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The Coal-mining Industry in Great Britain.

THIS eagerly expected Report of the Coal Commission, which was issued on March 11, constitutes a document of the highest interest and importance (H.M.S.O.; 1*s.* net). The Commissioners evidently have been impressed by the gravity of the situation and the magnitude of the task entrusted to them, and have spared no pains in making a complete investigation of the questions involved.

It may be said at once that, as might be expected from the exceptional qualifications of the Commissioners, the report is an eminently sound and sane one, and the best evidence of this lies in the fact that it has impartially dissatisfied all parties to the dispute. It is too often forgotten that there are at least three parties concerned, namely, the miners, the mine-owners, and the general public: the first two are articulate, not to say vociferous; the third is so inarticulate that its interest, vital though it is, is too frequently overlooked. It is sincerely to be wished, though the hope is scarcely likely to be realised, that the public would bestir itself sufficiently to read this report and would for once find a means of expressing its views.

It is obviously impossible to discuss in detail so voluminous a report; only a few of the main recommendations can here be considered. Perhaps the recommendation which will impress most people is that coal royalties shall be acquired by the State by purchase from their present owners. There is no fault at all to find with the principle of State ownership of minerals; as a matter of fact the greater portion of the minerals in the world are owned by the States within the territories of which they lie and are granted to mine-workers in the form of concessions. The most striking exceptions to this general method are to be found in Great Britain and the United States, where the minerals are the property of individuals or have been acquired by them. Incidentally it may be noted that these are the two countries in which mining has made the most progress and in which the wages of miners are the highest; this fact may be only a coincidence, or it may possibly be more deeply rooted than we are able to see at present in the condition of private ownership of the minerals.

The Commissioners amply justify the position that royalties are a perfectly legal form of ownership, and that if the State desires to acquire them it will have to pay for them. Their reasons are set out in the historical account which they give of royalties, but they by no means present the case in its entirety, because it is in fact much stronger than the report would lead the reader to believe; the opinion of the Commissioners that the State should now repair the error which it made when it parted with these royalties would lead the reader to infer that the State had at one time possessed these coal royalties. Such, however, is far from being the case: the State, or rather the Crown, in the past repeatedly claimed the ownership of metalliferous minerals, but never at any time set up the slightest claim to an ownership of coals.

Ownership of land and all that pertains to land in England dates from the Norman Conquest, and it is significant that the Doomsday Book, though it

mentions other mines, never once mentions a coal mine, so that it may fairly be inferred that at the date of the Conquest no coal mines existed in England. The earliest document concerning coal mines of which we have any knowledge is a Scotch deed dated 1202, in which the superior granted a lease of certain collieries in Newbattle, and even at this period the absolute right of the land-owner to dispose freely of his coal appears to have been unquestioned, and has remained so until the present day. As stated by the Commissioners, the Great Case of Mines settled the rights of the land-owner to mines within his land, as has been very clearly set forth by Sir John Pettus in his *Fodinæ Regales*, published in 1670. Apparently the first mention of coal mines in legislation appears to have been in the well-known Statute of Elizabeth in 1601, which instituted the Poor Rate and empowered the overseers of the poor to levy such rate upon any occupier of lands, houses, *coal mines*, etc. It is highly significant that this Act excludes other mines from the operation of the Poor Rate, and assimilates coal mines to houses and other appurtenances of the land. In England, therefore, the State never parted with the ownership of coal mines, for the simple reason that it never owned them, and it is obvious that if it now wishes to acquire them, it can only do so by purchase. The Commissioners suggest that a purchase price of 100,000,000*l.* would be a fair equivalent; this price is only sufficient if royalty owners consent to accept a lower income than they are at present receiving on condition that it shall be in a more secure form, and the suggestion is not an unreasonable one.

Whilst the principle of State acquisition of royalties is clear enough, its execution bristles with difficulties, not a few of which the Commissioners, to do them justice, have foreseen and have endeavoured in part to meet. The principle which they propose, namely, that coal, the existence of which is not to-day proved, shall belong to the State, is a perfectly defensible one, though curiously enough they have missed the main argument in its favour. It is certain that such coal can only be discovered as the result of the exact knowledge of the geological structure of the country, which has been obtained by the labours of a public department, namely, the Geological Survey, to the maintenance of which every taxpayer has contributed. It is difficult to see why a Kentish farmer who has bought land purely for agricultural purposes should claim the ownership of the coal which happens to lie under that land, when he has contributed to the discovery of that coal nothing more than has an equally taxed person in any other part of the country.

The Commissioners have evidently realised, as every one who knows the industry must realise, that, if it is to survive, the cost of production must come down, and as two-thirds of this consists of wages, it is obviously here that the greatest economies are possible; of the alternatives, either of lowering wages or of increasing the hours of labour for the same wage, the Commissioners pronounce in favour of the former. It does seem, however, that they have not looked at the question of length of the working day from the proper point of view. Their main argument against increasing the length of the working day is that if it were so increased in Great Britain as to be brought up to the level of our principal competitors, these would immediately increase the length of their working day. Obviously the same argument might apply to a lowering of wages, but there is not a particle of evidence that anything of the kind would happen.

Surely the proper way to approach the question of the length of a working day is to determine whether an increase of hours would unduly overtax the workers. Those who remember that, not so many years ago, the length of the working day was something like 50 per cent. more than it is to-day, and that men engaged in the even more arduous work of metal mining to-day work longer hours than coal miners, would unhesitatingly declare that the length of the coal miners' working day could be lengthened without inflicting the slightest hardship upon them. There is another alternative which never seems to have been placed before the Commissioners; even if it be suggested that a man who is hand-hewing in hard steam coal for six and a half hours has done as much physical work as can fairly be expected of him, the same cannot be said of the man whose work is running a coal-cutter, and it would appear to be a wise policy to have recommended that the hours of the men working in machine-cut faces should be lengthened. No doubt such a recommendation would present certain difficulties in practice, especially in mines where some districts are hand-cut and others machine-cut, but these difficulties would not appear to be insuperable. The recommendation would have the advantage of more nearly equalising the demands made upon the men, and it would encourage the more extensive use of machinery underground, because it would thus enable owners who put in machinery to get a better return on the capital thus invested.

It is rather surprising to find that in the chapter on profits, as indeed throughout the report, the wasting nature of the industry is nowhere recognised, and the fact is missed that it is necessary to make provision for the capital sunk in a colliery which must be replaced out of revenue before anything like a profit can be earned. The Commissioners estimate that to purchase the collieries of Great Britain would cost 350,000,000*l.*; as the annual output of the country may be averaged at 250,000,000 tons, this amounts to a capitalisation of 28*s.* per ton per annum. If it is assumed, as the Commissioners appear to suggest, that the average life of a colliery may be expected to be about forty years, it is not difficult to calculate what sinking fund would be required to replace the above capital. Assuming the interest on gilt-edged securities to be 4½ per cent., and that income-tax remains as at present 4*s.* in the *l.*, the annual amount to replace the capital outlay would be as nearly as possible 4*d.* per ton, thus reducing the real profit from the figure of 1*s.* given by the Commissioners to 8*d.* Furthermore, the Treasury most unjustifiably charges income-tax on the aforesaid 4*d.*, although, as just pointed out, it is not profit at all but merely a replacement of capital, so that the nominal profit of 1*s.* is thus cut down to 7*d.* Incidentally it may be suggested that if the Treasury were to refrain from collecting income-tax, which is strictly speaking a tax on profits, from that portion of the income of colliery owners which serves only to replace the capital sunk in the collieries, the nucleus of a fund could be formed which might help to tide the industry over difficult times.

Probably the most difficult point which the report discusses is the problem of what the industry is to do in May next. The Commissioners are quite clear on the point that the subsidy must not be renewed in any form whatever, and the figures which they present make their reason abundantly clear. It is shown that the subsidy has been employed to pay hewers at the high rate of 76*s*. per week on the average, or as much as 90*s*. per week in some districts, whilst it has enabled certain collieries to make quite handsome profits. It is clear enough that neither wages on so high a scale as this nor dividends to shareholders in collieries ought ever to be paid out of the pockets of taxpayers. It is, however, very difficult indeed to see how the industry is going to tide over the next few months without assistance of some kind, because the returns from the industry itself are not sufficient to pay what may be considered a reasonable wage to the lower paid men. The Commissioners, like all intelligent men, realise that the only wages which any industry can pay in the long run are the proceeds of the industry itself, although the Commissioners have not always expressed this clearly; for example, in discussing the policy of the subsidy, they speak of a gap "between the amounts that employers are willing to pay and the amounts that the workers are willing to accept"; it is not a question of what the employers are willing to pay but what they are able to pay; it cannot be too often repeated that the employers do not find the money wherewith to pay wages, they are merely the medium through which the money realised by the industry is handed over to the workers.

The Commissioners realise fully that if the various recommendations which they make are carried out, and if they have, as they well may have, the desired effect of re-establishing the industry, this will be a matter of time, and they do not indicate how the industry is to exist meanwhile. It is possible that some means might be found of tiding over the period of struggle which lies before the industry by an advance from the State, say on the joint guarantee of repayment by the Miners' Federation and the Mining Association, such advances to be used solely for keeping the wages of the lower paid men above subsistence level and not to pay high wages to the higher paid men or dividends to the colliery owners.

In any case, and whatever is done, all engaged in the coal industry must make up their minds to bear their share of the hardships which will have to be faced. As the Commissioners point out, the War has to be paid for, and they show "how impossible it is to insist that real wages shall in no case be below those ruling before the War." Men in the sheltered industries have been able to secure this unfair advantage, and have thus thrown an additional burden on those engaged in the competitive industries, and there seems no alternative but for the latter to shoulder it. Whilst in the words of the Commissioners in discussing the coal industry "the only generalisation about it that is safe is that no generalisation is possible," this much is certain: neither the Commissioners nor any one else can find any royal road by which the industry can be brought to the desired condition of prosperity, and the only avenue by which that goal may be reached for all engaged in the industry, whoever they may be, is hard work and privation.

H. LOUIS.

Egyptian Archæology.

(1) *The Mummy: a Handbook of Egyptian Funerary Archæology*. By Sir E. A. Wallis Budge. Second edition, revised and greatly enlarged. Pp. xxiv+513+39 plates. (Cambridge: At the University Press, 1925.) 45*s*. net.

(2) *Egyptian Religion and Ethics*. By F. W. Read. Pp. viii+152+6 plates. (London: Watts and Co., 1925.) 4*s*. 6*d*. net.

(1) WHILE Egypt has been fortunate in having a preservative climate and an industrious and artistic people who portrayed all its life, it has suffered by the rise of the Nile bed burying its early habitations under the ground. The prominence thus given to the tombs on the desert, as our main source of information, and the popularity of mummies, has led to a false idea of the importance of the funeral rites. This is further enforced when an encyclopædia of Egyptian usages, like the first volume under notice, is called "The Mummy," though that subject does not occupy a twentieth of its bulk. The greater part of the volume deals with the more interesting subjects of the history and language and the objects of utility; thus the living rather than the dead Egyptian is the object of this work.

A brief running account of the history of the kingdom occupies sixty pages on well-known lines, scarcely touching the long prehistoric ages. The list of principal kings' names in hieroglyphics further fills forty pages. A like space is given to a full recital of the stages in the decipherment of the method of writing, showing how far the different scholars carried it between Akerblad in 1802 and Hincks in 1848; this is illustrated by the finest photograph yet taken of the Rosetta stone. The principal hieroglyphs are listed in twenty-five pages, and rather more is given to a list of amulets and figures of gods, with some account of each. The description of usual tombs and their accessories fills the last hundred pages. Thus the stock subjects are pretty fully dealt with, in the form required by a general reader for reference, without entering on the detail needed by a student. A work of this scope is much needed, and no other single volume fills its place.

The great length and continuity of civilisation in Egypt renders it, perhaps, the most important country for studying the nature of man. It was in continual change, its fashions fluctuating around a norm which varied but slowly; yet it was often invaded by fresh peoples, who in mind and body always became assimilated to its culture, until the last two thousand years. This aspect is scarcely touched on in "The Mummy"; the distinctive changes in the history of the mirror,

the head-rest, canopic jars, kohl pots, or beads, which serve as landmarks in archæology, are not noticed. The head-rest is said to support the neck, whereas it fitted close above the ear. Soap is said not to have been known early; but a cake of *suab* is figured along with a wash-basin in the IVth dynasty; the meaning of the name is 'causing to be clean,' and it may well be the origin of our *soap*. The red lip-salve is said not to have been found, but the little balls of soft pale rouge are known in the XIIth dynasty. The scarab beetle is said to be of one kind (p. 271), or of two kinds (p. 278), but five or six different genera are already known. The method of *cire perdue* casting is ignored. Thus a great opportunity has been lost of supplementing the knowledge of forty years ago which is here laid out, and the celebrated discoveries and the books of the last few years are not included. Some twenty slips in matters of fact also need correction.

The author expressly disclaims touching the subjects of art and architecture, and considers that they do not belong to the "professional Egyptologist . . . busy with his texts." To the Egyptian nature their art was, perhaps, more than their language as a national expression; they had a far higher and more complete mastery of form than of writing. To deal with Akhenaten—as here—without a word about his new naturalistic work, and its reflex on his ethics, is to miss the most pervading influence of that astonishing period. The sudden movement of thought was as if the Pre-Raphaelites had become the rulers of England with Comte to dictate the religion. The literature of the time could not express half of what the change would mean. We need to get away from the idea that words are needful to express thought; they are ambiguous, inadequate in scope, inexact in connexion. A good cartoon expresses more than a page of writing; it makes us think in things, and not in words. To write about a people it is needful to think as they did, to become one of themselves; in this Maspero succeeded better than any other writer.

(2) The smaller work by Mr. Read is a more detailed account of one section, the views on religion and ethics, and it claims to "depart widely from the views of recognised authorities." There does not seem to be anything fresh, however, in this account of the gods and the religious texts, and the work forms a convenient and readable introduction to the subject. The incessant formula which begins offering tablets, "An offering which the king gives," is discussed, without noting its social explanation. In primitive societies the chief is supported by food-rents from the estates, which he visits in turn. It would, then, be a gift from the king if he allowed this surplus to be devoted to the service of the dead. A further reason for keeping the formula would be that misappropriation of the offerings would be an offence against royalty. The list of sins is said not to have any principle to be traced in the order of it; but it has been shown to be grouped in fives of a similar nature, and this construction was probably to help memory by learning them on the fingers, like the ten commandments. Mr. Read has a considerable regard throughout for historical development, and treats the changes that are seen in the beliefs with the insight of modern writers, recognising that the Egyptians—like most other people—did not apply logic to the inconsistencies of different faiths.

FLINDERS PETRIE.

Agricultural England and Wales.

An Agricultural Atlas of England and Wales. Made on behalf of the Agricultural Economics Research Institute, University of Oxford. By J. Pryse Howell. (Published by Direction of the Ministry of Agriculture and Fisheries.) Pp. iv+26 maps. (London: H.M. Stationery Office; Southampton: Ordnance Survey Office, n.d.) 10*s*. net.

THIS atlas presents for England and Wales the agricultural statistics published in 1921 for Wales only. It follows the same plan as the earlier publication, except that a separate base map of the market-towns replaces the one on tracing-paper in the atlas of Wales. The new work has thus both the merits and defects of its predecessor, some of the defects being increased by the greater delay in publication.

The parish returns of agricultural statistics for June 1918, plotted in the first instance on maps of the scale 1 : 250,000, have been graphically represented by a quantitative 'dot' method on a scale of 1 : 1,500,000. The effect is to show at a glance the distribution of mountain and heath-land, permanent grass, and arable land, and also the principal crops and live-stock. The greatest value of the atlas lies in this statistical confirmation of general and regional impressions based hitherto only upon experience. Details of soil, relief, climate, and weather, so essential to the individual farmer, obviously cannot be shown, but a generalised soil map might have been prepared in place of, or in addition to, that showing solid geology. Much of northern and eastern England has surface soils of glacial and post-glacial origin, and in the chalk country much variety exists due to greater or less admixture of gravel or clay and flints.

It is unfortunate, too, that a winter census of live-stock could not be shown. In spring and autumn extensive movements of cattle take place. Not only is there the movement between mountain pastures and the valleys, but there is also the transference of

stock in autumn to arable lands for fattening. The Midlands and the west supply beef cattle from June to December, the east from January to May. The summer census shows Norfolk as one of the counties with the least number of horned cattle and Leicester as one with the greatest. A winter census map would show a reversal of these positions. For general purposes, the greatest defects arise from the abnormal character of agriculture in 1918 and the changes which have taken place since. That year saw the maximum war effort in food production, and since then there has been a substantial decline both in the acreage of arable land and in certain crops. The general abnormality of 1918 may be seen by the following table:

	Arable Land (1000 Acres).	Wheat (1000 Acres).	Oats (1000 Acres).	Potatoes (1000 Acres).	Cows and Heifers in Milk or in Calf (1000).	Other Cattle (1000).	Ewes for Breeding (1000).	Other Sheep (1000).
1913 . .	11,058	1702	1975	442	2264	3453	6699	10,431
1918 . .	12,399	2557	2780	634	2578	3623	6487	9,988
1925 . .	10,682	1500	1868	493	2713	3450	6397	9,578
Av. for 10 yrs., 1915–24 . .	11,503	1988	2237	509	2512	3429	6041	9,316

Three of the principal counties in wheat and milk production give the following figures:

	Wheat (1000 Acres).						Cows and Heifers in Milk and in Calf (1000).				
	1912.	1913.	1918.	1924.	1925.		1912.	1913.	1918.*	1924.	1925.
Essex .	136	128	156	106	96	Chester .	115	111	114	118	127
Norfolk .	136	120	135	99	103	Lancaster .	138	134	135	142	142
Lincoln .	188	158	224	172	184	Somerset .	122	120	122	139	138

* Excluding heifers in calf.

The cultivation of sugar-beet may be said to have begun in 1920, and is therefore unnoticed in this atlas, though the acreage has reached nearly 55,000 with a possibility of doubling in 1926.

Nevertheless, with all these limitations, the atlas has great value. It is a permanent record of agriculture as it was in 1918 at the close of the War, and although in an absolute quantitative sense the maps may already be out-of-date, the relative distribution of farm lands, of crops and of live-stock—which is the real value of the atlas—probably still holds true.

Experimental Optics.

Experimental Optics: a Manual for the Laboratory. By Dr. G. F. C. Searle. (Cambridge Physical Series.) Pp. xvi + 357. (Cambridge: At the University Press, 1925.) 16*s*. net.

IT is not often that an original investigator lays aside research work in which he has already established a reputation, and bends the whole of his energy and ability to the art of training others in the spirit and practice of his science. It is, perhaps, particularly rare in that vitally important branch of teaching which has for its province the practical laboratory. There is a certain stimulus in lecturing which makes it a not altogether unwelcome interlude in the day's work; but the demonstrator, who must wrestle year in and year out with errors which remain always the same while students come and go, has no such aid to cheer him in his task. When, however, as sometimes happens, a teacher arises with the faith and insight to find in this too often routine work a suitable outlet for his energy and ingenuity, the results for science are apt to be noteworthy. For, after all, it is in the practical laboratory that the experimental scientist is made or marred. There are many old Cambridge men, teaching or practising physics in various parts of the world, who have passed through Dr. G. F. C. Searle's hands, either as students of the art of experimenting, or as raw beginners in the still more difficult art of teaching practical physics to others, who feel towards him a debt of gratitude the sense of which deepens as the years roll on.

For these no review is necessary. The mere announcement that Searle's "Experimental Optics" is out at last will be sufficient to send them post-haste to the bookseller. They have been waiting for it for a time exactly equal to that which has elapsed since they left 'the class.' They will wish to renew old memories of the time when, having worked conscientiously through six methods of measuring the focal length of a thick lens, they were confronted with the demand that the same processes should be repeated on the telescopic system, or the 'model eye'; to fill up gaps left by the carelessness of youth in now highly prized practical note books; and to see what new experiments have been added to the course since their time. For "Experimental Optics" is not a book written in a hurry to meet some sudden demand. It is the work, we will not say of a lifetime (for we cannot possibly spare Dr. Searle until he has completed this series of laboratory manuals with an "Experimental Heat," and a much-needed "Experimental Electricity and Magnetism"), but certainly the work of many years, and the experiments it describes have been tried out on many generations of students. They are not ingenious suggestions which the author thinks might possibly work. They have been tested and tried, under by no means easy conditions, and have gradually ripened to their present perfection. It is this which gives to these manuals by

Dr. Searle, of which "Experimental Optics" is the latest, their unique value.

It must be confessed that this fact adds somewhat to the difficulties of the present reviewer. It is hard to be correctly calm and critically cool towards a book with some parts of which, in their manuscript form, one has that intense familiarity which comes from actual use in teaching in times past. Its qualities, good or bad, are known with an intimacy which is unbecoming to a reviewer. It says something for the quality of the book that, on re-reading these familiar portions after some long interval, its merits seem even greater than we had remembered, and its defects so few as scarcely to call for comment.

Dr. Searle's method of treating his subject is now well known from his previous books, and "Experimental Optics" does not differ in plan from its predecessors. It is written around the experiments, some seventy in number, which make up the course in practical optics in Dr. Searle's class at the Cavendish Laboratory. Many of these experiments are highly original, and they are described with such care and precision that the reader should have no difficulty in following them out, even in their minuter details. The apparatus is usually of the simplest, such as, for the most part, can easily be constructed in a very modestly equipped workshop (a consideration by no means to be despised in these days when prices are high and funds are meagre), and adequate instructions are given for its construction. The accuracy of measurement obtainable is, however, high, as is shown by the practical examples appended to each experiment, which are usually a record of the work of some student in the class. Dr. Searle's ingenuity and experimental skill is nowhere shown more clearly than in the way in which, by ingenious devices and skilful arrangement, he makes it possible even for the ordinary student to obtain results with this simple apparatus which would not be discreditable in a laboratory equipped with the most elaborate and expensive optical devices. No experiment is left until the utmost accuracy of which it is capable has been extracted from it. Experimental optics is not one of the most popular branches of physics at the moment, but there is no part of the subject which is better calculated to instil that meticulous care and precision in measurement which is now, as always, the basis of physics. A student who works conscientiously through the course described in this book will have learned something greater than practical optics: he will have learned how physical experiments ought to be carried out.

The book, however, is more than a practical manual. The theory involved in each experiment is very adequately dealt with either in an introductory paragraph or in a separate chapter. We have thus an excellent treatise on geometrical optics, written, moreover, in a style which brings it within the range of students whose mathematical equipment is not of the strongest. These theoretical sections are, in fact, exceptionally well done. Personally we feel some regret that Dr. Searle should have followed the "lens manufacturers, opticians, and oculists" in assigning a positive focal length to a thin converging lens, instead of following the practice most commonly adopted in mathematical and physical text-books of assigning a negative value to this quantity. Nearly all students will have learned the latter convention before commencing to read Dr. Searle's manual, and though the introduction of a new convention may provide useful food for thought to a good student, weaker students are almost sure to find it disconcerting, and a little confusing.

In scope the book covers adequately, or even more than adequately, all that a student of physics (as distinct from the technician) will require in geometrical optics. In comparison, the section on physical optics, which occupies less than one-quarter of the whole, seems rather scanty. To devise simple apparatus which will permit of even approximately accurate measurements in interference and diffraction is by no means easy, and we are grateful to Dr. Searle for showing us how, in one or two cases, it can be done. We hope he will find it possible to give us more on this branch of the subject, as these two concluding chapters are as interesting and illuminating as anything in the book.

We have here, then, a text-book on optics, accurate, practical, and original, which every teacher will wish to have, and which, we predict, will find a place in every physics laboratory. Unfortunately, it seems impossible nowadays to publish scientific books at a price which the average student can afford to pay, but we are sure that no student who can contrive to add this volume to his library will have cause to regret his purchase.

J. A. CROWTHER.

Quantitative Biology.

Physical Chemistry in Biology and Medicine. By Prof. J. F. McClendon and Prof. Grace Medes. Pp. 425. (Philadelphia and London: W. B. Saunders Co., 1925.) 21s. net.

IN the heyday of evolutionary biology, Francis Galton remarked "that until the data of any branch of human enquiry have been submitted to measurement, it cannot be said to have acquired the dignity of a science." It is strange to think that after thirty years the truth and the falsity of this remark are apparent to all except that branch of the biological public to which it was most particularly

addressed. To suggest to a physiologist or to a biochemist that an adequate treatment of his subject is possible without a knowledge of physical chemistry, is as ludicrous as to suggest to a student of heredity that a solution of all his difficulties is to be found in the pages of *Biometrika*. Until recently, however, those sciences most closely associated with Galton and with the idea of evolution have shown little tendency to evolve new methods, and little tendency to acquire the 'dignity' which Galton hoped would grace their later years.

The advance of zoology, for example, has been due to the theory of evolution and to the description of animals at all stages of their life-history, and when we view this imposing contribution to human knowledge, we may perhaps regard the acquisition of further complexity with doubtful pleasure. Yet whether we like it or not, Galton's remark was made to all biologists, and it is for them to refute or affirm. So long as we are content to describe the structure of an organism and draw therefrom a mental conception of its evolution, the realm of zoology will be a peaceful haven for all who enter. But if we wish to regard an animal as a real and dynamic system, and if we wish to apply some logical test to our conclusions as to how it lives and how it evolved, then we must use those methods which are available for the study of *changing* systems, whether these be alive or dead.

The study of life is the study of change, and we can either speculate or we can proceed by logical methods placed in our hands by other sciences. One ventures to think that the pathetic striving of the young zoologist for an accurate measurement of his data is a natural reaction from the speculative hypotheses of the past. His problems are not new, but it is by new methods that he seeks to answer old questions. Like all other fledglings, he has difficulties and disappointments. He grasps the delicate instruments of physical chemistry and finds they may break in his hands. He uses a mathematical notation, and only slowly does he learn its value and its limitations. By far his greatest problem is to choose his weapons with discretion and to learn their use. If Prof. McClendon is to be believed, these weapons vary from a knowledge of the electron to a knowledge of higher mathematics. This is indeed a terrifying thought, and this book may well repulse even the most intrepid reader. With breathless speed the authors lead us across wide fields of learning. There is no time to acquire knowledge or to see the great and real difficulties; there is only time to note the valuable lists of references which close each chapter.

We do not think that this book will help those who—according to the preface—"fail to receive early training which they later feel the need of." Nor do we think that it will greatly help the specialised research worker; the material is too scanty and the treatment is too vague. The real value of this and similar books is that they throw out, once more, the challenge to biology to support its speculations by experiments and to acquire more quantitative 'dignity.' J. G.

Our Bookshelf.

Handbuch der Zoologie: eine Naturgeschichte der Stämme des Tierreiches. Begründet von Prof. Dr. Willy Kükenthal. Herausgegeben von Dr. Thilo Krumbach. Erster Band: Protozoa, Porifera, Cœlenterata, Mesozoa. Sechste Lieferung. Pp. 737-896. Siebente (Schluss-) Lieferung. Pp. 897-1060+xiv. 12·40 gold marks. (Berlin und Leipzig: Walter de Gruyter und Co., 1925.) 9 gold marks.

THE sixth part of this work opens with an account of the pennatulids which, as would be expected from the pen of the late Prof. Kükenthal, is a thoroughly sound piece of work. One of the few points which permits of criticism is the statement that observations on regeneration are wanting; the work of Torrey and of E. B. Wilson on regeneration in young Renillas was evidently overlooked. The chapter on Octocorallia (anemones, corals, etc.) is by Prof. F. Pax and gives a good account of the structure, biology, and classification. The description of the nervous mechanism is, however, disappointing; it is too general, does not get down sufficiently to facts of detail, and there are no illustrations of the nerve elements.

The seventh part is devoted to accounts of the Ctenophora and the Mesozoa. The editor, Prof. T. Krumbach, has undertaken the preparation of the chapter of 90 pages on the Ctenophora and has produced an admirable account of the structure, biology, geographical distribution, and classification of this class. The diagrams illustrating the structure, the variations in form of different genera, the origin of the creeping habit (*e.g.* in Ctenoplana), and the more detailed figures, many drawn from recent memoirs, afford excellent support to the text, but a better figure illustrating the details of cleavage and early development should have been given. The numerous views which have been put forward by different authors on the affinities of the Ctenophora are exhaustively set forth, even the relationships with sponges; a critical discussion and summary of the matter would have been helpful.

Prof. M. Hartmann describes the Mesozoa (17 pp.) and adds a short account of the imperfectly known genera Neresheimia and Salinella. In his account of the Mesozoa he has omitted to refer to the important contributions of Caullery and Lavallée (1912) and of Lameere (1916, 1917, 1919) which add new facts, and offer new interpretations, that should have received notice in a work of this kind.

The seventh part, completing the first volume of the work, contains a full index thereto and a short notice in remembrance of the late Prof. W. Kükenthal. The volume has, in our opinion, improved in quality, in both text and illustrations, in its later parts, and if the rest of the work can be maintained at the high standard attained in most of the recent chapters, it will certainly be an admirable text-book of descriptive zoology for teachers and advanced students.

Hephæstus : or, The Soul of the Machine. By E. E. Fournier d'Albe. (To-day and To-morrow Series.) Pp. 90. (London : Kegan Paul and Co., Ltd. ; New York : E. P. Dutton and Co., 1925.) 2*s.* 6*d.* net.

THE publishers make claim for the "To-day and To-morrow Series" that it has revived the pamphlet as a form of literature. Now a pamphlet, one supposes, should be brief, provocative, and readable. If the author is a little angry, all the better ; Milton was angry when he wrote the "Areopagitica" and his treatises on divorce. If the author has several very obvious blind spots, all the better ; some one else will immediately write another pamphlet to point them out to him ; and so the joyous game of pamphleteering will grow like a snowball.

Dr. Fournier d'Albe is brief, provocative, and readable, but not angry ; he is lyrical. His pamphlet is a pæan in praise of the machine, daughter of Hephæstus and Fire, liberator of mankind. "The victories of Hephæstus are victories of mind over matter. The *mechanical age*, which to some appears as the very negation of the soul, is, on the contrary, the age of supreme psychical achievement" (p. 50). "Fire has made all things new" (p. 57). "The whole earth must be Vulcanized" (p. 80). So the European. We may now confidently await the pamphleteer, with sympathies more Asiatic than European, with mind given pause by the speculations of, say, Spengler, who will point out to Dr. Fournier d'Albe that nine-tenths of mankind are still, always have been, and probably always will be, supremely indifferent to, and slightly contemptuous of, any but the most rudimentary form of machine. Modern European civilisation is built on machinery ; other civilisations have had other foundations.

J. Y. T. G.

An Introduction to Organic Chemistry. By Prof. Alexander Lowy and Dr. Benjamin Harrow. Pp. ix+389. (New York : J. Wiley and Sons, Inc. ; London : Chapman and Hall, Ltd., 1924.) 15*s.* net.

BOTH the teacher and student of organic chemistry must at times seem overwhelmed by the enormous and ever-growing mass of material that now constitutes this branch of the science ; but, fortunately for both, the subject is well systematised and lends itself well to a broad, general treatment. The work under review can be recommended from this point of view : the outline presented is broad and clear, structural formulæ are numerous and well set out, especial prominence is given to applications in the industrial arts, biochemistry, and pharmacy, and the parts dealing with nomenclature and the meanings of technical terms are very useful.

Although the method of presentation is, in general, not sufficiently didactic for use in secondary schools, and is inclined to be too dogmatic, fact and hypothesis being inadequately differentiated, the book will serve as an excellent introduction for students when used as an auxiliary to a good course of lectures and experimental work. The exclusion from the main body of the text of melting- and boiling-points, and similar physical details, the up-to-date character of the subject matter, and the insertion of some excellent folding charts relating mainly to industrial applications, all help to make the work thoroughly readable and to awaken the interest of the student. The literature references given throughout the book, with the view of inciting collateral reading, add considerably to its value.

Dwellers of the Sea and Shore. By William Crowder. (Hutchinson's Nature Library.) Pp. xv+300+44 plates. (London : Hutchinson and Co., n.d.) 7*s.* 6*d.*

"DWELLERS OF THE SEA AND SHORE" is a true natural history book, and is written by a real naturalist who obviously delights in observing the living animals and plants in their haunts. Although it is published in England as one of "Hutchinson's Nature Library," the reader will not find in it an account of the inhabitants of British shores and seas. The region described is on the American coast not many miles from New York Harbour, and although we have many seashore animals and plants in common, there are of course many differences. This is perhaps really an advantage, as we are given an excellent picture of a foreign shore. The illustrations are good, especially the photographs of living animals taken in the water, and the extremely interesting pictures of the king crab. The chapters on the habits of the individual animals remind one of Fabre, those on the king crab, fiddler and hermit crabs, and the moon snail having a peculiar charm. We gather from the author the sad fact that Limulus, the "living fossil" as he terms it, is in danger of extinction in spite of its great abundance. There is little to criticise in the book, which is a genuine contribution to the biology of sea animals, but why should it be said that brachiopods differ from bivalve molluscs in having both valves similar ?

A Summary of Physical Chemistry. By Prof. K. Arndt. Translated from the fourth German edition by W. H. Patterson. Pp. v + 92. (London : Methuen and Co., Ltd., 1925.) 3*s.* 6*d.* net.

THE "Summary of Physical Chemistry" which Mr. Patterson has translated covers 86 pages, apart from the two indexes. It is just the sort of abstract that an able student would prepare in order to recall the essential points of the lectures to which he had listened, and of the text-books which he had read. A ready-made summary of this kind provides a means of 'spoon-feeding' which is likely to be acceptable to many hard-pressed students, but in the opinion of the reviewer they would be well advised to make use of it only after compiling a summary of their own, and then mainly in order to check the completeness of the 'home-made' product. If used in order to provide a supply of 'catch-words,' as a substitute for detailed knowledge, its introduction would be definitely harmful.

An Introduction to the Physics and Chemistry of Colloids. By Emil Hatschek. (Text-books of Chemical Research and Engineering.) Fifth edition. Pp. xiii+183. (London : J. and A. Churchill, 1925.) 7*s.* 6*d.* net.

THE first edition of Hatschek's "Introduction to the Physics and Chemistry of Colloids" appeared in 1913. Since the fourth edition was entirely rewritten, the fifth edition includes only a few additional sections describing recent important advances ; apart from these, the text is substantially that of the previous edition.

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.*]

International Phenology.

OUR appeal in NATURE of October 25, 1924, and April 25, 1925, for international phenological co-operation has met with unexpected response. We now know that, on the continent of Europe alone, apart from individual workers, networks of observing stations have been established in the following countries:—Holland, under Dr. H. Bos; Belgium, under the late Prof. Vanderlinden; Norway, under Asche Moe; Germany and Austria, under Dr. E. Ihne; Czecho-Slovakia, under Prof. J. Kopecky; Hungary, under Dr. J. Schenk; Tyrol, under Dr. W. Pfaff; North Italy, under Dr. M. A. Minio; Russia in Europe, under Prof. P. Schmidt. Of these, we had previously only been in touch with Holland, Belgium, and Germany.

The total number of stations exceeds two thousand, besides more than three hundred and fifty in the British Isles. Dr. A. D. Hopkins carries on similar and more organised work in the United States, and it is developing in western Canada. Numerous isolated observers in Europe and in the more distant British Dominions, Java, etc., are in touch with us. Agricultural colleges are participating more and more as they realise the practical value of phenology.

In order to develop closer co-operation and greater uniformity in method, some suggest holding an international congress and founding a periodical. We are further indebted to Prof. Paul Pelsener, of Brussels, who, at the International Conference of Biological Sciences held there last July, presented our appeal and obtained a resolution recommending their branches in their respective territories to organise phenological work analogous to that of the Royal Meteorological Society.

These results are gratifying, even if conditions are as yet scarcely ripe for a special congress or periodical. But with the help of NATURE we should like to present a definite scheme for observations, based on the valuable criticisms of the suggested list of 43 plants given in last communication. This we have condensed to about 30, and associated with them a few observations of birds and insects, all as tabulated below.

SUGGESTED PHENOLOGICAL SCHEDULE FOR INTERNATIONAL OBSERVATIONS.

	Plants.		Day of Year.
1.	*Galanthus nivalis**	Snowdrop	19
2.	*Eranthis hyemalis**	Winter Aconite	20
3.	*Crocus aureus**	Yellow Crocus	33
4.	*Ulmus campestris*	Common Elm	44
5.	*Corylus avellana* ♀ (Female)*	Hazel	44
6.	*Ranunculus ficaria**	Lesser Celandine	47
7.	*Tussilago farfara**	Coltsfoot	65
8.	*Prunus amygdalus*	Almond	85
9.	*Anemone nemorosa**	Wood Windflower	92
10.	*Prunus spinosa**	Blackthorn	102
11.	*Quercus pedunculata*	Stem-seeded Oak	115
12.	*Ribes rubrum*	Red Currant	115
13.	*Alliaria officinalis* or *Sisymbrium alliaria**	Garlic Hedge Mustard	120
14.	*Pyrus malus*	Wild Crab-apple	130
15.	*Syringa vulgaris**	Common (purple) Lilac	130
16.	*Æsculus hippocastanum*	Horse Chestnut	133
17.	*Prunus padus*	Bird Cherry	135
18.	*Cydonia vulgaris*	Quince	135
19.	*Cytisus laburnum*	Laburnum	138
20a.	*Cratægus oxyacantha**	Hawthorn	139
20b.	,, *monogyna*	Southern Hawthorn	145
21.	*Chrysanthemum leucanthemum**	Ox-eye Daisy	154
22.	*Sambucus nigra*	Elder	160
23.	*Rosa canina**	Dog Rose (pink)	163
24.	*Symphoricarpus racemosus*	Snowberry	165
25.	*Robinia pseudacacia*	White Acacia	190
26.	*Lilium candidum*	Madonna Lily	195
27.	*Castanea vesca*	Sweet Chestnut	200
28.	*Scabiosa succisa**	Devil's-bit Scabious	220
29.	*Colchicum autumnale*	Autumn Crocus	245
30.	*Hedera helix**	Ivy	276
31.	*Helleborus niger*†	Christmas Rose	350

	Birds.	Day of Year.
A.	*Turdus musicus* (Song Thrush), in song after Dec. 31.	22
B.	*Phylloscopus rufus* (Chiffchaff), heard	95
C.	*Hirundo rustica* (Swallow), arrives	109
D.	*Cuculus canorus* (Cuckoo), heard	114
E.	*Cypselus apus* (Swift), arrives	125
F.	*Muscicapa grisola* (Spotted Flycatcher), arrives	135
G.	Last *Hirundo rustica* (Swallow), leaves	283

	Insects.	Day of Year.
J.	*Apis mellifica* (Honey Bee), visiting flowers	60
K.	*Vespa vulgaris* (Queen Wasp), flying in open	103
L.	*Pieris rapæ* (Small White), flying in open	111
M.	*Anthocaris cardamines* (Orange Tip), flying in open	131
N.	*Epinephile janira* (Meadow Brown), flying in open	164

The dates are the average for the thirty years 1891 to 1920 in the British Isles. The plants marked *, and all the birds and insects, are on the British Schedule.

† To be entered on the schedule for the following year

The following, among other points, have governed the selection, after careful comparison of lists from the above nine countries and our own.

(1) That each country may find among them at least ten to twenty plants which are easily accessible. The birds and insects are well distributed over Europe.

(2) That at least a few, as garden growths or wild, shall be found in all temperate regions. Tropical countries it seems most difficult to include.

(3) That the whole phenological year shall be covered. Where observers can undertake the work, we commend further observations, especially with trees, on the date of leafing (trees look green), fruiting, colouring (full tint), and leaf-fall (trees bare). All who can are asked to do this at any rate for *Æsculus hippocastanum*.

(4) For flowering date it is advantageous to select such as bloom quickly, when once buds begin to open.

The stage at which flowering is recorded varies very awkwardly in different countries. We suggest the selection of tree, bush, or herb, or better still, a group, situated in the most normal exposure available, neither exceptionally early nor late in maturing, and that on such plant or group the first flower to expose its stamens (or *pistils* for *Corylus avellana*) shall be recorded *if—and only if*—the other buds are about to do the same.

The observer's district should be as concentrated as possible. A five-mile radius should be regarded as the limit, and elevation above sea-level differ as little as possible.

The same plant or group should be observed from year to year, or of herbs a selection from those under similar conditions.

Where they can, British observers are invited to include part or all of the extra plants in a supplementary table.

We wish again to make it clear that there is at present no central body to collect and, above all, tabulate results. This must be done by each country independently, after having circulated to their observers such a list, selected from that subjoined, as best adapts itself to local conditions, including the same as part of, or as supplement to, their present schedule. All the lists sent us already include quite a large number.

In the course, say, of ten years, we may well hope that these records will be collocated and produce, directly and by correlation, interesting data for scientific analysis and also of value for agricultural and other practical applications.

Long before then we might have preliminary annual comparisons on special events, and even pan-European isophenal charts, such as Hoffmann and Ihne have given us for much of western Europe.

As an initial step, and by way of a practical experiment, we suggest the preparing by each network of stations four isophenal charts of their area for 1926, namely, one each for *Prunus spinosa* (102), for *Hirundo rustica* (109), *Pieris rapæ* (111), and *Cuculus canorus* (114), sending a copy to our Committee, that each of the four may be combined to form one of Europe. The interest would lie in investigating how far the relative dates in one part of the continent held from region to region.

Finally, we would appeal again to the other British Dominions, especially in the sub-continent, asking them in their countries also to collaborate so far as possible with the older countries in this work.

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Zoological Nomenclature.

THE Secretary of the International Commission on Zoological Nomenclature has the honour to announce the publication of Opinions 82 and 90, rendered by the International Commission on Zoological Nomenclature, by the Smithsonian Institution in *Smithsonian Miscellaneous Collections*, vol. 73, No. 3, pp. 1-40. The summaries read as follows:

Opinion 82. Suspension of Rules for Musca Linnæus, 1758a, type *M. domestica*. By authority of the power conferred on the Commission by the ninth International Congress of Zoology to suspend the Règles as applied to any given case where in its judgment the strict application of the Règles will clearly result in greater confusion than uniformity, Article 30 is hereby suspended in the case of Musca Linnæus, 1758, and *Musca domestica* Linnæus, 1758, is hereby designated as type of Musca without prejudice to other cases.

Opinion 83. *Acanthiza pyrrhopygia* Vigors and Horsfield, 1827, versus *Acanthiza pyrrhopygia* Gould, 1848. The principle of the Rule of Homonyms is that any properly published identical name of later date is "stillborn and cannot be brought to life." *Acanthiza pyrrhopygia* Vigors and Horsfield, 1827, invalidates *Acanthiza pyrrhopygia* Gould, 1848.

Opinion 84. Trematode, Cestode, and Acanthocephala names placed in the Official List of Generic Names. The following names are hereby placed in the Official List of Generic Names: Trematoda: Dicrocoelium, Fasciola, Gastrodiscus, Heterophyes. Cestoda: Davainea, Dipylidium, Echinococcus, Taenia. Acanthocephala: Gigantorhynchus.

Opinion 85. Ninety-eight generic names in Crustacea placed in the Official List of Generic Names. The following names are hereby placed in the Official List of Generic Names: Crustacea: Acmaeopleura, Asthenognathus, Bathyplax, Camptandrium, Camptoplax, Catoptrus, Ceratoplax, Chasmagnathus, Chasmocarcinus, Clistocoeloma, Cyrtograpsus, Dissodactylus, Durckheimia, Epixanthus, Euchirograpsus, Eucrate, Eucratodes, Eucratopsis, Euryetisus, Euryplax, Eurytium, Fabia, Galene, Geryon, Glyptograpsus, Glyptoplax, Gomeza, Goneplax, Halimede, Helice, Hephthopelta, Hexapus, Holometopus, Holothuriophilus, Homalaspis, Lachnopodus, Leptodius, Liagore, Libystes, Liomera, Lipaesthesius, Litocheira, Lophopanopeus, Lophopilumnus, Lybia, Melybia, Metasesarma, Metopocarcinus, Micropanope, Notonyx, Oediplax, Ommatocarcinus, Opisthopus, Orphnoxanthus, Panoplax, Paragalene, Parapanope, Parapleurophrycoides, Paraxanthus, Percnon, Perigrapsus, Pilumnoides, Pilumnus, Pinnaxodes, Pinnixa, Pinnotherelia, Pinnotheres, Planes, Platychirograpsus, Platypilumnus, Platyxanthus, Polydectus, Prionoplax, Pseudocarcinus, Pseudopinnixa, Pseudorhombila, Psopheticus, Ptychognathus, Pyxidognathus, Rhithropanopeus, Rhizopa, Ruppellioides, Sarmatium, Scalopidia, Scleroplax, Speocarcinus, Sphaerozius, Tetraxanthus, Tetrias, Thaumastoplax, Utica, Varuna, Xanthasia, Xanthodius, Xenophthalmodes, Xenophthalmus, Zosimus, Zozymodes.

Opinion 86. Conulinus von Martens, 1895. The generic name Conulinus von Martens, 1895, takes as type *Buliminus* (*Conulinus*) *conulus* Rv., and is not necessarily invalidated by Conulina Bronn.

Opinion 87. The status of proof-sheets in nomenclature. Printer's proof-sheets do not constitute publication, and therefore have no status under the International Rules of Zoological Nomenclature.

Opinion 88. *Otarion diffractum* vs. *Cyphaspis burmeisteri*. The name of a species is not disqualified merely because the author included in his conception bodily parts of more than one species. The name of a genus based on such a species is therefore available. *Otarion diffractum* Zenker is valid. Otarion is to be preferred to Cyphaspis, and *C. burmeisteri* Barr. is a synonym of *O. diffractum*.

Opinion 89. Suspension of the rules in the case of Gronow 1763, Commerson 1803, Gesellschaft Schauplatz 1775 to 1781, Catesby 1771, Browne 1789, Valmont de Bomare 1768 to 1775. Under suspension of the rules, in any case where such suspension may be considered necessary according to the interpretation now or hereafter adopted by the Commission, the following works or papers are declared eliminated from consideration as respects their systematic names as of their respective dates: Gronow 1763, Commerson 1803, Gesellschaft Schauplatz 1775 to 1781, Catesby 1771, Browne 1789, Valmont de Bomare 1768 to 1775.

Opinion 90. Report on sixteen generic names of mammals for which suspension of rules was requested. None of the sixteen names receives a unanimous vote for suspension; accordingly, the Commission is not empowered to suspend the rules for these cases. Six names (namely: Cercopithecus, Gazella, Hippotragus, Lagidium, Nycteris, and Manatus) receive two-thirds majority or more for suspension, and are, therefore, to be referred for final decision to a special committee of three to be appointed by the president of the section on nomenclature of the next international congress. Ten names (namely: Echidna, Anthropopithecus, Coelogenys, Chiromys, Dasypus, Dicotyles, Galeopithecus, Hapale, Rhytina, and Simia) fail to receive a two-thirds majority vote for suspension, and therefore the law of priority is to be applied in these cases. C. W. STILES (Secretary).

International Commission on Zoological Nomenclature.

The Isomeric Chromic Chloride Hexahydrates.

THE Werner formulation for the dark-green chromic chloride hexahydrate, namely, $[CrCl_2(H_2O)_4]Cl,2H_2O$, has been criticised recently by Britton (*J. Chem. Soc.*, 1925, **127**, 2128), who offers the alternative view that the basic chromium complexes apparently present in green solutions are "micellar" in structure and virtually constitute a colloidal electrolyte in which the cations are composed of chromium hydroxide and varying amounts of acid radical, a portion only being ionisable. This view accounts for the fact that green salts show greater resistance towards alkali than the analogous violet modifications.

In an endeavour to confirm the Werner formulation for the three chromic chloride hexahydrates, we had commenced a series of viscosity determinations on aqueous solutions of these salts. Three such hydrates are known:

Name.	Colour.	Werner Formula.
Hexa-aquo chromic chloride .	Violet	$[Cr(H_2O)_6]Cl_3$.
Monochloro-penta-aquo chromic chloride monohydrate . .	Blue-green	$[CrCl(H_2O)_5]Cl_2,H_2O$.
Dichloro - tetra - aquo chromic chloride dihydrate . . .	Dark-green	$[CrCl_2(H_2O)_4]Cl,2H_2O$.

The violet hydrate is unstable in the solid state and passes slowly into the dark-green hydrate; the latter, which is stable in the solid state, passes into the violet form in solution. The intermediate hydrate is unstable in the presence of moisture; it changes to the dark-green form, and measurements on its solutions were not attempted.

The comparative flow method of measurement was used, a viscosimeter of the type described by Martin (*Bull. Soc. Chim. Belg.*, 1925, **34**, 81) being found to give very consistent readings. Our measurements are summarised in the following table, η/η_{H_2O} representing the ratio of the viscosity of the solution to that of water at the same temperature.

Temperature 25°.			
Dark-green Chloride.		Violet Chloride.	
Wt. of Hydrated Salt per 100 gm. of Water.	η/η_{H_2O}.	Wt. of Hydrated Salt per 100 gm. of Water.	η/η_{H_2O}.
50·32	1·8095	62·20	3·3571
35·67	1·5397	33·64	1·9206
21·50	1·3333	20·61	1·4841
16·34	1·2462	17·58	1·3968
12·91	1·1984	16·27	1·3730
6·35	1·1111	11·23	1·2381
3·58	1·0635	8·48	1·1944
		5·75	1·1270
		3·68	1·0793
Temperature 18°.			
52·40	1·8904	40·18	2·1644
36·36	1·5616	26·82	1·6575
24·80	1·3493	16·81	1·4315
22·38 [1]	1·2808	13·57	1·3356
17·07	1·2329	9·44	1·2123
12·79 [2]	1·1507	8·02	1·1849
10·04	1·1166	5·48	1·1164
6·86	1·0890	3·46	1·0753
4·05	1·0548	1·63	1·0342

[1] This was a freshly prepared solution.
[2] This solution was freshly prepared; the subsequent solutions were obtained from it by progressive dilution.
The figures in the fourth decimal place under η/η_{H_2O} are not wholly reliable. The figures for dilutions greater than 5 gm. per 100 gm. of water should be accepted with reserve.

The dark-green solution changes to violet with time; it follows that, except for those cases in which solutions have been freshly prepared, the figures for the dark-green chloride are too high. In any case, for equivalent salt concentrations, the viscosities of the violet chloride solutions are much higher than those of the corresponding green solutions.

This is in qualitative agreement with the formulæ assigned to the two salts by Werner. Presumably, the co-ordinated nucleus affords the greater contribution to the viscosity of the solution, and one would expect solutions containing the larger nucleus to be more viscous than those containing the smaller one. In other words, one would expect violet solutions to show a higher viscosity than the analogous green ones; experiment confirms this. On Britton's view the exact opposite should hold, since he considers the green solutions to be colloidal in nature. Endeavours are being made to apply the above results quantitatively.

A paper has recently appeared by Birk and Biltz (*Z. anorg. Chem.*, 1925, **150**, 20) in which the molecular volumes in petroleum of the chromic chloride hexahydrates are recorded. The molecular volumes are found to increase with decreasing stability, *i.e.*, in the order dark-green, violet, and blue-green. The molecular volumes of the water in the three salts are given as 14·7, 15·2, and 15·7, respectively. Presumably, therefore, if these figures are correct, the unstable blue-green salt should give solutions even more viscous than solutions of the violet salt.

An X-ray examination of the salts has been commenced with the object, if possible, of elucidating the relative positions of the water in the nucleus and the water of crystallisation, and so forming an ultimate confirmation or negation of the applicability of Werner's ideas to these compounds.

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S. K. TWEEDY.
East London College, University of London,
Mile End Road, London, E.1,
February 4.

On Nocturnal Colour Change in the Pea-crab (*Pinnotheres veterum*).

WHILE investigating the moulting stages of pea-crabs, a nocturnal colour change—analogous to that described by Gamble and Keeble in Hippolyte (*Quart. Journ. Micros. Sci.*, 1900; *Phil. Trans. Roy. Soc.*, B, 1903, 1905)—was observed by me in what is apparently *Pinnotheres veterum*. Last June I received from the Marine Biological Association, Plymouth, an ascidian (*A. mentula*) which had been dredged off the Mewstone, and from the branchial chamber of which a pea-crab had been found attempting to escape. By the time it reached me two crabs had escaped, a male and a berried female. These are most probably *P. veterum*.

P. veterum is the pea-crab which inhabits the Pinna of the Mediterranean and is also found in the large Pinna of the Salcombe Estuary in Devonshire. It has been recorded as well from parts of the Irish coast in Pinna and Modiola. *P. veterum*, however, is much less common than *P. pisum*, the pea-crab which is found living within the mussel (*Mytilus edulis*), as well as in other bivalve molluscs.

It so happened that the paper lining of the lid of the jar in which the ascidian and crabs travelled from Plymouth had become sodden and had fallen into the water in numerous small pieces. After the contents of the jar had been turned into a bowl and allowed to rest for a while, it was noticed that the crabs had hidden themselves beneath the paper. When

uncovered they proceeded to hide themselves again, sidling under the fragments, and throwing them on to their backs with their legs. The female being of considerable size (11 mm. in width) had more difficulty in hiding itself and made more use of its legs in placing pieces of paper on its back. Occasionally it was seen holding there fragments of paper, and once a tiny empty bivalve shell. The last two or three pairs of legs were used in these operations, and not the chelipeds, as perhaps one might have expected. The dactyli of the legs of this crab are long and curved. When in hiding the antennules were withdrawn.

At night the crabs came out of hiding and were very active. The female appeared at dusk; the male some while, an hour or an hour and a half, later. The nights being very short in June, the crabs were only active for a few hours out of the twenty-four. The more tardy male never showed itself until 10.30 P.M., and was hidden again soon after daybreak, about 5 A.M. Summer Time.

If at night the crabs were brought into the light they almost immediately made efforts to hide themselves. Their activity in the dark was accompanied in the male by loss of colour. In daylight or in a lighted room the dorsal surface of the male crab was a golden brown, shaded with dark brown, and more richly coloured anteriorly than posteriorly. This coloration was due to the presence of orange and dark brown chromatophores, which in this condition were so expanded and their pigment so diffuse as to be almost invisible with a low power of the microscope. In the dark the male became pallid and transparent, the food in the stomach and intestine showing black and the testes white. This loss of colour is due to the retraction of the pigment in the chromatophores induced by the onset of darkness. When the chromatophores were quite contracted some faint yellow diffuse pigment was visible towards the centre of the carapace.

The orange pigment appeared to have a quicker rate of flow than the dark brown, and contracted to a smaller area; it is probable that it is lodged in a smaller cell than the dark brown. It appeared as irregular patches of reddish brown or deep orange pigment near the more dendritic or stellate dark brown chromatophores. The ventral surface of the male crab was pale, with very few chromatophores.

The female *P. veterum* had a dirty appearance, but seemed to have no definite colour, and after being in the dark there was no appreciable change in its appearance. I was unable to make out chromatophores in this female, though I have seen them in other adult females which had a definite brown colour.

It is interesting that the male *P. veterum* which suffered nocturnal loss of colour only came out of hiding after it had been really dark some considerable time, while the female appeared at dusk.

During the day the experiment was tried of covering the crabs' bowl with something dark. This was done several times, and on a few—but not all—occasions the crabs came out of hiding in about forty to sixty minutes, the male gradually losing colour during this time. When the bowl was uncovered and the crabs exposed to light, the male took about the same time to recover its colour.

The crabs were kept under observation for about forty days. The conditions were unfavourable, for they were kept without change of water and without the addition of food. After about a month the male *P. veterum* failed to react to the stimulus of light, the chromatophores remained expanded at night and the crabs did not hide themselves during the day. It is hoped to continue the observations in the near future.

D. ATKINS.

The Laboratory, Citadel Hill, Plymouth.

Magnetic Storm of February 23-25, 1926.

FEBRUARY 1926 was characterised by rather considerable magnetic activity, there being during the month only four really quiet days, namely, February 6-9. The outstanding feature of the month was the storm of February 23-25, which, as regards duration, was of greater magnitude than that of January 26-27, some aspects of which were discussed in NATURE by Father J. P. Rowland, S.J. It will be noticed that the storms were separated by an interval of twenty-eight days.

According to the Eskdalemuir records, the first movements definitely associated with the February storm began shortly after 23 d. 14 h. From about that time until 24 d. 1 h. the geographical north (N) and west (W) components of force were mainly in excess of the normal quiet-day values (as derived from the records on the four days mentioned above), and during this interval fluctuations of considerable magnitude occurred in N and, to a less extent, in W. For several hours after 24 d. 1 h., N and W were definitely in defect of their normal values; the ranges of movement were less than in the earlier part of the storm, but there was very considerable short-period oscillatory movement after about 5 h. From 24 d. 9 h. and 24 d. 13 h., W and N respectively were, on the whole, above normal until about 19 h. Thereafter N remained mainly below normal for several hours, while W was less than normal until shortly after 25 d. 2 h. Irregular disturbance ceased soon after noon on February 25. The largest and most rapid changes in N and W, and the absolute extreme values attained during the storm, occurred during the *post-meridiem* hours of February 24. The times of occurrence of the extreme values were: N: maximum, probably between 16 h. 10 m. and 16 h. 50 m.; minimum, 21 h. 13 m. W: maximum, 16 h. 13 m.; minimum, 21 h. 18 m. The corresponding ranges were: N, $>580\gamma$; W, 550γ ($1\gamma = 10^{-5}$ c.g.s. unit).

Vertical (downward) force, V, began to increase from 23 d. 14 h. and remained considerably above the normal undisturbed value during the greater part of the ensuing twelve hours. The sequence of changes during the first part of this interval were somewhat similar to those which occurred in the corresponding stages of the storm on January 26; in particular may be mentioned the broken increase between 16 h. and 18 h. and the two maxima, near 19 h. 30 m. and 21 h. respectively (the earlier being the greater), on each occasion. For about ten hours after 24 d. 2 h. V was below the normal undisturbed value, the lowest value during the first part of the storm being reached at 24 d. 6 h. 44 m. After noon on that day a fairly rapid increase set in. Between 14 h. and 16 h. oscillations of considerable magnitude were superimposed on the general increase. The absolute maximum of the storm occurred between 16 h. 14 m. and 17 h. 42 m., the spot of light passing beyond the limit of the photographic paper during this interval. V decreased fairly rapidly but irregularly between 19 h. and 22 h., and thereafter more gradually to 25 d. 2 h. 40 m., when the minimum value was reached. V was below the normal undisturbed value throughout the interval 24 d. 22 h. to 25 d. 8 h. The recovery from the minimum value was accompanied by pulsations of a few minutes period, but these small changes were less strongly developed than those during the corresponding stages of the January storm. The absolute range in V in the February storm exceeded 560γ.

The ranges in N, W, and V during the interval 23 d. 14 h. to 24 d. 12 h., *i.e.* during the earlier part of the storm, were 386γ, 225γ and 314γ, and therefore distinctly less than the ranges in the later part. It

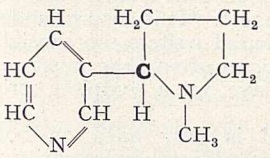
will be seen that the storm of February 23-25 reached its greatest development during the second part of its course and so differed from the January storm, in which the extreme values, together with the largest and most rapid changes, occurred during the first thirteen or fourteen hours. The rapidity of the irregular changes during the phase of greatest disturbance was less in the February than in the January storm. In regard to the absolute ranges in the three components in the two storms, exact data are lacking in the case of N and V, for the record was 'off the sheet' in the neighbourhood of either one or both of the extreme values in each case; but it seems probable that the ranges in N and V in the February storm were not greatly, if at all, inferior to those in the January storm. During the latter the range in W exceeded that in the February storm by about 180γ. A rather interesting feature is that in all three components the minima were higher, *i.e.* less in defect of the normal undisturbed value, in the February than in the January storm.

Aurora was not visible from this locality, which was enveloped in low cloud throughout the course of the storm; but reports of aurora observed elsewhere would be of interest. H. W. L. ABSALOM.

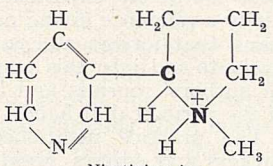
Eskdalemuir Observatory,
March 2.

Asymmetric Nitrogen Atoms in Natural Products.

IT has been generally admitted that, although optical activity can be developed in compounds containing asymmetric atoms of carbon, nitrogen, phosphorus, arsenic, sulphur, selenium, tin, etc., as well as in "centro-asymmetric" compounds in which no asymmetric atom can be detected, all naturally-occurring compounds owe their optical activity to the presence of one or more asymmetric carbon atoms. It is, therefore, somewhat of a surprise to discover that the salts of nicotine contain an asymmetric nitrogen atom, in addition to the asymmetric carbon atom to which the free base owes its optical activity, since it was believed that the former type of asymmetric atom was only to be found in laboratory products. It is nevertheless clear, from the formulæ set out below, that the addition of a proton to the nitrogen atom of the pyrrolidine ring of the base does in fact convert this atom into a quaternary ammonium ion, which is linked to four different radicals, and must therefore be regarded as asymmetric, whatever opinion may be held as to the asymmetry of the tri-substituted ammonia from which it is derived.



Nicotine (base).



Nicotinium ion.

These deductions from the structural formula of nicotine receive a partial verification in the fact that the rotatory power of the salts of nicotine, *e.g.*, $[\alpha]_D = +18{\cdot}85°$ for the acetate, is of opposite sign to, and much smaller than, that of the free base, for which $[\alpha]_D = -169°$. This anomaly is not observed in compounds such as camphorsulphonic acid, where the formation of a salt is not accompanied by any fundamental change either in the character of the asymmetric system or in the optical rotatory power of the acid; but it is well known in alkaloids such as narcotine. Several cases are also known in which the rotatory power of a benzoyl-derivative differs widely from that of the free base.

Further verification of the view set out above is found in the fact that (according to a preliminary series of experiments made by Prof. B. K. Singh) the rotatory dispersion of nicotine acetate is "complex," depending on the superposition of at least two "simple" partial rotations, whereas the base itself exhibits only a "simple" rotatory dispersion (Lowry and Singh, *Comptes rendus*, 1925, 181, 909), thus suggesting that a new partial rotation has been developed on converting the base into its acetate.

A series of additional experimental tests has been arranged, and it is proposed to extend the inquiry to other cases in which an asymmetric nitrogen-atom may be developed in derivatives of an optically-active base. T. M. LOWRY.

Laboratory of Physical Chemistry,
Cambridge, February 4.

Abnormalities produced by Amniotic Pressure, and their Relation to Heredity.

IN his review of Haecker's work on pluripotency published in NATURE of November 28, 1925 (vol. 116, p. 776), Prof. MacBride stated that according to researches of Jansen in Holland, Tornier in Germany, and Sir Robert Jones in Great Britain, polydactyly and brachydactyly are both due to pressure of the amnion on the growing rudiments of the fingers, when too little amniotic fluid is secreted during embryonic development. I know from my own experiments that polydactyly is hereditary, and from the observations of others that brachydactyly is likewise hereditary. Does Prof. MacBride really believe that these abnormalities are produced by mechanical pressure of the amnion on the embryo and are at once in the following generation developed by heredity? Such a belief is contrary to the general trend of all the evidence concerning the question of the heredity of somatic modifications. In the case of lizards it is possible, by cutting off the tail and dividing the stump, to obtain lizards with two regenerated tails, but I have never heard it even suggested that the offspring of lizards so treated develop two tails by heredity.

In his letter in NATURE of February 13, p. 232, Prof. MacBride writes: "we can show in the case of Vertebrata that 'mutations' as apparently diverse in nature as mental defect and supernumerary fingers can be explained as due to varying degrees of abnormal amniotic pressure." This is a contradiction in terms: if the abnormalities mentioned were mutations they would not be due to amniotic pressure, and if they were due to amniotic pressure they would not be mutations.

If the abnormalities to which Prof. MacBride refers are not hereditary, the matter is of little importance, but if he means that they are hereditary, like the abnormalities usually described under the names polydactyly and brachydactyly, it would be interesting to know what is the evidence on which his statements are based. He will probably reply that I can read the evidence in the papers of the authors whose names he has given. But he has not given references to their papers; and, further, he is responsible for his own statements implying or suggesting that a hereditary abnormality (for that is the usual meaning of mutation) may be produced in a single individual by mechanical pressure in the embryonic stage of development. It seems to me that other biologists have a right to ask him either to justify or withdraw his statements. J. T. CUNNINGHAM.

East London College,
Mile End Road,
February 18.

On the Polarised Emission of Mercury Lines.

EXPERIMENTS are in progress in which the mercury spectrum is excited by a directed stream of electrons from an oxide coated filament, and the polarisation of the lines examined. The track of the electron beam in a field-free space at a pressure of 1/1000th mm. is well defined, and little visible light is emitted from points not in the path of the electrons. Accelerating voltages of 30-40 volts have mainly been used, and the light from the stream is observed at right angles to its direction. Under these conditions a number of p-d combinations are polarised, the plane of polarisation being with the maximum electric vector parallel to the stream. The plane of polarisation rotates with the tube and so cannot be governed by any stray field.

The following are the lines so far tried, the brackets indicating lack of separation :

Polarised.		Unpolarised.	
λ 5791 Å.U.	$\left\{\begin{matrix}2P-3D\\2P-3d_3\end{matrix}\right\}$	λ 5461 Å.U.	$2p_1-2s$
5770	$2P-3d_2$	4916	$2P-3S$?
$\left\{\begin{matrix}4347\\44\\39\end{matrix}\right.$	$\left.\begin{matrix}2P-4D\\2P-4d_3\\2P-4d_2\end{matrix}\right\}$	4358	$2p_2-2s$
		4108	$2P-4S$
$\left\{\begin{matrix}3906\\04\\02\end{matrix}\right.$	$\left.\begin{matrix}2P-5D\\2P-5d_3\\2P-5d_2\end{matrix}\right\}$?	4078	$2p_2-2S$
		4047	$2p_3-2s$
		3650	$2p_1-3d_1$
3663	$\left\{\begin{matrix}2p_1-3D\\2p_1-3d_3\end{matrix}\right\}$		
3655	$2p_1-3d_2$		

It is seen that the effects on combinations involving the various d and D levels are not completely disentangled, but that the results seem consistent with the view that the polarisation occurs in the case of combinations of the p or P levels with the D, d_2, and d_3 levels.

In the case of the yellow mercury lines 5770 and 5791, the effects can be investigated visually, using a filter. It has been found that the degree of polarisation decreases as the speed of the electrons is increased. At 20 volts the polarisation is about 20 per cent., but falls to less than 3 per cent. for an exciting voltage of 70 volts. Further, the polarisation of the light emitted directly from the path of the electrons can be distinguished from the smaller degree of polarisation of the light emitted from points outside the path of the stream. This seems to lead definitely to the conclusion that the polarisation is caused by the directed character of the electron stream.

The polarisation of the yellow lines is reduced to zero by a magnetic field of about 20 gauss at right angles to the stream and in the direction of observation, but a similar field parallel to the stream has no effect. The same field perpendicular to the stream and to the direction of observation reduces the amount of polarisation to roughly half its value. It remains to be seen whether balancing out the earth's field will bring to light any further effects.

The polarisation of the D lines of sodium excited by a directed stream of electrons has independently been investigated by Kossel and Gerthsen (*Ann. der Phys.*, 77, 273, 1925), but no effect was found; and just as this note was prepared, a paper of Ellett, Foote, and Mohler (*Phys. Rev.*, 27, 35, 1926) came to hand. Using a very low vapour pressure and exciting voltages only a little greater than the corresponding excitation potentials, they studied the cases of the sodium D lines, again with a negative result, and of the mercury line 2537, in which case they found a polarisation of 30 per cent. with the maximum electric vector *perpendicular* to the direction of the stream, that is, in a plane at right angles to that in which polarisation has been found in the case of the p-d combinations. As these authors point out, theoretically we should expect a polarisation with the maximum electric vector parallel to the stream, as is observed in the cases referred to in the present note. The decrease of the magnitude of the polarisation with increasing speed of the exciting electrons and the influence of the application of a magnetic field are also effects which may be interpreted theoretically.

H. W. B. SKINNER.

Cavendish Laboratory,
Cambridge, February 8.

The Leaping Salmon.

WHEN Dr. Starr Jordan says "All salmon will leap over a waterfall where it is possible" (NATURE, January 16, p. 85) he surely refers to salmon in countries like America and Norway, where spring fish do not occur. In Britain salmon enter fresh water, in very many rivers, in every month of the year, and those which do so in the cold-water months—February, March, January, and April, to mention them in the order of coldness—do not leap at falls.

On arrival at the foot of a fall where there is much white water, even when the fall is only a few feet high, all farther ascent is stopped until the wintry thermal conditions have passed. In Scotland, this is usually about the third week in May.

Another point to which, perhaps, I might venture to direct attention is the title of the illustration of the leaping salmon. This gives the impression that the particular fish shown is leaping a fall 30 feet high. This must mean that the falls of this Oregon river are really a series of cascades, since no salmon can leap anything like 30 feet. Provided there is a deep pool below the fall, from the bottom of which a fish can make a rapid upward swim, a salmon can leap about 8 to 9 feet vertical height. I have seen a sea-trout of apparently only about 2½ lb. do the same.

W. L. CALDERWOOD.

Edinburgh, March 1.

Re-Paging of Reprints.

I THINK every one will agree that one of the worst crimes of an author is to give wrong references. Will you kindly allow me to point out that a very frequent source of such errors arises from the re-paging of authors' separate copies? In my editorial work for the *Geological Magazine* I find many instances, and have learnt by experience always to mistrust and verify a reference giving page 1. It is easy to understand that foreign and colonial writers are specially likely to fall into this trap, as often they must rely on authors' reprints and have not a complete series of the periodical at hand.

The practice mentioned is very hard on both authors and editors, besides adding unnecessarily to the cost of reprints.

R. H. RASTALL.

Christ's College, Cambridge.

On One-Eyed Vision.

IN continuation of Sir Arthur Schuster's letter, February 28, p. 228, I feel sure that a person looking with one eye, when time enough is allowed for attention, substitutes for the doubleness of appearance utilised by two eyes a slight unconscious waggle of the head, and thereby secures the needed parallax.

Also I recall that once, glancing over back premises in London with one eye, I caught a glimpse of a cat walking on a near wall which looked surprisingly like a tiger on a far wall.

OLIVER LODGE.

Italy, February 19.

Peregrine Phillips, the Inventor of the Contact Process for Sulphuric Acid.

By Sir ERNEST COOK, D.Sc.

IT is unfortunately the usual fate of the inventor of a novel process of chemical manufacture to find that his monetary reward is little or nothing and that even his name soon ceases to be associated with the process. But probably in few instances is there so little known about the author of an important new method as in the case of Peregrine Phillips, the inventor of the 'Contact Process' for the manufacture of sulphuric acid. Possibly this is partly due to the long period that elapsed between the publication of the patent and the successful working of the process; and yet the broad details as practised to-day were described with fair accuracy in the application for protection originally asked for.

There can be little doubt that this method of manufacturing the acid is growing in importance every day—spacious and well-appointed works, erected at considerable cost, are either already started or soon will be, in Great Britain and other countries. The chamber method, which has served for so long a period, is gradually being superseded and will probably cease to exist as a commercial proposition in a few years' time.

This development has naturally directed attention to the personality of the original patentee. Who was he? Where did he live? What else did he do in the way of scientific discovery? In these respects we are figuratively up against a blank wall. Practically all that is known about him is contained in the specification of his patent; this states that ". . . PEREGRINE PHILLIPS, Junior, of Bristol, Vinegar Maker, send greeting."

The patent was applied for in 1831 and duly granted. It cannot be said that these particulars afford an extensive history of one who has given to the world the means of making an important advance in useful practical knowledge. This is regrettable, and in order to see if other details could be discovered I have made a search of such local records as could be consulted. The result, whilst not telling us much about the scientific career of the author, throws some light upon his business activity. Collecting the facts, the story is as follows.

Since the middle of the seventeenth century there have been several families of the name of Phillips amongst the inhabitants of Bristol, but no representative combining with that surname the Christian name of Peregrine appears until 1803. In that year a Peregrine Phillips opened a tailor's shop in Milk Street in that city. Here he continued to reside and work at his trade until 1831. I think we may consider that the business was fairly successful, because we find that in 1824 he was able to join one John Thorne in starting a business for the manufacture of vinegar at what must have been fairly large works at that time, at 48 Thomas Street. At the present time 48 Thomas Street is a part of the premises of a large hauliers' business, the buildings being of modern date. In 1824 the district was partly residential, with fairly large houses with several courtyards. Messrs. Phillips, Thorne and Co. adapted this house to their requirements and equipped it with suitable apparatus. Apparently this was done very successfully, because I find that vinegar-making was carried on here until 1865—a period of more than forty years. This venture also enabled him to find an opening for his son Peregrine, junior, who became the inventor of the sulphuric acid process. I think it may be taken as certain that Peregrine Phillips, jun., was born in Milk Street, Bristol, and was the son of the tailor, but I have quite failed to find any record amongst the local church registers (the only ones kept in those days), or the newspaper announcements in existence at the time, of the actual date of his birth. The similarity of name, and the association in business, leave little doubt of the relationship of father and son.

Whether the son took a hand in his father's business is doubtful, but judging by the wording and scope of the patent, I think we may conclude that he was well educated and possessed a considerable amount of sound scientific knowledge.

Nothing further is recorded about the firm until July 1831, when there appeared in the issue of *Felix Farley's Journal* for July 11, 1831, the following notice:

> Notice is hereby given that the Partnership between the undersigned PEREGRINE PHILLIPS, the elder, JOHN THORNE, and PEREGRINE PHILLIPS, the younger, of the City of Bristol, vinegar makers, was dissolved by mutual consent on the 13th day of June last, so far as respects the said PEREGRINE PHILLIPS, the younger.
>
> PEREGRINE PHILLIPS, Senior.
> JOHN THORNE.
> PEREGRINE PHILLIPS, Junior.
>
> *Witness*—Andrew Livett, Solicitor.
>
> The above business will in future be carried on under the firm of Phillips and Thorne by whom all the affairs of the above partnership will be settled.

This notice tells its own story. From it we can conclude that the business was not sufficiently prosperous to satisfy the ambitions of the three partners. But whether the dissolution of partnership was brought about by the dissatisfaction of the younger man with his prospects, or by the dissatisfaction of the older men with the attention to the business given by Peregrine, junior, we can only conjecture. In all probability both these considerations came into the problem.

The important patent which has given Peregrine Phillips, jun., a very high place amongst the comparatively short list of those inventors who have introduced a really new process of manufacture of an article of primary importance in all kinds of industries, was applied for in the early days of the year 1831. The licence was granted on March 21, the "particular description of the nature" of the invention made known on July 15, and the patent inrolled on September 14.

The patent is numbered 6096, A.D. 1831, and consists of two parts, in the first of which the inventor describes the plan he proposes for causing the combination of "sulphurous acid gas with the oxygen of the atmosphere" by making these gases pass through hot tubes containing finely divided platinum and other

substances. In the second part he describes how he will obtain a more perfect condensation of the sulphuric acid when it is made. The whole document, obviously drawn up with the aid of those learned in the law, makes very interesting reading, and I venture to copy it in its entirety:

A.D. 1831 . . . . . *Patent No.* 6096.

Manufacture of Sulphuric Acid.

Phillips' Specification:

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, PEREGRINE PHILLIPS, Junior, of Bristol, Vinegar Maker, send greeting.

WHEREAS His present most Excellent Majesty King William the Fourth, by His Letters Patent under the Great Seal of Great Britain, bearing date at Westminster, the Twenty-first day of March, in the first year of His reign, did, for Himself, His heirs and successors, give and grant unto me, the said Peregrine Phillips, His special licence, sole privilege and authority, that I, the said Peregrine Phillips, my exors, admors, or assigns, or such others as I, the said Peregrine Phillips, my exors, admors, or assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein mentioned, should and lawfully might make, use, exercise, and vend, within England, Wales and the Town of Berwick-upon-Tweed, my Invention of "CERTAIN IMPROVEMENTS IN MANUFACTURING SULPHURIC ACID COMMONLY CALLED OIL OF VITRIOL"; in which said Letters Patent is contained a proviso that I, the said Peregrine Phillips, shall cause a particular description of the nature of my said Invention, and in what manner the same is to be performed, to be inrolled in His said Majesty's High Court of Chancery within six calendar months next and immediately after the date of the said in part recited Letters Patent, as in and by the same, reference being hereunto had, will more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said Peregrine Phillips, junior, do hereby declare that the nature of my said improvements are herein set forth and explained; but for the better understanding of the subject I shall first describe the present mode of manufacturing sulphuric acid, next, the improvement I propose to effect, and then the means by which those improvements are effected.

Sulphuric acid or oil of vitriol is generally manufactured at present by the combustion of sulphur or brimstone and saltpetre, either mixed together and placed in large leaded chambers or separately in ovens connected with these chambers, into which chambers more or less of atmospheric air is admitted. The sulphur at first is converted by the combustion into sulphurous acid gas, and then by the agency of nitrous gas united with oxygen from the atmospheric air in the chamber or from that liberated from the saltpetre, and is thus converted gradually into sulphuric acid, and is afterwards absorbed by the water which covers the bottom of the chamber.

The first improvement, then, which I propose to effect is, an instantaneous union of the sulphurous acid gas with the oxygen of the atmosphere, and thereby save the constant expense of saltpetre, and also the great outlay of capital in the chambers where any great quantity of sulphuric acid can be manufactured by the gradual conversion of the sulphurous acid into the sulphuric acid.

The second improvement I propose to effect is, to effect a more perfect condensation of sulphuric acid when made by an improved mode of absorbing the same. The first improvement then, namely, the instantaneous union of sulphurous acid with the oxygen of the atmosphere, I effect by drawing them in proper proportions by the action of an air pump or other mechanical means through an ignited tube or tubes of platina, porcelain, or any other material not acted on when heated by the sulphurous acid gas. In the said tubes or tube I place fine platina wire or platina in any finely-divided state, and I heat them to a strong yellow heat, and by preference in the chamber of a reverberatory furnace; and I do affirm that sulphurous gas being made to pass with a sufficient supply of atmospheric air through tubes as described, properly heated and managed, will be instantly converted into sulphuric acid gas, which will be rapidly absorbed as soon as it comes in contact with water. The sulphurous acid gas I cause to be generated by the combustion of sulphur or pyrites, or any other metallic sulphuret, in a close oven, having one or more apertures for the admission of atmospheric air, and another aperture leading to or communicating with the aforesaid tubes. The relative proportions of sulphurous gas and atmospheric air are regulated by the size and working of the air pump, which must pump out at least eighty-five cubic feet of air for every pound avoirdupois of sulphur consumed.

My second improvement, namely, a more perfect condensation of the sulphuric acid when made, I effect thus:—I cause a chamber or chambers to be erected, of any size and materials that may be thought convenient, but by preference of silicious stone in a circular form, and about eight feet in diameter and thirty feet high. This I cause to be lined nearly or throughout with lead, to be filled nearly to the top with silicious pebbles, or any substance presenting an extensive surface, and not acted upon by the sulphuric acid. Upon the pebbles or other substances I place a sheet of lead, pierced with small holes, for the better distribution of the liquor to be hereafter mentioned. The chamber is to be domed over, and rendered air-tight on the outside, except by an opening on the top, through which a quantity of water or dilute acid is let in upon the pebbles to the height of about fourteen inches. A lead pump is fixed by the side of this chamber, drawing the liquor from its bottom, and emptying its contents into a lead funnel placed in and over the aforesaid opening in the top of the dome, and which said pump is kept constantly worked by a steam engine or any other power that may be preferred. The pipe of the funnel must be of such a size as always to keep some liquor in the funnel, and never to allow any air to pass down that way into the chamber; and the pump must throw a sufficient quantity of liquor to keep all or the greater part of the pebbles moistened. A pipe leading from the ignited tube or tubes, after passing through some water for the purpose of cooling it, terminates in this chamber just above the top of the liquor, while another pipe going off from the top of the chamber leads to the air pump, so that all the air charged with sulphuric acid has to pass through the bed of moistened pebbles, which have a constant supply of water or dilute acid continually passing down them. When the liquor is considered sufficiently charged, or when it will not absorb the sulphuric acid gas, which may be known by examining, the air discharged from the air pump is to be drawn off by a pipe and cock in the bottom of the chamber, and treated in the usual way.

Note, I do not claim a right to any mode by which sulphur or sulphurets may be converted directly into sulphuric acid by the action of heat or otherwise, if

such method ever has been or ever shall be discovered; but I claim an exclusive right to any plan by which sulphurous gas and atmospheric air, either alone or mixed with any other gas or gases, shall be either forced or drawn by an air pump or anyother mechanical means through an ignited tube or tubes.

I also claim the exclusive right to the use of platina in any finely-divided state, for the purpose of assisting the action of heat in combining sulphurous gas with oxygen in the manufacture of sulphuric acid.

I likewise claim an exclusive right to every mode by which chambers used in the manufacture of sulphuric acid can be charged with silicious pebbles or other substances for the purpose of exposing extensive surfaces, and which surfaces can be either constantly or occasionally moistened by the liquor pumped or drawn from below them.

IN WITNESS WHEREOF, I, the said PEREGRINE PHILLIPS, have hereunto set my hand and seal, this Fifteenth day of July, in the year of our Lord One thousand eight hundred and thirty-one.

PEREGRINE (L.S.) PHILLIPS, Junr.

Signed, sealed and delivered in the presence of

JAMES LIVETT, Solr., Bristol.
RICHD. HOWELL, His Clerk.

AND BE IT REMEMBERED that on the Fifteenth day of July, in the year of our Lord, 1831, the aforesaid Peregrine Phillips came before our said Lord the King in His Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and specified, in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

Inrolled the Fourteenth day of September, in the year of our Lord One thousand eight hundred and thirty-one.

When we remember the time, and the absence of institutions for acquiring scientific knowledge, I think we may conclude that the author of the process had acquired a considerable amount of accurate information which he was able to apply to practical use. Moreover, this invention was no lucky or momentary inspiration. The knowledge displayed could only have been acquired by steady and continuous work.

Peregrine Phillips, jun., was a young man who had made good use of his youth in acquiring valuable knowledge. It is noteworthy that although nearly a hundred years have elapsed since this young Bristolian made his experiments and gradually improved his apparatus, yet the essential details are the same to-day as they were when first made known.

The necessary protection having been obtained by the grant of the patent, the next point to inquire about is as to the author's success in working the process. But here my records absolutely fail me. Both directories and newspapers give no information. We may therefore conclude that no works for making sulphuric acid by this process were established in Bristol. Moreover, the name of Peregrine Phillips, jun., disappears from every local record after 1831, and his late private residence is occupied by another. In all probability this means that directly after the dissolution of partnership in June, he left Bristol to seek his fortune elsewhere.

Possibly in that elsewhere he tried to work his invention, but probably without commercial success. This is not to be wondered at when we remember the large amount of plant employed in modern works using the method.

In these works engineering skill and chemical knowledge, which were not even thought of in 1831, are made to assist, and the combined results are highly satisfactory. But the poor inventor had none of these things, and his reward was probably nil. It was not until nearly fifty years after that the Badische Anilin und Soda Fabrik successfully worked the process on the large scale in Germany.

The youngest partner having left the vinegar business, its subsequent history is soon told. In the notice of dissolution quoted above it is stated that the business will in future be carried on under the name of Phillips and Thorne. But it did not last long. In 1831 the elder Phillips gave up his business of tailor and went to live at the vinegar works in Thomas Street. But in 1832 the works were abandoned. No notice of any bankruptcy can be traced, so we may conclude that trade had gradually declined so much that it was not worth while carrying on any longer.

In the *Bristol Journal* for October 5, 1832, appears the notice of a sale by auction on the premises, 48 Thomas Street, of the "entire vinegar plant, stock in trade, complete apparatus, &c. &c.," of the "late firm of Phillips and Thorne, they having dissolved partnership." Full details are given, and it is obvious that the works were fairly extensive and well equipped.

Immediately after this the father seems to have left Bristol, for no other record later than the date of this sale can be found. The name of Peregrine Phillips, either senior or junior, entirely disappears from Bristol records. Parish registers, as well as the official records, have been searched, but no notice of the deaths of either of our worthies can be discovered. Undoubtedly they left Bristol finally in 1832.

The discovery of Peregrine Phillips, jun., was undoubtedly of first-rate importance, and the young man must have been of far more than ordinary intelligence; yet it is quite easy, if not probable, that the history recorded above reveals a note of tragedy. As thus: Peregrine the elder was probably an industrious and prosperous tradesman, and was making a good income. He was blest with a clever son whose future was dear to him. Money was freely spent on his son's education, and when he became of age the savings of his father were used to start him in a business of far greater possibilities than that in which his father had done so well. So great was the father's confidence in his son's ability that he left the conduct of the business to him and his partner whilst he himself continued to work at his trade in Milk Street. But the genius of the son was not suited to the humdrum of business details. He was experimenting on bigger things than vinegar making, and as a result of his work he introduced the process which has benefited succeeding generations but not himself. The result was inevitable. The business did not pay and a rupture ensued. The son left, and the old father, in order to save his money which he had invested in the business, gave up his tailoring to try to save his capital; but without much success. Possibly the old man, having lost most of his money, left the city where he had held an honourable position for so many years.

Seasonal Sunshine in Great Britain.

By CHAS. HARDING.

NEVER before has the good effect of sunshine on health been so fully recognised as it is now; the great benefit derived from sunshine by individuals of all ages, whether strong and robust, or weak and delicate, is being brought home to us in many ways. The records of sunshine by Campbell-Stokes' self-registering instruments are very satisfactory so far as registration is concerned, but compared with other meteorological elements such as pressure, temperature, and rainfall, they are of more recent date. Sunshine records were practically commenced in about 1881, but by ordinary observers they have been somewhat tardily used.

The "Book of Normals" published by the Meteorological Office, giving monthly normals for stations for the 35 years from 1881 to 1915, supplies the principal facts for comparisons here made. These on examination are found to contain comparatively few complete records for the 35 years; the majority of the stations are for shorter periods and are worked up to the 35-year period by comparison with adjacent stations. For the most part, only those stations are taken which have observations of sunshine for the complete period, so that the comparisons are more trustworthy than they would otherwise be.

Dealing first with the annual results, and comparing the records for the year in different parts of Great Britain, it is found that in Scotland there are five stations which yield an average annual duration of sunshine amounting to 3·41 hours a day; the most is 3·80 hours a day at Aberdeen; the least, 2·97 hours a day at Glasgow. In the south of England, taking Southampton, Falmouth, and Plymouth, the average annual duration is 4·65 hours a day, ranging from 4·56 hours at Plymouth to 4·82 hours at Falmouth. The excess in the south of England over Scotland amounts, on the average, to 1·24 hours a day for the year.

Comparing eastern and western districts, the stations in the eastern districts of England give an annual duration of 4·19 hours a day, while the western stations give 4·17 hours a day.

The central or Midland counties give an annual average duration of 3·90 hours a day—two of the three stations taken are Oxford and Cirencester, which give 4·13 hours a day, the agreement for the year and for the several seasons being remarkably similar.

Dealing with quarterly results of sunshine, dividing the year as generally recognised in meteorology, the winter quarter being represented by December, January, and February, and the summer quarter by June, July, and August. In the north of Scotland, as shown by the Orkneys and the Hebrides, there is little difference between the spring and summer sunshine; indeed, in the Orkneys the duration of sunshine is rather greater in the spring, the relative amounts being 4·60 hours a day in spring and 4·54 hours a day in the summer. For Scotland as a whole the average daily sunshine for the four quarters, starting with winter, is 1·34, 4·64, 5·02, and 2·60 hours; for the south of England the corresponding seasonal values are 2·08 hours a day, 5·78, 6·94, and 3·78 hours. The greatest gain for any season in the south of England is 1·92 hours a day in the summer season, and the least gain is 0·74 hours a day in the winter.

In the east of England the seasonal daily values are 1·85 hours in the winter, and in the following seasons 5·23, 6·26, and 3·40 hours; in the western district of England the corresponding values are 1·68 hours a day in the winter, followed in the other seasons by 5·46, 6·26, and 3·25 hours. The average daily duration of sunshine is thus less in the winter and autumn in the western district, including St. Ann's Head and Douglas in the Isle of Man, than in the eastern, absolutely the same in summer in both districts, but more in the western district in the spring.

In the central or Midland counties the seasonal sunshine records give for the winter 1·68 hours a day, and for the following seasons 4·88, 5·87, and 3·13 hours; these are less than for the east of England in all seasons, and are less than in the western districts except for the winter, when the two districts are in absolute agreement.

A later "Book of Normals" published by the Meteorological Office gives the weekly, monthly, quarterly, and seasonal normals for districts for periods ending with 1915. In all seasons the least sunshine occurs in the north of Scotland and the most in the English Channel. Comparing south-east England with south-west England and South Wales, the average sunshine for the year in south-east England is 4·49 hours a day, and in south-west England and south Wales, including the so-called Cornish Riviera, it is 4·28 hours. In the winter, south-east England has an average daily sunshine of 1·92 hours, and in south-west England and south Wales the value is 1·91 hours a day; in spring the hours of sunshine for the two districts are respectively 5·50 and 5·36; in summer 6·88 and 6·41, and in autumn 3·46 and 3·31 hours. In each season, therefore, the value for the eastern district is above that of the western.

The amounts of sunshine vary considerably in different years and in different seasons. A record of 40 years' sunshine at Oxford, from 1881-1920, shows that the highest total in any year is 1810 hours in 1899, and the least, 1158 hours in 1888. In the winter months the amounts range from 106 hours in February 1899 to 5 hours in December 1890; in spring from 294 hours in May 1909 to 62 hours in March 1916; in summer from 310 hours in July 1911 to 99 hours in July 1913; in autumn from 223 hours in September 1911 to 30 hours in November 1888.

For the corresponding 40 years at Greenwich Observatory the maximum hours of sunshine in any year is 1778 in 1911, and the least in any year is 1069 hours in 1888. The year 1921 had sunshine for 1761 hours, but this is after the 40-year period. In the years 1892–96 the records at Greenwich are doubtful, owing to the development of cloudiness in the glass sphere of the sunshine recorder, the glass having deteriorated; this suggests the need of great care at other stations at home and abroad. In the winter months the amounts

range from 106 hours in February 1914 to 2 hours in December 1890; in spring from 326 hours in May 1909 to 46 hours in March 1888; in summer from 335 hours in July 1911 to 95 hours in August 1913; in autumn from 234 hours in September 1911 to 23 hours in November 1912.

In the abnormal summer of 1911, in the 18 weeks from the commencement of June to the end of September, there were 15 weeks with an excess of sunshine in England E., Midland Counties, England S.E., and England S.W.; 14 weeks in England N.E. and N.W.; 13 weeks in Scotland W. and in the English Channel. July was exceptionally bright; in the south of England the excess of sunshine was very great, averaging about 5 hours a day more than usual at some stations. Eastbourne and Hastings had 160 per cent. of the average; Greenwich and Kew Observatory, 161; Brighton, 163; Plymouth, 169; Torquay, 172; and Tunbridge Wells, 180 per cent. At Greenwich the duration was 335 hours, which is 110 hours more than the average; this was the brightest July since the commencement of sunshine records. The duration of bright sunshine at Greenwich for the four months June to September was 1053 hours, a higher total than in any previous year on record. In 1911 the duration of sunshine at Greenwich was 1778 hours; at Westminster, 1592 hours; and at Bunhill Row, in the heart of the City, 1444 hours, showing clearly the loss of sunshine in the metropolis; the loss is usually proportionately greater in the winter than in the summer. The duration of sunshine at Greenwich for the summer season June to August in 1911 was 819 hours, and the mean temperature for the three months was 66°·1, about 5° in excess of the normal.

The following shows the difference between a good and bad season for sunshine: The year 1903 was about the wettest year on record, certainly the wettest at Greenwich Observatory for the last hundred years. The summer rainfall at Greenwich, June to August, was 16·16 inches, and the duration of bright sunshine 560 hours; whereas in 1911 the duration of bright sunshine was 819 hours. Last year, 1925, was a dull and comparatively sunless summer; the total duration of sunshine in the three summer months was 587 hours, and the total rainfall was 6·10 inches. The year 1924 also had a dull summer; the total sunshine at Greenwich was 589 hours, and the rainfall was 8·49 inches. These summers were remarkably dull in comparison with 1911 and 1921.

However desirable it may seem to decide which part of England enjoys the longest duration of sunshine, it is not easy to determine the most sunny region, although the following results seem to give a preference to south-east England. The published records of the Meteorological Office available for 35 years, which enable a trustworthy comparison to be made, give results for fewer stations than seem desirable, and in years to come, as the periods increase, results will become more satisfactory.

The highest average annual duration of sunshine at any station for the period of 35 years, 1881 to 1915, is 4·92 hours a day at St. Leonards, in England S.E.; and the station with the next highest average annual duration is Falmouth, in the Cornish Riviera, with 4·82 hours a day. The seasonal values for the two stations are: St. Leonards in the winter 2·25 hours a day, and in the following seasons 6·01, 7·34, and 4·03 hours; at Falmouth in the winter 2·21 hours a day, and in the following seasons 6·01, 7·15, and 3·90 hours; St. Leonards having most sunshine at all seasons except in the spring, when the duration of bright sunshine is the same in both places.

Records for less than 35 years given in the Meteorological Office normals show that, after weighting with other stations near, Felixstowe in England E., with 11 years' observations, ranks highest for the year, with 5·04 hours a day, and with a summer average of 7·84 hours a day. Worthing, with 17 years' observations, has an annual average of 4·98 hours a day and a summer average of 7·42 hours a day. Eastbourne, with observations for 30 years, has an average annual duration of 4·88 hours a day and a summer average of 7·37 hours. All of these have a higher daily average sunshine than the Cornish Riviera.

A rough summary of sunshine observations such as that here given is far from satisfactory, and is drawn up for the most part on published data readily to hand. Without doubt there are many considerations of greater importance to the Meteorological Office and to the general public, but since there has been a great accumulation of sunshine observations over Great Britain in recent years, an official discussion bringing the normals up-to-date would be of considerable scientific interest and would, without doubt, be heartily welcomed.

News and Views.

GENERAL approval from scientific men and naturalists the world over will be extended to the Society for the Preservation of the Fauna of the Empire in its active propaganda against the indiscriminate and wholesale destruction of wild game as a means for the extermination of tsetse flies, and, therefore, of the diseases, both of human beings and stock, which they are the means of transmitting. Certain proposals to throw open game reserves in Zululand led to a deputation from the Society, headed by Dr. P. Chalmers Mitchell, to the High Commissioner for the Union of South Africa, to protest against this measure, and a report of its proceedings, together with a memorandum on the subject, printed in the December number of the Society's journal, will be read with great interest and sympathy. The Society urges that the indiscriminate slaughter of big game does not necessarily lead to the extermination of the tsetse flies, but may have the result of leading the flies to seek other and smaller hosts, still more difficult to control, or failing a suitable wild host, to attack man himself. The danger to the human population would, therefore, be increased rather than decreased, and, in the Mwanza district of the Tanganyika Territory, where wholesale game destruction due to military operations was followed by a serious epidemic of sleeping sickness, there would appear to be evidence in support of this view. The Society urges strongly

a more scientific approach to the solution of the problem by detailed studies of each separate species of fly and host, and a painstaking survey of local conditions before any measures are adopted. It points to the success which has been achieved in Tanganyika Territory by systematic attack on the important bush elements by the native population and by organised late grass-burning as measures for controlling the breeding-places of the flies, and pleads for further trial of such methods in Zululand. It agrees that discriminate control of wild game would probably help in the final solution of the problem.

MR. SAMUEL AUGUSTINE COURTAULD has given 30,000*l.* to the Middlesex Hospital Medical School, London, to found an Institute of Biochemistry. The new building will be in the precincts of the Hospital, and will probably consist of seven storeys, the upper five of which will be devoted to all branches of biochemistry. The Hospital has endeavoured to develop the study of this subject during the past years, with the result that the size of the work has outgrown the existing accommodation. At the present time chemical physiology, chemical pathology, and the chemical routine work for the Hospital patients, together with the more purely chemical investigations of natural products, are dealt with in the same department. This has necessitated the acquiring of a series of scattered laboratories and of occupying rooms in the Bland-Sutton Institute of Pathology.

MR. COURTAULD'S gift will enable the Middlesex Hospital to constitute a compact department of much greater size, in which all the above-mentioned branches of study can be pursued. Workers in the new institute, however, will still retain the privilege of close co-operation with the Bland-Sutton Institute of Pathology, and with the clinical staff of the Hospital, and thus the new institute will be in rather a unique position. The constant passage of routine work through such a department will focus the attention upon the clinical and therapeutic aspect of biochemistry. Although the plans of the new department, which will be called the S. A. Courtauld Institute of Biochemistry, have not yet been definitely decided upon, it is proposed to make ample provision for the teaching of both chemical physiology and chemical pathology. A large laboratory for the more organic chemical side of the work will be included, together with accommodation for the pharmacological testing of chemo-therapeutic substances. Mr. Courtauld's very generous gift will enable the Hospital to continue its support of this very valuable line of teaching and research.

A RECENT announcement made in the Legislative Assembly at Delhi by Mr. J. W. Bhore, the Secretary of the Department of Education, Health and Lands, is of considerable interest since it brings to an end a period of uncertainty as to the future position both of research and education in forestry in India. It will be remembered that the Forest Research Institute at Dehra Dun was inaugurated in 1906, the Forest School being given the status of a College. A two-year course for the training of the Provincial Service was afterwards instituted, the courses previously given being for the subordinate staff only. In 1914 the Research Institute building was opened. The War made considerable demands upon the Institute, and the research work carried out there, especially in utilisation, was of material importance to the country. By 1919 it was apparent that the research work had already outgrown the block of buildings erected in 1914. The value of this work was fully appreciated by the Government of India, and a scheme was drawn up for the erection of a new Research Institute on a far larger scale, land being acquired for the purpose. A check was given to the development of the new scheme owing to the recommendations of the Inchcape Retrenchment Committee. The Institute was placed on a block grant for three years. Mr. Bhore now announces that the Government of India has sanctioned the whole grant for the new buildings. He also states that the training of the Indian probationers for the Imperial Forest Service will in future be undertaken at Dehra Dun; a two-year diploma course will be given there, the old Research Institute building of 1914 being converted for this purpose. It is perhaps a little sanguine to hope that the training at Dehra will be as good as that given at the universities of Great Britain, but the experiment will be watched with interest.

SIR FREDERICK GOWLAND HOPKINS presided on March 13 over a dinner of the Biochemical Society held at the Grosvenor Hotel, London, to celebrate the hundredth meeting of the Society. In proposing "The Society" he traced the change of opinion concerning bio-chemistry, which has taken place since he went to Cambridge thirty years ago, and was informed that bio-chemistry was not biology and certainly not chemistry. After paying a tribute to Mr. J. A. Gardner and Prof. R. H. A. Plimmer in inaugurating the Society, he directed attention to its constantly accelerating progress, remarking that only one plateau has appeared in the curve of membership, and that was during the years 1914–18. Biochemists, he said, are highly privileged persons, because many of them are brought into close contact with agriculture and other vitally important industries. They need, however, encyclopedic knowledge, because they never know from what source they may derive information of vital importance. Describing the genesis of the Society, Mr. Gardner explained his indignation one morning in 1911 on learning in the daily press that an Austrian was to be sent over to England to teach British workers how to apply chemistry to living tissues. In response to post-cards sent out by Prof. Plimmer and himself, thirty-two bio-chemists attended a meeting and the Society was founded. Prof. Harden spoke of the keenness of members; in the Chemical Society, he said, there is one paper to every ten members, but in the Biochemical Society there is one paper to every three members. Prof. E. H. Starling proposed the health of Sir Frederick Hopkins. Characterising

him as the leader of the school of British bio-chemistry, he said that he differs from most workers in being a natural historian as well as a trained chemist. In his work there is no such thing as an unconsidered trifle. He referred also to the bearing that his appreciation of colour has had on his researches.

THE Bureau of Chemical Abstracts, which now issues the *British Chemical Abstracts* for the Chemical Society and the Society of Chemical Industry, is endeavouring to secure uniformity in the method of referring to original papers. It issues to its abstractors a pamphlet of instructions as to what information the abstracts should contain, the use of the terminations *ous* and *ic*, the distinction between hydroxides and hydrates, and the restriction of *ol* to alcohols, the other *ols* to become *oles*. A list of recognised abbreviations and symbols is also given. Of the great need of more uniformity in the nomenclature and notation of chemistry there can be no doubt, and in these matters the views of the Bureau will have great weight, but on questions common to all sciences the views of other bodies publishing abstracts at home and abroad must be considered. The Chemical Bureau advocates the order: title, author, journal, year, volume, page in abstracts or references, while the more common practice is to give the year last. For dates it uses (p. 4) '25.6.23,' but does not indicate whether the year is the first or the last number given, and astronomers would understand 1925.6.23. Although the method of writing the time of an event is not one of the points dealt with in the instructions, and one might write 5.30 P.M. June 23, 1925, without being considered unmethodical, the astronomer's logical 1925, June 23, 17h. 30m. has much in its favour.

NEAR Quetta in British Baluchistan, Dr. C. G. Abbot, assistant secretary of the Smithsonian Institution of Washington, D.C., and Director of the Smithsonian Astrophysical Observatory, has found the most suitable site that he has seen thus far in his search of the eastern hemisphere for a place to locate a new solar observation station. This new station, to be erected by the Smithsonian Institution with funds provided by the National Geographic Society, will be the third under the direction of the Smithsonian Institution making daily observations of the variable radiation of the sun, the other two being located in Chile and California. This third station will furnish a needed check on the values from the other two, providing a more dependable daily value of the solar constant. It is hoped that accurate long-range weather forecasting may become possible as a result of this fundamental work by the Smithsonian Institution. Dr. Abbot has visited the Sahara and India and now is on his way to south-western Africa.

IN his discourse at the Royal Institution on Friday evening, March 12, Sir J. J. Thomson, Master of Trinity College, Cambridge, observed that the brilliance of the electric discharge has long been known, and exemplified in its greatest brilliancy in lightning and the aurora; but the subject of his lecture was confined to the radiation from electric discharges through gases in tubes of various forms. The radiation from Röntgen rays and other kinds of radiation inside tubes cannot get out. Evidence of the existence of radiation in these tubes can be obtained by means of the luminescence discovered by Wiedeman; it can be located by shadows, or its effects shown by ionisation (Hoffmann). The radiation from electric discharges can be observed and measured by the use of films of various substances inside the tube, showing the photo-electric effect. By using aluminium and celluloid screens with the tube, the absorption of radiation can be shown. The stream of negative and positive particles can readily be demonstrated by reversing the current. There were elaborate experiments shown during the course of the lecture by means of alternating currents and the use of reflectors within the tubes: in one case a magnificent ring of light appeared in the tube.

THE Department of Scientific and Industrial Research has recently established a small research laboratory in the vicinity of Covent Garden fruit and vegetable market. The laboratory will work in close connexion with the Low Temperature Research Station, Cambridge, which is the headquarters of the fruit and vegetables section of the Department's organisation for food investigation. Problems which are beyond the resources of the laboratory can therefore be handed on to the Station without delay. The object of the laboratory is to bring the Low Temperature Research Station into closer contact with the trade in fruit and vegetables, and with the practical aspects of the problems of their transport and storage. Covent Garden has been selected as the most suitable situation for the Laboratory because fruit and vegetables can be studied there at all times of the year; because its supplies are derived from all quarters; and because it is a convenient centre from which to reach the main producing areas in England, and the chief ports to which supplies are brought from overseas. The address of the Laboratory is: The Covent Garden Laboratory, Dudley House, Endell Street, London, W.C.2.

THE December issue of *Isis* contains the seventeenth Critical Bibliography of the History and Philosophy of Science and of the History of Civilisation. The original conception of this extremely useful annual bibliography was due to Dr. George Sarton, who continues to edit it, although the journal *Isis* itself is now published by the History of Science Society. In the present bibliography there are no less than 482 items, a fact which speaks well for the progress of what the Bishop of Birmingham recently referred to as the new humanism. The entries are systematically arranged, so that scholars interested in a particular subject or period can gather the information they require with very little trouble. The more important items are provided with short descriptive notices, generally from the pen of the editor himself, but occasionally written by experts on the subject under consideration. Of all the features of *Isis*, we regard these critical

bibliographies as among the most valuable; they are, indeed, unique and indispensable. The useful bibliography given by Prof. Aldo Mieli in the *Archivio di Storia della Scienza* deals practically entirely with Italian work, while the *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften* does not cast its net nearly so widely as the indefatigable Dr. Sarton. Readers of NATURE who wish to support the invaluable work which *Isis* is doing should write to Dr. Frederick E. Brasch, secretary of the History of Science Society, Smithsonian Division, Library of Congress, Washington, D.C., U.S.A.

A PAMPHLET of nineteen pages from the Geological Survey of China includes a useful summary of the progress of the Survey under four heads, namely: (1) Ten years' work of the National Geological Survey of China; (2) Provisional programme of "Palæontologia Sinica"; (3) Memorandum on the establishment of museums in Peking; (4) Memorandum on the extension and rebuilding of the Geological Museum. The first section includes an index map showing the areas of China which have been geologically surveyed and of which a geological map on the scale of 1:1,000,000 has been prepared; the first sheet has been issued, and four others are in the press. The Survey Library was mainly established at the cost of 40,000 dollars subscribed by the mining companies and private donors. The Geological Survey was allotted in 1916 an annual grant of 80,000 dollars, but the amount received has fallen to 20,000 dollars, and the work has been carried on through the self-sacrifice of the members of the Survey. The list of the Survey publications shows an output of work which is highly creditable in consideration of the political and financial embarrassments of the past few years. A memorandum by Dr. Gunnar Andersson announces the proposed establishment of a Biological Museum at Peking of the same standard as the Geological Museum; the ideal is a group of museums, each organised as an institute for scientific research combined with an educational exhibition.

THE weather in the British Isles for the winter season ending February 27 is dealt with in the *Weekly Weather Report*, published by the Meteorological Office from observations during the months of December, January, and February. District values and their deviations from the normals are given for eleven districts of the British Isles, together with the mean values for the whole. Mean temperature was highest in the Channel Islands, where it was 46°·2 F., and lowest in the east of Scotland, where the mean was 37°·5; in the south-east of England, including London, the mean was 41°·7. Mean temperature for the winter was above the normal in all districts except in the east of Scotland, where the deficiency was 0°·1. The greatest excess over the normal was 1°·4 in the north of Ireland, and the next highest excesses were 1°·3 in the south-east of England and 1°·2 in the east of England. The absolutely highest temperature was 60° in the north-east of England, varying to 55° in the west of Scotland; the lowest was 4° in the east of England, ranging to 18° in the south of Ireland and 28° in the Channel Islands. Rainy days were in excess of the normal in all districts; the greatest excess was 10 days in the east of Scotland. The aggregate amount of rain was in excess in all districts except in the north of Scotland, where the deficiency was 1·77 in.; the greatest excess was 3·78 in. in the Channel Islands, while in the south-east of England the excess was 2·25 in. There was a slight deficiency of sunshine in all districts except in the south-east of England, where there was an excess of 0·1 hour a day on the normal, and the average duration of sunshine, which for the winter was 1·9 hours a day, was greater than in any other district except the Channel Islands, where it was 2·1 hours a day.

THE recently issued part of *Curtis's Botanical Magazine* (Part ii. of Vol. 151) contains eleven plates, most of them "L. Snelling del et lith," which worthily maintain the high standard appropriate to the present editor, Dr. O. Stapf. In the *Journal of the Royal Horticultural Society*, Vol. 51, Part i., January 1926, Dr. Stapf has a very vivid and forceful account of the history of this famous magazine, commenced in 1787 by William Curtis, as an illustrated magazine, to issue to subscribers to his garden at Lambeth Marsh and other interested patrons, and incidentally to retrieve his financial losses upon a monumental and far too expensive "Flora Londinensis." Dr. Stapf traces the history of the magazine through its various vicissitudes, its triumphal career under the Hookers, father and son, its association with Kew when Sir William Hooker became Director of the Royal Botanic Garden, and its submergence during the difficult years following the War. This history is a timely reminder to the fellows of the Royal Horticultural Society of the fine tradition of this magazine and the purpose it serves, as it is now edited by Dr. Stapf for the Society, which has undertaken responsibility for the new issue, and in so doing promoted the interests both of botany and horticulture. Incidentally the current issue illustrates by the proverbial exception the general rule as to its contents. The magazine illustrates, not native plants, but plants introduced to British gardens from all parts of the world, the illustrations being accompanied by authoritative and very valuable systematic descriptions, with notes on the distribution of the plant and its cultivation in Great Britain. In the present number, however, appears a British plant, *Aconitum anglicum*, Stapf, a new species which the editor creates for a monkshood often grown in English gardens, but also found wild in England. Dr. Stapf has failed to trace it outside England and is forced to the conclusion that it is truly native.

WE much regret to announce the death, on March 15, at the age of seventy-nine years, of Sir Philip Watts, K.C.B., F.R.S., lately Director of Naval Construction, Admiralty.

THE seventh Mackenzie Davidson Memorial Lecture of the Röntgen Society will be delivered by Dr. A. Dauvillier of Paris. Particulars of the subject and date will be given later.

SIR ARTHUR SMITH WOODWARD has left England for Beirut, Syria, where he will be engaged for the next three months in the preparation of a work on the Cretaceous fishes of Mount Lebanon.

AT the meeting of British botanists held in the rooms of the Linnean Society of London on March 10, it was resolved to send an invitation to the members of the fourth International Botanical Congress (Congress of Plant Sciences) meeting at Ithaca, New York, U.S.A., in August, 1926, to meet for the fifth International Botanical Congress, in London, in 1930.

THE Council of the British Association will nominate Sir Arthur Keith, Hunterian professor in the Royal College of Surgeons and secretary of the Royal Institution, as president of the Association for the meeting in Leeds in 1927. The presidency of Section K (Botany) at the Oxford meeting, made vacant by the death of Dr. William Bateson, will be filled by Prof. F. O. Bower, formerly Regius professor of botany in the University of Glasgow.

THE New Museums Club, an association of University employees at Cambridge, is organising a popular scientific exhibition to be held in the University Examination Hall and the new wing of the Chemical Laboratory on March 24-27. The entire proceeds are to be given to the benevolent fund of the University Servants' Pension Scheme. The exhibition will be arranged with the view of giving a popular idea of the teaching of science and the scope of research in the University, and three lectures are to be given each day by different members of the University staff, including the vice-chancellor, Prof. A. C. Seward, who will describe "A Trip to Australia."

AT the annual general meeting of the Ray Society held on March 11, the following officers were re-elected: *President*, Prof. W. C. McIntosh; *Treasurer*, Sir Sidney F. Harmer; *Secretary*, Dr. W. T. Calman. Mr. C. D. Soar was elected a vice-president, and Mr. J. M. Offord and Mr. E. Whitley were elected new members of council. It was announced that Prof. von Goebel's "Wilhelm Hofmeister: the Work and Life of a Nineteenth Century Botanist," translated by Mr. H. M. Bower and edited by Prof. F. O. Bower, would shortly be published, and that the Society's issue for 1926 would be the second volume of "British Hydracarina," by Mr. C. D. Soar and Mr. W. Williamson.

THE following have been elected officers of the Physical Society for the year 1926–27: *President*, Prof. O. W. Richardson; *Vice-Presidents*, Sir Oliver Lodge, Sir Richard Glazebrook, Dr. C. Chree, Prof. H. L. Callendar, Sir Arthur Schuster, Sir J. J. Thomson, Mr. C. Vernon Boys, Prof. C. H. Lees, Sir William Bragg, Dr. Alexander Russell, Mr. F. E. Smith, Dr. E. H. Rayner, Dr. J. H. Vincent, Dr. D. Owen, Prof. F. L. Hopwood; *Secretaries*, Prof. A. O. Rankine, Imperial College of Science and Technology, Mr. J. Guild, National Physical Laboratory, Teddington, Middlesex; *Foreign Secretary*, Sir Arthur Schuster; *Treasurer*, Mr. R. S. Whipple, 45 Grosvenor Place, S.W.1; *Librarian*, Mr. J. H. Brinkworth. Prof. Charles Fabry, professor of physics at the Sorbonne, has been elected an honorary fellow of the Physical Society.

A LENGTHY catalogue (New Series LX.) of new and second-hand books and periodicals on zoology and biology has just reached us from Messrs. G. E. Stechert and Co., 31 East 10th Street, New York. The prices asked, in American currency, appear to be reasonable.

MESSRS. Longmans, Green and Co., Ltd., will shortly publish a new work by Sir Jagadis Chunder Bose on "The Nervous Mechanism in Plants." A further volume is to follow. Another forthcoming book in Messrs. Longmans' list is "A Manual of the Flowering Plants and Ferns of the Transvaal with Swaziland, South Africa," by Dr. J. Burtt Davy, in four parts; Part I.—Pteridophyta to Bombacaceæ. The four parts when completed will be issued in one volume.

MESSRS. Dulau and Co., Ltd., 34 Margaret Street, W.1., have just issued a catalogue (No. 139) which should be of interest to many readers of NATURE. It gives the titles of nearly 1400 second-hand works relating to astronomy, astrophysics, and the industrial arts, many from the library of the late Dr. W. H. Maw. Copies are to be had upon application.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—An assistant inspector for the examination of laboratory and general scientific instruments under the India Store Department—The Director-General, India Store Department, Belvedere Road, S.E.1 (March 30). A professor of anatomy at the Ceylon Medical College, Colombo—The Private Secretary (Appointments), Colonial Office, 38 Old Queen Street, S.W.1 (March 31). An assistant pathologist under the Metropolitan Asylums Board—The Clerk, Metropolitan Asylums Board, Victoria Embankment, E.C.4 (April 1). An investigator under the Safety in Mines Research Board to carry out work on the strengths of materials and structures for the support of underground workings in coal mines—The Under-Secretary for Mines, Establishment Branch, Mines Department, Dean Stanley Street, S.W.1 (April 6). A mycologist for the Forest Research Institute, Dehra Dun, United Provinces, India—The Secretary to the High Commissioner for India, 42 Grosvenor Gardens, S.W.1 (April 7). A science master at the Lord Wandsworth Agricultural College, Long Sutton, Basingstoke—The Secretary, Lord Wandsworth College Trustees, 71 Piccadilly, W.1. A head of the department of hygiene and bacteriology and part-time lecturer in hygiene and maternity and child welfare at King's College for Women (Household and Social Science Department); also a part-time lecturer in economics—The Secretary, Campden Hill Road, W.8. An assistant lecturer in hygiene and public health at Battersea Polytechnic—The Principal.

Our Astronomical Column.

AURORAL DISPLAY OF MARCH 9.—A display of the Aurora Borealis causing widespread interest was seen from a number of places in the south and east of England during the evening of March 9, between half-past seven and half-past eight. It was visible, at least partially, from the suburbs of London, its probable commencement being noted by two members of the staff at Greenwich Observatory at $19^h\ 30^m$. Communications we have received from Mr. R. T. Gunther of Oxford and Mr. C. Leaf of Cambridge give interesting details of the rapid changes invariably associated with this phenomenon.

As seen from Greenwich, with the glare of the lights of east London to the north of the Observatory, the aurora appeared between $19^h\ 30^m$ and 20^h as a changing and indefinite area of suffused light, of a dull flame colour in the north-west and for a short time in the north-east sky. At Cambridge and Oxford a number of variable bands and streamers were visible, being at first white or greenish in the north and reddish in the north-west. Immediately after 20^h, Mr. Leaf states: "The pink colouration [of the streamers] became very strong, changing to a dark but intensely luminous red. At the same time the red streamers became a luminous patch which rapidly spread across the sky through north to east. At the western end of this band was a vast red patch which, starting at the horizon, reached almost to the zenith forming a most beautiful spectacle."

Mr. Denning, writing from Bristol, states that at $19^h\ 30^m$ an intense red glow was diffused along the northern horizon. This quickly faded and then rapidly increased in brightness, streamers developing at 20^h. "In the north-west . . . a broad column of white light 4° in width and apparently double became exceedingly conspicuous. It immediately widened until it consisted of a mass of rays 20° in width and the colour changed to an intense red."

An examination of the magnetograph traces at Greenwich shows that the magnets began to be noticeably disturbed at $19^h\ 30^m$, and at $20^h\ 5^m$ the Declination magnet was suddenly deflected 35′ towards the east. The magnet recovered its normal position by about 21^h, but it continued to show minor disturbance until the following morning. At the time, a large group of sunspots (see NATURE, March 6 and February 27) was very near the sun's west limb. There was, however, no large spot near the central meridian, although one of comparatively minor importance was slightly east of the meridian, in latitude 21° north, in a part of the sun not active in spots recently.

ENSOR'S COMET.—There is abundant evidence that Ensor's comet is now much fainter than was expected from its appearance in the southern hemisphere in January. It has evidently expanded greatly since perihelion passage, and now fills the whole of an ordinary telescopic field, so that the lack of contrast makes visual observation very difficult.

Mr. B. M. Peek, of Herne Bay, obtained a photograph on Wednesday morning, March 10, which shows a large faint nebulous blur so close to the tabular position of the comet that identity with it is probable. It may be recalled that Holmes's Comet in 1892 underwent a similar expansion which rendered it unobservable for a time. There was then a recrudescence of brightness at the nucleus, which later expanded again. The possibility of similar changes in the present case should be borne in mind. As the comet is now becoming circumpolar, it is well placed for observation. The following ephemeris is for 6 A.M.

	R.A.	N. Decl.	log r.	log Δ.
March 20.	$22^h\ 17^m\ 48^s$	58° 12′	9·9928	9·9616
,, 24.	22 59 21	65 27	0·0265	9·9847
,, 28.	23 58 59	70 59	0·0572	0·0134
April 1.	1 19 32	74 17	0·0855	0·0455
,, 5.	2 48 24	75 14	0·1114	0·0790
,, 9.	4 5 7	74 20	0·1353	0·1124

NEPTUNE'S SATELLITE.—A paper by Prof. Eichelberger, Director of the American Nautical Almanac, was read at the meeting of the Royal Astronomical Society on March 12, in which all the observations of Neptune's satellite from its discovery until the year 1923 were discussed. The work was commenced by Prof. Newcomb, but left unfinished at his death; his computations were utilised, but they have been greatly added to. A splendid series of observations by Prof. Barnard extending over twenty-five years deserves special mention. The period of revolution of the pole of the satellite's orbit about Neptune's north pole is found to be 585 years. The eccentricity of the orbit is very small, about 0·0049, but its reality appears to be shown by the fact that, when the observations are grouped by observers, each series indicates motion of the apse in the same direction, this being the opposite direction to that of the node, as it should be. The values found for the annual motion of the apse vary from 1·5° to 3·0°, but are very uncertain.

Dr. Jackson used Prof. Eichelberger's results to obtain an estimate of the period of Neptune's rotation. On certain assumptions as to the distribution of matter within the planet, he found the period 19^h; but he thought it quite possible that the true period was double the $7^h\ 50^m$ announced by Maxwell Hall from photometric observations, and afterwards supported by Opik and Liviander at Tartu.

THE DISTRIBUTION OF NON-GALACTIC NEBULÆ.—Some years ago a series of photographs of selected areas were taken by Fath for the purpose of the Mount Wilson Catalogue of Magnitudes. The limits of magnitude photographed were so low as 18 to 19 on the international scale, and counts were made of the nebulæ found in each area. These counts are re-examined by F. H. Seares in the *Astrophysical Journal*, vol. 62, p. 168. The selected areas are 139 in number, distributed at intervals down to 15° South Declination, and are arranged by Seares first to show the distribution of the nebulæ in galactic latitude. The diagram shows the gradual appearance of nebulæ at about 20° latitude (in both hemispheres), followed by a rapid increase in numbers up to 30°. The well-known concentration near the galactic poles is shown in the case of the North Pole, but the south polar region is not included among the selected areas. The distribution in galactic longitude is interesting in showing strong evidence of a band of nebular concentration crossing the North Pole in longitudes 50°-220°. It appears, however, that the distribution in longitude depends on the size of the nebulæ under consideration. The majority of those discussed by Seares are very small, having diameters of less than 30″. An estimate is made (after allowing for losses arising from aberration) of the total number of nebulæ in the sky. This number (estimated at 300,000) is considerably smaller than that given by Curtis (722,000); and though there is a source of error in the asymmetrical distribution of the photographs, Seares considers that it is insufficient to reconcile the considerable discrepancy between his estimate and that of Curtis.

Research Items.

THE AURIGNACIAN STATION AT LA QUINA (CHARENTE).—In the *Bulletin of the Société d'Anthropologie de Paris*, Ser. 7, T. 6, Fasc. 1-3, Dr. Henri Martin gives an account of the Aurignacian levels of the well-known site of La Quina, where he has been engaged in systematic exploration since 1908. Although the site was brought to the notice of archæologists in 1884, when Dr. Martin first visited it in 1905 he could find no trace of any attempt at systematic or scientific investigation outside the excavations made in the course of the original road-making operations. Dr. Martin's investigations have revealed that the area of occupation was situated at the base of the cliff. The Aurignacian levels, three in number and superimposed, are on material brought down by land-slides, beneath which at the bottom is a Mousterian station. Over this station the debris formed a mound four metres thick and forty metres in extent, separated from the cliff by a hollow ditch in which was found the refuse of the earliest Aurignacian settlement, consisting of broken bones, in particular those of the reindeer and the horse, calcined stones and relics, broken and whole, of the industries of the inhabitants. On each of the occupation levels were layers of fallen material similar to that overlying the Mousterian and separating the stations one from another. Of the Aurignacian levels, the first or lowest and the third are the most important. The absence of audi points and of transitional forms in the lowest station showed that a certain development in culture had already been attained. The characteristic form is a reindeer horn assegai or lance head, flattened, but not quite conformable to the usual type. No graves were found and no example of artistic activity has come to light. The station belongs to the Lower Middle Aurignacian, and is comparable to Isturitz. The middle station contains no specially characteristic features, and occupation was probably not prolonged. In the uppermost level of occupation the characteristic implement is the keeled scraper, and its culture is comparable with that of the Bouïton site.

BUDDERMOKAN.—In the *Indian Antiquary* for February, Sir Richard Temple publishes the first part of some notes of investigations made some years ago into the question of a seamen's spirit of which the shrines, known to Europeans as Buddhamakam, are found along the coast of Burma from Akyab to Mergui. These shrines have no connexion with Buddhism. They are universal, being accepted by Buddhists, Hindus, and Mohammedans alike, and by natives of India, Burma, and China, a sign that they are symbols of the animism which underlies all Indian religions. Their chief votaries are sailors, fishermen, and those who obtain a livelihood by the water. The name is Indian, not Burmese, and Mohammedan in origin. It is properly the shrine of Badar–Badarmaqâm, who is Pir Badar of Chittagong, known to Indian Mohammedans as Badru 'ddîn Auliâ, who represents by his attributes Khwâja Khizar in modern Bengal. Khwâja Khizar in turn is Al-khidhr of the Koran, whose legend is mixed up with Mehtar Ilyâs, the prophet Elias of Jewish tradition, the Spirit of the Flood. This form of belief is still extant in Russia and finds expression in the water festival of the prophet Ilyâ. So far as the evidence obtained from Burma goes, it appears that at certain spots along the Burmese coast, at Akyat, Sandoway, and Mergui, a supernatural being is worshipped, his worship being mainly that common all over the east, *i.e.* it is a survival of a local animistic worship. Its connexion with Pir Badar is due to the fact that, as often happens, one of the local professed religions, in this case the Mohammedan, has annexed the supernatural being of the older belief and has identified it with the saint best known to the bulk of the sea-faring population, Pir Badar of Chittagong.

THE SYSTEMATIC CHARACTERS OF SEA-GULLS.—There is a freshness of treatment and wealth of observation in Dr. J. Dwight's monograph of the world's gulls which make it invaluable to the systematist (*Bulletin of the American Museum of Natural History*, Dec. 31, 1925). Difficulties in the determination of species have always been involved in the complicated series of plumages gulls pass through before attaining finality, which vary from the two-year plumage-cycle of the small gulls to the four-year cycle of the large species, each year having its own non-nuptial and nuptial arrangements. Consequently great attention has been paid by Dr. Dwight to the discrimination of the stages of immaturity, with the result that the description of a species, say the lesser black-backed gull, expands into an account of ten different stages of plumage, which, with an abbreviated synonymy, accounts of distribution and of the four geographical races, cover nine pages of print. The succession of changes is made readily intelligible by excellent diagrams of the colour patterns of the wings and tail of every species in every plumage, and the flesh colours of bills and feet of many species are accurately portrayed. Single type specimens no longer meet the needs of this detailed analysis of stages, so that a series of "reference specimens" is appended to each plumage. The author has examined each of the forty-four known species of gulls, and his classification remains conservative, though he creates a new sub-genus Saundersia for a Chinese species of Hydrocolœus.

CANADIAN SALMON.—There have as yet been no published records of the examination of scales from Canadian salmon: Mr. Menzies' paper on the salmon (*Salmo salar*) from the River Moisie, flowing into the north side of the Gulf of St. Lawrence (*Proc. Roy. Soc. Edinburgh*, vol. 45, Pt. iv. No. 30), is welcome, therefore, as giving the first information on the life-history of the Canadian fish furnished by scale-readings. Unfortunately, the samples collected for Mr. Menzies for examination were small and cannot, as he admits, be considered as representative of the salmon population frequenting the river. The scale-markings resemble exactly those of the scales of Scottish fish: the period of slow growth is well-marked. Scales taken from fish in June and early July showed that 81 per cent. were 'spring' fish; in Scotland at this period one expects clean-run fish to be almost exclusively 'summer' fish. The majority were 'maiden' salmon returning from the sea after three winters. Grilse were absent from the sample. The spawning-scar, when it occurred, was clear and showed that 16·7 per cent. were spawned fish, as compared with the usual 4 per cent. on the east coast of Scotland; most had spawned once, but the numbers with two and three spawning rings were noteworthy; one even was returning to spawn a fifth time. The average age of the smolts at migration was between that of smolts from the north-east of Scotland and smolts from Norway. The three-winters fish were fat and well nourished, comparing favourably with the most finely shaped Scottish fish. Length calculations from scale measurements did not differ materially from those of Scottish salmon.

A PECULIAR PARASITIC CRUSTACEAN.—Prof. T. Komai describes (*Mem. Coll. Sci., Kyoto Imp. Univ.*, vol. 1, No. 3, Oct. 1924) a new species of Sarcotaces, fourteen examples of which were found embedded in the subdermal connective tissue of Antennarius. Their presence causes prominent lumps on the surface of the fish. Each individual is enclosed in a thin sac formed of the host's connective tissue, and the sac has no opening to the exterior. The parasite, which varies in length from 5 mm. to 15 mm., is rounded anteriorly and pointed posteriorly, and exhibits eleven segments, the first six of which constitute the cephalic and thoracic region and the last five the abdomen. In the first segment is a small mouth bordered on each side by a hand-shaped process—possibly the maxilla. Farther back is another pair of processes—possibly the vestigial maxillipeds. There are no antennæ and no limbs. The mouth leads into a blindly ending gut which contains dark particles, apparently the coagulated blood of the host, intermixed with muscular and connective tissue fibres. The ovary is freely branched; the oviduct arises in the sixth segment and opens near the anterior margin of the seventh, but continues backwards round the blind end of the alimentary sac and unites with the corresponding oviduct of the other side. On each side in the lateral region of the second segment is a testis, the lumen of which is continuous with that of a neighbouring branch of the ovary. In the fluid which fills the space between the body and the enveloping sac were found numerous developing eggs and free nauplius larvæ. The two previous observers—Olsson and Hjort—who have investigated Sarcotaces, placed it respectively in the Copepoda and in the Cirripedia. Prof. Komai agrees with Olsson's view, because the opening of the oviduct is in the first abdominal segment, and in the nauplius antero-lateral and anal spines are absent. The two previously known species of Sarcotaces were obtained from fishes taken off the West Indies and off Norway. The present species is regarded as new (*S. pacificus*).

INFLUENCE OF ROOTS OF WALNUT TREES UPON OTHER PLANTS.—A. B. Massey has an interesting paper upon this subject in *Phytopathology* for December 1925 (vol. 15, pp. 773-784). He gives very convincing evidence that the presence of the roots of walnut trees in close contact with the roots of lucerne, tomato, and potato is responsible for the wilting and death of these other plants. The effect does not spread from the walnut tree roots generally into the soil, and is only produced when the walnut roots lie in close contact with the root system of the other plant. An extract of the bark of the walnut root is shown to have a toxic action upon the roots of the tomato plant grown in water culture, and it is suggested, but not experimentally established, that the action of the walnut roots is produced by a toxic constituent substance, juglone, which is a naphthaquinone.

TREATMENT OF GRAIN FOR BUNT.—The treatment of bunt (caused by *Tilletia tritici* and *T. lævis*) with solutions of copper sulphate on formalin, as is usual, is open to the objections that the wheat seed has to be dried before sowing, and that care is needed to avoid the use of too strong solutions, which would injure the grain. Experiments on dry treatment with copper dusts have given very satisfactory comparative results, bunt being controlled, though not completely eliminated, by the use of such dusts (K. Sampson and D. W. Davies, *Welsh Journ. Agric.*, 2, 1925). The most successful applications were dehydrated copper sulphate and copper carbonate containing 50 per cent. copper, at the rate of 2 oz. per bushel of grain, other dusts with lower percentages of copper proving effective at 4 oz. per bushel. On the whole, copper dusts were more efficient than formalin solutions, and had the advantage of eliminating risk of damage to the seed. The treated seed gave better growth in the field, with increased tillering and higher yield of grain, indicating that *Tilletia tritici* has some deleterious action on the plant apart from that caused by the replacement of healthy grain by bunted grain. The possibility exists of some stimulating action by the chemicals employed, and this is being investigated. The advantages of dry treatment lie in its convenience, as no solutions need making up, the grain is more easily handled at sowing time, and the dusting can be carried out at any time between harvest and sowing without danger of lowering the germination capacity of the seed.

INVESTIGATIONS ON POTATO DISEASES.—The growing importance of research on virus diseases entails constant seeking for new methods of investigation, of which some of the more recently devised are described by P. A. Murphy and R. McKay (*Sci. Proc. Roy. Soc. Dublin*, vol. 18, January 1926). Investigations are much hampered by the usual necessity of conducting experiments in insect-proof houses, but for experiments that can be completed in one year this is obviated by a new method of grafting by cores inserted from one tuber into another, planting being done in the open. Mosaic diseases are transmitted freely by using infected cores, but leaf roll does not appear to be transmittable unless the tubers are kept in the cold after grafting. This affords a useful means of separating mosaic from leaf roll infection by keeping the grafted tubers at about 20° C. before planting. If leaf roll infection is desired, cleft grafting on the sprouts is a very useful method of obtaining tuber infection. Cleft grafts are also reliable for infecting stalks and foliage, all diseases and combinations being equally transmitted, except occasionally streak, the latter, however, being readily transmitted by leaf mutilation. The rate of spread of virus in the potato plant has been studied by infecting single-stemmed plants at the top, and then removing the lateral shoots at intervals and growing them as cuttings, or by similarly removing tubers. In such plants the virus spreads to all parts of the stem and tubers after an interval of more than 8 to 10 days and less than 14 to 15 days. Further work deals with the isolation of streak, which causes much trouble in endeavouring to isolate other diseases, as it is frequently present in certain varieties of potatoes in which it does little or no harm and where its presence would never be suspected.

PLANT CUTICLES IN COAL.—Ordinary domestic experience convinces many of us that there are wide differences in coals. When it is considered what extensive vegetable remains must be embodied in the coal and what a varied panorama living vegetation provides, the fact seems less surprising if none the less annoying on occasion. Obviously not only the method of preservation, but also the nature of the original vegetation concerned must affect the quality of the coal, and from this point of view attention is being directed, under the ægis of the Safety in Mines Research Board, to the identification of characteristic vegetable debris, with the view of seeing whether any special properties, such as inflammability, show correlation with particular vegetable components. As Paper No. 17 of the Research Board (London: H.M. Stationery Office, 1926; 1s. net), V. H. Legg and R. V. Wheeler publish an account of their study of the chemistry of the cuticle of a living plant, *Agave americana*, and of the well-known paper coal from the Moscow basin, which consists almost

entirely of compressed plant cuticles. They find this paper coal to be only very slightly attacked by alkalis. The authors state that they are now engaged in the separation of cuticles from bituminous coal by a method which leaves them unaltered in composition, with a view to their further chemical study. It must not be forgotten, however, that there are other fat impregnated layers, at least in living plants and peat deposits, which are likely to be as well preserved in coal as cuticles, and it is not clear that some of the excellent photomicrographs in Plate IV., described as of cuticles from bituminous coals, necessarily represent cuticles at all.

NEW MEXICAN LAND SHELLS.—There seems to be always something new from Mexico in the way of land shells. Two more papers have lately appeared. Dr. P. Bartsch describes (*Proc. U.S. Nat. Mus.*, 77, art. 22) three new species of Holospira. Dr. Pilsbry and Prof. Cockerell (*Proc. Acad. Nat. Sci. Philad.*, 77) deal with a series of shells belonging to several genera including two new species of the carnivorous Glandina, bringing the total number of species of that genus known from north-western Mexico up to ten. They further describe a very handsome little helicoid, *Polygyra nayarita*, n. sp., from the State of Jalisco, Central Mexico.

PARAGENESIS OF PEGMATITES. — An important study of the minerals and their sequence in certain of the granitic pegmatites of Maine has been carried out by K. L. Landes, and the results are published in *The American Mineralogist*, vol. 10, 1925, pp. 355-411. The original pegmatite magma crystallised after the manner of a granite, accessories including tourmaline and beryl being followed in turn by microcline and quartz. Mineralisation then continued through the agency of ascending solutions which were also responsible for the development of pockets and cavities. A high-temperature hydrothermal phase came first and introduced minerals such as quartz, cleavelandite (albite), and various lithium-bearing species. Then followed an intermediate phase in which many rare lithium-manganese phosphates were deposited. The third and final phase is represented typically by quartz, cookeite (a lepidolite-like mineral), and purple apatite. Weathering by groundwaters was responsible for the last crop of minerals produced, the chief alterations being to clay minerals and manganese hydroxides. Many of the minerals, including some remarkable quartz pseudomorphs, are described in detail with analyses.

THE GEOLOGY OF SOUTH AFRICA.—The Geological Survey of the Union of South Africa has just issued a geological map of the Union on the scale of one to a million. The map is a revision of one that was compiled for and exhibited at Wembley. It now appears in four unmounted sheets, each 38 in. by 28 in. (Price 25*s*.) The colour scheme has been well chosen, and the printing and registration carefully executed. In all, 29 different formations are distinguished, and nowhere is there any source of confusion either in geology or topography. An explanation of the map (sold separately at 6*d*.) by the Director, Dr. A. W. Rogers, provides a valuable summary of the geological structure of the Union. An account of the physical features is followed by a description of the geological history and the outstanding structural features, and the pamphlet concludes with a table of formations, igneous intrusions, and earth-movements. The chief differences from former interpretations are (*a*) the removal of the Vredefort granite from the end of the Witwatersrand system; (*b*) the transferring of the former Lower Waterberg to the Upper Transvaal; (*c*) the assignment of the Bushveld complex to the Upper Transvaal; and (*d*) the inclusion of the Pilandsberg alkaline rocks with the Cape System at its base. The Swaziland system remains, as formerly, a convenient class into which all the older rocks are placed pending more satisfactory evidence of their ages. There is still no means of deciding whether the Transvaal system is Palæozoic or pre-Cambrian. This is a case where a determination of the age of the younger granites or of the Bushveld complex by radioactive methods would be of the utmost importance. At the moment one can only direct attention to the lead-ratios of the Katanga (probably Ordovician) and Morogoro (probably Late pre-Cambrian) uraninites. These suggest that the equivalents of the Transvaal and Waterberg systems are respectively of pre-Cambrian and early Palæozoic dates.

RAINFALL OF THE DUTCH EAST INDIES.—The Royal Magnetical and Meteorological Observatory of Batavia has published volume 2 of a monograph on the rainfall of Java and Madura based on the observations of several hundred rainfall stations during the period 1879–1922. The atlas consists of fifteen beautifully printed maps on a scale of 1 to 1,000,000. Relief of the highest ground is shown by hill-shading. The first map shows the location of the stations, while the others give the mean annual and the monthly rainfall. Volume 1 of the monograph is to contain the tables and volume 3 the text. The text is in both Dutch and English.

SQUALENE.—An account of further research on the unsaturated hydrocarbon squalene, occurring in large amounts in certain shark-liver oils, appears in volume 1 of the *Scientific Papers of the Institute of Physical and Chemical Research, Tokyo*. Decomposition of the hexa-ozonide, together with other facts, show that squalene is a higher aliphatic terpene.

INVERSION OF CANE-SUGAR.—The kinetics of the inversion of cane-sugar in acid solution have been reinvestigated by S. W. Pennycuick, of the University of Adelaide, whose results are given in the January number of the *Journal of the American Chemical Society*. In the presence of a large excess of water the reaction

$$C_{12}H_{22}O_{11} + H_2O = C_6H_{12}O_6 + C_6H_{12}O_6,$$

first investigated from this point of view by Wilhelmy in 1850, is usually assumed to be unimolecular, since the active mass of the water remains practically constant. According to the investigations of Worley in 1911 the unimolecular law is not followed, and Armstrong and Caldwell in 1905 asserted that, with weak acids, the earlier stages are represented by a linear and not a logarithmic concentration-time formula. Other observers state that the unimolecular law holds with weak acids but not with strong acids, whilst a number of investigators claim that the inversion process follows the unimolecular law within the limits of experimental error. The principal advance claimed in the above investigation is the elaboration of three methods by means of which the rotation at zero time may be directly determined. In this way it was found that the velocity constant k increases slightly and steadily during the inversion, the maximum increase not exceeding 5 per cent. The very constant results of other workers are probably vitiated by errors which are discussed in detail. The hydrogen ion activity also shows an increase, as measured by the hydrogen electrode, of from 1 to 3 per cent. during inversion, according to the strength of the acid used. The use of the bimolecular equation: Velocity $= k$(sucrose)(water) is shown to be unsound, and the inversion is best represented by the equation: Velocity $= k$(sucrose molecules per molecule of water)(H ion activity).

Archæology and Natural History in Lithuania.[1]

Prehistoric Flint Implements.

AMONG the many remarkable achievements of archæological research during the last few years, not the least noteworthy has been the piecing together of the evidence for bridging the gap which, it was once almost an article of faith to hold, lay between the palæolithic and neolithic periods of the stone age. Dr. F. Birkner has recently added to the record of sites in eastern central Europe from which evidence has been obtained bearing upon this still obscure question. During the War a collection of stone implements was made by Dr. E. Stechow while on a zoological expedition in Lithuania. The implements were surface finds and came from Zubrovo, 55 km. north-east of Grodno on the banks of the Kostra, an affluent of the Niemen, from the shores of Lakes Berszty, Oziery (Jeziory), and Nowaja Ruda. According to the description furnished by Dr. Stechow, the sites on which they were found agree in being strips of dry open land in the neighbourhood of marshy ground running along streams or on lake shores. Sometimes they are backed by wooded or forest land. Prof. Birkner compares a number of stone age sites in Lithuania recorded by Wandalin Szukiewiez from the banks of the rivers Mereczanka and Gruda and the Stegela, Ula, Duba, and Pielasa lakes.

The implements found by Dr. Stechow included knives of various forms, points of various types, arrowheads with concave bases, implements of geometrical form, triangular and trapezoidal, various forms of scrapers, gravers, axes, some of the latter of characteristic Scandinavian type. He refers to similar types recorded by Szukiewiez, and in both cases compares them with finds in Bavaria made during the last ten years in the neighbourhood of Lichtenfels. At Schönsreuth in particular a large number of scrapers and geometrical implements of Tardenois type was found, also at Ansbach and at Neumarkt. It is evident that a large proportion of the implements are of a character typically Tardenoisian. Dr. Birkner goes on to point out certain features which he maintains are common to the sites. They are for the most part located on open ground, sand, loam or gravel, sometimes, as in Lithuania, near marshy ground or on the shores of rivers and lakes. The implements themselves include gravers, which are to be referred to a palæolithic type, while they also include forms neolithic in character, as for example the axes and chisels. Taking all the circumstances into account, his conclusion is that they represent a distinct culture — *Oberfläschensteinzeit* as distinguished from *Wohngrubensteinzeit*. This culture belongs to a people living in dry open spaces, by fishing primarily and by hunting. The survival of palæolithic and relation to or occurrence of neolithic forms indicates a true transitional phase.

Taking these facts, and the distribution of the "*Oberfläschensteinzeit*" culture into account, Dr. Birkner takes a different view of the Tardenoisian and Azilian culture from that of Obermaier, who brings the Tardenois culture into relation with the Late Capsian of Spain, from which centre it is distributed over middle and northern Europe, and groups together Late Capsian, Tardenois, and Azilian as Epipalæolithic. Dr. Birkner, however, would regard the Tardenois culture of the "*Oberfläschensteinzeit*" as a true mesolithic culture developed by a hunting and fishing people, and distributed from eastern Europe as a centre to Syria, North Africa, and western Europe. Further, he holds that the progressive deterioration in the size of palæolithic implements, which reaches its extreme in the Tardenois types, is related to changes in the climate during the period.

While the evidence relating to this obscure period of prehistory is still far too scanty to justify dogmatic statement, an alternative explanation of the variety of forms to which Dr. Birkner refers may well be possible. The conditions in which these collections of varying types are found inevitably suggests the possibility of either a succession or an impact of cultures at different stages of development. Apart from this, the evidence of distribution is at present too slender to support his view; indeed it seems to point in the opposite direction.

Birds.

It is well known that during the War the advancement of science in many branches was not left out of sight, even close to the front. British and German men of science and collectors at least have done work on the eastern and western fronts in Europe, Mesopotamia, East Africa, and elsewhere. In Germany specialists were appointed and worked under the protection of and assisted by the military authorities in several places. Ornithologists are familiar with the "Avifauna Macedonica" by Dr. Stresemann, based on a collection of 3258 bird-skins made by the "Macedonian Scientific Commission," which appeared in 1920. The work before us gives the ornithological results of Dr. E. Stechow's explorations in Eastern Lithuania, chiefly north-east of Grodno, now belonging to Poland.

These countries are of special zoogeographical interest, because in them is found the boundary for several species with eastern and western representatives, which actually meet in Lithuania, and in some instances interbreed. Unless such subspecies are separated by obstacles like sea, desert, or enormous mountain ranges, their boundaries are often not quite sharp, forms either frequently interbreeding where they meet, or overlapping. The collection of 703 skins, however, gave also opportunities to study individual, sexual, and seasonal differences, and time and manner of moult. The author has, with full regard to the literature on the subject by Russian, Baltic, and more recently by a number of German ornithologists, made excellent use of the material entrusted to him. Of the many more interesting details the following may be pointed out.

The west European carrion crow, *Corvus corone corone*, is entirely replaced by the hooded crow, which the author regards as a subspecies of the former, calling it *Corvus corone cornix*. The jackdaw agrees fully with the Swedish *Coloeus monedula monedula*, and the author seems to doubt that *C. monedula soemmeringii* is separable. Both species of tree creepers are found, *Certhia familiaris* common, *C. brachydactyla*, which finds in Lithuania its north-eastern limit, rare.

[1] Abhandlungen der math.-phys. Klasse der Bayer. Akademie der Wissenschaften. Beiträge zur Natur- und Kulturgeschichte Lithauens und angrenzender Gebiete. Herausgegeben von Prof. Dr. E. Stechow.
Einleitung, von Prof. Dr. E. Stechow. Vögel, von Dr. H. Sachtleben. (Suppl.-Band. Einleitung und 1 Abhandlung.) Pp. 232.
Steinzeitliche Funde aus Lithauen, von Prof. Dr. F. Birkner. Parasitische Insekten aus Lithauen, von Prof. Dr. Günther Enderlein. Parasitische Trematoden aus Lithauen, von Dr. L. Scheuring. Biologische Beobachtungen, von Prof. Dr. E. Stechow. (Suppl.-Band. 2-5 Abhandlung.) Pp. 233-256+6 Tafeln.
Die Zweiflügler des Urwaldes von Bialowies, von Prof. Dr. P. Sack. Hymenoptera (Aculeata, Ichneumonidae, Chalastogastra), von Dr. H. Bischoff. Trichopteren und Ephemeropteren aus dem Bialowieser Wald, von Dr. G. Ulmer. Über Waldbienenzucht in Lithauen und einigen Nachbargebieten, von Dr. H. Klose. (Suppl.-Band. 6-9 Abhandlung.) Pp. 257-406+9 Tafeln.
(München: Verlag der Bayerischen Akademie der Wissenschaften.)

Of the nuthatch, two forms occur, called *Sitta europaea europaea* and *S. eur. homeyeri*. This led the author to review the European forms of Sitta in 26 pages, and to supply a large folding map, showing their distribution and representing nine forms in colour. He explains that the extremes are very different, and must be named *Sitta europaea europaea* (Sweden) and *S. europaea cisalpina* (Italy), the former being the whitest, the latter the most richly coloured one, and that *caesia* (western and central Europe generally) and *homeyeri* (East Prussia, Baltic States) might have names, but that the various forms completely merge into each other; therefore he rejects the use of the names *sordida*, *reichenowi*, and *stolcmani*, as given to changeable, insufficiently defined units. He thus does not differ much from the arrangement in the "Vögel der paläarktischen Fauna," vol. 1 (1905), except that there the Italian form was only indicated, but not supplied with a name; of the British form with its pallid underside and the Spanish-Moroccan one he had no specimens to examine, and therefore only alludes to the former without comment.

The Lithuanian long-tailed tit belongs to the northern subspecies with entirely white head, *Aegithalos caudatus caudatus*, while the British form has wide black lateral stripes, and in central Europe a form is widely spread with the head either pure white without or with lateral black stripes. Of the genus Regulus (Goldcrest) only *R. regulus* is found, as in England, while in central Europe two species, *R. regulus* and *R. ignicapillus*, occur side by side, the latter becoming dominant in southern Europe, and being the only one inhabiting the forests of north-west Africa (Morocco, Algeria, and Tunisia). Woodpeckers are very well represented; besides the three British species (all in different subspecies), the black, the white-backed, the middle spotted, and the three-toed woodpecker inhabit the vast forests, the latter in a differentiated new subspecies, called *Picoides tridactylus stechowi*.

Where different geographical forms are separable, the northern one is in nearly all cases the one found in Lithuania. Exceptions are the bluethroat (*Cyanosylvia svecica cyanecula*) and the yellow wagtail (*Motacilla flava flava*), which are represented by the central European subspecies, while of Sitta the northern and central European forms meet, Picoides being intermediate between the northern and central European (mountain) forms, and the crested lark (*Galerida cristata*), and the buzzard (*Buteo buteo intermedius*) showing eastern influence.

INSECTS.

Four articles in the publications under notice are devoted to the natural history of Lithuania and neighbouring provinces. The first article (pp. 259-277) is by Dr. P. Sack, of Frankfurt a. M., and contains an enumeration of Diptera found in the "Urwald von Bialowies." In so far as certain families are concerned, the list is evidently far from complete, and the Brachycera and Cyclorrhapha appear to have been better worked than the Nematocera. The region is apparently rich in Syrphidæ and the larger Asilidæ, no less than seven species of Laphria, for example, being recorded.

Dr. H. Bischoff, of Berlin, gives a general list of the Lithuanian Hymenoptera, including the aculeates, ichneumons and saw-flies. This contribution appears to be remarkably complete, and it includes useful data respecting localities and times of occurrence. Of the Aculeata it is a matter of interest to British entomologists to note that the genus Bombus is represented by twenty species and numerous varieties, while Psithyrus only comprises the same six species that occur in Britain. There are seven species of Vespa, two of which, *media* and *saxonica*, do not occur in Britain. The Chrysididæ are represented by seven genera and eighteen species. The region appears to be rather poor in ants, only twelve species being recorded. There is a long and valuable list of Ichneumonidæ and the Tenthredinoidea are tolerably well represented. The Trichoptera and Ephemeroptera of the Bialowieser Wald (pp. 339-342) are listed by the well-known authority, Dr. G. Ulmer of Hamburg: in the first-mentioned order forty-three species are enumerated, but only five species of Ephemeroptera are recorded.

The fourth article (pp. 343-406) is by Dr. H. Klose, of Berlin, who gives a very full illustrated account of the history and practice of bee-rearing in the forest regions. Of special interest are the curious vertical log-hives used in that part of the world. Some of the older forms of these are carved with bizarre human effigies and several are figured from the "Brandenberg Beweherte Bienen-Kunst," dated 1696.

Annual Meeting of the Association of Technical Institutions.

THE annual general meeting of the Association of Technical Institutions was held in Regent Street Polytechnic on March 5 and 6. The new president (the Marquis of Londonderry) was unable to be present, and his presidential address was read by Lord Emmott, who prefaced his reading with a reference to the unofficial Committee which is at present inquiring into the relationship of technical education to other forms of education and to industry.

That the time is ripe for such an inquiry became evident during the Conference. Three of the papers submitted dealt with the education of employees in distributive trades—a matter which has hitherto received little attention. Prof. Knox's paper on "Recent Developments in the Teaching of Mining in Technical Colleges" was particularly noteworthy in view of recent suggestions that the mines of Great Britain are inefficiently equipped and managed. His description of the general manager (whose staff organisation has three main divisions: colliery engineering, colliery managing, and chemical engineering) is illuminating and deserves reproduction:

"He is by innumerable Acts of Parliament held legally responsible for the safety of all workmen in and about the mines. Besides having to supervise all the work of . . . engineering departments he must be fairly expert in Geology and Surveying. . . . He must have an extensive knowledge of the Laws relating to Coal Mines, Use of Explosives, Use of Electricity in Mines, Workmen's Insurance and Compensation . . . the Law relating to Leases, Surface Supports, Trespass, Leasehold, and Copyhold, Railways, Local and Imperial Taxation, etc. Last, but most important of all . . . he requires to have a knowledge of psychology and be imbued with a broad understanding in the handling of workmen."

Lord Londonderry's theme included the twin problems of the increase in the numbers entering the 'black-coated' professions and the serious lack of skilled manual workers (which will be felt most keenly when industry revives). In spite of the development of scientific appliances and automatic machinery, he insisted upon the continued necessity for good craftsmanship, and submitted that preference is being

given to 'black-coated' occupations because of causes not often considered. In the past we have allowed the manual worker to become skilled at the expense of his intellectual equipment: his formal education usually ceases after the elementary school —a matter which needs attention if there is ever to be a redress of the social balance to the advantage of the craftsman as opposed to the clerk. During recent years, too, there has been the factor of the enhanced cost of living: boys must earn quickly, and 'blind-alley' jobs have been accepted eagerly. Further, there can be no doubt that, not only does unemployment fall most heavily on the skilled worker during trade depression, but wages, too, in those times, fall below those for unskilled work. What incentive is there for parents to send a boy to a long apprenticeship if, at the end, he may receive 10*s*. per week less than an unskilled man? The obsolete apprenticeship system is a final point requiring reconsideration: among the many things the War taught us is the fact that a long apprenticeship is not always necessary for the production of skilled workers.

The most animated discussion of the Conference, however, centred round the question of 'Adult Education.' A Board of Education Circular (1355) appears to encourage local education authorities to organise and control 'adult education,' although intimate administration might be delegated to voluntary organisations acting as advisory committees or managing bodies. Prominent among such organisations is the Workers' Educational Association, but opinion concerning it appears to have been divided because it is alleged to have ceased to be an entirely independent organisation since it became one of the contributory bodies to a new scheme with the Trades Union Congress, and must therefore tend to be governed by the latter in its educational policy.

As part of the Conference, a paper on "The Place of the Local College (Technical Institution) in Adult Education" was read by Prof. Peers, and, in the discussion, opinion was divided as to whether local education authorities should, or should not, accept financial responsibility for this type of education. The whole matter is to be discussed further, but it is to be regretted that no one attempted to define 'adult education.' Education has suffered considerably from the tendency to divide it into water-tight compartments. Already we have elementary, secondary, technical, and university education. Now another term is used to describe something which is looked upon as another compartment. No wonder there is confusion of objects and aims! A body of students (age 20 years plus) under a voluntary organisation studies psychology; that is 'adult education.' Students of the same age study engineering or commerce (in their broadest implications) in a technical institution: this type of education appears to be regarded as outside the field of adult education.

An ancient error still persists. Technical education is regarded as synonymous with vocational instruction. What are the facts? In most technical institutions the course subjects are so presented that they become an education liberal in the fullest sense. Again, in such schools there is always a large percentage of students taking subjects which are thoroughly non-vocational. These facts do not appear to be well known. The inquiry referred to by Lord Emmott is therefore timely.

The Fate of the Hexosephosphoric Acid Esters in the Mammalian Organism.

THE importance of compounds of hexose and phosphoric acid, both in the intermediary metabolism of carbohydrates and in the process of ossification, is now well established. One need only mention the origin of the lactic acid of striated muscle from a hexosediphosphate, the connexion between inorganic phosphorus and glucose in the mechanism of the action of insulin, the occurrence of hexose-phosphates in the fermentation of yeast, and the hydrolysis of one of these esters present in the blood by means of extracts of bone. But our knowledge of their physiology is still very incomplete, so that interest is attached to any work which helps to fill the gaps. O. Fürth and J. Marian (*Akad. Wissensch. Wien*, 1925, No. 18, p. 175) have attempted to follow the fate of the hexosediphosphoric acids in the mammalian organism, by injecting a pure neutral or acid sodium salt subcutaneously into dogs; this route was chosen in preference to feeding by mouth in order to avoid any bacterial decomposition in the intestine. It was found that the diphosphate was broken down; part of the phosphorus appeared in the urine as inorganic phosphate, but about half was retained in the body, together with all the hexose. The authors suggest that the portion retained was utilised by muscle in the formation of lactacidogen. No effects were produced on the general metabolism even by doses so large as 40 gm. per kilo. body weight. It is of interest to note that some preliminary chemical experiments have led the authors to suggest that the molecules of these compounds may possess a cyclic structure.

Fürth and Marian have shown that a hexose-diphosphate can be utilised by the body after parenteral administration. H. D. Kay in some recent work (*Biochem. Journ.*, 1925, vol. 19, p. 433) has brought forward some evidence as to the tissues in which this destruction occurs. In an investigation into the phosphorus compounds of milk, he has found at least two organic acid-soluble phosphorus compounds in cow's, goat's, and human milk, one of which is readily hydrolysable by tissue extracts whilst the other is more stable. The fact that muscle extract does not hydrolyse the compounds at all readily suggests that they are not of the yeast hexosediphosphate type, although preliminary experiments indicate that the one, which is attacked by bone enzyme, is probably a hexosephosphoric acid ester. Of more interest in connexion with Fürth and Marian's work is the finding that the compounds present in milk are not attacked by saliva, gastric or pancreatic juice, but are broken down by the intestinal juice. On the other hand, most of the tissue extracts examined were active in this respect, including both extracts of gastric mucosa and pancreas, although the external secretions of these latter were inactive.

It appears, therefore, that hexosephosphates are hydrolysed in the gut before absorption, but the general presence of hydrolytic enzymes in the tissues implies that under suitable conditions the latter will be able to synthesise these compounds, as is also suggested by the fact that the esters occur in the circulating blood. Kay finds that phosphorus is present in milk in no fewer than eight different forms, including free phosphate, caseinogen, phosphatides and acid-soluble esters, and suggests that this abundance is to ensure adequate absorption of this element. The compounds will be hydrolysed at different levels in the gut, and it is thus possible that the concentration of PO_4''' ions will be kept so low that the solubility product of calcium phosphate is not exceeded, thus obviating the precipitation of this insoluble salt in the alkaline or neutral contents of the intestine, with the resultant loss of both calcium and phosphorus in the fæces.

University and Educational Intelligence.

ABERDEEN.—Mr. G. Leslie Purser has been appointed lecturer in embryology. Mr. W. H. Bruford, reader in German, Mr. J. Macfarlane, reader in geography, and Dr. J. P. Kinloch, lecturer in public health, have been appointed members of the Senatus Academicus.

The University Court has resolved to institute a post-graduate course of study in the faculty of medicine, during the ensuing summer term, for the benefit of practitioners in the north-east of Scotland.

CAMBRIDGE.—Mr. A. Hutchinson has been reappointed demonstrator in mineralogy and assistant curator of the Mineralogical Museum.

L. R. Bishop, scholar of Trinity College, has been appointed to a Frank Smart studentship in botany. He was placed in Class I. in the Natural Sciences Tripos in 1925, and is engaged in research on respiration in plants.

Rayleigh prizes have been awarded to R. C. Cooper, of Trinity College, and H. Horrocks, of St. Catherine's College, for essays on "Some Inequalities applicable to the Theory of Functions" and "The Effect of Wind on Tides and Currents and the Decay of Waves in a Circular Basin" respectively.

Smith's prizes have been awarded to G. S. Mahajani, of St. John's College, who wrote on the theory of ferromagnetic crystals, and Ll. H. Thomas, of Trinity College, whose essay dealt with Kronecker's theorem in relation to adiabatic invariants.

The University Appointments Board has presented the annual report reviewing the work during the past year of the Board and the present position of the labour market as it affects students who have finished their university courses. It is stated that there are many opportunities available for men with a knowledge of both chemistry and engineering; another point of importance is that there is a lack of candidates for good appointments on the educational side in the Dominions.

LONDON.—The title of professor of physiology in the University has been conferred on Dr. J. S. Edkins, in respect of the post held by him at Bedford College. During the War, Prof. Edkins was a member of the Physiology Committee of the Royal Society and of the Grain-Pest Committee, and he also acted as secretary of the Chemical Warfare Medical Committee (a joint committee of the War Office and Medical Research Council). Since October 1911 he has published a text-book on practical physiology (with Pembrey, Beddard, L. Hill, and McLeod) and papers on the physiological and histological effects of poisonous gases and vapours, on the effect of various gaseous reagents upon the flour moth (*Ephestia Kühniella*) and other pests found in flour, and more recently on parasitic organisms in carnivores and on an organism normal to the human stomach.

OXFORD.—On March 9 the second annual report of the Committee of Management of the Lewis Evans Collection of Scientific Instruments was presented to Convocation. The report deals, in the first place, with the public opening of the collection on May 5, 1925, and then proceeds to record the work done on the structure of the Old Ashmolean Museum, which has resulted in the restoration of one of the features originally provided by Wren. The complete text of the mural inscription over the old Library door has now been recovered, and its restoration has been thereby rendered possible. A list is given of accessions during the past year; many of these are of great interest. They include an early example of a Sprengel mercury pump, a seventeenth-century pharmacy jar for the reconstruction of one of Mayow's experiments on respiration, and a copy of Lieut.-Col. F. Pepys-Cockerell's well-known portrait of Samuel Pepys, F.R.S. A beginning has been made with the construction of models of obsolete instruments, notably the 'perspectograph' and bowl level designed by Wren for the rebuilding of London after the Great Fire. Prof. Jenkin has made a special study of the astrolabes in the collection, and has published an explanatory book. Many collections have been deposited on loan; among the contributors being New College, St. John's College, and the Curator of the Daubeny Laboratory at Magdalen College. The Library has been enriched by the accession of works by Elias Ashmole, given by his representative, Mr. Bernard Ashmole. An account of the whole collection has been published by the Clarendon Press, under the title of "Historic Instruments for the Advancement of Science." At the conclusion of the report, the energetic Curator, Mr. R. T. Gunther, fellow of Magdalen College, directs attention to the need for service rooms and accommodation for office work in the Ashmolean Building itself; the deficiency being at present supplied by the provision of part use of the Curator's private study at Folly Bridge.

SHEFFIELD.—The Council of the University has decided to confer the title of honorary professor of mining on Mr. Douglas Hay, formerly professor of mining.

The following appointments have been made: Dr. D. C. Harrison to a lectureship in pharmacology; Mr. H. Blacow Yates to a part-time demonstratorship in anatomy; Mr. R. A. Mott to the post of research assistant in fuel.

THE doctorates conferred in the sciences by American universities have increased in number sixfold during the past twenty-five years, the number conferred in 1900 and 1925 being 102 and 621 respectively. The Research Information Service of the National Research Council has compiled annually since 1919–20 a classified list of the theses of the recipients of these degrees and a statistical analysis by university and by subject is published in *Science* of December 25, 1925, with an announcement that statistics regarding the doctorates in chemistry and a list of dissertations covering the period 1922–23 to 1924–25 will appear in the *Journal of Chemical Education*. The list of the theses is on file in the Research Information Service, and information regarding them will be furnished on request. Of the 621 doctorates conferred in the sciences in 1925, no less than 244 are classified under the head of chemistry. Zoology and botany come next with 71 and 65 respectively. These three with physics (56) and psychology (51) include more than three-fourths of the total number of doctorates, the remainder being distributed among geology (25), mathematics (22), bacteriology (20), physiology (17), agriculture (13), geography (13), and eight other sciences (24). The number of doctorates conferred in mathematics has decreased noticeably since the War years, whereas almost every other subject shows an increase. Of the seven hundred and odd degree-conferring institutions in the United States, only forty-one conferred the doctorate in science in 1925, and of these, Wisconsin, Chicago, and Columbia head the list with 64, 59, and 51 respectively. Harvard conferred only 25.

Contemporary Birthdays.

March 21, 1861. Sir George Hadcock, K.B.E., F.R.S.
March 21, 1873. Dr. Andrew Balfour.
March 21, 1865. Right Hon. Herbert A. L. Fisher, F.R.S.
March 22, 1868. Dr. Robert A. Millikan.
March 25, 1863. Dr. Simon Flexner, For.Mem.R.S.

Sir GEORGE HADCOCK, formerly an officer in the Royal Artillery, is managing director of Sir W. G. Armstrong, Whitworth and Co., Ltd. He is an associate member of the Ordnance Committee. Sir George has written much on modern artillery developments. He is Hon.D.Sc. (Durham).

Dr. ANDREW BALFOUR was born at Edinburgh and educated at George Watson's College, and at the Universities of Edinburgh, Cambridge, and Strasbourg. He was Director of the Wellcome Tropical Research Laboratories, Khartoum, 1902–13, and for most of that period Medical Officer of Health, Khartoum. In 1918 he was president of the Egyptian Public Health Commission. Dr. Balfour is Director of the London School of Hygiene and Tropical Medicine.

Mr. FISHER is a Londoner, and was educated at Winchester, New College, Oxford, and at Paris and Göttingen. He was Vice-Chancellor of the University of Sheffield, 1912–16; then he became President of the Board of Education, holding office until 1922. In 1925 he was designated Warden of New College, Oxford. He is also a trustee of the British Museum. Mr. Fisher delivered the Lowell lectures at Boston, Mass., in 1909 and 1924. He was a member of the Royal Commission on the Public Services of India, 1912–15.

Dr. MILLIKAN, Director of the Norman Bridge Laboratory of Physics, Pasadena, California, was born at Morrison, Illinois, U.S.A. He graduated at Oberlin College, Ohio, and for two years afterwards taught elementary physics there; later on he occupied the chair of physics in the University of Chicago. He was Nobel laureate in 1923. Dr. Millikan's researches in the fields of electricity, optics, and molecular physics have been of outstanding importance. Most notable was the measurement of the charge of the electron. It was recorded that "this work furnishes the most direct and complete demonstration which has yet been found of the atomic structure of electricity." Recently he has announced the discovery of high-frequency radiation of cosmic origin. Dr. Millikan was Hughes medallist of the Royal Society in 1923. He is the author of "Science and Life" (1923).

Dr. SIMON FLEXNER was born at Louisville, Kentucky, and took his doctorate in medicine at the university of that city in 1889. He studied also at Johns Hopkins University, and at the Universities of Berlin, Prague, Strasbourg, and Paris. At the first-named he was professor of pathological anatomy, 1889–99, afterwards occupying a similar chair at the University of Pennsylvania until 1903, leaving to become Director of the Laboratories of the Rockefeller Institute for Medical Research, New York. He is an Officer of the Legion of Honour of France, Hon.LL.D., Cambridge, and D.Sc., Harvard, Yale, and Princeton Universities. Dr. Flexner is the author of many papers and monographs relating to bacterial and pathological subjects, including "The Bio-chemical Constitution of Snake Venoms"; "Epidemic Cerebrospinal Meningitis and its Serum Treatment"; "Experimental Epidemiology."

Societies and Academies.

LONDON.

Royal Society, March 11.—J. A. **Campbell**: The effects of ultra-violet radiation upon the metabolism of healthy subjects. Radiation by total rays (223 $\mu\mu$-770 $\mu\mu$) from the mercury-vapour lamp, or by the group of rays through blue uviol glass (290 $\mu\mu$-436 $\mu\mu$), or by the visible rays from either of these sources (400 $\mu\mu$-770 $\mu\mu$ and 400 $\mu\mu$-436 $\mu\mu$ respectively) has no effect upon the metabolism of healthy men, mice, or rats. When mice lie together in groups there is apparently a decrease of carbon dioxide output due to reduction of surface area. A simple method of estimation of carbon dioxide output and oxygen intake in small animals is described.—E. **Ponder**: A study of certain forms of inhibition and acceleration of hæmolysis. Four types are recognised: (1) the inhibition produced by plasma and serum, described by expressions which suggest an interaction between the plasma or serum and the lysis not unlike those which occur in adsorption processes; (2) the inhibition produced by certain bases, sugars, and neutral salts, which are described by linear expressions; (3) the acceleration produced by acids and by certain salts, also described by linear expressions; and (4) the acceleration produced by plasma or serum when added to a hæmolytic system in which the lysis is one of the bile salts or soaps. Types (2) and (3) are the most generally met with, and the expressions necessary for their description are given, the object of the study being to investigate the kinetics of such hæmolytic systems. In the case of substances the reaction of which is not neutral, the effect is not wholly dependent on the *p*H.—S. B. **Schryver** and H. W. **Buston**: The isolation of some undescribed products of hydrolysis of proteins. From the hydrolysis products of one of the oat proteins, two hitherto undescribed amino-acids were isolated by the authors' 'carbamate method' and were found in the non-basic fraction of the soluble barium carbamates. These latter can, by means of the zinc salts, be separated into three main fractions, one of which contained two amino-acids. These were separated by taking advantage of the fact that one gave a copper salt insoluble in methyl alcohol and the other a copper salt soluble in this solvent. The former has a formula corresponding with hydroxy-aminobutyric acid, $C_4H_9O_3N$, and gave a dibenzoyl compound, m.p. 112°, and a phenylisocyanate compound, m.p. 143°. The other amino-acid has a formula corresponding with hydroxyvaline, $C_5H_{11}O_3N$, and gave a dibenzoyl compound, m.p. 117°, and a phenylisocyanate compound, m.p. 145°. There is evidence of the presence of other undescribed substances.—A. W. **Greenwood** and F. A. E. **Crew**: Studies on the relation of gonadic structure to plumage characterisation in the domestic fowl. Into a brown leghorn hen, ovariotomised when four days old, the testes of a brother were implanted. The bird first assumed the plumage characterisation of the cock, but after a general moult its plumage became as that of a hen. Post-mortem examination revealed a small fragment of degenerate ovarian tissue left behind at the time of operation, an active right gonad of testicular structure, and abundant testicular tissue which had developed from the grafts. Ovarian and testicular tissues in respect of their own individuation seem to exert demands upon the general economy of the same kind but different in degree; the functioning of an ovary is physiologically more expensive, but it is possible to augment the demands of the testes until they become equivalent to the ovary. This hen became cocky-feathered because in her body

at this time there was active testicular tissue; later she became henny-feathered because the amount of testicular tissue had become greatly increased and had exerted demands upon the body equivalent to those of an active ovary.—E. P. **Cathcart** and W. A. **Burnett**: The influence of muscle work on metabolism in varying conditions of diet. A long series of muscle-work experiments were carried out on a human subject living on different types of diet: (1), low nitrogen, meat-free; (2), high nitrogen, meat-free; (3), as in (1), but meat extractives added; and (4), a meat-containing diet. The nitrogen exchange and the respiratory exchange were both studied. A definite rise in both the output of nitrogen and sulphur resulted from muscle work. Only a slight disturbance in the distribution of the nitrogen-containing constituents in the urine was noted. The consumption of oxygen seemed to be dependent to some extent on the nature of the food consumed.—E. **Fischer**: The heat liberated by the beating heart.

Royal Meteorological Society, February 17.—T. H. **Somervell**: On temperature at high altitudes; meteorological observations of the Mount Everest Expedition, 1924. The performance of any little extra work, such as even the recording of a temperature, is very irksome at high altitudes. Temperatures were usually recorded at 8.30 h., 12 h., and 16 h. each day, and readings were taken from a minimum thermometer freely exposed to the sky about one foot above the ground. The lowest temperature recorded from this freely exposed thermometer was at Camp 3 (21,000 ft.), the reading being −24° F. Only a few observations were taken at Camp 4 (23,000 ft.) towards the close of the expedition.—F. J. W. **Whipple**: The significance of the observations (above), and particularly the lapse rate of temperature with respect to height.—Vaughan **Cornish**: Observations of wind, wave, and swell on the North Atlantic Ocean. The speed of the waves measured directly by the time taken to run the length of the ship, and the period as measured by the intervals between their arrival, gives an observed speed in agreement with that calculated from the period by the usual mathematical formula. Using a new and speedy method for determining the period of waves at sea which permits the separation of the wave proper from the swell, it was found that when there was no crossing swell, the speed of the waves was so nearly equal to that of the wind that their crests were travelling in almost calm air. When there was a crossing swell, the wind was unable to produce waves travelling with nearly its own speed, the deficiency being increased when the crossing swell was not from a following but opposing direction. The height of the waves was also kept down by crossing swell; this leads to an underestimate of the force of the wind as entered in the ship's log. The direction of the wind is more reliably recorded by the general run of the waves.—L. G. **Garbett**: Admiral Sir Francis Beaufort and the Beaufort Scales of Wind and Weather.—Admiral Sir Francis Beaufort was for twenty-six years Hydrographer of the Navy. Extracts from Beaufort's private logs show the interest he took in the study of the weather. The Beaufort scales were devised in 1806 by Beaufort when in command of H.M.S. *Woolwich*, but were not introduced into the Navy until 1838, and then in a form somewhat modified from the original.—J. **Bartels**: On the determination of minute periodic variations. A method is described for obtaining the best possible values for amplitude and phase of a periodicity of given length, if the period is hidden by comparatively large irregular fluctuations. The scheme is applied to the determination of the lunar diurnal variation of atmospheric pressure in higher latitudes.

Linnean Society, February 18.—C. C. A. **Monro**: Polychæta of the *Alert* Expedition: families Hesionidæ and Nereidæ. This paper is the last of the series containing a systematic account of the Polychæta collected by H.M.S. *Alert* during her voyage in 1881–82. It is an account of the families Hesionidæ and Nereidæ and attempts to place the classification of the genus Hesione on a more satisfactory basis. All the examples are from the Indo-Pacific area.—J. **Ramsbottom**: "Fairy rings" in air-photographs.—F. O. **Bower**: A scheme of phyletic grouping of ferns. In "The Ferns," vol. 1., an analysis has been given of those criteria of comparison of the ferns which may be used with the view of their phyletic grouping. These have been arranged under twelve heads. An 'archetype' for the class would seem to be substantially similar to plants which were actually living in the Devonian period, namely the Psilophytales. It would consist of a simple upright shoot of radial symmetry, possibly rootless, dichotomising if it branched at all, and with the distinction between axis and leaf ill-defined. The whole plant would be relatively robust as regards cellular construction, and traversed by conducting strands with a solid xylem-core. The solitary sporangia would be relatively large and distal in position, with thick walls and a simple method of dehiscence, and each would contain numerous homosporous spores. Vol. 2 of "The Ferns," now passing through the press, is devoted to those ferns which both comparison and palæontology indicate as relatively primitive. They include all the eusporangiate ferns, together with certain families which have archaic features. The eusporangiate and leptosporangiate types, with intermediate types, are Simplices, and all date back to Mesozoic or even to Palæozoic time. Their existence makes it appear probable that in the course of descent a gradual transition took place from the eusporangiate to the leptosporangiate state. In vol. 3 of "The Ferns" an attempt will be made to trace the phyletic relationships between the various groups.

Faraday Society, February 22.—A. J. **Allmand** and R. H. D. **Barklie**: The influence of alternating currents in the electrolytic corrosion of iron. The corrosion of iron in alkaline solutions by direct current, alternating current, and by alternating current superposed on direct current has been investigated. The superposition of the two types of current causes relatively increased corrosion. A similar result has been found when using typical subsoil drainage liquid saturated with carbon dioxide. Experiments have also been carried out on the accelerating effects of added alkaline chloride on corrosion in alkaline solutions.—A. N. **Campbell**: The direct oxidation of manganous ion to permanganate. The conditions under which manganous ion can be anodically oxidised to permanganate have been studied, and the optimum conditions evaluated. Only permanganate is produced by this oxidation.—H. J. **Poole**: The elasticity of jellies of cellulose acetate in relation to their physical structure and chemical equilibria. The load-strain curve for cellulose acetate jellies bends continuously towards the load axis, suggesting a sponge-like or fibrillary structure of rigid material in the jelly. The elasticity in a solvent consisting of benzyl alcohol and water in constant ratio follows approximately the square of the concentration. Thus the material of the rigid phase exists as a result of a dynamic solvation equilibrium between the cellulose acetate and the solvent. Permanent deformation was not induced by heating and cooling temporarily deformed specimens, so the structure first formed on gelation is mainly of a permanent nature. Equilibrium in elastic properties

was only reached after a considerable period following a change in temperature. The creep under stress was studied and a coefficient of inner resistance proposed. Values of this coefficient run parallel with the viscosity of the parent sols. Benzyl alcohol as a solvent is deficient in OH groups. Partial replacement of benzyl alcohol by water resulted in a decrease in elasticity and an increase in solvation. On the other hand, partial replacement by xylene resulted in an increase in elasticity and a decrease in solvation.—F. G. **Tryhorn** and W. F. **Wyatt**: (1) The adsorption by a coconut charcoal of saturated vapours of some pure liquid. The adsorptive power at 20° C. of a purified coconut charcoal has been determined for fourteen liquids. The initial rate of adsorption, in accordance with the laws of diffusion, is proportional to the vapour pressure of the liquid, and inversely proportional to the square root of its molecular weight. For eleven of the liquids the velocity of adsorption is a discontinuous function of time. The discontinuities may correspond with the sudden formation of a liquid surface in the charcoal. (2) Stages in the adsorption by a coconut charcoal from vapour mixtures of alcohol and benzene and of acetone and benzene. The adsorption curves consist of three parts. The first stage is adsorption of the two components in a constant ratio. When the density of the adsorbed vapour exceeds a certain value, condensation to a liquid occurs in the charcoal. This marks the second stage, which continues until the liquid phase is in equilibrium with the bulk liquid. With the charcoal employed, this change occurred without further increase in the total number of moles adsorbed, and in every case involved displacement of alcohol or acetone by benzene. The difference between the compositions of the adsorbed liquid phase and of the bulk liquid is attributed to selective adsorption. The third stage of the adsorption process is one of isothermal distillation of the bulk liquid into the intergranular spaces of the charcoal, and is the result of the curvature of the liquid surfaces at the points of contact of the grains.—I. R. **McHaffie**: A device for circulating fluids under high pressure. This is essentially an electro-magnetically operated pump which by a suitable arrangement of valves produces a constant flow of gas in the desired direction. It has been used continuously for the circulation of air at pressures up to 100 atmospheres.

DUBLIN.

Royal Dublin Society, February 23.—W. E. **Adeney** and Miss B. B. **Dawson**: The estimation of organic matter in water by means of potassium bichromate and sulphuric acid. These reagents are used for the estimation of small quantities of oxidisable matter in water; the method is especially valuable for dealing with sewage liquors.—T. G. **Mason** and C. J. **Lewin**: On the rate of carbohydrate transport in the greater yam, *Dioscorea alata* Linn. Experiments carried out on a large scale in southern Nigeria proved that the average increase of tuber dry weight per stem amounted to 45 gm. a week during the period of maximum growth. Assuming the concentration of carbohydrates in the sieve tubes to be 25 per cent., this would represent a velocity of 88 cm. per hour. A movement at this rate through the sieve tubes being clearly impossible, it is concluded that, even if high concentrations are assumed, the phloem is incapable of transmitting the main flow of carbohydrate.—J. **Reilly**, P. J. **Drumm**, and C. **Boyle**: The production of lavender oil from Irish-grown plants. Preliminary experiments on the production of lavender oil from Irish-grown plants have yielded promising results. Further work on a larger scale is in progress. The possibility of the economic production of high-grade lavender oil in Ireland is considered.

EDINBURGH.

Royal Society, February 22.—Rev. T. Crouther **Gordon**: The finding of the Galilee skull. An excavating expedition was organised in the spring of 1925 by the British School of Archæology in Jerusalem, to examine some caves in Wadi 'Amud in Galilee. In the largest cave there were 110 cm. of stratified deposits on the floor, and below this a petrified layer of prehistoric flints. All the historic periods were represented by the 28 strata. Beneath two large stones in the Palæolithic level the frontal bone of a human skull was found, along with the malar bone, and the right half of the sphenoid bone, completely petrified. The pronounced supra-orbital ridges mark it as distinctly Neanderthal in type, and the associated flints testify to the same culture. It is the first trace of the Mousterian type of man outside of Europe.

MANCHESTER.

Literary and Philosophical Society, February 23.—T. A. **Coward**: (1) The vertebrates of the Manchester district; a contribution to the regional survey. There are moorland, foothill, lowland, mossland, and urban faunas. The true moorland fauna has, perhaps, the most exclusive character; it is confined to the higher hills to the north and east of Manchester, typical grouse-moors with spongy mosses and rocky outcrops. The foothill and lowland faunas have much in common, though certain animals are typical of each. The foothills lie south and west of the moors; the lowlands, partly agricultural, partly suburban, extend farther to the south and west, and contain many parks, woodlands, and lakes or meres inhabited by animals which are mainly characteristic of these environments. The mosslands are, or were, in the river valleys, and are in a transition stage, drainage and cultivation and the growth of residential areas constantly altering the character of the fauna. The urban fauna is that which is restricted by the populated areas, and it too suffers change through increase in population, but is recovering some of its former character under the influence of municipal protection and the provision of open spaces and parks. (2) The vertebrates of the Shetland Isles. Certain of the characters of the fauna are due to latitude and isolation. Terrestrial mammals are few, and one at least, the wood-mouse, is an insular form, having much in common with the mouse of the Faeroes; other animals owe their status to introduction rather than survival. Although there is a large passage avifauna, resident birds are not numerous in species though abundant in individuals; most of them have a marine life. Two of the resident passerine birds are insular forms, and others are of a northern type. Cetaceans and pinnipedes are more numerous than in any other part of the British Islands. The fish, except for migratory species like the herring, are of northern type. Thanks to protection, the birds are rapidly increasing in numbers, but other factors influence the spread and colonisation of the fulmar, gannet, and perhaps one or two other species.

PARIS.

Academy of Sciences, February 22.—A. **Lacroix**: A new eruption of the volcano of Reunion (December 30-31, 1925). This eruption took the same form as

that of September 12, 1924, and the lava is flowing in the same direction.—M. Georges Perrier was elected a member of the section of geography and navigation in succession to the late L. Gentil.—B. **Hostinsky**: The transformation of differential expressions.—N. **Saltykow**: The general integral of characteristics.—Paul **Lévy**: A theory of growth.—N. **Boneff**: The origin of satellites.—Thadée **Pecsalski**: The crystallisation and sublimation of the metals. Continuing previous experiments on the cementation of metals by salts, experimental proof is given of the sublimation of metals in contact with their salts, the vapours of the metals arising from the reduction of the chlorides.—**Michel-Samsœn**: The change of the coefficient of expansion of substances in the amorphous state. Experiments on silicates, borates and phosphates described in an earlier communication have been extended to amorphous organic substances. From the experiments detailed it is concluded that all bodies in the amorphous state show a discontinuity in the coefficient of expansion for a viscosity of the order of 10^{14} poises. To this discontinuity there corresponds a change in all the physical properties. In the case of the silicates this anomaly has been attributed to a change in the allotropic state of the silica. It is, however, a general property of matter.—Jean A. **Athanasiu**: The use of mixtures of water and alcohol in the electrometric study of reactions by precipitation. An enumeration of the advantages presented by the use of aqueous alcohol (30 per cent.) in place of water in some electrometric estimations of cerium, barium, mercury and lead.—S. **Glixelli** and Mlle. **Deniszczukowna**: The preparation and properties of solutions of antimonic acid.—Albert **Portevin**: The fringes due to cold hardening or corrosion. An account of the superficial deformations of the crystalline grains produced by polishing and of the effects shown after etching.—André **Kling** and Daniel **Florentin**: The hydrogenation of organic substances at a high temperature and under high pressures in the presence of non-hydrogenating catalysts. It was to be supposed that the addition of catalysts would lower the temperature at which hydrogenation under pressure takes place, and this has been confirmed by experiment. The examples given include the production of cyclohexane and normal hexane from cyclohexanol in the presence of alumina, and of benzene, toluene, xylene, etc., from naphthalene in the presence of ferric or aluminium chloride.—**Pastureau** and **Bader**: The chlorhydrins of some unsaturated $\alpha\beta$-ketones.—Albert **Michel-Lévy**: Crushed zones and mylonites later than the Stephanian in the crystalline Maures massif.—P. **Corbin** and N. **Oulianoff**: The chain of the Aiguilles Rouges in the alpine orogenic movement.—Casimir **Rouppert**: Benzidine as a reagent in living plants. An account of results obtained by the culture of the bean in weak benzidine solutions.—O. **Munerati**: The possibility of determining the age of grains of wheat by the temperature of their germination. From a study of the manner in which the seeds germinate when exposed at temperatures varying from 32° C. to 6° C., the age of the seeds, if collected within three years, can be accurately judged. It follows from this that the optimum germination temperature of seeds, at least so far as concerns cereals, is a function of the age of the seed.—Mlle. Panca **Eftimiou**: Nuclear evolution in the Exoasceæ.—Davy de **Virville**: The action of the subterranean medium on the mosses.—L. **Lavauden**: The presence of a cypress in the mountains of Tassili des Azdjers (Central Sahara).—Jules **Amar**: Growth and alimentary interactions.—L. **Fournier** and A. **Schwartz**: The preventive action of bismuth in experimental syphilis of the rabbit.

Official Publications Received.

Agricultural Experiment Station of the Rhode Island State College. Bulletin 202: Field Observations and Laboratory Findings in Paralysis of the Domestic Fowl. By Henry G. May, Ralph P. Tittsler and Kenneth Goodner. Pp. 20. (Kingston, R.I.)

Report of the Botanical Survey of India for 1924-25. Pp. 10. (Calcutta.)

New Zealand: Department of Lands and Survey. Annual Report on Surveys. Pp. 10. (Wellington, N.Z.: W. A. G. Skinner.) 6*d*.

Dominion of New Zealand: Department of Lands and Survey. Surveys and Maps: an Exposition of the Work, Methods and Organisation of the New Zealand Survey. Special Publication for Distribution at the New Zealand and South Seas Exhibition, Dunedin, 1925-26. Pp. 24. (Wellington, N.Z.: W. A. G. Skinner.)

Bureau of Education, India. Education in India in 1923-24. Pp. iv+73. (Calcutta: Government of India Central Publication Branch.) 14 annas; 1*s*. 6*d*.

University of California Publications. Publications of the Lick Observatory, Vol. 15: Meridian Circle Observations made at the Lick Observatory, University of California, 1904-1924. By Richard Hawley Tucker. Pp. 262. (Berkeley, Calif.)

Smithsonian Miscellaneous Collections. Vol. 73, No. 3: Opinions rendered by the International Commission on Zoological Nomenclature. Opinions 82 to 90. (Publication 2830.) Pp. 40. (Washington, D.C.: Smithsonian Institution.)

Report of the Secretary of the Smithsonian Institution for the Year ending June 30, 1925. (Publication 2834.) Pp. vi+122. (Washington, D.C.: Government Printing Office.)

Annual Report of the Director, United States Coast and Geodetic Survey, to the Secretary of Commerce for the Fiscal Year ended June 30, 1925. Pp. iv+79+23 plates. (Washington, D.C.: Government Printing Office.) 50 cents.

Koninklijk Magnetisch en Meteorologisch Observatorium te Batavia. Verhandelingen No. 8: Het Klimaat van Nederlandsch-Indië (The Climate of the Netherlands Indies). Door (by) Dr. C. Braak. Deel 2 (Vol. 2), Aflevering 1 (Part 1): Sumatra. (With English Summary.) Pp. v+156+67. Verhandelingen No. 17: Diepteloodingen in den Indischen Archipel (Depth Soundings in the East Indian Archipelago). Aflevering 1 (Part 1). Pp. 16. (Batavia: Typ. Javasche Boekhandel en Drukkerij.)

Field Museum of Natural History. Zoölogical Series, Vol. 15: The Marine Fishes of Panama. By Seth E. Meek and Samuel F. Hildebrand. Part 2. (Publication No. 226.) Pp. vii+331-707+plates 25-71. Museum Technique Series, No. 1: Herbarium Organization. By Charles F. Millspaugh. Pp. 18. (Chicago, Ill.)

Aeronautical Research Committee. Reports and Memoranda, No. 982 (M. 30): High-Frequency Fatigue Tests. By Prof. C. F. Jenkin. (M.C. 140.) Pp. 24. 9*d*. net. Reports and Memoranda, No. 983 (Ae. 195): A Comparison of Model and Full Scale Performance of the Bristol Fighter using Flight Lieut. Capon's Method of Presentation. (A.3.k. Misc. Model Expts., 50. A.4.b. Full Scale Work—Aeroplanes General, 126 (T. 2106).) Pp. 3+2 plates. 4*d*. net. (London: H.M. Stationery Office.)

Philosophical Transactions of the Royal Society of London. Series B. 415, Vol. 214: On a new Type of Crustacean from the Old Red Sandstone (Rhynie Chert Bed, Aberdeenshire)—*Lepidocaris rhyniensis*, gen. et sp. nov. By D. J. Scourfield. Pp. 153-187+plates 21-23. (London: Harrison and Sons, Ltd.)

Smithsonian Miscellaneous Collections. Vol. 77, No. 9: Fossil Footprints from the Grand Canyon. By Charles W. Gilmore. (Publication 2832.) Pp. 41+12 plates. (Washington, D.C.: Smithsonian Institution.)

Reprint and Circular Series of the Bureau of Standards. No. 63: Second Census of Graduate Research Students in Chemistry. By James F. Norris. Pp. 14. 15 cents. No. 64: International Biology; an Address prepared for the Third Pan-American Scientific Congress, held at Lima, Peru, December 20, 1924-January 6, 1925. Pp. 11. 15 cents. No. 65: The Vital Need for greater Financial Support of Pure Science Research; an Address presented upon the Henry Robinson Towney Lectureship before the American Society of Mechanical Engineers, New York City, December 1, 1925. By Herbert Hoover. Pp. 6. 20 cents. (Washington, D.C.)

Agricultural Research Institute, Pusa. Bulletin No. 162: Tentative Keys to the Orders and Families of Indian Insects. By T. Bainbridge Fletcher. Pp. iv+101+9 plates. (Calcutta: Government of India Central Publication Branch.) 1.4 rupees; 2*s*. 3*d*.

Conseil Permanent International pour l'Exploration de la Mer. Rédigé par Dr. E. S. Russell. Vol. 1, No. 1. Pp. 96. (Copenhague: Andr. Fred. Høst et fils.) 4.50 kr.

The Rockefeller Foundation: International Health Board. Eleventh Annual Report, January 1, 1924-December 31, 1924. Pp. xviii+179. (New York City.)

Department of the Interior: Bureau of Education. Bulletin, 1925, No. 25: Constructive Tendencies in Rural Education. By Katherine M. Cook. Pp. 27. 5 cents. Bulletin, 1925, No. 34: Educational Boards and Foundations, 1922-1924. By Henry R. Evans. Pp. 12. 5 cents. (Washington, D.C.: Government Printing Office.)

United States Department of Agriculture. Department Bulletin No. 1371: Effectiveness against the San Jose Scale of the Dry Substitutes for Liquid Lime-Sulphur. By W. S. Abbott, Julian L. Culver and W. J. Morgan. Pp. 26. (Washington, D.C.: Government Printing Office.) 5 cents.

Dominion of Canada: Department of Agriculture. Bulletin No. 58, New Series: A Survey of Canadian Plants in relation to their Environment. By J. Adams. Pp. 60. (Ottawa: F. A. Acland.)

Carnegie Institution of Washington. Annual Report of the Director of the Department of Terrestrial Magnetism. (Extracted from Year Book No. 24, for the Year 1925.) Pp. 171-220. (Washington, D.C.)

University of London: University College. Report of the University College Committee (February 1925-February 1926), with Financial Statements (for the Session 1924-25), and other Documents, for Presentation to the Senate. Pp. 106. (London: University College.)

Diary of Societies.

SATURDAY, MARCH 20.

BRITISH MYCOLOGICAL SOCIETY (at Lister Institute), at 11 A.M.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Sir Ernest Rutherford: The Rare Gases of the Atmosphere and their Importance in Atomic Theory (3).

INSTITUTE OF BRITISH FOUNDRYMEN (Lancashire Branch, Junior Section) (at Manchester College of Technology), at 7.—A. Hodgkinson: A General Talk on Foundry Work.

HULL ASSOCIATION OF ENGINEERS (at Hull Technical College), at 7.15.—W. A. Jackson: Machinery and Plant Maintenance in the Textile Trade.

PHYSIOLOGICAL SOCIETY (at University College).

MONDAY, MARCH 22.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Mr. Shattock: Demonstration of Specimens of Surgical Affections of the Kidneys.

INSTITUTION OF ELECTRICAL ENGINEERS (North-Eastern Centre) (at Armstrong College, Newcastle-upon-Tyne), at 7.—L. C. Grant: Developments in High Power Fuses.

ROYAL SOCIETY OF MEDICINE (Odontology Section), at 7.30.—F. N. Doubleday: Demonstration of Blood Films and Kiamographic Records of Hearts.—At 8.—F. N. Doubleday: Action of Local Anæsthetic Solutions on Living Cells.

ARISTOTELIAN SOCIETY (at University of London Club), at 8.—J. Levine: Naturalism and Values.

ROYAL SOCIETY OF ARTS, at 8.—W. F. Higgins: Thermometry (Cantor Lectures) (2).

ROYAL GEOGRAPHICAL SOCIETY (at Æolian Hall), at 8.30.

MEDICAL SOCIETY OF LONDON, at 8.30.—Prof. Blair Bell: The Use of Lead in the Treatment of Malignant Disease.

TUESDAY, MARCH 23.

ROYAL DUBLIN SOCIETY, at 4.15.—Prof. W. E. Adeney: On the Rate and Mechanism of the Aeration of Water under Open Air Conditions.—J. Bell: The Constitution of Dicyano Diamide with a Note on the Formation of a Mercury Deviative.—Prof. J. Doyle and Miss P. Clinch: The Pentoran Theory of Cold Resistance applied to Conifers.

ROYAL COLLEGE OF PHYSICIANS OF LONDON, at 5.—Sir Thomas Horder, Bart.: Endocarditis (Lumleian Lectures) (1).

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Prof. C. H. Desch: The Growth of Crystals (2).

INSTITUTION OF PETROLEUM TECHNOLOGISTS (at Royal Society of Arts) (Annual Meeting), at 5.30.—Sir Thomas H. Holland: Presidential Address.—Discussion on paper by Dr. Wade on The Search for Oil in Australia.

ZOOLOGICAL SOCIETY OF LONDON, at 5.30.—Secretary: Report on the Additions to the Society's Menagerie during the month of February 1926.—J. Omer-Cooper: A Revision of the Genus Periscyphis Gerst. (*Isopoda Terrestria*).—B. N. Schwanwitsch: On the Modes of Evolution of the Wing-pattern in Nymphalids and certain other Families of Rhopalocerous Lepidoptera.—R. I. Pocock: (*a*) The External Characters of the Jamaican Hutia (*Capromys brownii*); (*b*) The External Characters of the Flying Lemur (*Galeopterus temminckii*).

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY, at 6.30.—Prof. A. Sommerfeld: The Periodic System, Chemical Bonds, and Crystal Structure.

INSTITUTE OF MARINE ENGINEERS, at 6.30.—D. Brownlie: Super-Pressure Steam Generation.

INSTITUTION OF ELECTRICAL ENGINEERS (East Midland Sub-Centre) (at University College, Nottingham), at 6.45.—C. C. Sutton and J. H. R. Nixon: Power Factor.

INSTITUTION OF AUTOMOBILE ENGINEERS (at 83 Pall Mall), at 7.—Prof. J. J. Guest: The Main Free Vibrations of an Autocar.

SOCIETY OF CHEMICAL INDUSTRY (Glasgow Section), at 7.—R. Maclaurin: Causes of Reactivity and Inactivity in Cokes.

INSTITUTION OF ELECTRICAL ENGINEERS (North Midland Centre) (at Hotel Metropole, Leeds), at 7.—J. W. J. Townley: The Operation of a Modern Power Station.

ROYAL PHOTOGRAPHIC SOCIETY, at 7.—B. Park: A Glimpse of Corsica: l'île parfumée.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND (at 39 Elmbank Crescent, Glasgow), at 7.30.

INSTITUTE OF CHEMISTRY (Edinburgh and East of Scotland Section) (and Society of Chemical Industry (Edinburgh and East of Scotland Section)) (at 36 York Place, Edinburgh), at 8.—Sir W. H. Perkin: The Early History of Ring Closure.

WEDNESDAY, MARCH 24.

SOCIETY OF CHEMICAL INDUSTRY (Chemical Engineering Group) (at Chemical Society), at 3 and 6.—Symposium on Bearings and Lubricants:—R. Amberton: Roller Bearings.—R. Allan: Ball and Roller Bearings: Characteristics affecting their Practical Application and Use.—Dr. A. E. Dunstan and R. W. L. Clarke: The General Properties of Lubricating Oils and their Practical Application.—J. E. Hackford: Some Characteristics of Lubricating Oils.

INSTITUTE OF HYGIENE, at 3.30.—Lieut.-Col. R. H. Elliot: Eye Troubles of School Life.

ROYAL SOCIETY OF MEDICINE (Comparative Medicine Section) (jointly with Electro-Therapeutics Section), at 5.—Dr. J. F. Halls Dally: Ultra-violet Radiation in Man.—E. Middleton Berry: The Therapeutic Effects of Ultra-violet Rays and High Frequency Currents in Animals.—Prof. Leonard Hill, Dr. Weinbein, Dr. H. Munro, H. Stainton, and Dr. L. Dobson: Discussion on above.

GEOLOGICAL SOCIETY OF LONDON, at 5.30.—Sir T. W. Edgeworth David: The Physiography and Tectonic Structure of the Commonwealth of Australia (Lecture).

RADIO SOCIETY OF GREAT BRITAIN (at Institution of Electrical Engineers), at 6.—Prof. E. W. Marchant: Fading (Lecture).

ROYAL MICROSCOPICAL SOCIETY (Industrial Applications of the Microscope Section), at 7.30.—James Swift and Son, Ltd.: Exhibition of Prof. S. J. Shand's Recording Micrometer and a Screw Measuring Microscope.—R. and J. Beck, Ltd.: Exhibition of (1) Proof Plates; (2) Lewbeck Micrometer; (3) Cobweb Micrometer; (4) Micrometer Eyepiece; and (5) Barnard's Interferometer Plates.—At 8.—W. H. Johnson: The Use of the Microscope as a Measuring Instrument.

THURSDAY, MARCH 25.

CHEMICAL SOCIETY (Annual General Meeting) (at Manchester University), at 4.—Dr. A. W. Crossley: Presidential Address.

ROYAL SOCIETY, at 4.30.—E. B. Verney: The Secretion of Pituitrin in Mammals, as shown by Perfusion of the Isolated Kidney of the Dog.—H. W. Florey and H. M. Carleton: Rouget Cells and their Function.—*To be read in title only*:—Seana King: Oogenesis in *Oniscus asellus*.—R. M. Sargent: The Relation between Oxygen Requirement and Speed in Running.

ROYAL COLLEGE OF PHYSICIANS OF LONDON, at 5.—Sir Thomas Horder, Bart.: Endocarditis (Lumleian Lectures) (2).

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Prof. J. Holland Rose: The Indecisiveness of Modern Warfare (2).

ROYAL AERONAUTICAL SOCIETY (Students' Section), at 6.—S. S. Hall: Stalled Flying.

BRITISH ASTRONOMICAL ASSOCIATION (West of Scotland Branch) (at Royal Technical College, Glasgow), at 7.30.—Rev. J. T. Bird: Austral Orientation, with Special Reference to the Calendar and to the Teaching of Geography.—Dr. G. D. C. Stokes: The Equation of Time.

INSTITUTE OF CHEMISTRY STUDENTS' ASSOCIATION (London), at 8.—Debate.

TUBERCULOSIS SOCIETY (jointly with Society of Superintendents of Tuberculosis Institutions) (at Cambridge).—Sir Humphry Rolleston, Sir St. Clair Thomson, Prof. E. Collis, Prof. L. Cummins, Dr. J. Crocket, and Dr. G. Marshall: Communications.—Demonstration by Dr. H. De Carle Woodcock: Apparatus for Artificial Pneumothorax.—Dr. C. Riviere, Dr. V. Pearson, M. Davies, and Dr. P. Morgan: Discussion on the foregoing.

FRIDAY, MARCH 26.

ELECTRICAL ASSOCIATION FOR WOMEN (at Holophane, Ltd., Elverton Street, S.W.), at 3.—Scientific Illumination.

PHYSICAL SOCIETY OF LONDON (at Imperial College of Science and Technology), at 5.—I. Backhurst: Obliquity Corrections in Radium Estimation.—Dr. A. Griffiths and P. C. Vincent: The Viscosity of Water at Low Rates of Flow, Determined Comparatively by a Method of Thermal Convection.—Dr. E. H. Rayner: Demonstration of Some Simple Experiments with Thermionic Valves.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Sir Arthur Keith: Demonstration of Specimens of Spina Bifida and Allied Conditions.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS (Metropolitan District Meeting), at 6.30.—J. Garvie: The Life of Wood Paving as affected by Expansion.

INSTITUTION OF MECHANICAL ENGINEERS, at 7.—S. Hunter and others: Discussion on 'Perlit' Iron.

ROYAL PHOTOGRAPHIC SOCIETY, at 7.—J. MacSymon: A Criticism of the 1925 Competition Prints.

ROYAL SANITARY INSTITUTE (at Guildhall, Derby), at 7.—Dr. P. Turton, Dr. E. Milligan, and others: Discussion on Goitre.—C. A. Clews and others: Discussion on Some Aspects of the Housing Problem.

MANCHESTER ASSOCIATION OF ENGINEERS (at Engineers' Club, Manchester), at 7.15.—P. W. Seemer: Hydro-electric Engineering.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—A. B. Miller: Metal Aeroplane Construction.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Sir Ernest Rutherford: The Radiation from Atomic Nuclei.

SOCIETY OF CHEMICAL INDUSTRY (Chemical Engineering Group).—Symposium on Bearings and Lubricants.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

TUBERCULOSIS SOCIETY (jointly with Society of Superintendents of Tuberculosis Institutions) (at Cambridge). (Continuation.)

SATURDAY, MARCH 27.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Sir Ernest Rutherford: The Rare Gases of the Atmosphere and their Importance in Atomic Theory (4).

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS (at Neville Hall, Newcastle-upon-Tyne), at 3.—J. F. C. Friend: Winding Ropes.

TUBERCULOSIS SOCIETY (jointly with Society of Superintendents of Tuberculosis Institutions) (at Cambridge). (Continuation.)

PUBLIC LECTURES.

SATURDAY, MARCH 20.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—C. Daryll Forde: Agriculture and the Origin of Civilisation.

MONDAY, MARCH 22.

MAIDSTONE.—Sir Wilfred Beveridge: Insects in Relation to Public Health (Chadwick Lecture).

THURSDAY, MARCH 25.

DYERS' HALL (Dowgate Hill, E.C.), at 6.—Dr. H. Levinstein: The Dyestuff Industry and the State.

SATURDAY, MARCH 27.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Dr. H. S. Harrison: Early Man and his Wanderings.

CONGRESS.

APRIL 2 TO 23.

JERUSALEM AND BEIRUT, INTERNATIONAL ARCHÆOLOGICAL CONGRESS.