of correlation between these two variables, in the thirty-two skulls measured, is 0·475, which is definitely significant. The regression formula for the calculation of the cranial capacity in terms of the width has been found to be as follows:

$$\text{Cranial capacity} = 27{\cdot}98 \times \text{width} + 894{\cdot}2.$$

In connexion with this equation there is a probable error of $\pm 69{\cdot}0$.

The average width of the two transverse sulci of the Piltdown occipital bone added together is 18·6 mm. The cranial capacity is therefore estimated from the above formula to be 1415 c.c., or to lie somewhere between a lower limit of 1346 c.c. and an upper limit of 1484. This makes the Piltdown skull mesocephalic, and supports those who have arrived at this conclusion by other methods.

Mr. S. Cohen and Mr. P. R. v. d. R. Copeman kindly assisted me in taking the measurements and in making the calculations.

M. R. DRENNAN.

Anatomy Department,
University of Cape Town.

γ-ray Emission and the Law of Radioactive Transformation.

SOME time ago I described a method (*Phil. Mag.*, vi. **47**, 23; 1924) of determining the period of transformation of RaC′, which consisted essentially in comparing the transformation constant λ with the velocity v of the recoil-atoms from RaC. The apparatus is shown in Fig. 1*a*: the active source, which consists of RaC deposited on nickel, is placed on the cone in the lower end of the apparatus. A beam of recoil atoms is limited by the screens S; midway between the screens a number of slits is provided through which the α-particles from the recoil atoms

are observed. If the transformation of RaC′ takes place according to the law

$$N_t = N_0 e^{-\lambda t}, \quad . \quad . \quad . \quad . \quad (1)$$

where $t = 0$ represents the moment at which the β-particle is sent out, it is easily shown that the number of α-particles as a function of the distance x from the active source to the slit will be represented by

$$n = n_0 e^{-\frac{\lambda}{v}x}. \quad . \quad . \quad . \quad . \quad (2)$$

The experiments showed that the number of α-particles decreased approximately exponentially with increasing distance from the source (Fig. 1*b*), the value obtained for $\lambda : v$ being about 1.

Later on, Barton (*Phil. Mag.*, vii. **2**, 1273; 1926)

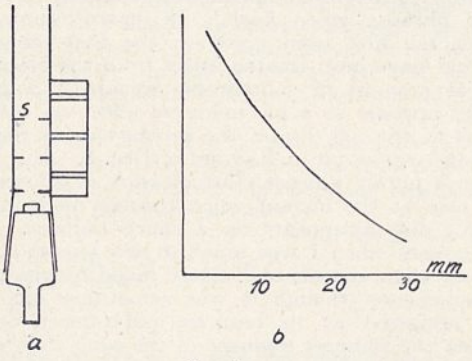

FIG. 1.

repeated the experiment with an apparatus somewhat different in construction and obtained a similar value for $\lambda : v$.

In the course of a series of experiments, the object of which was to obtain a determination of v by measuring the stopping power of gases for the recoil atoms, the apparatus shown in Fig. 2*a* was used among others. The active source is again RaC, deposited on the flat end of a nickel rod 4 mm. in diameter; by means of a

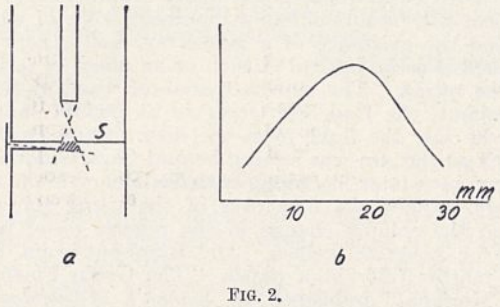

FIG. 2.

screen S with a circular hole 4 mm. in diameter a beam of recoil atoms is defined. The α-particles emitted by the recoil atoms are observed through a flat tube 2 × 10 mm. in cross-section, which is placed immediately below the screen. The number of α-particles observed will be proportional to the number of recoil atoms transformed in the hatched space. By means of a screw arrangement, not shown in the figure, the distance between source and screen could be varied.

The result of an experiment is shown on Fig. 2*b*, where the number of α-particles is plotted as a function of the distance between source and screen; a correction has been applied for change in the solid angle covered by the beam of recoil atoms when the source is moved. It is seen that the number of α-particles with increasing distance rises from zero to a maximum value, from where it again decreases.

By a comparison of the curves in Fig. 1*b* and Fig. 2*b* a striking disagreement is found; obviously in one or both of the corresponding apparatus a source of error must be present which has hitherto been overlooked.

The origin of this difference in behaviour of the phenomenon may be briefly summarised as follows. From the work of Knudsen and Langmuir it is known that when atoms of mercury collide with a glass surface they will in general be reflected by an elastic collision, but no condensation occurs when the temperature is above a certain critical value. The collisions between the recoil atoms and the metal walls in the apparatus in Fig. 1*a* may be expected to behave in a similar manner. When a solid obstacle is placed in the path of the recoil atoms, an accumulation of recoil atoms will result. This will especially be the case in the space between the first and the second screen in the apparatus Fig. 1*a*, which will act as a trap for the recoil atoms. When a recoil atom has suffered a collision with one of the walls, the chance for getting out of the space in question without being transformed will be relatively small. It is clear that the number of α-particles emerging from the first slit may be increased several times in this way. For the slits at longer distances from the source a similar effect will be present, but not to the same degree.

The conclusion here arrived at could be verified by placing screens in the path of the recoil atoms in the apparatus Fig. 2*a*; when the distance source–screen was 5 to 10 mm., the number of recoil atoms could be increased from 2 to 5 times in this way; at longer distances the increase was relatively smaller. From these considerations we may conclude that the decay curve for RaC′ has the shape shown in Fig. 2*b*, and that the apparently exponential decay shown in Fig. 1*b* has its origin in the source of error outlined above. In the apparatus used by Barton this source of error is not present. The reason that Barton observed a steady decrease in the number of α-particles with increasing distance, seems to be that the regions, which in his apparatus corresponded to the hatched part in Fig. 2*a*, were broader and at longer distances from the source.

At first sight the curve in Fig. 2*b* might be taken to indicate a deviation from the general law of radioactive transformation, the transformation constant λ depending upon the time. A closer consideration shows, however, that a more reasonable explanation, in which the transformation law is conserved, can be obtained by taking into consideration the time required for the emission of the γ-rays. It is known that a nuclear electron is sent out from RaC and an α-particle from RaC′. According to Ellis and Meitner, the emission of the γ-rays must be placed between these two, such that the following picture is obtained:

$$\underset{\text{RaC}}{\beta} \longrightarrow \underbrace{\gamma \longrightarrow \underset{\text{RaC′}}{\alpha}}$$

At the time $t = 0$ the β-particle is sent out and the movement of the recoil atom started. The α-activity of the recoil atom will now vary in the same way with time as if the γ- and α-rays were sent out from two consecutive radioactive substances. When both the γ- and the α-transformation are assumed to take place according to an exponential law (1), and the constants λ_γ and λ_α are adjusted in a suitable way, the curve in Fig. 2*b* for the α-activity will result. From the shape of the curve it appears that λ_γ and λ_α must be of the same order of magnitude. By putting λ_γ equal to λ_α and assuming for v, the velocity of the recoil atoms, a value of 2×10^5 cm. per sec., λ_γ is found equal to 10^5 sec.$^{-1}$.

This can only be regarded as a rough approximation, since the recoil $h\nu/c$ due to the emission of the γ-rays

has been disregarded. As a result of this, neither the solid angle covered by the beam of recoil atoms nor the time can be simply determined from the distance source-screen.

Experiments are in progress to test the following two points.

(1) In the case of ThC′, λ_α from the Geiger-Nuttall formula may be expected to be very large. Provided λ_γ is of the same order of magnitude as the velocity of the recoil atoms from ThC, we should expect to find an exponential decay of the α-activity of ThC′ with time.

(2) When a preparation of RaC deposited on nickel is placed in a vacuum, part of the γ-radiation should originate from the space surrounding the source; by a suitable screening it should be possible to detect a variation with the pressure in the apparatus of the ionisation due to the γ-rays.

I desire to express my thanks to Prof. Bohr for the interest he has taken in the work.

J. C. JACOBSEN.

Institute for Theoretical Physics
University, Copenhagen,
Oct. 14.

The 'Green Flash.'

REFERRING to Sir Oliver Lodge's conviction that the green flash at sunset is mainly physiological (NATURE, Dec. 3, p. 807), I would point out that this does not explain the appearance at sunrise. The green flash has been seen at sunrise by numerous observers; I have myself seen it repeatedly. As seen through field glasses the green flash at sunset has no appearance of being physiological; the two ends of the last visible segment of the sun take on the green hue first, and this spreads rapidly over the whole segment as it grows smaller, until the last visible part of the sun becomes a vivid blue green. This appearance as seen through field glasses has been described more than once. The green flash is only seen when the sun sets behind a distant horizon, whether this be sea, land, or cloud, as would be expected if the flash were due to refraction. If the cause were physiological the flash should be seen when the sun sets behind a horizon close at hand, but so far as I know this is not the case.

With regard to Sir Oliver Lodge's observation of the appearance of a momentary greenness when he switches off a bright light, I have tried a similar experiment (1) with the naked eye, when the first after-image seemed to me to be golden; (2) looking through a yellow, Wratton G, filter, when the first after-image was a deeper gold; and (3) through a deep red, Wratton A, filter, when the first after-image was a very deep red. Some seconds later, when its intensity began to fade, the after-image became a dirty green, and this lasted for a considerable time. Probably different observers react differently, for I notice that my two eyes react in a slightly different manner. It would be interesting to know whether the greenish appearance mentioned by Sir Oliver Lodge has any of the vividness and distinctness of any of the appearances of the green flash that he may have seen.

The green flash at sunrise and sunset lasts a very short time. I should estimate it as half a second at most as seen with the naked eye; it does not fade away gradually as would an after-image, but 'goes out' suddenly at sunset, and at sunrise it changes as suddenly to the yellow of the sun. The appearance at sunrise seems to me definitely to rule out the physiological explanation.

The literature of the green flash is very voluminous, and extends into fiction, but the whole subject was dealt with by Dr. A. A. Rambaut in the *Meteorological Magazine*, vol. 41, pp. 21 and 41. After reading these articles, and after having myself seen the green flash many times both at sunrise and at sunset, I can feel no sort of doubt that the explanation is physical and not physiological. The explanation as a refraction phenomenon is so simple, and fits the facts so well, that it is curious that there should be such a reluctance to accept it.

C. J. P. CAVE.

Stoner Hill, Petersfield, Hants,
Dec. 3.

MUCH confusion has beset this subject, because two entirely different things are unfortunately covered by the phrase 'green flash.' If separate names had from the first been given to the two things, each would have been treated apart from the other and a great amount of controversy avoided. A greenish light appears as a physiological effect on ceasing to look at the red disc of the setting sun, as Sir Oliver Lodge points out in NATURE of Dec. 3. But there is also a purely physical phenomenon of sunset which is seen at the instant when the last portion of the sun's disc disappears on a sharp horizon. During the years when I was much at sea I used to watch every clear sunset, and rarely failed to observe this phenomenon though it was sometimes incomplete. It appeared at its best on half-a-dozen occasions when the thinnest segment of the sun's disc was still above the horizon, but with its light so much reduced that it could be looked at easily through a field-glass. However red the sun may have been when fully visible, the tiny shaving of a flat arc had become distinctly yellow, and as it was disappearing, the ends turned greenish and seemed to shrink towards the centre, at which the last light visible seemed to be intensified to a clear green point, which changed into blue and vanished in violet in a fraction of a second too short to estimate.

During the visit of the British Association to South Africa in 1905, I had many arguments on the subject with sceptical fellow-members, some of whom denied the existence of a green ray, and others explained it as an optical illusion or an effect of fatigue of the retina. The sturdiest doubter was Dr. A. A. Rambaut, the Radcliffe Observer at Oxford, but at last he saw the light from the deck of the *Durham Castle* as the sun was setting behind Cape Guardafui. A few days later, he, along with Sir Henry Miers and others, caught the first rays of the rising sun and found the colours change in the reverse order from blue or green to yellow. Dr. Rambaut went into the matter fully in a paper, "The Green Flash on the Horizon," published in *Symon's Meteorological Magazine* for March and April 1906 (vol. 41, pp. 21-23, 41-45). His explanation was that the images of the sun formed by light of different wave-length are not exactly superimposed, and that as the last of the disc passes below the horizon the red image disappears before the yellow, the yellow before the green, and the green and blue images respectively go before the violet image fades. The duration of this change was worked out for various dates and different latitudes, and the conclusions arrived at in this paper have not been controverted so far as I know.

HUGH ROBERT MILL.

Dec. 3.

THE physiological theory of the green flash, resuscitated by Sir Oliver Lodge, is not now held by any competent observer who has made a careful study of the phenomenon. The late Mr. Whitmell was, I

believe, the first to arrive at the correct and simple explanation, and he was the first to describe the red flash. His observations are, I believe, recorded in back numbers of NATURE, and in other journals.

I have made very numerous observations of the green flash, at sea and on land, and have confirmed Mr. Whitmell's conclusions.

If the sun is observed in an achromatic telescope when near the horizon, a green fringe is seen round the upper limb, and a red fringe round the lower limb, due of course to atmospheric dispersion. This green upper segment remains visible for about a second or perhaps two after the sun has set, and it sometimes turns a beautiful violet at the last instant if the atmosphere is clear enough to transmit violet light. The green may be seen with a telescope or binoculars at any sunset or sunrise, in clear air and with a low horizon. It is conspicuous to unaided vision only under certain conditions at sea, when mirage effects enhance its brilliancy (NATURE, vol. 111, p. 13).

The red fringe may also be seen when the lower limb emerges from the sharp boundary of a dense cloud near the horizon, but the necessary conditions for seeing this 'red flash' are rare.

J. EVERSHED.

Highbroom,
Ewhurst, Guildford,
Dec. 3.

THIS summer, six of us were watching the sun set behind the hills of Jura in a sky absolutely free from cloud and haze. We stood on a moderately high hill, and the sea, four miles broad, lay between us and Jura. Four had not even heard of 'the green ray.' I, who had seen the ray on other occasions, suggested that five of us should turn our backs to the sun and close our eyes until the sixth should signal that the upper edge of the sun was disappearing. On his signal we turned, and each saw for an appreciable time a thread of bright green light lining the silhouette of the island at the point where the sun was last seen. In the case of the five, at any rate, this could not have been a subjective after-image.

WILLIAM SEMPLE.

Mile Ash,
Dumfries.

Chinese Alchemy.

COMMUNICATIONS upon the subject of Chinese alchemy have appeared several times in NATURE during the past year by Prof. J. R. Partington and have greatly interested me. The Pent'sao and similar books upon Chinese mineral drugs make repeated reference to the transmutation of metals into gold. However, few of these books have very old editions extant, so I have been looking up the subject of alchemy from other sources.

With the help of Mr. Chen Yung, I have made the following abstracts from books referring to this subject:

(1) 116 B.C., Ssu Ma Ch'ien wrote "The Shih Chi." He discusses the history of Ch'in Shih Huang Ti (221 B.C.) and states: "Hsu Shih led several thousand boys and girls to search for the immortals in the sea, where there were three mountains, P'eng lai, Fang shan, and Yin chou.

"Ch'in Shih Huang Ti was unable to find the miracle medicine 'ch'i yao' because things came to harm him; but after he had been protected from the devils, he was able to find it.

"Lu Sheng wished Ch'in Shih Huang Ti not to let others know where he lived, then he can obtain this medicine of immortality, 'Pu ssu chih yao.'

"Ch'in Shih Huang Ti directed a large number of scholars and magicians to make the country peaceful by producing the magic medicine.

"Li Shao-chun said to Han Wu Ti, cinnabar can be smelted to form pure gold; this made into eating utensils, when used will produce longevity: with longevity one is able to visit the immortals of the P'eng lai mountain, the worship of whom will bestow immortality.

"Then Han Wu Ti sent the Fang Shih into the sea to find the immortals of the P'eng lai mountain, and others he sent to smelt *cinnabar with other medicines* to change them into gold.

"Although much money was spent they did not succeed in finding the immortals and immortality."

(2) 92 B.C. In the Shen-hsien-chuan we read that the "King of Huai nan," named "Liu an," kept several thousand people who wrote many books, of which eight chapters were upon the immortals and alchemy.

These writings are repeatedly referred to in other works. They are now lost, but their existence and substance matter were definitely established.

(3) A.D. 142. Wei-Po-yang wrote the "T'san T'ung Ch'i," which he stated was the first book on internal alchemy (nei chin tan). It is included in the "Ssu-ku-ch'uan-shu" (the Imperial Encyclopædia), which establishes its reliability in the eyes of the Chinese. In the chapter upon "the creation of true earth" he refers to "the many fruitless attempts of men to make the philosopher's stone, by heating together Tangut ore, talcum, alum, magnetic iron ore, and sulphur. These are useless, because they are foreign to the body. Used a thousand times they will fail ten thousand."

He believes in immortality from the true harmony produced by water and earth in the body, but he expressly opposed the alchemy of his day which tried to produce immortality by chemical means.

Ko Hung, in writing "Pao P'u Tzu," states that "Wei Po-yang was the 'Father of Alchemy,' and had three disciples who went into the mountains to make medicines. When made, they first tried them on dogs to see if they were fatal or immortal in their effects. Dogs died when fed on them; one of the disciples ate one and he also died. Wei Po-yang also ate one and died, etc. When they were being put into their coffins they resurrected." This account occurs in "Li-tai-shen-hsien-ch'uan," which is not so trustworthy as the "Tsan T'ung Ch'i."

I should like to emphasise in this material two points:

(1) Prof. Partington agrees that the accuracy of Ssu Ma Ch'ien's work seems to be unquestionable. In this we read, Ch'in Shih Huang Ti directed a large number of magicians to make the philosopher's stone. Now a large number could not have been in existence if alchemy had not been already well established by that time, 221 B.C., as concluded by the writers of the Bengal Monograph.

(2) The writings of Wei Po-yang are apparently quite authentic. The book I have quoted makes constant reference to the pill of immortality and the many schools which supported the use of mineral drugs to produce immortality, whereas the writer claimed the production of internal harmony as all important to immortality. His treatise implies a well-established school of alchemy in his day which also antedates "Pao P'u Tzu."

If the above evidences be accepted, it gives further strong support to the independent origin of Chinese alchemy, that it antedated the Egyptian school, and

that it certainly arose earlier than the conquest of Egypt by the Arabs, A.D. 640. It does not seem probable, when all is considered, that Berthelot was right in considering that Chinese alchemy was derived from the Arabs. B. E. READ.

Peking Union Medical College,
Peking, Oct. 22.

THROUGH the kindness of the Editor of NATURE, I have had an opportunity of seeing Prof. Read's interesting letter. The citations which he gives from Sse Ma Tsien's chronicles (a careful translation of a portion of which by Chavannes has been published), and the reference to books on alchemy in 92 B.C., indicate an early date for the practical study of this subject in China. No one who has read the information available in translations such as these can, it would seem, agree with the hypothesis of Arabic transmission put forward by Berthelot on such slender evidence, and dogmatically repeated by later writers, some of whom have added to the confusion by citing the conclusions of authorities in a form which is the exact opposite of that held by the authors to whom reference is made. Anyone who is interested in Chinese alchemy is recommended to refer to careful translations of Chinese books, where these exist, and to ignore the very uncritical and garbled accounts of the subject given in recent compilations on the history of alchemy. I have already alluded in NATURE to the entirely independent support given to my suggestions by the valuable work of Stapleton and Azo. It appears that the ground is gradually being cleared, and if Chinese experts can be induced to render some assistance, a new chapter on the transmission of alchemy to the West may soon be written. J. R. PARTINGTON.

Dynamics of Whirlwinds.

IN NATURE of Oct. 8, J. S. Dines gives an example of small whirlwinds in which the reduction of pressure at the foot of the central core was much greater than it could possibly have been at the top of the column, and further compares this with the case of an actual tornado where the same thing evidently takes place.

In the *Quarterly Journal of the Royal Meteorological Society* for 1896, page 71, W. H. Dines described an artificial tornado cloud which he produced by very simple means, and stated that this phenomenon was observable to a marked degree in his model. With a rotating column about two feet in height he found it possible to get a reduction of pressure equivalent to about 1 inch of water at the foot, while at the top the fan which was employed to cause the updraught was incapable of producing a suction of more than about $\frac{1}{8}$ of an inch.

There is no difficulty in explaining the low pressure at the foot, but what we have to explain is why air does not flow down the core from the top and ultimately equalise the excess reduction of pressure. I suggest that the reason is to be found in turbulent motion of the air comprising the column. There are good reasons for supposing that there is considerable turbulence, and in such case there is no reason why a pressure gradient along the core should not exist.

Consider some definite portion of the vortical column, let r be the distance of an air particle from the central axis, p the pressure, ρ the density, and v the velocity component resolved perpendicular to the axis,

Then $$\frac{dp}{dr} = \frac{\rho . v^2}{r}. \quad . \quad . \quad . \quad . \quad (1)$$

The question now arises as to what relation exists between v and r. If there be no turbulence the primary determining factor will be the viscosity of the air, and this will always tend to make any section of the column rotate like a solid disc, that is, v/r will be constant.

If, then, we neglect changes in ρ we have from (1) the equation

$$\frac{dp}{dr} = \rho . k^2 . r, \text{ where } k \text{ is a constant,}$$

whence $$p = \frac{\rho . k^2}{2} . r^2 + \text{constant}. \quad . \quad . \quad . \quad . \quad (2)$$

On the other hand, if the motion be turbulent there will be a continuous interchange of angular momentum between the different concentric shells, and the tendency will be towards the product $(v . r)$ being constant.

In such case we should have

$$\frac{dp}{dr} = \rho . k_1^2 \frac{1}{r^3},$$

whence $$p = -\frac{\rho . k_1^2}{2} . \frac{1}{r^2} + \text{constant}. \quad . \quad . \quad (3)$$

Actually, it seems certain that some relation lying between these two extremes must exist, but since the viscosity of air is small it is probable that the conditions are more nearly represented by (3) than (2). It will be noticed that equation (3) implies the existence of a small intense core of low pressure, but that (2) does not, while we know from observation that such a core does exist in the centre of a whirlwind.

The high values of v/r near the centre and consequent low pressure could of course be produced without the aid of turbulence if some external source of energy continually extracted air from the centre, but since the pressure gradient along the core is of the wrong sign for this to happen, we are left with the inference that turbulent motion must be the true cause of it.

The outer shells of a whirlwind are known to have a helical motion upwards and around the core, and if it be granted that the whole motion is turbulent they will continually exchange momentum in the axial direction between themselves and the central core. This explains both the axial pressure gradient and the reason why air does not flow downwards towards the region of low pressure.

Another point was raised, but not answered, in the paper of W. H. Dines, referred to above; namely, the curious fact that the central core in his model tornado cloud was comparatively clear, while the surrounding shells were dense with cloud particles. Now it is immediately calculable that if a suction of 1 inch of water can be produced in the centre of a whirl not more than a few inches in diameter (which was approximately the case in the model in question), the radial acceleration of the air comprising it must be of the order of 500 times that of gravity. Such an acceleration will throw all the larger water particles out of the air in the central region into the outer shells, where the acceleration is smaller; it would be interesting to know if the same thing happens in the ordinary small waterspout or dust whirl, and in the larger American tornado. L. H. G. DINES.

73 Fairfax Road,
Teddington,
Nov. 7.

The Struggle for Existence.

DARWIN attributed organic evolution chiefly to the combined action of variation and the struggle for existence, primarily the competitive struggle. This involves certain difficulties. First, the factors named tend to mutual exclusion—the more variation the less struggle. Secondly, were there no variation,

competition would be intense but barren; were variation so discontinuous as to exclude competition, many certainly of the variants would perish, but others would prosper, and since there would be greater variety than under competitive conditions, there would also be more abundant life and perhaps greater evolutionary progress. Thus, where competition is greatest the results for evolution are nil; where the results are greatest competition is absent.

The question then ensues, how does competition or, as I would call it, incompatible similarity, operate? In relation to variation, or rather to fit variation, incompatible similarity is perhaps best regarded as part of the environment. As such it is directly related only to the comparative fitness of certain variations fitly related to other environmental features; these variations it tends to specialise indefinitely, because adaptation to it only produces further incompatibility, necessitating further adaptation, and so on. But it is only on fit variations which, as discontinuous, considerably lessen, while not excluding, incompatibility that this incompatibility can operate. I assume discontinuity since the older view of natural selection as operating on minute innate differences is now found to involve serious difficulties, besides which I would suggest another, namely, that such differences would count for less than certain acquired differences—generally the surviving fittest would be those in the prime. Again, at least in progressive evolution, there is increasing environmental variety, partly due to the diffusion of life beyond the area in which it began into other and unlike areas, partly an actual increase in both organic and inorganic variety. There is also, I should suppose, at least until types have become much specialised, increasing germinal variation, attributable partly to greater environmental variety as affording richer means of subsistence. This general diminution of similarity involves a diminution of incompatibility, and therefore of its characteristic action upon variations. Decreasing fecundity as evolution advances also means decreasing similarity and incompatibility.

Regarding now the bearing of the above on the question how far relations of support, how far those of conflict are involved in natural selection. Fit organic variation obviously develops relations of support; at first one-sided, later becoming mutual—as between organism and organic environment—while later again actual co-operation among organisms, chiefly similar organisms, emerges. Relations of support, however, involve acute conflict where one race supports another as prey. Competition in intensifying certain qualities of fitness intensifies relations of support. Very largely, however, it affects such relations where they involve conflict, and this also it intensifies. Besides which it has itself an aspect of conflict, especially where there is direct rivalry. That fit variation, so far as involving increased help, has been much the more important progressive factor is suggested upon comparison of the results of evolution on land with its results in the much more extensive and less divided sea, where, partly at least from the scantiness of plant-life, competition involving conflict in its severest form has altogether preponderated. This conclusion, I would note, might help to reconcile the scientific conception of Nature with its æsthetic appeal.

The noncompetitive struggle is perhaps not a factor in evolution at all. For the total organic production is here the real cause of evolution as including by the law of probability, apart from any orthogenetic or Lamarckian tendencies, the production of a certain proportion of fitly varying organisms. The surviving fit—not fittest—here find Nature more helpful than hostile, and so strive perhaps rather than struggle; the unfit succumb without influencing the evolutionary process, in relation to which their struggle is therefore a useless by-product.

P. J. HUGHESDON.

41 Murray Road, Wimbledon.

Meteorological, Geological, and Biological Conditions on Venus.

THE absence of oxygen in the atmosphere of Venus, as shown by St. John's spectroscopic observations, and the consequent absence of life such as we know, are scarcely what one would expect at first sight on a planet so much like the earth in size and mass and having a mean temperature within the range of terrestrial abodes of life. An explanation, however, is suggested by further consideration of what might happen to the earth and its inhabitants if it could be transferred to the orbit of Venus, and also have its axial rotation speed reduced to one revolution in several weeks.

The changes of temperature produced by these two changes would of course be great, but would they alone eliminate life? The orbital change, doubling the supply of heat, would raise the mean temperature of the upper atmosphere by some 40° C., or perhaps less if we allow for an increase of albedo to that of Venus. This would leave even the tropics within the range of temperatures of such hot springs as contain life, and the polar regions would merely become comfortable.

The rotational change would increase the diurnal range of temperature seriously, but not so much as if the change of duration of the day's heat supply were the only factor to be considered. One mitigating factor is the increased moisture content, produced by the increase in average temperature. This would increase the thickness of the moist or cloudy region through which the solar heat must penetrate to reach the ground, or in which the radiation leaving the ground at night would be absorbed. The other mitigating factor is wind. On the earth as it is, the well-known deflexion of winds by its rotation limits greatly their ability to carry cold air to heated regions; on our hypothetical, transferred earth, this deflexion would be nearly eliminated. Thus the temperature differences would be so restricted by wind that it seems difficult to deny the existence of life on their account, especially in the polar regions.

The effects of this wind, however, would not all be so beneficial. For not only is the temperature range causing it great, even if not too great for life, but a wind blowing along the lines of the pressure gradient must acquire kinetic energy with far less loss by friction than occurs in our deflected winds. Hurricane strength at least, therefore, looks reasonable, and continual hurricanes would soon produce vast changes in our hypothetical, transferred earth. Vegetation on the land would be greatly impaired, leaving the surface exposed to wind erosion; in the tropics the increased violence and frequency of the thunderstorms (especially with increased temperature and moisture content) would add greatly to erosion by rain; along the coasts, likewise, wave erosion would be greatly accelerated. Altogether, would the continents endure? Or even if they could be maintained temporarily, by unusual orogenic activity, such as characterises the present geological epoch, could they endure under more normal conditions?

If they could not, the result would be a planet completely covered by its ocean, with water so rough as to give notable erosive action at depths at least

comparable with that to which sunlight can penetrate. Land plants would then be absent, and perhaps even shoal-water plants as well; and the question arises, Could the plankton algæ produce enough oxygen by photosynthesis to show in St. John's spectroscope?

Furthermore, assuming they could, on this hypothetical transferred earth, would there be any plankton algæ on a planet that had never had any continents, and so had never had any quiet tidal pools, such as are often described as the probable origins of life on the earth?

In short, is it not reasonable to suppose that Venus is a planet without land, without shoal water, and therefore without life? There are many questions here for the geologist and the biologist which a physicist cannot attempt to answer.

DAVID L. WEBSTER.

Stanford University,
California, Oct. 24.

The Tribal God.

I FEAR Prof. MacBride (NATURE, Dec. 3, p. 807) has entirely failed to distinguish between speaking contemptuously of the Deity and of some people's conceptions of the Deity. He has also withdrawn from mine and Mr. Squire's context the explanatory text. This is a common failing of the journalist, but ought not to be of the scientist.

My words in the lecture run as follows: "Nay, even to understand the Reformation itself you must appreciate that it was the replacement of a universal church by separate national churches, and in no forced sense a real return to tribal gods, invoked to support and render victorious their individual nations. Nay, if you kept your eyes open during the recent world war, I think you would have found many traces of religion as a tribal faith. This conception is strikingly expressed in the lines which Mr. J. C. Squire wrote in 1915 or 1916:

> "God heard the embattled nations' charge and shout
> 'Gott strafe England' and 'God save the King,'
> God this, God that, and God the other thing.
> 'Good God!' said God, 'I've got my task cut out.'"

To me, and I should imagine to many readers of NATURE, the conception of a God of Battles, to whom appeal is made to aid one or another nation in killing millions of their fellow-men, is contemptible, the product solely of ignorance. It is as barbarous an idea as that of the Greeks of Homer's day that the gods could mingle in the fray of men, killing mortals and wounding each other. When Ares and Athene assist their rival heroes, surely Zeus has his task cut out! May I not say to Prof. MacBride as Diderot to the god-makers of his day: "Détruisez ces enceintes qui rétrécissent vos idées! Élargissez Dieu!"?

KARL PEARSON.

University College,
Gower Street, W.C.1.

Flame and Combustion.

DOUBTLESS readers of NATURE will have noted that, although twice challenged by us to say what evidence there is for his notion that not 'hydrone' (steam) but something much more complex and 'hydronolic' (water) is formed by combustion in flames, Prof. Armstrong has vouchsafed no answer. If his fertile imagination cannot frame one we may be sure none is forthcoming, so that judgment will now go by default, however much in his closing speech he may gibe at his opponents.

So far as we are concerned, whilst making no pretence of having solved completely the whole problem of the precise rôle played by steam in the combustion of carbonic oxide—preferring to keep our minds open to the new evidence which is now rapidly coming in from various quarters—we wish in a closing word on this part of the case to say that in our opinion a point has been reached when it can be said quite definitely that the cumulative weight of experimental evidence is so conclusive against Prof. Armstrong's extreme 'water-theory'—or indeed any other postulating that steam plays a *necessary* intermediary *chemical* rôle—that it may now be dismissed as one of those 'Phantoms of the Cave' arising (as Francis Bacon said) from "a fanciful Philosophy, which regards only a few cases."

WILLIAM A. BONE.
D. T. A. TOWNEND.

Imperial College of Science,
South Kensington,
London, S.W.7, Dec. 6.

Sound Absorption Coefficients Measured by Reverberation and Stationary-wave Methods.

I HAVE to correct the calculation of a reverberation coefficient of absorption given in my letter published in NATURE of Dec. 3. Owing to a misprint in the paper from which I quoted (*Proc. Roy. Soc.*, **115**, 418; 1927) the value of $a\Omega_2$ (the imaginary part of the acoustical admittance per unit area multiplied by the velocity of sound) for an experimental acoustic plaster was given as $+0{\cdot}0100$, whereas it should have been $-0{\cdot}100$. Also the factor $(\Omega^2 + \Omega^2_2)$ occurring in the last term of the expression for the reverberation coefficient in terms of acoustical admittance should read $(\Omega_1{}^2 - \Omega^2_2)$.

The recalculated value of the reverberation absorption coefficient at 512 vibrations per second for the acoustic plaster is 0·37, which is very close to the reverberation coefficient quoted by Watson for 'Akoustolith,' namely, 0·36. For 'Akoustolith' itself I have found by the same method that the reverberation coefficient at 512 vibrations per second is 0·35.

E. T. PARIS.

Biggin Hill, Kent,
Dec. 6.

A Change in the Refractive Index of Air when an Electric Glow Discharge is passing through it.

THE change is studied by observing the shift in the interference fringes obtained by Jamin's plates. The change is purely local in the region of the luminous discharge. By varying the pressure inside the air-tube, it is found that the shift is a maximum at a pressure of the order of 2·5 cm. of mercury. Ionisation of the air by X-rays or by Tesla discharge does not cause any appreciable shift.

The shift does not appear to be due to any local changes of pressure. Whether it is purely a temperature effect is being studied. The shift was very small in the preliminary experiments, the maximum being only about a third of a fringe. A shift of two or three fringes has now been obtained and a higher degree of accuracy is expected.

J. B. SETH.

Physics Department,
Government College, Lahore,
Oct. 27.

Jubilee of the Institute of Chemistry.

JUBILEES and centenaries, as they recur and pass, serve at least to make us look forward as well as backward; to envisage the probable extension of influence as well as to recollect the circumstances of the birth of some of our most familiar institutions. The Institute of Chemistry has just celebrated its fiftieth birthday, as befits that age, in genial intercourse with the other members of the British branch of the chemical family. Fifty years is but a short life compared with the seniority which some corporate institutions have attained, but although it represents scarcely more than the passing of extreme youth it is, nevertheless, quite a respectable age when the modernity of the distinctive profession which it represents is taken into account. There was a time when chemistry was the spare-time accomplishment, so to speak, of the medical man or of the student of the diverse manifestations of Nature; now—so distinct are the details of their aims, their technique, and even their language—it is difficult enough for chemists of various tribes to find common ground in one another's interests. Yet all, as a unified but composite profession, are represented by this organisation; the works chemist, the public analyst, the consultant in metallurgy, in brewing, and other specialised branches, the instructor, the researcher, the professor, all meet within its fold.

The Institute, however, does not serve merely the profession. It has been continuously active in the interests of the country, whose citizens have a very real interest in the maintenance of proper scientific control of its food, its beverages, its medicines, its manufactures; there is, in fact, scarcely any phase of our material interests which does not at some time or other come under the professional observation of chemists. That such control or examination should be adequate, and that the examiner should be highly competent and trustworthy in the exercise of his functions, briefly sums up the policy of the profession.

The Institute of Chemistry of Great Britain and Ireland had its origin in a meeting, held in the rooms of the Chemical Society on April 27, 1876, to discuss the organisation of the chemical profession. Prof. Abel was in the chair. A committee with Mr. (afterwards Sir) Walter Noel Hartley as secretary was appointed to confer with the Chemical Society, and as a result of their deliberations it was resolved to form a new association, to be entitled "The Institute of Professional Chemists of Great Britain and Ireland," with Prof. (later Sir) Edward Frankland as its first president; the present title was, however, adopted in deference to official representations. It appears to have been in Sir Edward Frankland's mind that the idea of such an institution was formulated at a dinner given in honour of Cannizzaro on May 31, 1872, when he expressed his conviction of the necessity for the creation of some such body as would correspond with the Royal Colleges of Physicians and Surgeons, the Institution of Civil Engineers, and the Inns of Court.

The new Institute was incorporated by licence of the Board of Trade under the provisions of Section 23 of the Companies Act, 1867, on Oct. 2, 1877, and was afterwards incorporated by Royal Charter on June 13, 1885, with authority to grant certificates of competency, and to register persons qualified to practise. The membership roll now includes more than 5300 fellows and associates, and 800 students. In recent years it has been found desirable to establish local sections, in order to facilitate intercourse between the members, and to provide opportunity for the discussion of matters of professional interest. Local sections have thus been established as follows: Birmingham and the Midlands, Bristol and South-Western Counties, Edinburgh and East of Scotland, Glasgow and West of Scotland, Huddersfield, Irish Free State, Leeds Area, Liverpool and North-Western District, London and South-Eastern Counties, Manchester and District, Newcastle-on-Tyne and North-East Coast, Northern Ireland, South Wales, Cape of Good Hope, Malaya, and New Zealand, and honorary corresponding secretaries have been appointed to act throughout the Empire.

The patron of the jubilee celebrations is H.R.H. the Prince of Wales, K.G.; the present president of the Institute is Prof. Arthur Smithells, who is the seventeenth occupant of the presidential chair. The affairs of the Institute are in the hands of the president, six vice-presidents, a treasurer, and thirty-nine councillors, who number among them many of the names most honoured in the profession. Mr. Richard B. Pilcher holds the office of registrar and secretary; parenthetically, Mr. Pilcher has a deserved reputation for an encyclopædic knowledge of professional matters.

In the forefront of the Institute's work is the maintenance of a high standard of training and proficiency among members of the chemical profession. In this matter it does not intrude upon, but supplements, the work of the university and the technical college. It is not a training centre, but an examining body, particularly in certain specialised branches of vocational chemistry. The Institute recognises the hall-mark of the university by admitting first and second class honours graduates, under appropriate conditions, to the associateship without further examination; in order to qualify for fellowship it is necessary to pass a searching examination in one of the seven branches, namely: inorganic chemistry, physical chemistry, organic chemistry, biochemistry, the chemistry and microscopy of food, drugs, and water, agricultural chemistry, and industrial chemistry. The examinations, if not held at distant centres, take place at the Institute's own laboratories, which, together with the council room, library, and administrative offices, are located at 30 Russell Square, London, W.C. The Institute was formerly housed at 30 Bloomsbury

Square, W.C.; on the expiration of the lease of these less convenient premises, a fund was raised by private subscription among members and others, and the present building was erected in 1914–15.

Another side of the Institute's activities is concerned with the maintenance of a strict code of professional conduct, with professional status, and matters germane to appointments in the public service. An appointments register is largely used by members and prospective employers, and a benevolent fund has been instituted so that temporary assistance can be given in case of need. The usefulness of the Institute is also apparent in the organisation, both at headquarters and at local sections, of lectures on matters of professional interest, and in the publication of "Official Chemical Appointments" (a directory) and the registrar's useful guide entitled "The Profession of Chemistry." "Chemistry as a Career" is the title of a booklet containing a synopsis of lectures given by the registrar before college chemical societies during 1921–23. These books convey a warning as well as encouragement, for they clearly indicate that only a certain type of mind or personality can hope to attain even minor eminence, that material rewards are seldom of the richest and often of the poorest, and that real devotion to the spirit of service and inquiry is both expected and exhibited.

Although the variety and importance of the services which the chemist renders to the community are even now but inadequately realised, the Institute of Chemistry has thus done much to define, to explain, and to improve his position in both public and private practice; it has equally endeavoured at all times to assist His Majesty's Government in matters on which chemistry has a bearing, and in return the work and qualifications of the Institute have been in a large measure recognised by the State. At the time of its foundation, few universities and colleges provided satisfactory preparation for the profession of chemistry; indeed, it is difficult to realise what the position to-day would have been had this contribution to the development of systematic chemical education been withheld, and had no attempt been made to bring together in one body those who practise in a calling which is now acknowledged to be so vital to the progress of the civilised world. The strength and the future influence of the Institute will be fostered by the continued loyal co-operation of its fellows and associates in the maintenance of their own status and in the protection of such of the interests of humanity as are specially within their knowledge.

Belief and Evidence in Water Divining.

By Dr. HUGH ROBERT MILL.

AT the Public Works, Roads, and Transport Congress recently held in the Agricultural Hall, Islington, the subject of water divining was introduced by Prof. J. W. Gregory, who read a paper setting forth the admitted facts and stating his own reasoned judgment with the candour and conviction of an experienced man of science sure of his ground and satisfied with his conclusions. So frankly did he acknowledge the widespread popular faith in the use of the divining-rod as a means of finding water that the writer of a leading article on dowsers and doubters in the *Times* of Nov. 25 appears to class him amongst the believers. Prof. Gregory, however, developed the case against the dowser with a convincing moderation and clarity of reasoning, and in the issue of Dec. 2 he stated that his paper showed "that the evidence of all the controlled experimental tests in England of which I know is against water or oil . . . divining."

This important paper may be summarised as follows. The literature of the subject is enormous, and Prof. Gregory, who appears by his citations to have been exceptionally well read in it, does not claim to have read one-hundredth part of what has been written. He relies largely on the recent book on the divining-rod by Sir William Barrett and Mr. Besterman, but brings much personal experience to supplement it. He points out that while at one time the expenses of a water-diviner employed by a public body were surcharged on the members, recent decisions have allowed the cost to be met from public funds, and a diviner has even been employed in the crypt of St. Paul's Cathedral to seek for the water channels below the foundations.

The cause of the movements of the divining-rod may be explained in one of three ways: (1) by fraud and practical jokes; (2) by unconscious imposture; (3) by some actual force which acts on the rod directly or indirectly. This third view Prof. Gregory was at one time inclined to share, believing that the diviner might possess some idiosyncracy in virtue of which he might be affected by slight sharply contrasted differences of moisture in the atmosphere, but he abandoned it because it would not explain the response of the divining-rod to things other than water, and would not account for water-diviners obtaining results in rain; moreover, it was dismissed as improbable by three eminent physiologists whom he consulted.

There are three rival lines of explanation: (1) that the rod responds to some physical stimulus, possibly allied to radioactivity, as upheld by M. Henri Mager. As such matters were remote from Prof. Gregory's own province he submitted Mager's book "Les Baguettes" (1920) to Prof. Desch, who found that its arguments did not furnish any support for the view that the diviners have any powers of detecting water or minerals. Mager's claims were also dismissed as extravagant and absurd by the U.S. Geological Survey; (2) that the movement of the rod is due, though perhaps unconsciously, to the diviner. This is the view elaborated by Barrett and Besterman, who

dismiss the evidence for an external physical force by arguments which seem unanswerable. Their claim is that the diviner has a sort of second sight, the evidence for which is on a par with that brought forward by spiritualists for their alleged clairvoyance; (3) that the diviner unconsciously or subconsciously moves the rod owing to an impulse due to unintentional suggestion from the bystanders or by his recognition of indications favourable for water. The process of subconscious movement of the rod by the dowser is explained by Dr. Millais Culpin in his "Spiritualism and the New Psychology" (1920), as an example of the dissociation of the various streams of activity which flow side by side in the human brain, and Prof. Gregory considers that some of the best dowsers, like Mullins, probably act by this process, giving expression to the results of long experience or special quickness of perception of signs of water at the surface.

Prof. Gregory goes on to examine the evidence as collected in Barrett and Besterman's book in order to determine which of these conflicting explanations is the most reasonable, and he deals in turn with a series of experiments on which the authors of that book relied as examples of the triumphs of the dowsers over the geologists as water finders. His decision is that the happy selection of the sites in the four cases considered was in accordance with common sense and did not require cryptæsthesia. He cites a number of independent tests of the powers claimed by water-diviners, and shows that both geological surveys and individuals have on many occasions proved the inadequacy of the claims made. Similar tests with regard to dowsing for mineral oil were equally negative. It is pointed out that testing the divining-rod is difficult and promises no answer that will be universally accepted because the claims of different diviners are so contradictory and elusive that any test may apply only to the individual tested, and perhaps to him only on a particular day. It is pointed out that in the case of the Abbé Paramelle, claimed by Barrett and Besterman as a diviner who did not use a rod, the Abbé's own explanation that he found water by studying the indications of the surface is perfectly satisfactory.

As regards the nature of divining, Prof. Gregory says that the successful water-diviner is probably a quick observer who has usually had considerable experience in the search for water, and as he goes over the ground he probably recognises clues to the presence of underground water which subconsciously lead to movements of the strained muscles of the hands holding the rod. In some cases such an experienced dowser will probably score no higher a proportion of successes than a competent geological expert would do, while in other cases the reputation of the diviner is made by lucky coincidences which are remembered and exaggerated while the failures are forgotten. It is concluded that although the claims of the divining-rod are invalid, an expert diviner may be useful under some conditions.

The outcome of Prof. Gregory's discussion seems to be that the use of the divining-rod is a survival of primitive magic, and that there is no reason to suspect the existence of unrecognised properties of matter or power of mind from the experiences and performances of dowsers. From the point of view of the geologist it seems both reasonable and right to decide that further investigation of the divining-rod is waste of time and that his special knowledge can be of more service to the advancement of science if applied in other directions. Nevertheless, there are other points of view, and recent advances in physical and psychical science may enable a keen and cautious investigator to reach some more positive conclusion than the evidence now available justifies. Instead of taking as the subject of study the exploits of the expert dowser who has an axe to grind, or of the amateur enthusiast who has a theory to uphold, might it not be better to try some simple person who, while not using it for pay or reputation, is possessed of the gift—if gift it be—of finding a divining-rod turn in his hands in the neighbourhood of underground water?

Stress is usually laid on the erratic or even contradictory results of many of the experimental tests which have been made, as opposed to the certain and repeatable results of scientific demonstrations. But scientific demonstrations of this kind only become possible when all the conditions are known and are under control. Is this yet possible in the measurement of perception? If not, may not indications be found sometimes which indicate true relationships, though on a second attempt the demonstration may fail utterly? Every listener to distant broadcasting stations knows that for a week at a time he may pick up Cork every night and fail to find Belfast once, whereas at another time, though using exactly the same settings and the same battery strength, he may hear Belfast every evening and never get Cork at all. My view is that the facts which have been proved as to water divining are deserving from the strictly scientific point of view of as full and specialised attention as are the facts relating to electric waves. It would be very satisfactory if it could be established that Prof. Gregory's belief is correct and that the water-diviner succeeds by his quick, even if unconscious, recognition of surface signs that may escape the ordinary observer. It would be equally satisfactory if it could be shown that the nervous system is capable of detecting radiations of a different frequency from those of light and heat, and that water, and perhaps other substances, may emit such radiations at ordinary temperatures. The one suggestion does not seem to be intrinsically more improbable than the other. The research would of course be very difficult, and the first-class minds which alone could pursue it to a satisfactory conclusion can probably devote themselves to much more productive investigations at the present time.

If there is anything in these phenomena, the discovery will undoubtedly be made in the fullness of time, possibly many years hence; but meanwhile,

it is at least satisfactory to find that attention is being paid to things which are involved in such baffling perplexity that the easiest course is to look the difficulty steadily in the face and pass by. When the investigator emerges who is able and willing to tackle the problem, he must not be afraid of finding results which his present knowledge may lead him to think as absurd as the properties of radium seemed before they were discovered.

In the course of correspondence in the *Times*, induced by the article on dowsers and doubters already referred to, Mr. A. A. Campbell Swinton outlined in the issue of Nov. 30 a scheme of investigation which he suggested might be taken up by the National Physical Laboratory. He proposes the construction of an underground channel through which a controlled supply of water might be allowed to flow or percolate in such a manner that the fact of sensitiveness to the presence of water could be tested and, if found, the rate of transmission of the impulse from the water to the dowser might be measured. If this suggestion were acted upon, a committee, which would satisfy both the credulous and the sceptical, could no doubt be brought together to arrange details of the tests.

The Use of Radio-Elements as Indicators.[1]

By Prof. FRITZ PANETH.

THE use of radio-elements as indicators is a special chapter of radioactive investigation, which differs from the topics usually treated under the name of radioactive research, in so far that the radio-elements are here not the object of the study, but are used as a mere agent in the solution of problems which in general have nothing to do with radioactivity at all. These problems may be found in very different branches of chemistry, physics, and even biology, and it is to be expected that radio-elements as indicators will be more used the more familiar the advantages of this method become to non-radiologists.

Only an elementary knowledge of the principles of radioactivity is necessary in order to understand and even to apply the method. It is based upon the extreme sensitivity of radioactive measurements, and upon the chemical relations of the radio-elements to ordinary elements.

As to the first point, it is well known that by help of an electroscope, invisible and imponderable quantities of radioactive matter can be detected and exactly measured. From the radio-element thorium *C*, for example, which can very frequently be used as an indicator, 10^{-17} gm. allows for exact qualitative and quantitative determination. Now thorium *C* is 'isotopic' with ordinary bismuth. Since isotopes show identical chemical properties, it is possible to substitute the radio-element for its inactive isotope, and to acquire information concerning the element in extremely dilute solutions. The chemical behaviour of bismuth may thus be elucidated by a study of thorium *C*. In certain cases it is found advantageous to mix a certain amount of the radio-element with a sample of the inactive element in order that an otherwise indeterminable fraction of the original quantity may be detected or determined electroscopically. Instances in which such minute fractions of an element have been separated by some such process as diffusion, solution, or volatilisation, are discussed below. By choice of the appropriate ratio between the quantities of inactive element and radio-element in the sample, it is possible to cover the entire range of mixtures from those detectable only by means of the electroscope to those containing readily weighable amounts of material.

In selecting a radio-element for use as an indicator, it is generally desirable to find one that may be detected in very small amounts. It must be borne in mind, however, that the half-value period (T) varies inversely with the intensity of radiation, and that an element detectable in small quantities invariably has a short half-value period. It would therefore never be feasible to employ radium *C'* ($T = 10^{-7}$ seconds) or thorium *C'* ($T = 10^{-11}$ seconds) as indicators. Even the three indicators available for the element thallium are too short-lived for a number of experiments.

For this reason it is not practicable to use all of the elements included in the well-known lists of radioactive isotopes for the present purpose. Only the elements named in the following table can find practical application. Those to be recommended most highly are underlined in the table.

Even radio-elements such as ionium, uranium X_1, and uranium X_2, which possess no inactive isotopes, frequently are of service in increasing the radioactive intensity of their longer-lived, less active, and therefore less readily detectable radioactive isotopes. Uranium X_1, for example, is mentioned in the table as a satisfactory indicator for thorium. So also, thorium *X* may be used as indicator for radium, and radium *A* for polonium. But radium and polonium themselves may in a broader way be employed as indicators in certain lines of work. For, in the narrower sense, the function of the radio-elements 'as indicators' may be conceived to be restricted to those experiments in which the radio-elements are substituted for their active or inactive isotopes. In the broader sense, however, this function may be extended to cover any procedure in which *the radio-element is used as an instrument in the detection, determination, or investigation of matter in minute quantities.*

A brief account of some examples, where radio-

[1] From an address delivered to the Bedson Club, Newcastle-upon-Tyne, on Mar. 17, 1927. A fuller discussion of the subject in English by the same author, with references to the literature, will shortly appear in Volume 2 of the Baker Lectures, delivered by non-resident lecturers at Cornell University (Ithaca, N.Y.). For literature, see also G. Hevesy and F. Paneth, "Manual of Radioactivity" (Oxford, 1926).

elements have actually been used with success as indicators—rather than an abstract discussion of possible applications of this method—may help to a fuller understanding.

From the large number of experiments with radio-elements as indicators in the field of analytical chemistry, the choice of one typical case may well suffice. The *solubility of lead chromate* at room temperature is too small to admit of accurate determination by simple gravimetric methods. It is of course possible, in cases of this sort, to make use of conductivity measurements, or to calculate the solubility product from the equilibrium constants. With concentrations as low as that of the saturated solution of lead chromate, however, either of these methods would entail a lengthy and delicate investigation. With the aid of a radioactive indicator, on the other hand, the solubility of lead chromate may be measured with no more difficulty than that involved in a simple weighing.

RADIOACTIVE INDICATORS.

Element.		Indicator.	
Thallium		Radium C''	$T = 1{\cdot}32$ *m*
		Thorium C''	3·20 *m*
		Actinium C''	4·76 *m*
Lead		Radium *B*	26·8 *m*
		Radium *D*	16·0 *y*
		Thorium *B*	10·6 *h*
		Actinium *B*	36·0 *m*
Bismuth		Radium *C*	19·5 *m*
		Radium *E*	4·85 *d*
		Thorium *C*	60·5 *m*
		Actinium *C*	2·16 *m*
Polonium	$T = 136$ *d*	Radium *A*	3·05 *m*
Radon	3·85 *d*	Thoron	54·5 *s*
		Actinon	3·92 *s*
Radium	1580 *y*	Thorium *X*	3·64 *d*
		Actinium *X*	11·2 *d*
Actinium	20 *y*	Mesothorium 2	6·13 *h*
Thorium	$1{\cdot}65 \times 10^{10}$ *y*	Ionium	$7{\cdot}6 \times 10^{4}$ *y*
		Radiothorium	1·90 *y*
		Radioactinium	18·9 *d*
		Uran. X_1	23·9 *d*
Protactinium	$1{\cdot}2 \times 10^{4}$ *y*	Uran. X_2	1·17 *m*

To a definite amount of a soluble lead salt, a known quantity of thorium *B* is added. The activity of this preparation may be measured in any desired units, as, for example, the number of scale divisions per minute on the particular electroscope used. If, for example, 10,000 units of thorium *B* is thoroughly mixed with 10 milligrams of lead, it is apparent that one unit of thorium *B* will invariably indicate the presence of 0·001 milligram of lead. From the artificially activated lead thus obtained it is now possible by the usual chemical methods to prepare the chromate. After the saturated solution of this compound has been held at the desired temperature in a thermostat for a sufficient time, its composition may be ascertained by evaporating a few cubic centimetres to dryness, and measuring the activity of the well-nigh invisible residue in the electroscope. (This example is treated in more detail because the general procedure is typical also of the following cases.)

Had the radio-elements been available for use as indicators during the last quarter of the nineteenth century, one extremely important service might have been rendered with their aid, to the then newly advanced theory of *electrolytic dissociation*. Proof of the actual fact of dissociation, and of the interchange of ions, is readily obtainable with the help of the radio-elements, mixed, in accordance with the procedure just outlined, with their inactive isotopes. It is possible to demonstrate in this way the fact that the particular atoms or radicals assumed to be liberated by electrolytic dissociation do not retain their places in given molecules, but are free to move back and forth from one place to another. If, for example, equimolecular amounts of an inactive lead chloride and a radiochemically sensitised lead nitrate in aqueous solutions are mixed together, and the lead chloride is allowed to crystallise again, it will be found that the active lead atoms are distributed proportionally between chloride and nitrate, and must therefore have migrated in solution from lead nitrate to lead chloride until the kinetic equilibrium has been established.

Radio-elements have further shown their utility in connexion with *measurements of the surface of powdered adsorbents*. Information concerning the extent of surface is obviously necessary in deciding whether the adsorbed layer is of the thickness of one, or of more than one molecule. This question has been answered in various ways by various theories of adsorption. Particularly in the case of powders, which, because of their greatly extended surface, are preferentially used as adsorbents, determinations of superficial magnitudes have hitherto been unsuccessful. If the choice of materials be limited, however, to solid compounds of elements possessing a known radioactive isotope, a safe and simple method becomes available. It is based upon the fact that the radio-element, added to the saturated solution of the isotopic adsorbent, becomes in a very short time equally distributed between the molecules of the dissolved part of the adsorbent and those of the uppermost layer of its crystalline surface. In this way the extent of the surface can easily be computed from the decrease of the radioactivity of the solution. The surface of the sulphate and sulphide of lead, of the phosphate of bismuth, and so on, have thus been measured, and with these values it has been able to establish the fact that on all these adsorbents the limit of adsorption is reached as soon as a layer of one molecule in thickness has been formed.

From the chemistry of inorganic preparations, the discovery of the *volatile hydride of bismuth*

with the help of its isotopic radio-elements may be mentioned. From many fruitless investigations it had to be concluded that this compound, if it could be prepared, would be obtained only in very minute fractions of the initial material, and might therefore easily escape detection by the usual methods of analysis. The apparatus for measuring radioactivity can, however, be selected so that a ten-millionth part of the bismuth in the original material will give a product recognisable with certainty, both qualitatively and quantitatively. This wide extension of the range of measurement is quite necessary if the condensation and re-volatilisation of bismuth hydride are to be detected; its mere existence can be proven by relatively simple means and even by a lecture experiment. Decomposition of magnesia turnings, covered with thorium *C* or radium *C*, by dilute hydrochloric acid, yields the volatile hydrides of these radio-elements, which can be condensed at the temperature of liquid air and—on the other hand—decomposed and measured in a heated glass-tube. After experience had been gained with the radioactive method described above in the study of the best method of preparation, and of the stability of bismuth hydride, it was found possible later, with comparatively little difficulty, to prepare this compound also from inactive bismuth, making use of magnesium as before in the preparation of the hydride. It may be mentioned that the amount of material by which the existence of the compound was first recognised was but 10^{-15} gram, and that it was found possible, with further increase in the sensitivity of the process of detection, to establish by the use of radioactive indicators the existence of a *gaseous lead hydride* formed in still smaller amounts. Here also the radioactive test was a spur to ultimately successful experiments with ordinary lead.

That radioactive indicators might occasionally serve to advantage in *technological research* can scarcely be doubted, even if they have been more frequently applied hitherto to scientific problems. A question of this type is that of testing rubberised fabrics for their permeability to gases. When, during the War, in connexion with the choice of suitable samples of material for gas masks, the task of determining numerically the permeability to gases of the materials submitted by different firms was assigned, it was found convenient to employ, as a test gas, air with which was mixed a trace of radium emanation (radon). The fractional portion of the gas which penetrated the material under investigation could then be determined electroscopically.

A considerable number of problems in physics can be brought to solution through the agency of radioactive indicators. Among these, the experimental study of '*self-diffusion*' is of paramount importance. By this is understood the phenomenon, expected from the kinetic theory of matter, that the atoms of a homogeneous gaseous or liquid element move among one another under the same law that applies in the case of a diffusion of one element into another. Since in self-diffusion, however, the external properties of the element in question remain entirely unchanged, it has been possible to carry out this process hitherto only as an imaginary experiment, of which indeed Maxwell and Boltzmann have made frequent use. G. Hevesy, the author of many experiments with radioactive indicators, has succeeded in bringing self-diffusion within the scope of observation. He prepared and sealed in a hard glass tube, a fused cylinder of lead, of which three-fourths was ordinary lead and one-fourth activated lead; thorium *B* was used as radioactive indicator in experiments of only short duration, while the long-lived radium *D* was chosen for more extended experiments. If now the lead in the tube is cautiously melted, and is held at this temperature for several days, it is easy, after solidification, to measure the distribution of the activity that has taken place within the lead column during the period of the experiment. In this case, therefore, marked lead atoms have diffused among other lead atoms, and the self-diffusion constant can be calculated by the usual methods.

Among other applications to physical research which can only be mentioned here, are the formation of various alloys at low temperatures, the speed of solution of very thin layers, the rate of evaporation in relation to the amount of liquid to be evaporated, and diffusion in ideally dilute solutions.

Since bismuth compounds of very diverse composition have recently been investigated from the viewpoint of therapeutics as a substitute for arsenic, it was of interest to physiologists to learn in what proportions the *bismuth* introduced is *stored up in the different organs of the body*, and is eliminated in the urine and fæces. Since small amounts only are involved, the determination can best be accomplished by the radioactive method. Radium *E* was employed as indicator for bismuth in place of thorium *C*, in view of the fact that the experiments extended over a period of several days. It was mixed with the bismuth preparations and injected intra-muscularly into the guinea-pigs employed in the experiments. The products of excretion were ashed and measured electroscopically, and after the end of the experiment the organs of the animals were similarly treated. One conclusion to be drawn from the chart showing the exact distribution of the bismuth, is that the accumulation of this element takes place chiefly in the kidneys. Analogous experiments with lead preparations show that absorption takes place chiefly in the liver. The absorption and distribution of lead in roots, leaves, and fruits of a plant (*Vicia faba*) were investigated in a similar way.

The examples of the use of radio-elements as indicators here presented may suffice to show that the method thus illustrated is capable of many-sided application. It is to be hoped that in the future a greater number of chemists and physicists than heretofore may make use of the method, and may thereby facilitate materially the solution of many problems.

Obituary.

PROF. K. D. GLINKA.

SOIL students in all parts of the world will learn with deep regret of the death of Prof. K. D. Glinka on Nov. 2. He had for some time been in failing health and had felt some heart strain, but none of those who met him last June and July at the Soil Congress in the United States had any suspicion that he was so near the end. All who attended were prepared to accord him their deepest respect for his profound knowledge of the subject and his own brilliant work; and though they were with him but a very short time, his unfailing courtesy and his kindly good humour had endeared him to everyone who met him.

Glinka was born in 1867 in Smolensk, the son of one of the most ancient and honoured aristocratic families of the old regime in Russia.[1] He studied first at the University of St. Petersburg, which he left in 1889, and afterwards at the University of Moscow, where he obtained his doctor's degree in mineralogy. In 1900 he was appointed professor of mineralogy and geology at the Agricultural Institute of Novo Alexandria in the Government of Lublin, which since the War has again become Polish territory, and has therefore resumed its old Polish name Pulawy: the Institute, under this name, has now become the central agricultural experiment station of Poland. Within two years of his appointment he was, at his own request, and in consideration of his studies on soil, transferred to the chair of pedology at the same institute. Between 1908 and 1914 the Emigration or Settlement Board of Russia arranged a series of expeditions to study the soils of Russian Turkestan, putting Glinka in general charge; this, however, did not necessitate his giving up his professorship. He made the big expedition of 1909, travelling from Kabousaya to Vernogo, thence through Lepsinsk to Sergiopol, and finally Semipalatinsk. The material collected in this and the other expeditions was worked up by the Dokuchaiev Pedological Committee. Reports were issued in his name from 1908 to 1914: a general summary is given in Russian and German in *La Pedologie*, 1912, vol. 14, pp. 43-63. He became president of this Committee in 1912, and relinquished the chair at Novo Alexandria; in 1913 he went to the Agricultural Institute at Voronesh, the soils around which he studied; in 1922 he returned to Petrograd as director of the Agricultural Institute: this post he was holding at the time of his death.

Glinka was essentially a field worker, studying the section or profile of the soil from the surface to a depth of some six or eight feet. His methods are well illustrated in his paper "On the So-called Brown Earth," which appeared in *La Pedologie*, 1911, vol. 13, p. 17 (Russian and German). He had an amazing capacity for seeing things in a soil section that ordinary workers miss: the present writer had numerous opportunities of admitting Glinka's superiority as an observer during the Soil Excursion in the United States last summer. Glinka himself did but little laboratory work on soil, but his marked ability to use the results of others is illustrated in his studies of the differences between *podsols* and peaty soils, published in *La Pedologie*, vol. 13, p. 1.

In 1914 Glinka's book "Die Bodentypen" was published in Berlin; unfortunately its value was not at first recognised by British students, none of whom had at that time any adequate knowledge of the Russian soil work. It was not until the International Soil Conferences were resumed that this defect was remedied; now the Russian work is accorded full recognition, and some of the present-day investigators not only use Russian terms for the soil groups, but are also studying the Russian language in order to read papers that are not translated.

The chief difference between the Russian and the British soil work is that the latter has been chiefly directed to the study of the soil as a medium for plant growth, while the Russians have studied the soil as a distinct natural object without regard to questions of fertility. The difference arose from the circumstance that the early fertiliser experiments at Rothamsted and elsewhere had given striking increases in crop production, while those in Russia had not. The British workers therefore concentrated on soil fertility, which they were learning to control: the Russian workers took another direction. These studies began soon after 1861, when the serfs were emancipated by the Tsar Alexander II. The Free Economical Society was formed, and arranged with D. L. Mendeléeff, then a young man, to carry out fertiliser experiments in various parts of Russia. These experiments failed to give the definite positive results obtained in England and elsewhere, and Mendeléeff discontinued the work and returned to pure chemistry to discover the Periodic Law. It is interesting to speculate what might have happened in the history of science had the fertiliser experiments come out more definitely and Mendeléeff become an agricultural chemist. Later on the Society arranged with V. V. Dokuchaiev to study the *chernozem*—the black earths of Russia, on which wheat is so much grown.

Had this investigation been made in England, it would almost certainly have resolved itself into a study of the crop-producing power of the soil; in Russia things happened otherwise, and Dokuchaiev, disregarding relationships to plant growth, studied only the soil itself, and discovered the existence of layers more or less parallel with the surface and all related one to the other. Over considerable areas of Russia he and his pupils found similar morphological characteristics, on the basis of which, rather than of geological origin, they

[1] By a curious error in journalism, for which it is difficult to account, one of the best American daily papers, in dealing with the Soil Congress, described Glinka as the son of a peasant. This description was copied in other papers and read out at certain of the functions, much to his amusement.

classified the Russian soils. P. A. Kostychev studied these relationships chemically. A close connexion was found between the soil types and climate, and the generalisation gradually emerged that the soil is largely a function of the climate, this being more important than the parent rock.

This remains the fundamental thesis of the Russian workers. If the climate be known it is possible to predict what the soil type will be. Further studies have revealed discrepancies which, however, are courageously dealt with; where it is not possible to explain the soil on its present-day climate, as in the case of the so-called degraded *chernozem*, a change of climate is postulated to account for the observed facts. The British soils present considerable difficulties, many of them being so closely dominated by the properties of the parent rock that the geological classification is still the best, but they are being studied by the Russian methods. It is now universally recognised that the Russian pedologists have added much to the resources of soil science, and among the foremost of the pioneers Glinka's name will always be counted. E. J. RUSSELL.

LORD KENYON, K.C.V.O.

LORD KENYON of Gredington, Flintshire, who died on Nov. 30, aged sixty-three years, was a country gentleman with a fine record of public service in respect to agriculture and Welsh institutions such as the University and the National Museum of Wales. He was Lord Lieutenant of Denbighshire, and had been Lord-in-Waiting to three sovereigns.

The first Lord Kenyon of Gredington was the great jurist; the late peer, the fourth holder of the title, succeeded his grandfather in 1869 at the age of five. He was educated at Eton and Christchurch, Oxford, and was created K.C.V.O. in 1907. His interest in agriculture led to his appointment when a young man as a member of the Welsh Land Commission. In 1924 he was chairman of the Advisory Committee on Milk Production and of the Agricultural Wages Board.

As Pro-Chancellor of the University of Wales, Lord Kenyon did a great deal to foster and encourage scientific research in the University. He realised very clearly that one of the chief aims of a university must be the attainment of truth and the extension of knowledge. He took a particular interest in the new science buildings at the University College of North Wales, Bangor, which were opened in 1926, and in the well-equipped laboratories which have been set up at Swansea during recent years. He also watched with growing interest the rise of the new physics and chemistry buildings at the University College of South Wales and Monmouthshire, Cardiff, which are at the present time nearing completion. His great interest in the Welsh National School of Medicine was largely due to the fact that he realised the great services that by means of scientific research and investigation such an institution is capable of rendering not only to the solution of health problems in Wales, but also to the cause of medical science generally. For this reason he was a strong advocate of what is known as the 'medical unit system.'

Few realised more clearly than Lord Kenyon the function of a university in the life of the community, as a place for guarding and increasing our inheritance of knowledge and for keeping that knowledge alive. He was a great believer in post-graduate scholarships for research, and nothing gave him greater pleasure than to announce gifts made from time to time for the endowment of such scholarships. He secured many such gifts for the University of Wales.

Lord Kenyon's services to the National Museum of Wales at a critical period in its development were no less valuable. He was elected president of the National Museum for the five-year period which terminated on Sept. 30 last. Though he had had no previous connexion with the institution, he at once set himself to grasp the problems and needs of the Museum and threw himself heart and soul into its work. When he took office, only the western wing of the Museum building in Cathays Park, Cardiff, was in use. The great part of the south front was a mere shell, and there was at that time no possibility of finishing it. He was foremost in urging on all interested in education in Wales that the completion of a sufficient portion of the building adequately to illustrate the environment and history of man in Wales, and the achievement of the people of Wales in the arts and crafts, was vitally important. Generous benefactions having enabled this work to be carried out, it fell to Lord Kenyon, as president, to receive their Majesties the King and Queen on the occasion of the opening ceremony in April last, and it is a source of great gratification to all concerned that he should have been able, before his death, to see this national institution happily launched on its career.

Lord Kenyon proved an admirable president; he never spared himself in the services of the Institution, and attended every meeting at which his presence was desired, even at great personal inconvenience. Though the intra-mural work of the Museum was his chief interest—his personal inclinations leant towards art and archæology—his long experience of administration and of Welsh life and culture, led him to support in the warmest possible way the efforts made to extend the extra-mural activities of the Museum by the scheme successfully launched during his presidency of affiliating to the Institution the local museums in Wales.

Lord Kenyon's imposing figure, charming manner, and unfailing courtesy endeared him to all classes of the community. By his death Wales loses one of her most conscientious, painstaking, and influential public men, who combined the prestige of a great name with an exceptional personality. In the words of one who knew him well: "He brought to the service of the Welsh people the qualities which in the past made leadership easy and natural to aristocracy." C. F.
J. J.

News and Views.

AT the Savoy Hotel, London, on Dec. 10, a private demonstration of a new musical instrument was given by the inventor, Prof. Leo Theremin, of the State Institute of Technical Physics, Leningrad. The apparatus, designed for "drawing music from the ether solely by free movement of the hands in space," proved to be a loud-speaker connected with a thermionic valve circuit which included a metal rod, the electrostatic capacity of which is altered by the proximity of the performer's hand, the whole arrangement being an application of the familiar 'howling' of a badly adjusted broadcast receiving set when the hand is brought near to the tuning condensers. The intensity of the sounds is controlled by varying the position of the other hand in relation to a metal hoop, or varying the pressure of the foot upon what appeared to be a disc of carbon. For notes near the middle of the musical scale, the hand is at a few inches from the rod and a change in this distance of an inch or so alters the pitch of the note by a tone, the whole range being apparently about an octave. Faulty intonation occurs, therefore, unless the performer judges accurately the required distance from the rod for the desired frequency of oscillation. Wide variation of tone quality was shown to be producible, but the demonstration was limited to the performance of slow *vibrato* melody only. Prof. Theremin's apparatus is an ingenious application of well-known electrical effects, and it evidently possesses possibilities of development as a musical instrument, though of course harmony cannot be produced by it.

THE discovery of a large area of nitrate, 120 miles east of Alice Springs, the administrative centre of the new territory of Central Australia, has been confirmed by Sir Douglas Mawson, who has visited the locality. The existence of the nitrate was indicated by the report of an aboriginal that the earth ignited when thrown on the fire. Sir Douglas Mawson identifies it as potassium nitrate, and its value is estimated as from £60 to £90 a ton. Potassium nitrate occurs naturally in Bengal, where it is formed by the decomposition of excreta in the presence of nitrifying bacteria. Potassium chlorides occur in basins and in arid areas by the evaporation of waters which drain from rocks rich in potash. The new Australian deposit may have been formed in a basin by the decomposition of the animal remains in swamps. This discovery justifies the recent decision to extend the railway from Oodnadatta, the present northern terminus of the South Australian railways, to Alice Springs, and will probably lead to the completion of the long-projected and promised railway from South Australia across the centre of the continent to the Northern Territory.

THE retirement of Dr. L. O. Howard, Chief of the Bureau of Entomology, U.S. Department of Agriculture, took place on Oct. 17 last. After graduating from Cornell University, Dr. Howard joined the Department of Agriculture in 1878 and became Chief of the Bureau of Entomology more than thirty-three years ago. We are glad to learn that his retirement does not involve cessation of his entomological activities, and that he will now have opportunity to carry out researches for which his official life afforded him so little leisure. His frequent visits to Europe and his extensive travels upon that continent have made Dr. Howard one of the most familiar figures at congresses, and probably no living entomologist is more widely known personally among his fellow-workers. His unpretentious office in the Bureau of Entomology at Washington has for many years been the Mecca of all entomologists who have visited the continent of North America. In his earlier days he was well known as a leading authority on the Chalcidoidea, but as the years went on he exercised a wide influence on many branches of entomology in his executive capacity. His influence on the subject extends far beyond the United States, and one of his greatest aims has been to further the interchange of ideas between men of diverse nations. Dr. Howard carries the good wishes of entomologists throughout the world on entering his retirement.

DR. C. L. MARLATT, who succeeds Dr. Howard as Chief of the U.S. Bureau of Entomology, is a graduate of the Kansas Agricultural College and an administrator of wide experience. He has for many years been associated with the U.S. Department of Agriculture, and for the last five years has been associate chief in charge of the executive work of the Bureau of Entomology. Dr. Marlatt is the author of a number of official bulletins of the Bureau, and was instrumental in the drafting and administration of the Plant Quarantine Act of 1912. He also holds the position of chairman of the Federal Horticultural Board.

ON Dec. 23 occurs the centenary of the death of Robert Woodhouse, the Cambridge mathematician, who was successively Lucasian and Plumian professor and was also the first director of the Cambridge Observatory. Born at Norwich on April 28, 1773, the son of a linen-draper, Woodhouse was educated at the Grammar School, North Walsham, and entered Caius College, Cambridge, in 1790. He took his degree in 1795, being Senior Wrangler and Smith's prizeman, and was made a fellow of his College. His services to mathematical studies at Cambridge have often been commented on. Ball refers to him as "the apostle of the new movement," while Peacock said that his "Elements of Trigonometry" contributed more than any other book to revolutionise mathematical studies in Great Britain. He is entitled to the entire credit of introducing the calculus into England, and his efforts were ably seconded by Babbage, Peacock, and Herschel, who formed an Analytical Society, with the object of advocating the general use in the university of analytical methods and of the differential notation. Woodhouse died at the age of fifty-four years and was buried in the Chapel of Caius College.

IN his presidential address to the Newcomen Society on Dec. 7, Mr. J. W. Hall dealt with the history of the making and rolling of iron. Starting with the Middle Ages, when iron was more expensive than lead, costing

more than £100 a ton, he traced the various improvements in the making of iron down to the present time. The output for centuries was very small and, even in the middle of the eighteenth century, the production for the whole of Great Britain was but 250 to 350 tons per week. With the introduction of Cort's process of 'dry' puddling on a sand bottom in a reverberatory furnace, iron could be produced in larger masses, and Cort showed for the first time how bars could be produced entirely with the use of pit coal. All iron was worked under the hammer, but for small rods recourse was had to the 'slitting mill.' Sheets and bars of lead, tin, and copper were rolled long before iron bars, and the first iron rolling mills simply finished to size bars previously hammered to form and dimensions. The merit of Cort's second invention was that he reduced the raw iron in a series of rollers with gradually decreasing grooves, and laid the foundation of the existing methods. The address abounds in references and extracts from authors of the past and is a valuable summary of the technique of a most important industry.

WE have received from Messrs. Lever Brothers, Ltd., Port Sunlight, Cheshire, samples of their new vitamin products, 'Essogen' and 'Advita.' The former is a concentration of vitamins A and D in a neutral oil, and the latter is a concentrate of higher potency put up in capsules. The oil has a bland flavour and is without any nauseous taste and smell, such as are associated with cod-liver oil. The strength of the products is controlled by animal feeding tests and also, in the case of vitamin A, by the antimony trichloride test of Carr and Price. The standards adopted are based on that given in the tenth edition of the "United States Pharmacopœia" for vitamin A, which is, that 20 mgm. of cod-liver oil should contain one 'unit,' that is, produce growth in a rat, kept on a diet deficient in vitamins A and D until growth has ceased, at the rate of 2-4 gm. a week for five weeks. The standard adopted for the normal concentrate on this basis is 2·0 mgm., and for the special concentrate 0·4 mgm.: thus 'Essogen' has ten times the potency required by the United States Pharmacopœia for a cod-liver oil, and 'Advita' fifty times this potency. The dose of 'Essogen' recommended is half to one teaspoonful twice a day, and of the capsules, one per diem. 'Essogen' is put up in 4, 16, and 80 oz. bottles, whilst the capsules are put up in tubes of 24.

PUBLICITY which has recently been given to the establishment of a National Fund for Scientific Research in Belgium, and to arrangements in connexion with the Exhibition of Industry and Science to be held at Liège in 1930, has resulted in some little confusion between these two distinct undertakings. By the courtesy of M. Paul Pelseneer, the permanent secretary of the Royal Academy of Belgium, we are able to record the exact circumstances leading to the foundation of the Fund. Speaking at Seraing on Oct. 1, 1927, on the occasion of the one hundred and tenth anniversary of the establishment of the Cockerill works, H.M. the King of the Belgians referred to the important part played by 'pure' science in laying the foundations of technical success and industrial prosperity, and deplored the penurious provision which existed in Belgium for the prosecution of study and investigation in that domain. The position was critical, and he looked to private initiative to move, and to sustain effort, in remedying the situation. King Albert spoke in no uncertain terms of the serious consequences of neglect in this direction. "Le public," he declared, "ne comprend pas assez chez nous que la science pure est la condition indispensable de la science appliquée, et que le sort des nations qui négligent la science et le savant est marqué pour la décadence. . . . Je demande à tous ceux qui forment l'élite industrielle à penser souvent à nos Universités, à nos écoles spéciales, à nos laboratoires."

HIS Majesty's call to his subjects has not gone unheeded. A gathering organised by the "Fondations Hoover pour le développement des Universités libres de Bruxelles et de Louvain," was held at the Palais des Académies, Brussels, on Nov. 27, at which the King, the Diplomatic Corps, the Ministers, and influential representatives of industry, finance, politics, and science were present. A number of delegates from the professoriate of the "Universités libres" and the "Universités de l'État" (Ghent and Liège) presented reports disclosing the difficulties, caused by the paucity of financial resources, which beset them in their scientific work. The King again declared that science, poor herself but the creator of riches, must receive assistance, or the country and her industries would be in jeopardy; that scientific men must be accorded such security and independence as would permit their entire devotion to the service of pure science. He then announced the creation of a "Fonds national de la recherche scientifique," for which a special committee would be constituted, and warmly appealed for support from industrial and financial quarters. British scientific workers, to whom their Belgian colleagues' difficulties are not unfamiliar, will cordially wish the new fund all success.

THE Geological Survey of Denmark will celebrate its fortieth anniversary in June next year by a series of excursions and meetings to which foreign geologists are to be invited. Before the meeting to be held in Copenhagen, two simultaneous four-day excursions will be arranged (June 21–24): to Bornholm, which forms part of the Baltic Shield and is of great petrological, stratigraphical, and tectonic interest; or, alternatively, to Moën and South Sjælland, where remarkable dislocations in the Senonian white chalk can be compared with the undisturbed formations. The meeting itself (June 25–28) will be devoted to lectures and discussions on the general geology of Denmark and to visits to the celebrated museums of Copenhagen. After the meeting an eleven-day excursion (June 29–July 9) will enable visiting geologists to study a wide range of glacial phenomena in north-west Sjælland, Fyn, Langeland, and Jylland. Further particulars relating to the detailed programme, accommodation, and charges will be provided in a later circular. Application for this

may be made to the Secretary of the International Meeting of Geologists, Danmarks Geologiske Undersøgelse, Gammelmønt 14, København K.

THE Photographic Materials Preservation Committee, which was appointed by the Royal Photographic Society at the request of the Historical Section of the Committee of Imperial Defence of the Australian Commonwealth, has presented its report. The report states that "the production of records by photography has been in existence for so short a period that the Committee is not able to make any recommendations of which it can be said that their application will ensure permanence for all time. All that could be done was to select such processes and methods of treatment as were likely to give the most durable results." It is recommended that negatives and positives on glass be refixed, washed, hardened in chrome alum solution, washed, dried, and varnished with a lac varnish. Negatives and positives on celluloid should be similarly treated, but there is no suitable cold varnish for them. If invaluable, they should be copied on to glass, as both celluloid and cellulose acetate are unstable. Bromide prints should be sulphur toned. Finished prints should be refixed, washed, sulphur toned, washed, hardened in chrome alum solution, washed, and dried, and mounted (if desired) by the 'dry' process on boards of the best quality. Mounted finished prints that are invaluable should be copied and the new prints treated as above. All prints should be thoroughly dried and varnished by immersion in a solution of gum dammar in benzene. The storage of prints is dealt with, formulæ for the various solutions are given, and also the usual tests in solution for silver and thiosulphates. The carbon and platinum processes of printing are not referred to. It is surprising that printing in platinum, which gives such ideally simple and permanent results, has not been recommended, particularly when new prints have to be made for preservation.

THE region around the headstreams of the Indigirka and the Kolima is one of the least known regions in eastern Siberia. An expedition sent by the Russian Geological Society under S. Obruchev penetrated this district in 1926, working east from Yakutsk on the Lena to Moma and Omekonsk on the Indigirka. Between lat. 65° and 66° N. the Indigirka was found to cross, in narrow valleys, a lofty range of snow-clad mountains rising to about ten thousand feet. This range is reputed to be continued eastwards to the Kolima and between the Kolima and the Omolon, and to be about 600 miles long and 180 miles wide. Its further exploration is promised in the near future. The range has been named the Cherski range, after a Russian geologist who lost his life in the Kolima region in 1892. An account of the new range by the discoverer and some photographs of it appear in the *Geographical Journal* for November. The north-western end of this range is evidently the Taskhayakhtakh range, but it crosses the Indigirka in a region that was formerly considered to be a low-lying plain. Existing maps of this part of Siberia, however, are far from accurate, and it is difficult to fit the new features on to the map until more data are available. The Cherski range appears to be built of folded Triassic strata and is roughly parallel with the great folded and faulted arc of the Verkoyansk and Kolimsk ranges.

THE elimination of 'atmospherics' which sometimes seriously interfere with trans-Atlantic telephony is a problem to which the Post Office engineers have devoted a great deal of attention. Some of the partial solutions obtained are described in a paper read on Nov. 7 by Colonel A. G. Lee to the radio section of the Institution of Electrical Engineers. Numerous valuable experimental data have been obtained recently by Watson Watt and others. Generalising from these, the author concludes that an atmospheric is either of an aperiodic or quasi-periodic form. It has a peak voltage of about 0·1 volt per metre and has a duration of the order of 0·003 sec. Sometimes, however, atmospherics are observed which have a fine ripple structure superposed upon the main wave form. The order of strength of an atmospheric is very considerably higher than that of any ordinary commercial radio signal. Measurements of these disturbances in Scotland show that they are much smaller there than in the south of England. The noise ratio at Thurso, for example, is only about one-eighth of the ratio farther south. When considerable amplification is being used in radio telephony, owing to bad atmospherics, and electrically charged rain is falling, a loud hissing sound is heard on antenna systems. This is sometimes sufficiently strong to put the service out of action. A receiver should be designed to admit only just sufficient of the signal and its modulation products to ensure intelligibility. This is the best defence against atmospherics. Seeing that these disturbances may come to the receiving station from any point of the compass, it is a great help to employ a directive system of reception as this will be insensitive to atmospherics coming from other directions. This seems to be the only means of defence left which can be improved.

DESPITE the great increase in motor traffic in the streets of Paris and the danger of increased air pollution by dust or gases, the results of the analyses made periodically on the air of Paris at the Laboratory of Hygiene are satisfactory. The percentage of carbonic acid gas averages 30 to 45 parts in 100,000, while carbon monoxide is found only in confined spaces and in percentages varying from 5 to 6 parts per 100,000. M. Kohn-Avrest, reporting on this subject at a recent meeting of the Paris Academy of Sciences, intends supplementing the ordinary analyses by investigations to determine what he terms the 'smoke vault.' Experiments in this direction have already been made in the gardens of the Champ de Mars and at various levels of the Eiffel Tower. Contrary to what might be expected, the air in these neighbourhoods of Paris may be regarded as very pure, being just as pure in the lower regions as in the upper. On the other hand, vitiation of the atmosphere would seem to increase with the level, either by the

presence of small quantities of carbon monoxide in the upper layers of the air, or by the appreciable increase of carbon dioxide. From these results it may be surmised that the air in the highest regions of the city can scarcely be purer than it is in the lower parts, and that there is a perceptible 'smoke vault' at slightly below 1000 feet. For this reason M. Kohn-Avrest is in favour of increasing squares and open places and keeping buildings at a reasonable height.

MR. E. F. STEVENS, librarian of the Pratt Institute Free Library, Brooklyn, New York, has favoured us with a copy of a useful annotated list of "Technical Books of 1925" compiled by Mr. Donald Hendry, head of the applied science reference department of the library. This additional guide to selected scientific and technical books supplements the sources of information referred to by Sir Richard Gregory in the paper on "Standards of Book Selection in Science and Technology" published in NATURE of Oct. 8. Mr. Stevens informs us that an annual list of technical books has been issued by the applied science reference department of the Pratt Institute Free Library for eighteen years. The annotations are made with great care, and the books are designated by symbols as to their character and scope. The list is distributed free upon request to libraries in many parts of the world; and although it is limited to about one hundred books and cannot therefore be a complete guide for comprehensive libraries in science and technology, it should be of decided value to libraries in general.

"THE Industrial Transition in Japan" is the title of a pamphlet by Mr. M. Holland, published jointly by the National Research Council of the United States and the Japan Society. Japan is to-day distinguished by the liberal official support given to scientific research, and the generous subsidy provided by the government for national research institutes in every branch of industry. There is, on the other hand, little interest in research on the part of industrial organisations, and few private research laboratories in industry exist. Mr. Holland believes that the stimulus to research is hindered by the large number of research workers who have received their scientific training in Germany, Britain, and France, and their consequent dependence on foreign methods, technique, and instruments, and even their preference to publish their results in languages and journals foreign to Japan. In spite of these drawbacks, modern scientific methods have had striking results during the half century that they have been practised in Japan. The booklet contains an interesting outline of artificial pearl culture, and some other aspects of fisheries technology.

THE wild life of Spitsbergen has suffered much during the last hundred years from trappers, hunters, and sportsmen. Reindeer, foxes, and walrus, which were once numerous, are now rarely seen in the more accessible parts. One of Norway's first concerns on taking over the sovereignty of Spitsbergen has been to protect the wild life from further destruction. *Petermanns Mitteilungen*, 1927, Heft 9/10, contains a summary of the measures that have been proposed. Reindeer are entirely protected until 1934. After that date it is hoped that the stock will have increased enough to allow hunters to take 250 head a year. The Arctic fox, which is the staple of the Norwegian trappers, is not to be taken between April and October, when they are valueless for fur. There seems to be no means of protecting the polar bear, since it is really a sea mammal, and is generally shot on the ice on the high seas. The walrus are protected for ten years. No measures are to be taken with regard to other seals and whales. A close season is proposed for the shooting of geese, from July 15 to Aug. 15, and for the collection of the eggs and down of eider ducks. It is further proposed to set apart as reserves for game two national parks, in which all hunting is to be prohibited. The largest is to be in the north-west, and to include about five thousand square miles north of Ice Fjord and west of Dickson and Wijde Bays. The second is to be the small Bear Island, with an area of about seventy square miles.

A SERIOUS difficulty in connexion with electric ploughing is the dragging over the ground of the flexible electric cable connecting the tractor plough to the dynamo. A novel method has recently been tried experimentally in Italy of getting over this difficulty. A balloon is used to suspend the connecting cable in the air. An insulated aluminium cable was used. The diameter of the balloon was 17 feet, and its net lifting power was 110 lb. The tractor travelled at a speed of 2¼ miles per hour and ploughed to a depth of from 12 to 18 inches. The height of the balloon depends on the position of the tractor. As a precaution a steel safety cable is attached to the balloon. This is a novel development of the ancient art of ploughing. In a paper read to the Institution of Electrical Engineers by Mr. Borlase Matthews on Dec. 1, he pointed out that to solve the present farming crisis, agriculture will have to be industrialised by the aid of electric power. He described his experiences of electric ploughs, more than two hundred of which are now in use abroad. Some of the ploughs he described are only suitable for large areas and co-operative or contractor ownership, as they plough from 12 to 30 acres per day. He also describes smaller ploughs suitable for individual small farmers and market gardeners. A very interesting development in electric ploughing is the action of the electricity supply undertakings who are distributing current in the agricultural area some 30 miles round Paris. They have formed a separate company and a number of operating centres. Any farmer in this area can have the use of electric ploughs at the lowest commercial rates. Work can be carried on at night, and once the ploughing season starts there are no stops for Sundays or holidays. An electric plough can make a very deep furrow and can be usefully operated for 200 days in the year.

THE sum of £100 is being offered by the Royal Society for the Protection of Birds for an invention of a portable apparatus for the detection of small

quantities of carbon monoxide in mines, to supersede the use of canaries and small wild birds now forming part of the equipment of rescue brigades. Full particulars may be obtained from the Secretary of the Society, 82 Victoria Street, S.W.1. All competing essays should be received by Mar. 31 next.

IT is announced in *Science* that the John Fritz gold medal for 1928 has been awarded to General John J. Carty, of New York, for achievement in telephone engineering. This medal is awarded annually by a board representing the American Societies of Civil, Mining, and Metallurgical, Mechanical, and Electrical Engineers, for notable scientific or industrial achievement, without restriction on account of nationality or sex. This is the twenty-fourth award which has been made. The presentation of the medal will take place in February next in connexion with the annual meeting in New York of the American Institute of Electrical Engineers.

IT is announced in a recent Daily Science News Bulletin (No. 346 D), issued by Science Service, Washington. that Drs. Leonard and Feirer, of the Johns Hopkins School of Hygiene, have succeeded in utilising hexylresorcinol as a general antiseptic. This substance has been used as an internal antiseptic, but apparently a proper solvent for it was not known, so that it could not be used as a disinfectant solution. It is now stated that an aqueous solution of glycerin (strength not stated) accomplishes this, and that the solution is very potent in killing bacteria, while having little deleterious effect upon the tissues of the body.

WE have received the annual report of Livingstone College, Leyton, for the year 1926–27. The past year has seen the largest entry of students since the College started, and the financial position has therefore improved, though an accumulated deficit of £883 still exists. Donations and subscriptions are needed to help the work of the College, which is to give missionaries instruction in the preservation of health and treatment of disease.

A REPORT by Dr. H. M. Ayres to the Monmouthshire County Council appears in the October issue of *The Fight against Disease*, the journal of the Research Defence Society, on the vaccinal condition of the first 1230 cases of smallpox which occurred in that county between February and July 1927. Not a single case of the disease occurred in a child who had been successfully vaccinated before the epidemic, while among the unvaccinated school children of less than 15 years, there were not less than 355 cases.

PROF. ARCHIBALD LIVERSIDGE, emeritus professor of chemistry in the University of Sydney, who died on Sept. 26 last, leaving estate of the value of £46,000, bequeathed to the University of Sydney two sums of money, £2000 and £500, towards a scholarship and for the advancement of science in Sydney respectively. Other bequests include £1000 and £500 to Christ's College, Cambridge, towards a scholarship and a research lectureship in chemistry respectively; £1000 to the Royal School of Mines, towards a scholarship; £500 each to the Royal Society of New South Wales and to the Australasian Association, and also to the Chemical Society of London, towards research lectureships in chemistry, as well as a further £100 and his unpublished papers on scientific and chemical matters.—Another recent benefaction, which appears in the will of Mrs. Marryat, sister and heiress of the late Sir James Caird, is a bequest of £200,000 for the foundation of travelling scholarships in engineering, electricity, aeronautics, and music, to be eligible to natives of Scotland only, to be known as 'Sir James Caird's Travelling Scholarships.'

THE Juvenile Christmas Lectures at the Royal Institution will be delivered by Prof. E. N. da C. Andrade on "Engines," commencing on Thursday, Dec. 29. The general courses of lectures before Easter will begin on Tuesday, Jan. 17, at 5.15, when Mr. P. R. Coursey will deliver the first of two lectures on the development of dielectrics for electrical condensers. On succeeding Tuesday afternoons there will be three lectures by Dr. A. P. Newton on (1) the Mercantile Empire, 1606–1783; (2) the settlement of the Dominions, 1783–1870; (3) the Dependent Empire and the British Commonwealth of Nations, 1870–1926; and six lectures by Prof. Julian S. Huxley on the behaviour of animals. On Thursday afternoons at the same hour there will be three lectures by Sir William Bragg on Faraday's notebooks; two by Dr. F. Ll. Griffiths on Nubia in antiquity and in the Middle Ages; two by Dr. J. J. Fox on optics and chemistry; and two by Group Capt. M. Flack on the physiological aspects of flying. Sir Ernest Rutherford will deliver four lectures on the transformation of matter on Saturday afternoons at three o'clock. The Friday evening meetings will commence on Jan. 20, when the discourse will be delivered by Sir William Bragg on photo-electricity. Succeeding discourses will probably be given by Miss D. A. E. Garrod, Prof. E. C. C. Baly, Prof. B. Melvill Jones, Rev. E. M. Walker, Sir Farquhar Buzzard, Prof. E. A. Milne, Sir Ernest Rutherford, and others.

UNDER the energetic leadership of Prof. H. Arctowski, formerly working in the United States, the Institute of Geophysics and Meteorology of the University of Lwow, Poland, has become an active centre of theoretical studies in meteorology. The second volume of *Communications*, just issued, contains twelve papers by Prof. Arctowski and his collaborators. They are written in Polish, but with summaries in French. The subjects dealt with include the variations of temperature in North America, Japan, China, and Indo-China during 1910–1919; the large-scale transport of mass in the atmosphere; perturbations of atmospheric transparency; and the daily variation of the barometric pressure at Batavia and Manila.

A FULL and useful catalogue of books relating to the East has reached us from the Librairie d'Amérique et d'Orient Adrien-Maisonneuve, 5 Rue de Tournon, Paris (VI^{e}). The works offered for sale are carefully classified under the countries with which they deal. The prices asked are given in French francs.

A NEW part of the well-known "Catalogue of Science and Technology," No. III., of Messrs. H. Sotheran and Co., 140 Strand, W.C.2, has just been issued. Its designation is No. 806, Part VIII., including XII., and is devoted to works on mining and metallurgy. As usual with this publication, it is a mine of bibliographical information and should certainly be seen by those interested in the subjects dealt with.

WE have received from Messrs. C. Baker, 244 High Holborn, W.C.1, their classified list (No. 91) of second-hand scientific instruments. Microscopes and microscopic apparatus, particularly objectives and eye-pieces, occupy 20 pages of the list and offer a considerable range of first-rate instruments and accessories. Astronomical and other telescopes and field-glasses, spectroscopes, theodolites, and other surveying and drawing instruments, meteorological and ophthalmic instruments, and sundry electrical and other apparatus, are also catalogued. A supplementary list contains the large collection of scientific and photographic apparatus and engineering equipment, the property of the late Mr. Edward Sanger Shepherd, which Messrs. Baker have for disposal.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A pathologist at the Infants' Hospital, Westminster—The Secretary, Infants' Hospital, Vincent Square, Westminster, S.W.1 (Dec. 31). A lecturer in chemistry in the University of Durham (Durham Division)—The Head of the Department of Science, South Road, Durham (Jan. 2). A research assistant in the testing department of the British Cotton Industry Research Association—The Secretary, British Cotton Industry Research Association, Shirley Institute, Didsbury, Manchester (Jan. 4). A part-time principal of the L.C.C. Clapham School of Art, 6 Edgeley Road, Clapham, S.W.4—The Education Officer (T.1.a), The County Hall, Westminster Bridge, S.E.1 (Jan. 7). A principal of the Technological Institute, Cawnpore—The Secretary to the High Commissioner for India, General Department, 42 Grosvenor Gardens, S.W.1 (Jan. 15). A professor of chemical engineering at University College—The Academic Registrar, University of London, South Kensington, S.W.7 (Jan. 23). Two junior assistants under the Linen Industry Research Association, one with qualifications in physical chemistry and the other in engineering and with some knowledge of chemistry and physics—The Secretary, Linen Industry Research Association, Research Institute, Lambeg, Co. Antrim. A junior assistant chemist for a Government laboratory—The Commandant, Experimental Station, Porton, Wilts.

Our Astronomical Column.

SKJELLERUP'S COMET.—Another observation of this comet was obtained by Mr. Maristany at La Plata on Dec. $6^d\ 0^h\ 36^m$ U.T.; R.A. $16^h\ 27^m$; S. Decl. $50°\ 0'$; magnitude 2. The object was only $2\frac{1}{2}°$ above the horizon.

The following elements were calculated by Mr. H. E. Wood (Union Observatory, Johannesburg) and have been telegraphed from the I.A.U.

T 1927 Dec. 1·192 U.T.
ω 323° 29′
Ω 79 20 } 1927·0
i 72 10
log q 9·7824

Ephemeris for 0^h:

	R.A.	Decl.	log △.
Dec. 18.	$18^h\ 11^m\ 20^s$	5° 2′ S	9·47
22.	18 39 44	14 8 N	9·5223
26.	19 0 58	27 57 N	9·5980
30.	19 22 51	36 52 N	9·6799

The comet should become visible in England in the west after sunset about Dec. 20. Its altitude will rapidly increase, but its distance both from sun and earth will increase fairly rapidly, so that it is unlikely to be conspicuous for long.

The values of Ω, i, q, are fairly near those of De Vico's comet, but ω is 50° smaller, which is too great a difference for identity to be possible.

THE ROTATION OF THE GALAXY.—Dr. Oort returns to this question in *Bull. Astron. Instit. Netherlands*, No. 133. He introduces some faint distant Cepheids to add weight to his determination. They give $320° \pm 7°$ for the longitude of the centre, agreeing well with the value 324° obtained from eight other groups of stars. He considers that his results give an indirect confirmation to the validity of Shapley's parallaxes of distant Cepheids.

Dr. Oort notes that it is possible to explain the motions with a smaller central condensation of mass than that given in the previous paper. He now gives the density in the inner ellipsoid (the axial ratios of which are 10 to 1) as 0·66 of the sun's mass per cubic parsec, while in the shell outside this it falls to 0·30 of the sun's mass. These values involve the assumption either that there are many stars too faint to see or that there is a large proportion of non-stellar material in the galaxy.

OCCULTATIONS.—*Union Observatory Circular* No. 72 contains a careful discussion by Dr. Innes of 90 occultations of stars by the moon observed at Johannesburg in 1926. In the mean the correction to Brown's longitude of the moon is $+7''{\cdot}3$. The error has only varied very slightly since the introduction of Brown's tables in 1923. Dr. Innes gives the error as wholly one of time (due to variable rotation of the earth); it seems inadvisable to put the whole of it down to this source. Prof. Brown now admits that the secular acceleration of the moon is some $4''$ greater than the term used in his tables; this involves consequential changes in the longitude at epoch and mean motion; also there is a small correction to his longitude of perigee. Only the residue after making these corrections should be ascribed to variable rotation of the earth.

The circular also contains some observations of phenomena of Jupiter's satellites, and the deduction of time-errors from them. The mean error for the last four years is $-43^s{\cdot}7$ for satellite I., and $-45^s{\cdot}8$ for II.; these errors have increased greatly for both satellites since 1909, but seem now to have reached a maximum.

There are also some interesting observations of mutual eclipses by the shadows of other satellites, and comparison of these with the predictions in the B.A.A. Handbook for 1926. On June 29, 1926, an unusually dark transit of IV. was observed, and on Aug. 15, 1926, the date of opposition, I. was seen on the disc partially covering its shadow.

Research Items.

STRING FIGURES IN OCEANIA.—Mr. J. Hornell has published as *Bulletin* 39 of the Bernice P. Bishop Museum of Honolulu, a record of string figures collected in Fiji and in the Marquesas, the Society Islands, and Samoa and Tonga. Although these figures had not hitherto been recorded in Samoa, it is probable that further research would produce numerous examples. Tonga proved a rich field for study, but the largest number, 58, was obtained from Fiji. Most Fijian figures are named after the object they are supposed to represent, the owl, the caterpillar, the butterfly, and so on ; others represent trees or the leaves of the pandanus. In a few the Fijians see a resemblance to the sun and his rays, and one is named "The Star." The figures showed no mythological significance, but this may have been lost under missionary influence. A large number were originally worked to the accompaniment of a chant, some of which must have been of great antiquity, as the significance of the words has been lost. The geographical distribution of the figures suggests certain ethnological affinities. Of these the most striking is the predominance of Melanesian influence in Fiji. Of 30 figures and series of figures, 12 occur in New Caledonia, Torres Straits, Fly River, New Guinea, Loyalty Islands, and D'Entrecasteaux. Next in importance is relationship with Tonga, 7 figures being in common. Six of the Fijian games are Polynesian, being found in the Marquesas and Society Islands. Of these one is the most widely spread of any string game in Oceania. The Tongan games are wholly Polynesian if Fiji be excluded.

MARINE BIOLOGY AT MILLPORT.—The annual report for 1926–27 of the Scottish Marine Biological Association shows that a large amount of work has been done both by the staff and by the visitors. The valuable researches on plankton undertaken by the hydrographer, Mr. A. P. Orr, and the assistant naturalist, Miss S. M. Marshall, are still progressing. Following the work on Loch Striven, begun in 1926, now complete and published in the *Journal of the Marine Biological Association*, various experiments were made on the biology of diatoms, and these are still in progress. It was found that direct sunlight was injurious, specimens from five fathoms and more appearing much healthier than those from the surface, and diatom cultures grow best in the shade. A comparison of the amount of sunlight and diatom maxima extending over a period of three years shows that, unlike the results from Plymouth and Port Erin, the latest diatom maximum actually corresponded with the year which had most early sunshine. It is suggested that a measurement of the total amount of incident light, and not of sunshine alone, would be a more trustworthy guide. Mr. R. Macdonald, Carnegie Research Student, in continuing his work on the Euphausiidæ, has completed the life-history of *Thysanœssa Raschii* which is very abundant in the district. A survey of the sandy bays of Cumbrae by the superintendent, Mr. R. Elmhirst, and Mr. A. C. Stephen, with special reference to the biology of *Tellina tenuis*, begun only recently, should yield interesting and important results. This mollusc is exceedingly common in Kames Bay, the numbers sometimes reaching more than seven thousand per square metre in one station.

BIOLOGICAL INVESTIGATIONS IN THE BLACK SEA.—The Sevastopol Biological Station of the Russian Academy of Sciences (according to the *Information Bulletin* of the Academy, No. 20, 1927) carried out during the last summer a series of investigations in the Black Sea. A study of distribution of animal life was undertaken during two expeditions, one along the Crimean shores, while another covered a large area in the eastern portion of the sea. It was found that the fauna near the shores of the Caucasus and Anatolia is considerably poorer than that near the Crimean shores. The lower limit of benthos has been found not to drop below 140-160 metres, while in some parts it is still nearer to the surface. The lower limit of plankton proved to be also not deeper than 150-170 metres, and in some places in the central part of the sea it has been found only 90-100 metres deep ; in all cases the vertical distribution of plankton proved to be directly connected with the distribution of oxygen and of hydrogen sulphide in the water. Hydro-chemical work included also determinations of carbon dioxide in the water, for the first time in the Black Sea, and it has been found that the quantity increases with the depth, and reaches a very high absolute figure.

THE *HELIX BIPARTITA* OF AUSTRALIA.—The conspicuous *Helix bipartita* of Pfeiffer, hailing from north-eastern Australia and its neighbouring islands, and now placed in the genus Thersites, section Hadra, with all its innumerable varieties of form and size, has long been well known to collectors, who have been content to refer them to one, or at most four species. Now, however, a large collection has been presented to the United States National Museum, and Mr. W. B. Marshall, having arranged them in geographical sequence, considers that many characteristics are thereby revealed, showing that specialisation has taken place along certain definite lines and that the recognition of additional species and sub-species is necessary (*Proc. U.S. Nat. Mus.*, vol. 72, art. 15). His list now contains twenty-seven names, including *T. darwini*, which he has not seen. Four of these are given as new species, and the bulk are new 'sub-species' which may or may not prove valid. Since the author has adopted the method of late employed by certain zoological writers, more especially ornithologists, of stringing the sub-specific name on to that of the species, his nomenclature is for the most part quadrinominal instead of binominal. His paper, however, will have to be seriously reckoned with by anyone taking up the group.

JAPANESE JELLY-FISHES.—The Anthomedusæ of Japan are many and varied and a number of beautiful and interesting forms are described by Dr Tohru Uchida ("Studies on Japanese Hydromedusæ. I. Anthomedusæ." *Journal of the Faculty of Science*. Imperial University of Tokyo. Section 4. Zoology, vol. 1, Part 3, 1927). Not only is the morphology of all forms carefully worked out and a satisfactory classification arrived at, but also the life-histories are studied whenever possible, and very important additions are made to our knowledge of the metamorphoses in this group. The author bases his systematic work mainly on the structure of the canals, tentacles, manubrium, and gonads, regarding the oral tentacles and ocelli as of only secondary significance. An account of the early development of *Spirocodon saltatrix* is given, showing that spawning always takes place after sunset in natural conditions, but if brought into a dark room the medusa will lay eggs in half an hour to an hour, so that these are easily obtained for study. The hydroid is not known, but the development from the very young medusa is described, showing a wonderful series of changes beginning from a simple Sarsia-like form and passing through phases

corresponding with the Tiaridæ and Nemopsis until the final adult Spirocodon is reached. The principal changes are the appearance of numerous side branches from the radial canals, four arborescent canals from each inter-radius, the multiplication of the marginal tentacles, complication of the manubrium by frilling of the lips, development of the gonads, which form spirals in the radial canals, and the formation of a central cone of jelly. Good reasons are given for relegating *Spirocodon saltatrix* to the Anthomedusæ together with Polyorchis and Scrippsia instead of to the Leptomedusæ where they were formerly placed on account of the position of the gonads.

TERTIARY MOLLUSCA OF JAPAN. Prof. M. Yokoyama contributes (*Jour. Fac. Sci. Imp. Univ. Tokyo*, Sect. 2, vol. 2) three more papers on the Tertiary Mollusca of Japan. From the province of Kaga, about the middle of the northern side of the principal island, a series of some 120 species of mollusca was obtained referable to the Musashino, or Pliocene, and the more important species are described and figured. As before, the author finds that the sea of central Japan was somewhat cooler then than at present. From Western Hizen, in the neighbourhood of Nagasaki, a few fossils, including fourteen mollusca, mostly badly preserved and of Pliocene age, have been procured and form the subject of the second paper. The third paper describes those mollusca found in the Chikbets (Pliocene) and Haboro (Miocene) beds in the coalfields of Haboro, Province of Teshio, at the northern end of the Island of Yezo. Some thirty-three species are described and figured.

LIGHT REFLECTION FROM LEAVES.—Prof. Chas. A. Shull, of Chicago, gave some interesting details regarding the reflecting power of leaves at a recent meeting of the National Academy of Sciences held at Washington. A report of the paper has been issued by Science Service, of Washington. Prof. Shull finds that different leaves reflect different proportions of the incident light, and the same leaf reflects light of different colours in different percentages. Thus the upper surface of a silver poplar leaf reflects 7·5 per cent. of one of the violet hues, and 20 per cent. of the light in the green-yellow part of the spectrum. The upper and lower surfaces of the same leaf have different reflecting powers. The silver poplar leaf, which is dark green above but shining white beneath, reflects 8·5 per cent. of the deepest red rays from its upper surface and 50 per cent. of the same rays from its under surface. Autumn coloration of leaves also influences their reflecting power. Red leaves of woodbine reflect nearly twice as much red light as they do of violet; but their total reflection is far less than that of bright yellow birch leaves, which reflect more than 40 per cent. of the incident light, as against 13 per cent. for woodbine.

TIMBER SEASONING.—Timber in various forms is in such universal use that the importance of its proper seasoning before manufacture and utilisation is beyond dispute. With the increasing demands made upon the world's timber resources and the diminishing supplies, any factor which will assist in prolonging the durability of wood, and therefore its longevity when manufactured, will lessen in some degree the calls upon the forests. Seasoning is well understood by many persons in the timber trade. The practical disappearance of all stores of seasoned timber in Great Britain during the progress of the War has, however, disclosed the fact that a considerable section of those interested in timber and its seasoning are not so knowledgable. The new Forest Products Research Laboratory at Princes Risborough has recently issued a report by Major F. M. Oliphant on "The Air Seasoning and Conditioning of Timber" (Special Report No. 1). The report does not pretend to deal with new facts. Its author has had two objects in view: first, to discuss the fundamental factors governing the process of drying timber, and secondly, to illustrate methods by which such factors can be utilised to season it to the best advantage. The structure of wood and its moisture contents, weather aspects, especially as regards moisture, are first dealt with, followed by sections treating of defects caused by air-seasoning, and various methods of piling timber in stacks for air-seasoning; the report is illustrated, the photographs of stacking methods being particularly useful.

INHERITANCE IN MORNING GLORIES.—In a genetical investigation of *Pharbitis purpurea*, which is closely related to the Japanese morning glory, *P. Nil*, Mr. Yoshitaka Imai (*Jour. Coll. Agric., Imp. Univ. Tokyo*, vol. 9, No. 3) records certain interesting genetic differences from the latter species. The heterozygous condition of flower colour is intermediate in *P. purpurea* but dominant in *P. Nil*. There is an intensifying factor for red colour, which shows its effect in corolla and stem and also in changing the seed from tan to black, absence of the red factor producing white flower and green stem. Another factor causes extension of colour in the corolla, and here again the heterozygous condition is intermediate. A diluting factor may also be present, but its effect can only be detected in the presence of the extension factor. A feathered double type of flower occurs, similar to that of the other species, but it produces good seeds, whereas the double *P. Nil* is sterile. It behaves as a simple dominant in crosses, and there appears to be a low degree of linkage between doubleness and flower colour. More recent results by Prof. K. Miyake and Dr. Imai (*Jour. of Genetics*, vol. 19, No. 1) show that in *P. Nil* the common petaloid double is recessive to single flower. Many forms of doubling are found to exist in this species and they have been analysed genetically, so that the breeders' difficulties in perpetuating their stocks can now be overcome. There are four main types of doubling, some of which can be combined by crossing. In petaloid forms the pistil is fertile and the petaloidy commonly occurs on the anthers, but may refer to the filaments. In the 'Shishi' type the corolla tube is broken up into narrow lobes which take various forms, and the sex organs are more or less deformed. The 'Botan' type has no stamens or pistil, and the corolla tube contains additional flower buds. All these and other monstrous types, which are much admired by the fanciers, are shown to be determined by a series of genetic factors. The original doubles were introduced from China over a thousand years ago.

SURVEYING FROM AIR PHOTOGRAPHS.—In 1926 the Ordnance Survey experimented in air surveys in an area of 20 square miles near Arundel. The result was encouraging both as regards the speed with which the work was done and the standard of accuracy achieved. Moreover, the total cost was found to be reasonable, though the cost of air photography is high. On the other hand, the expense of aerial survey would not increase on difficult ground where the expenses of the usual form of survey would rapidly mount. In such areas, therefore, the air method would be the most economical. The detailed procedure of the Arundel Survey, with an account of the instrumental output, is given in a paper entitled "Simple Methods of Surveying from Air Photographs," by Lieut. M. Hotine

(Professional Papers of the Air Survey Committee, No. 3. London: H.M. Stationery Office). The paper contains a chapter on the making of controlled mosaics. There is also a specimen 6-inch drawing on transparent paper with the usual Ordnance Survey on one side and the aerial survey on the other.

THE ENERGY OF CYCLONES.—The problem handled by V. H. Ryd, in Meteorological Problems (2), "The energy of the winds" (Publikationer fra det Danske Meteorologiske Institut, Meddelelser Nr. 7, pp. v+96, Kjøbenhavn, G. E. C. Gad, 1927), is the fundamental one of the source of the energy developed in cyclones and anticyclones. After a careful examination of some simple cases in which the conditions can be worked out and definite conclusions reached, the author considers Margules' theories as stated in Exner's "Dynamische Meteorologie." He concludes that only a small part of the energy of a cyclone is to be found in the horizontal pressure field, and that if this field was expended, the kinetic energy generated would only be a small fraction, say 1/100, of its energy; the pressure field is rather to be looked upon as "the means whereby energy is *transported* from the atmosphere to the inner part of the depression." Margules' example of the energy available from the juxtaposition of masses of air at different temperatures is criticised on the ground that in Nature, where we have no partition walls, most of the potential energy would be spent in vertical velocities, ending in turbulence and heat; and this conclusion is in agreement with Hesselberg's results. This destructive criticism calls for something constructive, and Ryd produces a theory that the energy of cyclone formation comes from the west-easterly motion of the upper air. Here a locally strong wind will be deflected to the south and will produce a small area of low pressure, the effect of which is by some means transmitted downwards. Two advantages claimed for this theory are that it accounts for the escape of the air that ascends in a cyclone, and for Hesselberg's law that the direction of cyclone motion is that of the cirrus cloud.

INSULATING MATERIALS FOR TELEPHONE SWITCHBOARDS.—The problems which the designers of telephone switchboards have solved are appreciated by few. In one type of switchboard, there are 31,000 contacts, all insulated from one another, in an area five feet wide and two and a half feet high. The electric leakage on the surface and sometimes also through the material of the insulator itself often causes trouble. In damp weather the insulation resistance is often only a small fraction of what it is in dry weather. For telephone work, only insulating materials which are little affected by moisture can be used. Hence hard rubber, phenol fibre, and vulcanised fibre are widely used. Hard rubber in particular is an excellent insulator, but when subjected to long continued stresses it yields. This yielding is generally known as 'cold flow,' the hard rubber acting like an exceedingly viscous liquid. Another limitation to the use of hard rubber is its rapid deterioration when exposed to light. These two objections to the use of hard rubber have led to extensive researches to discover a better material. Various kinds of phenol fibre are found to maintain their insulation resistance much more satisfactorily than hard rubber, and these are put on the market under various trade names. Vulcanised fibre is also extensively used. In the October number of the *Bell Laboratories Record*, J. M. Wilson discusses the properties of sheet insulating materials. Many new varieties of these materials are tested in the Bell laboratories, and records are kept of the difference between their properties and those of the existing materials for which they are proposed as substitutes.

THE SPECTRA OF SCANDIUM.—The analysis of the arc and spark spectra of scandium is described by H. N. Russell and W. F. Meggers in a paper (No. 558) from the U.S. Bureau of Standards. These are of special interest from the fact that they come from the lightest element which possesses the complicated spectra of the type associated with the heavier metals. Some five hundred lines in all have been referred to spectral terms, leaving only a few scattered lines of feeble intensity unclassified. Almost all of the terms have been identified with definite atomic configurations, and it has thus been possible to find the beginnings of a number of series which lead to consistent determinations of the ionisation potentials. From the data obtained in this way, it has been shown that the energy required to ionise the neutral atom is 6·65 electron-volts, whereas from comparative observations of furnace spectra it should lie between the values for calcium (6·1 volts) and titanium (6·8 volts), whilst equally good agreement is obtained between the second ionisation potential of 12·8 volts predicted from these spectra, and a value of 12·5 volts which has been derived from the conditions of appearance of ionised scandium in stars.

THE CATALYTIC SYNTHESIS OF WATER VAPOUR IN CONTACT WITH METALLIC GOLD. The October number of the *Journal of the American Chemical Society* contains an account by A. F. Benton and J. C. Elgin of an investigation of the union of hydrogen and oxygen in the presence of a reduced gold catalyst between 130° and 150° C. Measurements of the reaction kinetics and the adsorptions of the two gases were made, but no satisfactory mechanism for the reaction could be deduced from the observed results. In spite of the similarities in their chemical properties and adsorption phenomena, gold and silver appear to bring about the catalytic synthesis of water vapour in quite different ways. It was found that the rate of reaction with a gold catalyst is dependent upon the oxygen pressure and the square of the hydrogen pressure, whereas Bone and Wheeler found that it was independent of the oxygen pressure. Benton and Elgin suggest that this apparent discrepancy may be due to the higher temperatures used by Bone and Wheeler.

THE DIELECTRIC CONSTANTS OF BINARY MIXTURES.—Two papers on this subject by Kirchma and Williams, and Williams and Allgeier, appeared in the *Journal of the American Chemical Society* for October. The first paper contains dielectric constant and density measurements for solutions of benzene, toluene, chloroform, ethyl ether, methyl and ethyl acetates, acetone and ethyl and *iso* amyl alcohols in carbon tetrachloride. The dielectric constants were determined by an electrical resonance method or by a new 'bridge' method. The electric moments of the molecules of the dissolved substance were calculated, and it was found that the moment of the benzene molecule is practically zero. It was also observed that the electric moments of organic molecules tend to increase as the length of the carbon chain increases. This is in accordance with the results of previous workers. The second paper contains similar measurements for benzene solutions of benzoic acid, phenol, iodine, stannic iodide, antimony tri-iodide, and silver perchlorate, and the values obtained for the electric moments are discussed in relation to atomic structure and solubility. The value for iodine is considered in some detail, since if the iodine molecule is symmetrical, its moment should be zero, and attention is directed to the explanation advanced by Lewis, who has shown that a symmetrical molecule such as iodine may become polarised and consequently have an electric moment.

Dutch Pendulum Observations in the Atlantic, the Pacific, and the Indian Oceans.

AN account of the first part of Dr. Vening Meinesz's voyage on board H.M. Submarine K XIII from Helder to Honolulu through the Panama Canal was published in NATURE of Dec. 25, 1926. I propose now to give some particulars about the voyages from Honolulu to Surabaya and to the Java Deep.

In my first communication I mentioned that the number of observations between Honolulu was 32; there were further:

Manila—Amboina, Nov. 20-Nov. 25 . . .	6
Amboina—Banda, Nov. 25	1
Banda—Bima, Dec. 2-Dec. 6	8
Bima—Surabaya, Dec. 7-Dec. 13 . . .	1

The number of observations at sea during the whole voyage is 113, 2 of which were made at the surface of the sea: in the Atlantic, the Philippines, the Straits of Manipa (Moluccas), and the Java Sea. Through a misunderstanding I mentioned in my first communication that the observation in the Atlantic was a failure.

Several observations were made on the same day:

2 observations	. . .	10 times
3 ,,	. . .	4 ,,
4 ,,	. . .	2 ,,

Double observations at sea were made 5 times, 3 of which sailing east and west (Eötvös-effect) and 2 with the freezing apparatus working and idle.

The number of observations in the harbours was 15; all were double, with free hanging apparatus and with fastened gimbals.

The time signals used were those of Lembang, Java, given by the radio station of Malabar. Between Honolulu and Manila the signals of Saigon were also audible, and after leaving Manila those of Bordeaux.

Because of the high temperature the films were no longer developed on board, but whenever a harbour was reached development took place. In the long run the quality of the films became less satisfactory; but though the records were not so perfect as might have been, they were still efficient.

The crossing from Honolulu to Guam in nineteen days was exceedingly trying, the temperature of the sea-water being 30° or 31° C. Owing to a leakage, the freezing machine lost all its methyl chloride and remained out of action for the rest of the voyage, as no supply could be made in any of the harbours at which the submarine called.

From Guam so far as the Straits of Surigao the weather was very rough, but happily the ship was in the rear of the typhoon which had swept over part of the Philippines just before its arrival.

The crew met a friendly reception at Guam, Yap, and Manila. On the arrival in the Dutch harbours Amboina, Banda, and Bima they were splendidly received by the authorities and by the population. From Banda the ship did not sail straight to Bima, but in order to make observations it went first in a southern direction so far as the Sahul shoal on the shelf of the Australian continent. In this manner the curved double range of islands on the border of the Banda Sea was crossed twice.

On Dec. 13 the ship arrived at Surabaya after a voyage of 200 days, 112 of which had been sailing days. The length of the whole track is 20,600 miles. Never before has so long a voyage been performed by an unescorted submarine. The crew arrived in good health notwithstanding the hardships of so long a stay on board the small vessel, which measured but 800 tons and offered very poor accommodation. The ship and the engines, built at the yard 'Feyenoord' at Rotterdam, were during the whole voyage in the most perfect condition.

Vice-Admiral A. F. Goossens, Commander of the Fleet and Chief of the Navy Department at Batavia, was present to welcome the crew, and informed Commander van der Kun and Dr. Vening Meinesz that H.M. the Queen had been pleased to make both of them officers in the Order of Oranje-Nassau, whilst many among the officers and the crew received other marks of distinction. The first days at Surabaya brought a series of festivities.

After having made one more observation in the harbour of Surabaya, Dr. Vening Meinesz was able to go to the mountains for a well-deserved rest. But again and again this rest was interrupted by his giving lectures in the principal towns of Java about his voyage.

On meeting the admiral at Surabaya, Dr. Vening Meinesz had availed himself of the opportunity to request if before his return to Holland H.M. Submarine K XIII could once more be placed at his disposal for the making of pendulum observations in the deep south of Java. This request was granted directly; so, on Feb. 3 he again embarked at Surabaya and sailed through the Straits of Bali into the Indian Ocean. The observations were made in four profiles perpendicular to the Java Deep; they are twenty-six in number, and will give a complete record of the gravity in this part of the ocean. The results have not yet been computed.

The submarine sailed through the Straits of Sunda to Batavia, where Dr. Vening Meinesz disembarked on Feb. 14. He left Java on Mar. 9 on board a mail steamer, and arrived at Amsterdam on April 9. At the meeting of the Amsterdam Academy of Sciences on June 25 he read a paper upon the provisional results of his observations and the conclusions which, with some reservation, may be drawn from them. These conclusions are principally the following:

1. In the Atlantic and the Pacific there are excesses of gravity extending over large areas. As has been explained by Dr. W. Bowie and C. H. Swick, both of the U.S. Coast and Geodetic Survey, these may be caused partially by a depression of the geoid with regard to the spheroid. The final computations will show in how far this circumstance may account for the excesses.

2. It is unlikely that the longitude terms introduced by Helmert and by Heiskanen in the formulæ will agree with the values of gravity obtained in the oceans.

3. In the Pacific there exists a remarkable parallelism between the variations of the anomalies and of the sea-depths.

4. The observations made above the four deeps all show a remarkable defect of gravity in the middle of the deep. The excesses on the borders do not make the impression that they may be ascribed to an excess of mass below the deeps, required for isostatic compensation, but give rise to the supposition of tangential pressure in the earth's crust.

5. The observations at the feet of the continental slopes give greater values of the gravity than should be the case according to the current theory.

6. The results obtained in the Banda Sea, especially near the double range of islands, show a large excess at the inside; that gradually changes into a very noticeable defect at the outside, where the tangential pressures which are probable in this part of the archipelago should make an excess probable. The great anomalies are in accordance with the general view that in this part of the world the earth-crust was recently, or is still at present, in a labile condition.

7. In general, the results obtained at sea give the impression of greater regularity than those obtained on land. This agrees with what was expected. The outer layer of water immediately below the observer is homogeneous and the disturbing masses in the solid crust are farther away. Moreover, the deformation caused by erosion is absent.

The list of the provisional results of Dr. Vening Meinesz's observations in the Atlantic and the Pacific is published in the *Proceedings of the Amsterdam Academy of Sciences*. The complete definite results, together with the isostatic reductions computed by the courtesy of the U.S. Coast and Geodetic Survey, will be published by the Dutch Geodetic Committee in the course of 1928.

Thanks to the skill of Dr. Vening Meinesz, the problem of the determination of gravity at sea is solved. By his indefatigable effort and the splendid co-operation of the Royal Dutch Navy, the earth is now surrounded by a chain of gravity observations, which will procure the necessary data for a crucial test of the existing theories about the constitution of the earth's crust. Dr. Vening Meinesz has been appointed professor of geodesy at the University of Utrecht, and is now a member of the Dutch Geodetic Committee.

J. J. A. MULLER.

Forestry in Kenya Colony.

THE Forestry Department in Kenya has been in existence for more than a quarter of a century, the Forestry Ordinance dating from 1911. In the annual report for the year ended Dec. 31, 1926, it is claimed that the year then dealt with was "a notable one, and in many respects the most successful in the history of the Department." For the first time, it is said, the revenue was in excess of the expenditure. The revenue of £36,938 exceeded the expenditure by £7083 and was 45 per cent. larger than that of any previous year. The Acting Conservator rightly remarks that a record exploitation of the forests would not necessarily imply a successful year. It might mean, he adds, as it has in many countries, record forest destruction and diminution of the capital forest wealth. Unfortunately, such destruction is still in force in different parts of the world. But it may be asked, is Kenya herself on sure ground in this respect? It is true the Acting Conservator points out that the record exploitation in Kenya in 1926 was accompanied by record progress in afforestation and re-afforestation, "the area of 3047 acres planted during the year being more than sufficient to replace the forest cut during the year." It is not apparent, however, from the report, on what premises such a statement rests.

One of the most serious features of the present position of the Department and its forests is to be found in the fact that no trustworthy estimate of the quantities of timber in the forests exists; in other words, no enumeration of the growing stock as a whole in the forests under the Department has yet been made. This the report quite rightly states is "the most unsatisfactory aspect of the forestry position."

The exploitation work is carried out by sawmill companies, which are granted timber-felling licences. Twenty-three of these firms worked in the forest reserves during the year, the area subject to such exploitation being approximately 447,518 acres, though it is estimated that not more than 197,700 acres of this area carried marketable timber. "As the rate of cutting," says the report, "varies very greatly with the different licence-holders, the total area under licence is no guide to the rate of exploitation of the Colony's forests. The only sure criterion by which to judge the Colony's forest position is a comparison of the annual cut with a reliable estimate of the total stock of mature timber in the forests. There is at present no such estimate available, nor can one be obtained without a considerable increase of the present Staff of the Department."

The plain meaning of these statements is that the forests are being worked without an adequate knowledge of their contents or what is the annual possibility. It should not prove difficult to settle this important matter, if only roughly, in order to avoid the grave chance of overcutting. It is fairly common knowledge how Brandis, single-handed, tackled a like proposition in Pegu in Burma in 1856. The Department in Kenya is obviously understaffed. But at least there is a trained officer in charge of each forest district. It can surely not be held that there is any work, however apparently important, not even planting work, which should take precedence over the carrying out of enumeration surveys, however rough, of the growing stock of the forests. For the exploitation work being conducted and the revenue accruing thereby is only justified, in economic forestry, when based on some adequate knowledge of the volume of growing stock per unit of area standing in the forests. Such knowledge, the Acting Conservator states, is non-existent. In its absence, fellings, according to modern forest practice and precept, should be made as sparingly as possible.

The other point in the report is the assertion that the planting work undertaken during the year, amounting to 3047 acres, is more than sufficient to replace the forest cut over during the same period. The volumes obtained from the latter were 1,316,566 cub. ft. of timber and 5,207,403 cub. ft. of firewood. An analysis of the planting work shows that 1195 acres were planted as fuel plantations for the supply of firewood to the railway. This area has no reference, therefore, to future timber production. The planting work to replace the timber felling comprised 860 acres of pencil cedar, 276 acres of other indigenous timber species, and 274 exotic timber species, or an area of 1410 acres in all. The balance of 442 acres was mangroves. Though admittedly a considerable portion of this planting work is still in the experimental stage, yet considerable success is being attained. Nevertheless, it appears somewhat optimistic, with the known history of the costly failures which have been experienced elsewhere in the past, to claim that this planting work will suffice to replace the forest areas cut during the year.

The report points to the necessity of undertaking research work in connexion with the forests and the need of special research officers. The beginnings of such research work have been initiated by the staff, and some very creditable work has already been achieved. Work of this nature, however, must be carried on with continuity, and the latter is not possible in the absence of the whole-time worker. But the mere enumeration of the growing stock of the Kenya Forests does not fall within the province of 'research.' It might be suggested that the best solution of this research question, as in the long run of the staff and its future prospects, would be the amalgamation of the gazetted forest staffs of the four colonies, Kenya, Uganda, Tanganyika, and Nyasaland, on to one list; following the precedent forced upon India some years after the Forest Service there was inaugurated.

In conclusion, it should be said that this report is a most interesting document and beautifully got up by the Government Press, Nairobi. In this latter respect it forms a model which some other Colonial government presses might take as a guide.

University and Educational Intelligence.

CAMBRIDGE.—Mr. R. H. Fowler, Trinity College, has been elected Stokes lecturer in mathematics. Sir Michael Sadler has been appointed Rede Lecturer for 1928, and Prof. G. H. Hardy has been appointed Rouse Ball lecturer in mathematics for 1928.

Girton College announces that a scientific research fellowship of the annual value of £300, tenable for three years, is offered for research in mathematical, physical, and natural sciences. Particulars are obtainable from the Secretary of the College. The latest date for the receipt of applications is Feb. 1.

LONDON.—Applications are invited for the Keddey Fletcher-Warr studentships for post-graduate research. The studentships are each of the annual value of not less than £200, are tenable normally for three years, and are open to men and women graduates of a British university, or who have passed an examination necessary to qualify for a degree, preference being given to a graduate of the University of London. Applications should reach the Academic Registrar, South Kensington, S.W.7, not later than Feb. 20 next.

OXFORD.—The honorary degree of doctor of science has been conferred upon Mr. Edward Ball Knobel for his distinguished contributions both to astronomical science and to Persian scholarship. Dr. Knobel has been president of the Royal Astronomical Society for two periods of office.

Among the financial decrees which have recently been brought before Congregation are those for the provision of senior studentships (£1000); for an assistant in the department of medicine (£150); for the botanical department (£450); and for providing and housing a destructor at the University Museum (£350).

A new botanical schedule for the Preliminary Examination has been published. It is to come into force on Oct. 1, 1929.

WITH the September issue of the *Journal of the Imperial College of Tropical Agriculture*, a 'Sugar Supplement' has been issued which describes briefly the system of training adopted at the Imperial College of Tropical Agriculture, Trinidad, for students in sugar technology, and also gives an idea of the courses of study available at that College for students in tropical agriculture. Before entering upon the special course of study in sugar technology, which occupies a year, the student must have gained the diploma awarded by the College to those who qualify by examination after undergoing a three years' course of study; the qualification for entrance to the College being the matriculation certificate of any university within the British Empire or its recognised equivalent. The sugar technology course, which is fully described, includes instruction in genetic research on sugar-cane, sugar-cane breeding, agronomic research in the sugar industry, theoretical and practical instruction in the extraction of sugar from canes, by-products of the sugar industry, the components of sugar-cane juice, chemical research problems in sugar-cane production, organic manures from sugar-cane, insect pests of sugar-cane, mycological and bacteriological problems connected with sugar-cane, questions of hygiene connected with life in the tropics and work in factories, and costings and records connected with the management of sugar-cane estates and factories. In each case an outline is given of the course of instruction, whilst some thirteen illustrations depict various cultural operations and factory features.

Calendar of Discovery and Invention.

December 18, 1879.—Huggins was a pioneer in the use of photography for the investigation of the physical condition of the stars. In 1864 he discovered that many of the nebulæ give spectra consisting of bright lines. In 1876 he obtained a photograph of the spectrum of Vega; and three years later, in a paper to the Royal Society, read on Dec. 18, 1879, he described the ultra-violet spectra of white stars.

December 19, 1844.—Just after his return from England, Liebig, on Dec. 19, 1844, writing to Faraday, said: "What struck me most in England was the perception that only those works which have a practical tendency awake attention and command respect, while the purely scientific works, which possess far greater merit, are almost unknown. . . . Here, in the eyes of scientific men, no value, or, at least, but a trifling one, is placed on the practical results. The enrichment of science is alone considered worthy of attention. I do not mean to say that this is better, for both nations the golden medium would certainly be a real good fortune."

December 19, 1898.—It was on this date that Prof. and Mme. Curie communicated to the Paris Academy of Sciences a memoir, "Sur une nouvelle substance fortement radio-active contenue dans la pechblende," the substance being named by them 'radium.'

December 20, 1842.—Darwin made many experiments to study the action of earthworms. "One experiment lasted nearly thirty years, for a quantity of broken chalk and sifted coal cinders was spread on Dec. 20, 1842, over distinct parts of a field near Down House, which had existed as pasture for a very long time. At the end of November 1871 a trench was dug across this part of the field and the nodules of chalk were found buried seven inches. A similar change took place in a field covered with flints, where in thirty years the turf was compact without any stones."

December 21, 1736.—The patent of Jonathan Hulls for a steamboat was granted on Dec. 21, 1736. The following year he published a description of his new invention, but so far no evidence has been found showing that he ever put his ideas into practice.

December 22, 1666.—The Royal Academy of Sciences of Paris was founded by Colbert in 1666, and its installation took place by order of Louis XIV. on Dec. 22, 1666. At first there were only twenty-one members, including three anatomists, two chemists, three physicists, three astronomers, and seven geometers. Huygens was included as a foreign associate.

December 22, 1896.—The Davy-Faraday Research Laboratory of the Royal Institution was founded and endowed by Ludwig Mond for furthering original investigations in chemical and physical science, and was opened by King Edward VII. on Dec. 22, 1896, Lord Rayleigh and Sir James Dewar being appointed directors without remuneration.

December 24, 1801.—Trevithick was the first to run a locomotive on rails, but his earliest steam vehicle made its trial trip on the roads of Camborne on Christmas Eve, 1801. This vehicle was referred to in a Falmouth newspaper, which said: "A carriage has been constructed, containing a small steam engine, the force of which was found sufficient upon trial to impel the carriage, containing several persons, against a hill of considerable steepness, at the rate of four miles an hour."

E. C. S.

Societies and Academies.

LONDON.

Royal Society, Dec. 8.—R. W. James and E. M. Firth: An X-ray study of the heat motions of the atoms in a rock-salt crystal. The ratio of the intensity of reflection of X-rays by rock-salt at the temperature of liquid air, to that at room temperature, has been measured for a number of spectra. The temperature factor is of an exponential form, the exponent being proportional to the square of the order of the spectrum, within the errors of experiment. The method of Fourier analysis has been used to calculate the distribution of electrons between the (111) planes of the crystal at different temperatures, and from the broadening of the peaks in the distribution curves the mean amplitudes of the atomic vibrations have been estimated.

I. Waller and R. W. James: On the temperature factors of X-ray reflection for sodium and chlorine in the rock-salt crystal. The factor for Na is greater than that for Cl, indicating that the Na atoms are the less firmly bound in the crystal lattice, and therefore have a greater mean amplitude of vibration than the Cl atoms. From the values of the temperature factors the root-mean-square amplitudes of vibration of Na and Cl are found to be 0·242 A. and 0·217 A. respectively at 290° abs. Waller's theoretical formula for the temperature factor agrees with experiment from 86° abs. to about 500° abs. if allowance is made for the difference in M for the two atoms.

N. K. Adam, W. A. Berry, and H. A. Turner: The structure of surface films (Part 10). Two series with liquid expanded films of area (at no compression) different from 48 sq. A. have been found, the phenols of 39 sq. A. and the α-monoglycerides of 70 sq. A. The hypothesis of coiled chains for the liquid expanded films cannot therefore be maintained. The evidence is inconclusive in favour of any specific form of a tilted molecule theory, although all forms appear possible. Since the heads appear to contribute to the cohesion in the expanded films, Langmuir's theory that the chains hold the films together against a disruptive force exerted by the heads appears incorrect. The monoglycerides form condensed films with close-packed heads, not appreciably rearranged by compression, area 26·3 sq. A. at no compression. Muller's suggestion that the chains are tilted is not incompatible with the theory of close-packed heads. The condensed film of dodecyl phenol shows hysteresis on compression and decompression.

G. Nonhebel, J. Colvin, H. S. Patterson, and R. Whytlaw-Gray: The coagulation of smokes and the theory of Smoluchowski. A special cell has been designed for counting smoke particles. The coagulation of clouds of ammonium chloride, antipyrin, and cadmium oxide obeys the same general law, which is probably valid for all smokes composed of non-volatile particles. The experimental data agree as closely as those obtained for sols with the theory of Smoluchowski.

P. I. Dee: The mobility of the actinium A recoil atom measured by the cloud method. The mobility of *individual* actinium A recoil atoms is measured at the instant of their reaching the ends of their recoil tracks. Photographs of four main types of grouped tracks were obtained, corresponding to the double disintegration: actinium emanation $\xrightarrow{\alpha}$ actinium A $\xrightarrow{\alpha}$ actinium B. The relative positions of the origins of these tracks gave the mobility and, in some cases, the life of the A atom. Results obtained for actinium A agree with the usually accepted value for the mobility, namely, 1·56 cm./sec./volt/cm. The method also gives *direct* evidence that some of the recoil atoms at the end of their recoil track are uncharged, and the percentage of such neutral recoil atoms agrees with Briggs's value, found by activity distribution methods.

A. C. Menzies: Shifts and reversals in fuse-spectra. A high-current arc is struck momentarily between wires. The spectrum of copper so obtained has been compared with the low-current arc spectrum, and regularities have been sought on the bases of shifts and reversals. Five, and possibly six, new terms have been deduced, leading to the allocation of 32 new lines. Some of these are identified with terms missing from Sommer's scheme. The lines which were reversed have final terms which belong to low levels; for copper they are $1\ ^2S_1$ or $^2D_2$ or $^2D_3$ terms. Lines have a tendency to shift as the current increases; for high-level initial terms having structure (core $+s$), the lines shift to the red; for high-level initial terms having structure (core $+d$), the lines shift to the violet; for low-level initial terms, the lines shift in accordance with the Stark effect mainly.

C. G. Darwin: The electron as a vector wave. In spite of the great success of the spinning electron in the theory of spectra, there are grave difficulties in its interpretation in terms of the wave theory. These are met by making the hypothesis that the wave of an electron, like a wave of light, has two components. The wave equations are worked out so as to fit the hydrogen spectrum, and this ensures that they will conform to all known conditions of quantum mechanics. They are found to be unsymmetrical, so that they take a different form according to what direction of space is chosen as prime axis. A general argument from analogy shows that they should therefore be interpreted in terms of a vector, in some degree arbitrary, so as to be invariant in form as well as fact. A relativity transformation is applied, so as to identify the 'doublet effect' with the Zeeman effect. This encounters the difficulty that it is not at present possible to see what form the Thomas correction should take in the wave theory, and so gives a value for the doublet separation twice as great as it should be.

W. Sucksmith, H. H. Potter, and L. Broadway: The magnetic properties of single crystals of nickel. The magnetic properties of single crystals of nickel have been examined in the principal crystal planes. The component of magnetisation parallel to the field was measured by the induction method, whilst the component perpendicular to the field was measured by a torsion method. The existence of directional properties in the crystal invalidates the torsion method for the measurement of the parallel component. The magnetisation and field coincide along the directions of the symmetry axes, the direction of easiest magnetisation being along the trigonal axis.

L. N. G. Filon: On the second approximation to the "Oseen" solution for the motion of a viscous fluid. We start from the "Oseen" solution as the 'first order' and substitute this first order solution into the terms previously neglected in the exact equations of motion (restricted, however, to steady motion). We then obtain integrals of the modified equations. The new solution contains a certain term in which $\log r$ appears as a factor, r being the distance from the obstacle. This term, when the torque on the cylinder is calculated, leads to a result logarithmically infinite. The force resultants remain finite and the expressions obtained for them from the "Oseen" solution remain unmodified.

C. V. Raman and K. S. Krishnan: A theory of the optical and electrical properties of liquids. The

theory is based on the idea that the molecules of the fluid are optically and electrically anistropic, and that, in addition, the polarisation field acting on a molecule in a dense field varies with its orientation relatively to the external field. It offers an immediate explanation why in general an *increased* density causes a *diminished* molecular refractivity as calculated from the Lorentz formula. These changes in refractivity and dielectric constant are closely related to a change in the effective optical or electrical anisotropy of the molecules produced by the influence of its immediate neighbours. Similar ideas have been adopted in theories of electric birefringence and of light-scattering in liquids developed by the authors, which have found strong experimental support.

E. W. R. **Steacie** and F. N. G. **Johnson**: The solubility of hydrogen in silver. The solubility of hydrogen in silver has been investigated from 200° to 900° C. at pressures of 5-80 cm. The solubility first becomes appreciable at 400° C. The solubility increases exponentially with increasing temperature. It is proportional to the square root of the pressure. The diffusion of hydrogen through quartz has also been measured from 200° to 900° C. The diffusion of hydrogen through quartz appears to be of a mechanical nature.

R. L. **Smith-Rose** and R. H. **Barfield**: Further measurements on wireless waves received from the upper atmosphere. The results previously published were confined to measurements on waves received from the Bournemouth transmitting station. The investigation has been extended to transmissions from Birmingham, London, and Newcastle. Measurements have been made of the mean angle of incidence of the downcoming waves, and from these the effective height of the upper ionised layer has been calculated. By making use of a knowledge of the attenuation of the surface wave over land, it has been possible to arrive at values for the coefficient of reflection of the ionised layer for the various cases dealt with.

(*To be continued.*)

DUBLIN.

Royal Irish Academy, Nov. 30.—P. J. **Nolan** and Cilian **O'Brolchain**: Observations on atmospheric electrical conductivity in connexion with the solar eclipse of June 29, 1927. Observations made at Llysfaen, Colwyn Bay, showed no variation in conductivity which could be attributed to the eclipse. The relation between the conductivity and the concentration of condensation nuclei was, however, anomalous. An explanation of the anomaly is put forward. Records of ionisation, conductivity, and nucleation under normal conditions are examined, and values for the rate of production of ions in the free atmosphere at different places are computed.

PARIS.

Academy of Sciences, Nov. 14.—H. **Deslandres**: Observations on the transit of Mercury across the solar disc, Nov. 10, 1927, made at the observatories of Paris and Meudon. All possible instruments at both observatories were utilised, but the atmospheric conditions were not favourable. A general account of the work done is given: details of the measurements will be given in a later communication.—G. **Bigourdan**: The transit of Mercury across the sun observed at the Paris Observatory on Nov. 10, 1927. There was no sign of the ring round the planet noticed in some earlier observations.—Maurice **Hamy**: Observation of the transit of Mercury across the sun on Nov. 10, 1927. On account of the unfavourable atmospheric conditions, only the second interior contact could be observed.—Maurice **Hamy**: An eyepiece permitting the images to be rotated.—Pierre **Termier**: Some results of the Congress of the Carpathian Association held at Bucharest in September 1927: the crystallino-mesozoic zone: provisional sketch on the whole of the structure of the Carpathians.—P. A. **Dangeard**: Researches on the natural contamination of the soil in cultures of *Phaseolus vulgaris*. The Rhizobium of the bean does not exist in a soil which has remained uncultivated for several years. Contamination of the soil by the Rhizobium is most easily accomplished by adding soil containing the germs of the organism, or more simply by watering with water with which such soil has been in contact.—Georges **Claude**: The utilisation of the thermal energy of the sea. A detailed reply to criticisms of the scheme proposed by Paul Boucherot and the author on the utilisation of the sea's thermal energy.—G. **Charpy**: A method for the superficial hardening of steel. The process suggested by the author, and named carburisation as distinct from cementation, consists in heating the steel to a temperature between 600° C. and 650° C. in an atmosphere of carbon monoxide, cyanogen, or hydrocarbons.—**Gonnessiat**: Observation of the transit of Mercury at the Observatory of Algiers. Twenty negatives were taken under fairly good atmospheric conditions: a full discussion of these will be given later.—A. **Recoura**: The sulphates of acetylated sesquioxides.—Ed. **Imbeaux**: The subterranean waters, the principal cause of the inclination of the leaning tower of Pisa. How can its stability be assured? Means are suggested for stopping the flow of the underground water at the base of the tower, afterwards consolidating the foundations with cement.—E. **Bataillon**: The destiny of the male nuclei in the crossed impregnation of immature eggs of the Triton.—Albert Calmette was elected a member of the Section of Rural Economy in succession to the late G. André.—Eugène **Cahen**: The ensemble of all integral algebraical numbers.—G. **Nicoladzé**: The generalisation of a theorem of Bertini.—Miloch **Radoitchitch**: The approximation of multiform analytical functions by algebraical functions.—Y. **Rainich**: The indices in a field of tensors. The generalisation of integral curvature.—**Kolossoff**: The centre of non-parallel forces.—E. **Carafoli**: The aerodynamic profiles of general form.—E. **Huguenard**, A. **Magnan**, and A. **Planiol**: A new principle permitting the realisation of apparatus measuring the aerodynamical conditions of the flight of aeroplanes.—**Schaumasse**: Observation of the transit of Mercury across the sun's disc made at the Observatory of Nice. Times of the last internal and external contacts are given.—G. Van **Biesbroeck**: The rediscovery of the Schaumasse comet and the photographic method for observing comets. This comet was found on Oct. 4, almost exactly in the position predicted by G. Merton. It appeared as a faint nebulosity of the 12th magnitude. It was afterwards observed on Oct. 8, 19, 21, 25, and 26. The advantages of the photographic method are pointed out.—J. **Nageotte**: The microscopic and molecular structure of myelinic formations.—**Dubar**: A verification of the theory of detectors and contact rectifiers. Description of experiments with a detector formed of blocks of graphite and silicon, separated by a very thin film of silica.—G. W. **Ritchey**: The comparison in the laboratory of the images and the fields furnished by a Newtonian telescope and a Ritchey-Chrétien telescope.—Y. **Rocard**: The rôle of the vibrations of the atoms in the molecules in the phenomenon of the diffusion of light.—G. **Labussière**: The production of light by the friction of the diamond on glass.—Pierre **Bricout**: The absolute measurement of the luminous energy emitted by a gas submitted to electron bombardment. From the results of the measurements recorded, the conclusion is drawn that there is a high probability that for each collision of

an electron and an atom one quantum is emitted. Hence all the shocks are efficacious for the production of the radiation.—L. Mallet and R. Cliquet: A photo-electric cell for the measurement of mean ultra-violet radiation. The best metal for the cell proved to be an alloy of silver and cadmium, the emission from which commences for a limiting wave-length of about 2900 A. The cell is free from inertia and photo-electric fatigue and is unaffected by ordinary daylight or by any sources of light surrounded by a glass covering.—R. Moens and J. E. Verschaffelt: Optical phenomena presented by quartz put in piezo-electric vibration.—René Dubrissay and Mlle. Florence Desbrousses: The action of phosphoric acid on lime-stone in the presence of clay and of powdered substances. The presence of absorbent materials, especially kaolin, interferes with the fixation of phosphoric acid by chalk. This action is notable even when the proportion of chalk is such that there should be sufficient to transform the whole of the acid into insoluble phosphate.—René Wurmser: The apparent potential of solutions of glucose.—Jean Cournot: The treatment of ferrous alloys in solutions of complex phosphates, with the view of their protection against corrosion. The method of treatment is to dip the iron, cast iron, or steel into boiling acid baths containing from 3 per cent. to 4 per cent. of phosphates of iron and manganese prepared with orthophosphoric acid. The treated metals are especially resistant to atmospheric corrosion; corrosion tests in various liquids are described, showing comparative results obtained by specimens protected by various processes.—Travers: Analytical consequences of the domain of stability of cryolite. The questions of the separation of silica and fluoride in the presence of aluminium, and the estimation of fluorine and silica are considered in the light of the results given in an earlier communication.—B. Bogitch: A method of removing iron from an alloy.—V. Hasenfratz and R. Sutra: The chemical properties of benzylidene-harmine. This substance, although containing a double bond, forms no addition product with bromine. Only one of the two nitrogen atoms which it contains can be methylated.—R. Barré: The action of organo-magnesium derivatives on tetra-ethyloxamide.—Frèrejacque: Oxyquinine and per-oxyquinine.—Maurice Fontaine: The causes of a variation of the salinity observed in the ocean at the promontory of Croisic. The reduced amount of salt is shown to be due to the Loire.—Ph. Hagene: Colonies of species attacking chalk in a limestone region.—Raoul Combes and Robert Echevin: The velocity of the autumnal migration of the nitrogenous substances of leaves towards the stems in ligneous plants.—René Souèges: The embryogeny of the Leguminoseæ. The first stages of the development of the embryo in *Medicago Lupulina*.—Lucien Daniel: The heredity of wormwood (Artemisia) grafted on *Chrysanthemum frutescens*.—Jacques Pellegrin: The presence of the green frog in the Hoggar (Central Sahara).—Mme. L. Randoin and R. Lecoq: The influence of the nature of the alimentary glucides on the production of acute polyneuritic states, relapsing or chronic, obtained in spite of the presence of yeasts or extracts of yeast.—Mlle. M. L. Verrier: The static refraction of the eye in fishes.—Marcel Brandza: The fusion or separation of the plasmodia, taken as criteria in the definition of the species in the Myxomycetes.—Edouard Chatton and André Lwoff: The metamorphoses in the Foettingeriidæ (ciliated) and the transformations of their ciliature in the course of their evolutive cycle.—K. Toumanoff: Attempts at the immunisation of bees. Bees possess a great natural immunity with regard to various organisms. It was proved that immunity against *B. alvei* could be conferred on bees.—S. Schmidt: Contribution to the study of the process of neutralisation between toxins and antitoxins (diphtheria and tetanus). These experiments show that the complex formed by the toxin and the antitoxin in excess, react with a new quantity of the toxin differently from free antitoxin.—E. Wollman and Achille Urbain: Antigen autonomy of the sarcoma of Roux.

CAPE TOWN.

Royal Society of South Africa, Sept. 28.—P. R. v. d. R. Copeman: Studies in the growth of grapes (Pt. 5). The relationship between the sugar and soluble solids in the juice of the grape is a linear function. The slope of the line is closely related to the growth yields of these two factors during the period of ripening. The variations of the constants for different varieties lie within narrow limits and it is possible to obtain a general expression for the sugar in terms of the soluble solids, which is practically independent of changes in locality and season.—M. R. Drennan: The dentition of a Bushman tribe. The collection comprises the remains of 53 individuals reputed to be Bushmen. Comparative data from the dentition of the Kaffir and a few gorillas and baboons are discussed.—D. Slome: The osteology of a Bushman tribe. Skeletons of a tribe of aborigines exhumed at Colesberg by the South African Museum, Cape Town, were examined. The larger group examined is composed of relatively pure Bushmen, more typically Bushman, especially as regards the smallness of their bones, than many other groups which have been described as Bushmen. Nevertheless, there appears to be a strain of what might be termed Hottentot blood in them, as evidenced by the narrowing of the skull, and the apparent subnasal prognathism.—James Moir: Colour and chemical constitution (Pt. 23). The pigments of flowers. The gap between the anthocyanidines and their parent, flavylium chloride, has been filled by synthetic derivatives. All the anthocyanidines, except the simplest, possess from three to five different shades, each according to the reaction of the solution.—Lancelot Hogben and Louis Mirvish: Some observations on the production of excitement pallor in reptiles. Excitement pallor in chameleons is shown by spinal transection to be determined by a segmental mechanism. The possibility of evoking pallor by stimulation of the cord in isolated segments after the circulation has been cut off indicates that the pigmentary effector organs are under direct nervous control. It is unlikely that adrenal secretion plays any significant part.—E. L. Gill: Note on a rorqual buried on the Cape Flats. A skeleton of a rorqual (Balænoptera sp.) has been found in surface deposits on the Cape Flats, near Maitland. The circumstances furnish evidence of a comparatively recent rise of level of the Flats in relation to the sea.—Vincent A. Wager: The structure and life history of the South African Lagarosiphons.

SYDNEY.

Linnean Society of New South Wales, Sept. 28.—P. Brough: Studies in the Goodeniaceæ (Pt. 1). The life history of *Dampiera stricta* R.Br. A detailed account is given of the chief phases in the life history of *Dampiera stricta* R.Br.—a representative of the family Goodeniaceæ. Therein are presented organogeny, microsporogenesis, megasporogenesis, female gametophyte, male gametophyte, pollination mechanism, fertilisation, endosperm formation, embryogeny, and conclusions arrived at, as a result of the facts brought out by this investigation.—J. R. Malloch: Notes on Australian diptera (No. 13). This paper deals with the families Sapromyzidæ, Agromyzidæ,

Chloropidæ and Asteiidæ. Numerous keys to both genera and species are given. Sixty-four new species are described, distributed as follows :—Sapromyzidæ 34, Agromyzidæ 6, Chloropidæ 23, Asteiidæ 1.—A. H. S. Lucas : Notes on Australian marine algæ (Pt. 4). The Australian species of the genus Spongoclonium. The critical distinction between Spongoclonium and Lasiothalia seems to be that the former is monosiphonius, articulated, without any true cortex, and thus nearer to Callithamnion, while the latter possesses a true cortex and is nearer Crouania. The object of the present paper is to illustrate so far as material will permit the Australian and Tasmanian species included by De Toni in the genus Spongoclonium. Eight species of Spongoclonium and two species of Callithamnion, which had been included in Spongoclonium by De Toni, are figured.

Official Publications Received.

BRITISH.

Proceedings of the Royal Society of Edinburgh, Session 1926–1927. Vol. 47, Part 3, No. 21 : Submergence and Postural Apnœa in the Swan. By D. Noël Paton. Pp. 283-293+1 plate. 1*s.* 6*d.* Vol. 47, Part 3, No. 22 : Researches into the Characteristic Numbers of the Mathieu Equation (Third Paper). By Dr. E. L. Ince. Pp. 294-301. 9*d.* (Edinburgh : Robert Grant and Son ; London : Williams and Norgate, Ltd.)

British Cast Iron Research Association. Sixth Annual Report for the Year ending June 30th, 1927. Pp. 22. (Birmingham.)

Livingstone College. Annual Report and Statement of Accounts for the Year 1926–27. Pp. 24. (London : Leyton, E.10.)

Royal Geographical Society. List of Honorary Members and Corresponding Members and Fellows. Corrected to 30 September 1927. Pp. 136. (London.) To be obtained by Fellows only.

Journal of the Indian Institute of Science. Vol. 10A, Part 5 : *iso*-Erucic Acid. By Tahilram Jethanand Mirchandani and John Lionel Simonsen. Pp. 57-63. 8 annas. Vol. 10A, Part 6 : Note on the Sorting, Classification and Briquetting of Chrome and Manganese Ores. By K. R. Krishnaswami. Pp. 65-69. 8 annas. Vol. 10B, Part 1 : Tests on Suspension Insulators after Ten Years' Service. By A. S. Venkateswaran and U. Ganguly. Pp. 19. 1 rupee. Vol. 10B, Part 2 : The Measurement of Voltage Gradient on a String of Suspension Insulators. By G. Yoganandam and R. K. Sen. Pp. 21-33. 1 rupee. (Bangalore.)

Sanatoria. List of Sanatoria and other Residential Institutions approved by the Minister of Health for the treatment of persons suffering from Tuberculosis and resident in England and Wales, with the names of the Administrative Counties and County Boroughs in which the Institutions are situate. (List 10(c).) Pp. 24. (London : H.M. Stationery Office.) 2*d.* net.

Union of South Africa. Department of Mines and Industries : Geological Survey. The Geology of the Country around Vredefort : an Explanation of the Geological Map. By Louis T. Nel. Pp. 134+15 plates. (Pretoria : Government Printing and Stationery Office.) 10*s.* 6*d.*, including Map.

The British Mycological Society Transactions. Edited by Carleton Rea and J. Ramsbottom. Vol. 12, Part 4, November 24. Pp. 231-323. (London : Cambridge University Press.) 7*s.* 6*d.* net.

The South-Eastern Naturalist : being the Thirty-second Volume of Transactions of the South-Eastern Union of Scientific Societies, including the Proceedings at the Thirty-second Annual Congress, held at Hastings and St. Leonards, 1927. Edited by A. F. Ravenshear. Pp. lxxvi+113. (London.) 5*s.* net.

Journal of the Chemical Society : containing Papers communicated to the Society. November. Pp. iv+2661-2903+viii. (London : Gurney and Jackson.)

International Federation of University Women. Bulletin No. 9 : Report of the Council Meeting, Vienna, July 1927. Pp. 72. (London : Crosby Hall.)

The Manchester Museum. Museum Publication 94 : New Carboniferous Lamellibranchs and Notes on other Forms. (Notes from the Manchester Museum, No. 31.) By J. Wilfrid Jackson. Pp. 93-122+3 plates. 3*s.* Museum Publication 95 : Report of the Museum Committee for the Year 1926–27. Pp. 23. 3*d.* (Manchester : University Press ; London : Longmans, Green and Co., Ltd.)

FOREIGN.

Scientific Papers of the Institute of Physical and Chemical Research. No. 105 : The Synthesis of β-Acid (2·6-Dioxyquinoline-4-Carbonic Acid) obtained from "Roh-Oryzanin" by Hydrolysis. By Yoshikazu Sahashi. Pp. 21-26. 20 sen. No. 106 : Resonance Radiation in the Excited Neon. By Yoshio Fujioka. Pp. 27-34+plates 1-4. 25 sen. Nos. 107-108 : The Effect of Alkali on the Oxidation of Ferrous Hydroxide with Air, by Susumu Miyamoto ; The Effect of Alkali on the Oxidation of Sodium Sulphite with Air, by Susumu Miyamoto. Pp. 35-45. 25 sen. Nos. 109-110 : On the Dehydration of Borneol, by Tetsusaku Ikeda ; On the Formation of Camphene from Pinene Hydrochloride, by Tetsusaku Ikeda. Pp. 47-73. 35 sen. Nos. 112-114 : A new Material for the Study of Photo-Elasticity, by Zirô Tuzi ; Photo-Elastic Study of Stress on a Specimen of Three Dimensional Form, by Zirô Tuzi ; Photo-Elastic Study of Stress in Heat-treated Column, by Zirô Tuzi. Pp. 79-120. 60 sen. No. 115 : On the Hydrogenation of "Biosterin." By Ziro Nakamiya and Kozo Kawakami. Pp. 121-142. 30 sen. Table No. 2 : Tables for Facilitating the Calculation of Self-Inductance of Circular Coil and of Mutual Inductance of Coaxial Circular Currents. By Hantaro Nagaoka and Sadazo Sakurai. Pp. 69-180. 3.50 yen. (Tokyo : Iwanami Shoten.)

The University of Chicago : Publications of the Yerkes Observatory. Vol. 4, Part 6 : Zone +45° of Kapteyn's Selected Areas ; Photographic Photometry for 1500 Stars. By John Adelbert Parkhurst. The preparation for Publication was completed after the Author's death by Alice Hall Farnsworth. Pp. vii+62. 1.50 dollars. Vol. 5, Part 1 : Measurements of Double Stars. By George Van Biesbroeck. Pp. v+265. 3 dollars. (Chicago : University of Chicago Press ; London : Cambridge University Press.)

Mémoires de la Société de Physique et d'Histoire naturelle de Genève. Vol. 40, Fascicule 3 : Rapport du Président de la Société de Physique et d'Histoire naturelle de Genève pour l'année 1926, par Émile Chaix ; Les mollusques post-glaciaires et actuels du bassin de Genève, par Jules Favre. Pp. 169-434+planches 14-27. (Genève : Georg et Cie.) 20 francs.

Proceedings of the United States National Museum. Vol. 72, Art. 2 : Undescribed Crane Flies from the Holarctic Region in the United States National Museum. By Charles P. Alexander. (No. 2698.) Pp. 17+1 plate. Vol. 72, Art. 8 : New Parasitic Hymenoptera of the Subfamily Anteoninae from the Americas. By F. A. Fenton. (No. 2704.) Pp. 16+2 plates. (Washington, D.C. : Government Printing Office.)

The Government of the Philippine Islands. Department of Agriculture and Natural Resources : Bureau of Science. The Mineral Resources of the Philippine Islands for the Years 1924 and 1925. Issued by the Division of Geology and Mines, Bureau of Science. Pp. 148+5 plates. (Manila : Bureau of Printing.)

Ministry of Public Works, Egypt : Physical Department. The Lake Plateau Basin of the Nile. Second Part. By Dr. H. E. Hurst. (Physical Department Paper No. 23.) Pp. vii+66+28 plates. (Cairo : Government Publications Office.) 10 P.T.

Ministry of Agriculture, Egypt : Technical and Scientific Service (Plant Protection Section, Entomological Research Division), Bulletin No. 76 : Key to Identification of Egyptian Scorpions. By Dr. L. H. Gough. With Notes and Additions by Stanley Hirst. Pp. ii+7+5 plates. (Cairo : Government Publications Office.) 5 P.T.

New York Academy of Sciences. Scientific Survey of Porto Rico and the Virgin Islands. Vol. 9, Part 3 : The Birds of Porto Rico and the Virgin Islands. Colymbiformes to Columbiformes. By Alexander Wetmore. Pp. 245-406+plates 55-61. (New York City.)

Department of Commerce : U.S. Coast and Geodetic Survey. Special Publication No. 135 : Tidal Datum Planes. By H. A. Marmer. Pp. vi+142. (Washington, D.C. : Government Printing Office.) 30 cents.

Department of the Interior : Bureau of Education. Bulletin, 1927, No. 23 : Pension Schemes for Public-School Teachers. By Nida Pearl Palmer. Pp. vi+84. 15 cents. Bulletin, 1927, No. 29 : Industrial Education in 1924–1926. By Maris M. Proffitt. Pp. 29. 5 cents. (Washington, D.C. : Government Printing Office.)

Cornell University Agricultural Experiment Station. Memoir 106 : Catalase in relation to Growth and to other Changes in Plant Tissue. By J. E. Knott. Pp. 63. (Ithaca, N.Y.)

Proceedings of the California Academy of Sciences. Fourth Series. Vol. 16, No. 20 : Notes on New or Rare Fishes from Hawaii. By David Starr Jordan, Barton Warren Evermann and Shigeho Tanaka. Pp. 649-680+plates 22-24. (San Francisco, Cal.)

Conseil Permanent International pour l'Exploration de la Mer. Rapports et Procès-verbaux des Réunions. Vol. 45, Procès-verbaux (Mai 1927). Pp. 153. (Copenhague : Andr. Fred. Høst et fils.)

Diary of Societies.

SATURDAY, DECEMBER 17.

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS (Newcastle-upon-Tyne), at 2.30.—W. C. Carr : Impressions of the Canadian Empire Mining Congress.—Dr. W. Hopkins : Further Modifications of the Correlation of the Coal-seams of the Northumberland and Durham Coalfield.—*Paper open for further discussion :*—Notes on an Inrush of Water at the Montagu Colliery, Scotswood, Northumberland, on March 30th, 1925, by H. T. Foster.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—F. J. M. Stratton : Recent Developments in Astrophysics (II.).

MONDAY, DECEMBER 19.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 8.—Dr. R. Miller, in conjunction with J. E. Franck : Some Medical Aspects of Damp in Dwellings.

ROYAL GEOGRAPHICAL SOCIETY (at Æolian Hall), at 8.30.—Capt. S. W. Kirby : Jahore in 1926.

BRITISH PSYCHOLOGICAL SOCIETY (Medical Section) (at Medical Society of London, 11 Chandos Street, W.), at 8.30.—Dr. J. A. Hadfield : The Reliability of Infantile Memories.

CHEMICAL INDUSTRY CLUB.

TUESDAY, DECEMBER 20.

ROYAL STATISTICAL SOCIETY (at Royal Society of Arts), at 5.15.—L. R. Connor : Certain Aspects of the Distribution of Income in the United Kingdom in the Years 1913 and 1924.

ROYAL SOCIETY OF MEDICINE, at 5.30.—General Meeting.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—Demonstrations of New Apparatus.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.30.—Dr. A. H. Mumford : Body Measurements, Respiratory Tests and School Progress.

WEDNESDAY, DECEMBER 21.

ROYAL METEOROLOGICAL SOCIETY, at 5.

INSTITUTION OF CIVIL ENGINEERS (Manchester and District Association) (at 36 George Street, Manchester), at 6.45.—W. H. G. Mercer : Notes on Sewage Works Design (Activated Sludge Process).

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Middlesbrough Branch—Graduate Section) (at Middlesbrough), at 7.30.—R. F. Battey : The Progress in Diesel Design.

INSTITUTE OF CHEMISTRY (London Section).