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Scientific Medicine.

MUCH of the more important subject matter of the annual report of the Medical Research Council recently published, and dealt with elsewhere in this issue (p. 598), was brought to public notice by the newspapers as occasion arose. The establishment at University College Hospital of a department of clinical research is an example. Scientific results achieved or foreshadowed during the year under review were many and valuable, and to be able to say of such a year that it "illustrates the general features that have marked the progress of modern medical investigation throughout the world during the present generation" is an indication of solid attainment. Nevertheless, there are two sides to progress—progress in discovery and progress in organisation; and the phrase quoted is strictly relevant to an argument concerning the machine and its design rather than its output.

This argument, unobtrusive but intense, affords an answer to professional criticism, which, having filled out its voice in the correspondence columns of the *Times*, died away again last summer, its 'airy swellings', unlike the music in "Endymion", unrevived. They will be revived sooner or later, for the sufficient reason that "the study of disease as such is by no means the only field of medical research: it is a field indeed that work in all the other fields is actually aimed at reducing". For the time being, the Medical Research Council resolves this dualism within its own organisation; but it cannot resolve it elsewhere. It holds a balance between the claims of investigations which lead at best to results of professional and technological value and the claims of what the authors of the report call the "intensive pursuit of the more primary studies" that serve medical science.

Fortunately from an evidential point of view, unfortunately otherwise, what sort and standard of investigation is deemed specially desirable by the Council's critics is revealed by the plans in existence for a research laboratory in the grounds of Charles Darwin's house, where young men waiting for hospital appointments are to wait less unprofitably than they wait now. Since a feather would turn the Council's scale in favour of applications, and since the existence of a laboratory for experimental surgery might as easily increase as diminish the clamour for a more professional outlook, it is not to be counted altogether a gain that the poise within the Council itself is so delicately adjusted.

Work accumulates faster than funds. Increasing responsibilities are laid upon the Council by the growth of work within the range of the Therapeutic Substances Act. "This growing burden depends in part upon the advisory relations of the Council to the routine administration of the Act. For the rest, it consists in the active promotion of research work concerned with the preparation and use of standards of reference for the proper assay of biological substances." It is urged that such work for the protection and assistance both of the public and of the medical profession is valuable. Of course it is, and so is the part played by the League of Nations in gaining international adherence to common standards. It is urged that the Council is charged by Parliament with the duty of aiding "from a narrowly limited fund whatever, being needy, is most fruitful and most hopeful" either in applications or in fundamentals, and that this duty is onerous. Of course it is. It is urged that the curative work of the physician or surgeon is vitally important but is not the sole concern of medicine, which increasingly, step by step as knowledge advances, is concerned "with the sciences and arts of preventive work in all its kinds". "The science of nutrition, newly born almost within this generation, is bringing into sight new possibilities of greatly augmenting the preventive services of medicine and of setting in the middle of the picture not so much the attack upon declared disease as the establishment of right development and full health." The management of life, in industry and in the home, replaces the control of active disease.

It is harder to delimit the boundaries to be set to medical research than to describe its major concerns. The Council gives up the attempt, falling back upon the words of the Ormsby-Gore Research Co-ordination Sub-Committee: "Medical research deals by no means only with the cure of disease. It deals with the proper development and the right use of the human body in all conditions of activity and environment as well as with its protection from disease and accident and its repair."

Scientific medicine is no longer preoccupied by disease, which was "the earliest preoccupation of medicine". Yet the report asks us to "think of it" as being still so preoccupied, in order that we may appreciate the dependence of the modern clinical worker "more and more upon the tools and methods of the laboratory". Problems are taken from the bedside to the laboratory for their solution and there new problems are distilled for exploitation in the clinic. Was Emerson the origin of this compensatory theme? "It is thus written, because it is thus in life. Our action is overmastered, and characterised above our will by the law of nature. We aim at a petty end quite aside from the public good, but our act arranges itself by irresistible magnetism in a line with the poles of the world." At all events, Emerson was equal to the theme to the end. If "an inevitable dualism bisect nature", compensation lurks: "the man or woman who would have remained a sunny garden-flower, with no room for its roots and too much sunshine for its head, by the falling of the walls and the neglect of the gardener, is made the banian of the forest, yielding shade and fruit to wide neighbourhoods of men".

It is to be hoped that the compensatory ingenuity of the Medical Research Council will equal the transcendentalist's in compassing the termination of its theme when the time comes. But that is not yet. "By far the greater part of the work the Council aid or initiate is done within the Universities or in Hospitals serving Universities. In this way the work gains not only from the intellectual freedom that belongs to University life and the opportunities that it brings of stimulating and recruiting youth, but it gains also by the use of material resources derived from other funds, both public and private, ancient and recent, without which not one half of the work now to be described could have been sustained." The weights are indeed exquisitely poised. It is, however, a wholesome reminder of realities to turn back a page or two to the confession that the contrasted (not compensatory in this case) tendencies of modern medicine, the extensive and the intensive, must each "bring its own difficulties". Nevertheless, it cannot be said that these have been obscured for readers familiar with them.

The Council, it seems, is marking time. It has arrived, as it were, at a definite stage in the race, the egg still in the spoon. Hints of future policy are scarcely discernible. A year ago there was some expectation of a policy of centralisation. It is not suggested in these pages. Praise of the universities is mere 'thank you', and gratitude is not always a vivid sense of benefits to come. Clinical research is policy active, and assay of biological substance an obligation. Policy waits on politics and the exchequer: whether England will prefer to receive modernisation at the hands of M. André Siegfried or Sir Oswald Mosley or will prefer not to receive it at all. It is all very well for Germans to remember "as an object-lesson of the conception of the State's functions,

that Prussia founded the University of Berlin in the days of her deepest political depression", in the words of General von Seeckt. Germany is not England, but a country that believes in what it calls "geistige Macht". Abraham Flexner ("Universities, American, English and German") may be right, and "To be frank, despite their great scholars and scientists and ours this sort of thing does not come easy to either Great Britain or America".

Flexner, an acute, if strongly individualised observer of the state of scientific organisation the world over, has it on the same page: "The creation of the University Grants Committee, the Medical Research Council, the Department of Scientific and Industrial Research indicates recognition of the fact that England lacks modern universities. The organisations just named give temporary relief—a block grant, support for a promising investigator or an important investigation. Such agencies are not superfluous; under all circumstances they have their uses; but they are no substitute for universities, amply endowed, amply equipped, and amply attended by a sufficient group of men and women dedicated to the search for truth. They seem to say: 'We lack developed universities. While we are waiting for them or in preparation for them, let us train this or that promising man, let us get this or that thing done.' It is all very well, but it does not answer." He calls the Medical Research Council "the one mitigating factor of importance" in Britain's unorganised and undeveloped resources in scientific medicine, and in this report we have the measure of its mitigation.

Egyptian Mathematics.

Mathematischer Papyrus des Staatlichen Museums der Schönen Künste in Moskau. Herausgegeben und kommentiert von W. W. Struve. Unter Benutzung einer hieroglyphischen Transkription von B. A. Turajeff. (Quellen und Studien zur Geschichte der Mathematik, Abteilung A: Quellen.) Pp. xii + 198 + 10 Tafeln. (Berlin: Julius Springer, 1930.) 48·80 gold marks.

THIS edition of the Moscow papyrus (complete with plates giving photographs of the whole of the text and a hieroglyphic transcription) has been eagerly awaited by Egyptologists and historians of mathematics alike. The volume is finely produced, and we can only congratulate the author upon the result of some three years' intensive study of the papyrus and all the literature of the subject of Egyptian mathematics. Egyptologists will in due course have much to say upon it; the present notice will deal with it from the point of view of the mathematician only.

The papyrus, now in the Museum of Fine Arts at Moscow, formerly belonged to Vladimir Golenischchev, who bought it in Egypt in 1892–93 or 1893–94. It is said to have come from the necropolis of Dra Abū'l Negga, in the immediate neighbourhood of the place where the Rhind papyrus was found, namely, in the ruins of one of the small buildings near the Ramesseum. Written during the Thirteenth Dynasty, it was copied from an original of the middle of the Twelfth Dynasty, slightly earlier, if anything, than the original of the Rhind.

We have known something of the content of the papyrus since Turaiev published in *Ancient Egypt*, 1917, a paper on "The Volume of the Truncated Pyramid in Egyptian Mathematics" (problem No. 14 in Struve's numbering). A further paper by Zinzerling published in 1925 contained the translation and transcription by Turaiev of four more problems from the papyrus, three of which are geometrical. These three problems, together with that of the truncated pyramid, are the subject of a long and important article by Battiscombe Gunn and T. Eric Peet in the *Journal of Egyptian Archæology* (vol. 15, 1929, pp. 167-185). As compared with the Rhind papyrus, the Golenischchev papyrus shows certain differences. Whereas the Rhind, although severely practical (there is only one hint in it of a general formula), has its problems arranged in distinct groups and is apparently a kind of handbook of instruction, the Moscow papyrus, where the problems are arranged anyhow, is more like an examination paper (with solutions); the suggestion of the editor is that it was in use, in a school for scribes, as a kind of test paper. The problem is given to the pupil by the scribe-teacher, "If thou art asked . . . do so and so"; the working is supposed to be shown by the pupil to the teacher, sometimes with the word "See!" added, and the teacher replies, "Thou hast found it correctly". The concrete numbers chosen for illustration are as simple as possible, so that there is none of the complicated arithmetical work which we find in the Rhind.

The problems (twenty-five in number) are rearranged by the editor in groups: (1) 'cooking-ratio' problems relating to the interchange of loaves and measures of beer according to the 'strength' of each, (2) simple rule-of-three problems, (3) 'hau' calculations corresponding to equations in one unknown, (4) problems of finding areas and volumes. We have also in the papyrus the operations of

squaring and finding the square root, which do not appear in the Rhind. A typical problem is to find the sides of a rectangle (or a right-angled triangle which is the half of a rectangle), when the area and the ratio of the sides are given. This leads to the equivalent of an equation of the form $(m/n)x^2 = A$. m/n is, of course, expressed as the sum of submultiples, for example, $\frac{1}{2}+\frac{1}{4}$. In one case $m/n = \frac{1}{2}+\frac{1}{4}$ and A is 12. The Egyptian says, "Reckon with $\frac{1}{2}+\frac{1}{4}$ to find 1 (that is, he divides 1 by $\frac{1}{2}+\frac{1}{4}$ or $\frac{3}{4}$): result $1\frac{1}{3}$". He then multiplies 12 by $1\frac{1}{3}$, making 16, and extracts the square root of 16: result 4. Thus the side we have called x is 4, and the other side is $(\frac{1}{2}+\frac{1}{4})$ 4 or 3.

Of outstanding interest is the problem No. 14, which, as indicated above, gives the correct computation of the content of a frustum of a pyramid with square base, cut off by a plane parallel to the base (in the particular case the side of the square base is 4, the side of the opposite face 2, and the height 6). In accordance with the correct formula $\frac{1}{3}h(a^2+ab+b^2)$, where h is the height and a, b the sides of the square base and top respectively, the Egyptian says, in short, "Square 4 (the side of the base); result 16. Double 4 (that is, multiply the 4 by 2, the side of the upper square): result 8. Square 2: result 4. Add $16+8+4=28$: take $\frac{1}{3}$ of 6 (the height), that is 2: reckon with 28 twice (that is, multiply the 28 by the 2): See! we have 56. Thou hast reckoned correctly." How came the Egyptian by the correct formula? The question is discussed at length by Gunn and Peet in the paper referred to, and we may expect it to give rise to much further speculation. The formula can be obtained by algebra (or its equivalent in the shape of mensuration) in two ways: (1) by regarding the frustum as the difference between two similar pyramids with square bases; (2) by drawing perpendiculars to the base from the four corners of the square top and so splitting up the figure into (*a*) a right parallelepiped with base a^2 and height h, (*b*) four prisms, each of which has for one face one of the erect faces of the parallelepiped, and (*c*) four small pyramids at the corners, with square bases, each of which has $\frac{1}{2}(a-b)$ for its side. The second method is, *mutatis mutandis*, that of Heron's "Metrica", II. 8, and the first that of II. 7. In either case we must know the formula $\frac{1}{3}a^2h$ for the volume of a pyramid with base a^2 and height h. The equivalent of this is obtained by Euclid in Props. 5-7 of Book XII. by the method of exhaustion, the ancient substitute for the calculus. It is not conceivable that the Egyptians had attained to this order of ideas. On the other hand, for the purpose of constructing their pyramids, they had the greatest practical interest in knowing the amount of material that would be required for a pyramid of given dimensions. Actual experience would in time give a rough guide, and they could easily arrive at an expression for the content of a pyramid by measuring how much corn, or what not, would go into a vessel of that shape; for they must have seen that the height and the area of the base would come into the calculation. Struve agrees that the Egyptians must have arrived at the formula for the complete pyramid in some such practical way; the rest of the calculation for the frustum would offer no insuperable difficulty.

The Egyptian achievement is the more remarkable when compared with other ancient attempts to solve the problem. A primitive mathematician would naturally think of multiplying the height by some mean area; the formula thus obtained might be $\frac{1}{2}(a^2+b^2)h$ or $\{\frac{1}{2}(a+b)\}^2h$. The former approximation is found in the "Stereometrica" attributed to Heron; it is parallel to, and may have been suggested by, a similar formula for the volume of a frustum of a cone used by the Babylonians about 2000 B.C. The second is found in Brahmagupta, as well as in the "Stereometrica". Improving on these cases, Kurt Vogel has recently suggested in the *Journal of Egyptian Archæology* that the Egyptian may have thought of multiplying the height by the average of *three* areas, a^2, ab, and b^2, that is, $\frac{1}{3}(a^2+ab+b^2)$; but it seems in the highest degree unlikely that this would occur to anyone who did not know the formula beforehand.

Space does not allow us to discuss the other remarkable problem (No. 10), where, if the interpretation is right, and assuming the known Egyptian estimate of the value of π, namely, $\frac{256}{81}$, the author seems to calculate correctly the surface of a hemisphere, whereas, so far as we know, Archimedes was the first person to prove scientifically that the area of the surface of a sphere is equal to four times the area of a great circle in it.

An important result incidentally obtained by Struve relates to the once disputed question whether certain triangles in problems 51 and 52 of the Rhind papyrus are right-angled or isosceles. He shows from the problems in the Moscow papyrus that in the case of the right-angled triangle the perpendicular sides are called by names which mean 'length' and 'breadth' as in a rectangle, whereas in problem 4, which is identical with No. 51 of the Rhind, the area of the triangle is obtained as the product of the 'tp-r' and the 'mryt', the

same terms as those used in the Rhind. The triangles in the Rhind are therefore not right-angled, and Struve concludes, like Peet and Gunn, that they are isosceles; like them, too, he arrives (though by a slightly different route) at the conclusion that, while 'tp-r' means the 'base', 'mryt' can only be the perpendicular height (as it must be if the formula used is correct), and not one of the sides other than the base. T. L. H.

Physical Chemistry applied to Biology.

(1) *Colloid Science applied to Biology: a General Discussion held by the Faraday Society, September–October, 1930.* Pp. 659-865. (London: The Faraday Society, 1931.) 12*s.* 6*d.*

(2) *Précis de chimie-physique: à l'usage des étudiants en médecine.* Par Prof. Fred Vlès. Pp. vii + 414. (Paris: Vigot frères, 1929.) 50 francs.

(1) THE Report of the Faraday Society's General Discussion at Cambridge on "Colloid Science applied to Biology" is a substantial volume, containing more than 200 pages. The twelve papers which were presented to the meeting only occupy about 120 pages, so that the discussion is responsible for the other 80 pages. This is an accurate reflection of the fact that a lively discussion was maintained during a series of sessions covering two complete days, of which only a small part was occupied by the presentation of papers which had already been circulated in advance. The keenness of the discussion, and the large number of eminent research workers who took part in it, provided a remarkable vindication of the recently adopted policy of the Faraday Society in undertaking the organisation of a discussion on colloid science in alternate years; but it also demonstrated, in an even more emphatic way, the value and importance of a meeting at which biologists on one hand and chemists and physicists on the other hand could meet on neutral ground to discuss problems for the solution of which co-operative effort from both sides is obviously needed.

The widespread belief that the study of living matter may in the near future lead to even greater advances than those which have resulted during the past twenty years from the study of atomic structure, emphasises the urgency of this co-operation, and indicates the liberality of the crop that is waiting to be harvested. From this point of view special interest is attached to the 'introductory remarks' on "The Structure of Living Matter", by Sir F. Gowland Hopkins, and to the 'conclusion' of Sir William Hardy, neither of which has hitherto appeared in print. The former directs attention to the almost absolute neglect of colloid science in the decade 1887–97, and the awakening of activity which followed the appearance of Hardy's papers in 1899 and 1900; but it also includes a warning that the problems presented by living systems are very complex, and that it is essential to keep in touch with the reality that is inherent in that complexity, since artificial colloidal systems do not and cannot "display, save in some accidental and unreal aspects (of which the importance is often exaggerated), the attributes of life". Sir William Hardy also urges that "at the present moment biology is overcharged with facts", and points out the "prodigious services" which could be rendered by a mathematical physicist who had sufficient courage to "leave his home in the physical laboratory" and "come over the way" to "live with biologists under the same roof".

If the Faraday Society had done nothing more than provide a platform from which the urgency of this call could be announced, the organisation of the meeting and the publication of the present report would have been sufficiently justified; the fact that the meeting was held in Cambridge may, perhaps, be interpreted as in some sense a challenge to the University to undertake the leadership in a new period of advance in natural knowledge.

(2) The modest volume of Prof. Vlès is at the same time an introduction to physical chemistry and a store of information as to its applications to biological problems. It could only have been written by a physical chemist who had taken up his abode in a biological environment and thus acquired an interest in and an insight into the bewildering problems of living matter. From this point of view, the fact that Dr. Vlès has been attached for some years to the faculty of medicine in the University of Strasbourg, instead of holding a general chair of physical chemistry, provides a sufficient explanation of the fact that the biological aspects of the subject really dominate the whole book, instead of being mere addenda to serve as a 'bait' to entrap the interest of the medical student, or 'sugar and spice' to tickle his palate when engaged in the compulsory study of an unpalatable subject. The sympathetic introduction written by the dean of the Faculty of Medicine is more than justified by the whole-heartedness with which Prof. Vlès has devoted himself to his task.

The book itself is divided into three parts, dealing mainly with osmosis and related properties of solutions, electrical properties of solutions, and the colloidal state; but there are two appendices, one

dealing with interfacial charges and the stability of suspensions and the other with the physical chemistry of bacteria and of the fluids of the body. The second appendix covers more than fifty pages and represents a course of lectures which has been delivered annually to the Faculty of Science during the past ten years. It is of a different character from the earlier sections of the book, where the primary object is to give instruction in physical chemistry, since its main purpose is to describe the advances in knowledge which have been made as the result of the application of physico-chemical methods of investigation to biological problems. Those who heard the recent Croonian Lecture will be interested to note the references made to the work and theory of Bordet on toxins and anti-toxins, but there is also a number of references to the author's own experimental observations.

The book is issued in a cheap and unpretentious form. Its importance depends not merely on the immediate value of the material which it contains, but also on the evidence which it affords of a growing collaboration between physicist and biologist in the difficult but fertile study of living matter.

Index Londinensis.

Index Londinensis to Illustrations of Flowering Plants, Ferns and Fern Allies, being an emended and enlarged edition continued up to the end of the Year 1920 of Pritzel's Alphabetical Register of Representations of Flowering Plants and Ferns compiled from Botanical and Horticultural Publications of the XVIIIth and XIXth Centuries. Prepared under the Auspices of the Royal Horticultural Society of London at the Royal Botanic Gardens, Kew, by O. Stapf. Vol. 3. Pp. iv + 555. Vol. 4. Pp. iv + 568. Vol. 5. Pp. iv + 549. (Oxford : Clarendon Press ; London : Oxford University Press, 1930–1931.) £5 5*s.* net each vol.

VOLUME 3 of this work appeared in June 1929. It contains 555 pages and references to illustrations of all plants from *Earina* to *Justicia* inclusive. Volume 4 was published in October 1930. It consists of 568 pages and references to plants from *Kadsura* to *Pedicellia* inclusive. Volume 5 appeared in February 1931. In its 549 pages are to be found references to illustrations from *Pedicularis* to *Sapium* inclusive. Thus, such important genera as *Pelargonium*, *Pinus*, *Pirus*, *Primula*, *Rhododendron*, and *Rosa* are included. As exemplifying how the same species may occur under different generic names in different parts of the "Index", *Pelargonium pallens*, *P. parviflorum*, *P. zonale*, and others are found under *Geranium* in Vol. 3 ; *Prunus Padus* occurs as *Cerasus Padus* and *Potamogeton palustris* as *Comarum palustre* in Vol. 2, *Rhododendron indicum* as *Azalea indica* in Vol. 1, and so on. Names are always quoted just as the author gives them from whose work the references are taken, and this necessarily involves the quotation of references to the same species in different volumes.

Sound orthography and grammatical correctness and consistency, though matters of minor importance, should not be conspicuous by their absence in a work of this nature, and the "Index", on the whole, sets a good example in this respect. It will be noted that tree-names ending in *us* which have come down from the old classical writers, such as *Quercus*, *Pinus*, *Rhus*, *Sambucus*, are of feminine gender, while those of recent origin, such as *Phyllanthus*, *Podocarpus*, *Pterocarpus*, are masculine. Again, the more correct spellings "*Pirola*" and "*Pirus*" are used in preference to "*Pyrola*" and "*Pyrus*" so commonly in vogue. "*Ranunculus acer*" is the name adopted for the common buttercup rather than the ungrammatical "*R. acris*" used by Linnæus ; and this seems quite logical ; but in the case of *R. palustris*, the form "*paluster*" would have been more consistently correct. The fact that some rather obscure classical authors, like Ennius and Columella, have used the forms "*acris*" and "*palustris*" for the masculine gender, cannot alter the matter.

A few of the features of the "Index" may be referred to here. In accordance with the most recent views, many of the old comprehensive genera have been broken up, so that, for example, in the case of the grass *Festuca*, there are now 25 recognised genera which formerly were all included in this genus. These are all arranged alphabetically and numbered in sequence after the heading "*Festuca* Auct.", and to each species cited under it a number is attached indicating to which genus it properly belongs ; thus, *F. duriuscula* is a true *Festuca* as understood by Linnæus, but *F. inermis* is a *Bromus*. On the other hand, there are other genera, such as *Bucetum* and *Gouinia*, which have been called *Festuca* but are not truly such. There is thus the second heading *Festuca* Linn., followed by "Vide *Bucetum*, *Gouinia*, etc.". Other genera in these volumes have been broken up in the same way, such as *Echinocactus*, *Gnaphalium*, *Orchis*.

In the "Index" will be found numerous references to Blanco's "Flora of the Philippines" (3rd edition, 1878–80). Blanco was only an

amateur botanist and many of his illustrations are erroneously named. The American botanist Merrill has issued a corrected list of Blanco's names. Hence, for each incorrectly named illustration in Blanco there are in the "Index" two distinct references, one giving Blanco's name and the other the correct name "fide Merrill", and in each case a cross-reference to the other is supplied.

In some botanical works, the names on the plates are different from those in the text referring to the same plant. This may be due to the fact that the plates were labelled and printed some time before the text was written, when different ideas of nomenclature had prevailed in the author's mind. In these cases, again, there are two distinct headings in the "Index", with the necessary cross-reference in each.

In John Hill's "Family Herbal", dated 1812, the illustrations are mostly very crude, and often names quite foreign to our modern ideas have been given to the plants. In these cases the editor has interpreted the plants figured in terms of modern nomenclature. For example, *Malva moschata* is called in the book "Vervain Mallow. Alcea". Every reference in the "Index" giving the correct name is always followed by the phrase "fide Ed.".

An interesting use to which the "Index" might be put would be the tracing of the evolution of the art of depicting any well-known or common plant. But references to pre-Linnæan pictures should, in most cases, be sought for elsewhere than in the "Index". W. C. W.

Our Bookshelf.

Sexual Reform Congress, London, 8-14: IX: 1929. W.L.S.R. World League for Sexual Reform: Weltliga für Sexualreform: Ligue Mondiale pour la Réforme sexuelle: Tutmonda Ligo por Seksaj Reformoj. Proceedings of the Third Congress: Bericht des dritten Kongresses: Compte rendu du troisième Congrès: Dokumentaro de la tria Kongreso. Edited by Norman Haire. Pp. xl + 670 + 8 plates. (London: Kegan Paul and Co., Ltd., 1930.) 25*s.* net.

THE Report of the Sexual Reform Congress held in London in September 1929 contains material of interest to men of science as well as to those concerned with social and moral problems. The reader will possibly turn first to Dr. Norman Haire's own paper on "Sterilisation, Abortion, and Birth Control", and will also read with interest Dr. Ernst Grafenberg's exposition of his silver ring method of preventing conception. Dr. Franz E. Hirsch's paper on the use of blood tests as indications of paternity, is also of interest; and the method seems to him to be capable of yielding fairly definite results. Dr. M. D. Eder, on the "Sterilisation of the Unfit", is rather doubtful as to the effectiveness of such methods in the present stage of our knowledge. We doubt, however, if eugenists will allow themselves to be thus discouraged. Dr. Bernard Hollander, in his paper, "Insanity and Divorce", urges the amendment of the law so as to allow divorce for incurable insanity.

Capt. G. Pitt-Rivers, in his paper, "Sex-phobia and Marriage", claims to have established the interesting and (if true) highly important fact that dense and increasing populations tend inevitably to yield a surplus of women. This lends additional interest to Miss R. B. Kerr's remarks on the "Sexual Rights of Spinsters". The writer claims that the increasing body of women who can afford to bring up one, two, or three children themselves, without the aid of any man, "should at once be sexually free". Another interesting paper, especially to medical men, will be that of Dr. Abraham Stone on "Pre-Marital Consultation", though much of it is a counsel of perfection, at the present time.

The value of the papers in this collection naturally varies. Feeling themselves under a cloud of opposition, the writers occasionally adopt a propagandist attitude, and here and there we find traces of rhetorical treatment—not so glaring, however, as we should find in the writings of those who take the conservative side in sex affairs. On the whole, however, the scientific attitude may be said to prevail. J. C. HARDWICK.

Monographs of the Geological Department of the Hunterian Museum, Glasgow University. 4: *Reports on Geological Collections from the Coastlands of Kenya Colony made by Miss M. McKinnon Wood.* With Introduction by Dr. J. W. Gregory and Report on the Ammonites by Dr. L. F. Spath; Report on the other Mesozoic Mollusca and Brachiopods by Dr. J. Weir; Report on the Kainozoic Mollusca by L. R. Cox; Report on the Cheilostomata by Dr. H. D. Thomas; Report on the Echinoidea by Dr. Ethel D. Currie; Report on the Corals by Dr. J. W. Gregory; Report on the Ostracoda and Foraminifera by Mary H. Latham; Report on the Fossil Plants by Dr. S. Williams; Report on Igneous Rocks by Agnes Neilson, and on the Stratigraphy of the Kenya Coastlands and a List of Localities by Meta McKinnon Wood. (Glasgow University Publications, 17.) Pp. vi + 232 + 24 plates. (Glasgow: Jackson, Wylie and Co., 1930.)

THE fossils described in this monograph were collected by Miss M. McKinnon Wood from an area extending from 20 miles north of Malindi to about 15 miles south of Mombasa and stretching inland for 30 to 40 miles along the Kenya-Uganda railway. The fossiliferous deposits dip gently toward the coast and are of Jurassic, Cretaceous, Miocene, Pliocene, and post-Pliocene ages. The oldest formation of the coastal sedimentary deposits

is the Duruma Sandstone, from which only a few non-marine fossils, affording but little evidence of age, were obtained. It is thought that this sandstone is mainly of Triassic age; but the lower part is probably equivalent to the Karoo Beds of South Africa.

The Jurassic deposits consist of shales and limestones which, from the evidence of the Ammonites, appear to range in age from Bajocian to Kimeridgian. The Cretaceous is represented by the Freretown limestone, which is regarded as of Urgonian age. The Tertiary deposits form a narrow strip along the coast, widening out to the north. Of these, the Funda Isa limestones of Lower Miocene age (Aquitanian-Burdigalian) contain a molluscan fauna closely related to that of contemporaneous deposits in Madagascar, Persia, and India, but a small number of the species are known to occur in the Lower Miocene of the Mediterranean region and indicate that some communication must have existed between the two regions. The North Mombasa Crag is of Lower or Middle Pliocene age. The mollusca in the post-Pliocene deposits belong mainly to species which are widely distributed throughout the Indo-Pacific province, but include three species which are not known to be living on the west side of the Indian Ocean.

The Year-Book of the Scientific and Learned Societies of Great Britain and Ireland: a Record of the Work done in Science, Literature and Art during the Session 1929–1930 by numerous Societies and Government Institutions. Compiled from Official Sources. Forty-seventh Annual Issue. Pp. vii + 384. (London: Charles Griffin and Co., Ltd., 1931.) 18*s.* net.

MESSRS. Charles Griffin and Co., Ltd., deserve the thanks of scientific workers generally for the money and care they have expended during the past half-century on the production of this useful reference book. This, however, is to be the last time we shall be able to welcome its appearance—at least, in its present form. For those who are unacquainted with the volume, we may say that it contains particulars as to the names, addresses, meetings, membership, and publications of the scientific and learned societies of the British Isles and of Government scientific departments, and to each society, where the information is available, is appended a list of the papers read during the session 1929–30. The societies are classified by their subjects. The information given is 'official' in the sense that it is supplied by officials, honorary or otherwise, of the societies, institutions, and laboratories dealt with, and we are grateful for the trouble they have taken.

Future issues of the book will be shorn of the lists of papers. We are sure this is a wise decision. Even though the lists are the latest available to the compilers, the titles of papers read during the session 1929–30 seem out-of-date in a reference book issued in 1931, and by their omission the size of the volume and cost of production should be considerably reduced. This in turn should react favourably on the sales, for the essential part of the book for reference purposes will remain. We hope it will be possible to retain the distinctive and serviceable binding in the new series.

A Handbook of English in Engineering Usage. By Prof. A. C. Howell. Pp. vii + 308. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1930.) 12*s.* 6*d.* net.

IT is seldom that a book appears which can be regarded as unique in the subject matter with which it deals; but this may be truly predicated of Prof. Howell's engrossing work. It is a shining example of the principles enunciated, and it is pleasant to peruse the flowing periods and incisive remarks permeating the pages. The advice that a writer should project himself into the reader's position is well urged. A fault to which attention may be directed, however, is that the text is unduly protracted, and there is a tendency to reiteration. In places, too, are encountered erroneous examples on phrasing—such as "The message will be delivered to *whoever* is authorized", "The kind of *pens* is the best", "*one* must write *his* paragraph" may be cited. For a book on engineering phraseology there are too many examples of non-engineering sentences given as illustrations. The author's remarks on reviewing, editorials, and cognate matters are inspiring. In a work like the present, the use of "*the same* letter", when "*a similar* letter" is intended, would not be expected. In conclusion may be commended the maxim on p. 93, "There is a vast difference between having to say something and having something to say". P. L. M.

Vertebrate Embryology. By Prof. Waldo Shumway. Second edition, thoroughly revised. Pp. x + 311. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1930.) 18*s.* 6*d.* net.

THE text-book of vertebrate anatomy by the professor of zoology in the University of Illinois was so eminently useful, being concise and lucid, and illustrated by an adequate number of very clear diagrams, that it is not surprising to record the appearance of another edition, which has been revised and improved. It provides an account of the early development of *Amphioxus*, the frog, the chick, and man, the formation of their germ-layers, embryonic membranes and bodily form, and an excellent section dealing with organogeny. The third part of the book consists of a very instructive atlas of sections, which includes drawings of a valuable series of pig embryos. Part four is concerned with technique and deals with the preparations of embryological material, the use of the microscope, the making of drawings, and reconstructions.

This book can be recommended to any demonstrator of zoology or anatomy who wishes to provide a course that is well adapted to the needs of the medical student. In those laboratories which are so fortunate as to possess the necessary embryological material, the book will serve as an excellent guide to the student.

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.]*

An Egyptian Axe-head of date 1800 B.C.: its Investigation and Reproduction.

SOME months ago, Mr. Guy Brunton asked me whether I would examine and report upon an Egyptian axe-head. It was one of several specimens of the

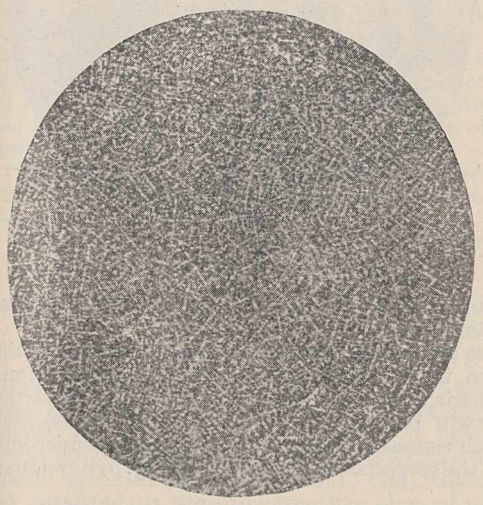

FIG. 1. ×7.

same date. He was so good as to give me permission to destroy this particular specimen if it was neccessary in the interests of a full scientific investigation. This examination I have now been able to complete, and

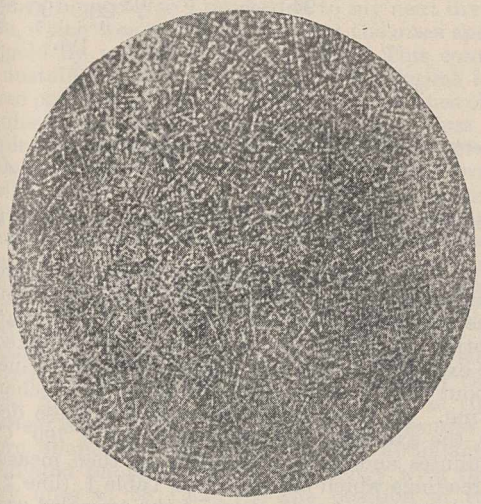

FIG. 2. ×7.

it may be of interest if I add that, except in one particular—and this, I think, would only be noticed by experts—the specimen has been in no way injured. I emphasise this, because the natural objection to their injury or destruction is the reason why so few investigations have been allowed to be made of ancient metal specimens.

The axe-head, the outline of which is shown in Fig. 7 ($\times \frac{3}{4}$), was coated with a green patina. This bore the pattern of the fibre wrapping in which it had been enclosed. It was removed by means of a wire brush with dilute hydrochloric acid. Underneath was a thin layer of cuprite which coated the metal. This also was removed. The metal itself was copper-coloured, but etching with ammonium persulphate developed a dendritic structure on the surface which showed that the material was not pure copper but an alloy of high copper content. The appearance of the deeply etched surface at a magnification of 7 diameters is shown in Fig. 1. The dendritic structure also showed that the axe-head was made from 'cast' material, and the fact that the dendrites were not

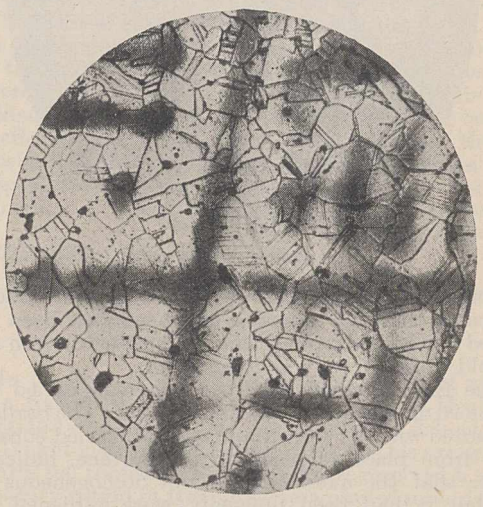

FIG. 3. ×100.

appreciably distorted showed that it was cast and not forged to shape. Even at its edge there was no evidence of severe working, as is shown in Fig. 2.

At higher magnifications it was seen that the metal

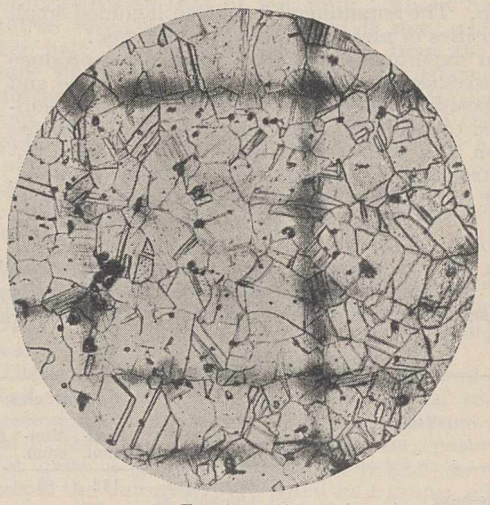

FIG. 4. ×100.

had completely recrystallised and that the resulting crystals were twinned. This showed that the casting had been worked to some extent and had been annealed during or after this treatment. These twin crystals are shown in Figs. 3 and 4 at 100 diameters magnification. The dark markings (called 'cores') represent some of the original structure of the specimen

and constitute definite evidence that it is an alloy. Speaking broadly, the recrystallised grains were undistorted, but some of the twin bands were slightly bent, as is clearly shown in Fig. 5 at 250 diameters magnification. This slight local distortion of the structure indicates that the annealed axe-head had been subjected to a comparatively mild and rather uneven form of cold working, such as hammering.

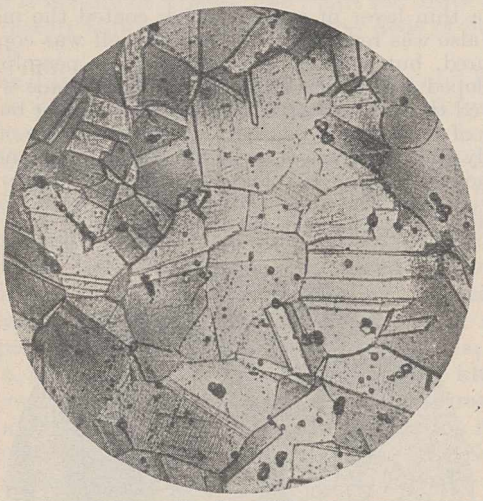

FIG. 5. ×250.

The Brinell hardness of the axe-head varied from about 90 on the flat to 112 at the edge. The hardness, measured with a 1 mm. diameter ball, varied considerably from place to place on the surface, indicating either that the axe-head was not homogeneous or that it had been unevenly work-hardened. Both these conclusions are in agreement with the microscopic evidence. The hardness measurements are shown in Table I. and in Fig. 7.

Chemical analysis showed that the axe-head contained 96·9 per cent of copper, 1·5 per cent of arsenic, 0·7 per cent of iron, and 0·2 per cent of tin. The remaining 0·7 per cent included small quantities of nickel, sulphur, and oxygen.

An experiment was then made to reproduce the axe-head. An alloy of the same shape and composition was cast in sand and was then subjected to the mechanical and thermal treatments which the microscopic and hardness data indicated the Egyptian axe-head had received. First of all, the casting was hammered lightly with a 7 lb. hammer. It was then annealed for periods of 15 minutes at intervals of 50° C. from 400° C. upwards until the metal recrystallised and the crystal grain size became approximately the same as that of the axe-head. This occurred at 700° C. The pronounced 'coring' of the cast alloy became less distinct as the annealing temperature was raised, and at 700° C. was comparable with the structure of the axe-head. The annealed alloy was finally re-hammered. Brinell hardness measurements of the alloy were made at all stages of the above treatments. They are shown in Table I.

TABLE I.

Material.	Treatment.	Hardness.		
		Maximum.	Minimum.	Average.
Axe-head	As received	112	82	97
	Annealed at 700° C.	61	54	57
Copper-arsenic-iron-tin-alloy of the same composition cast in the laboratory	As cast	60	53	56
	Hammered	106	86	96
	Annealed at 700° C.	63	56	59
	Re-hammered	103	82	93

As will be seen from the table, the hardness of the re-hammered alloy agreed satisfactorily with that of the axe-head.

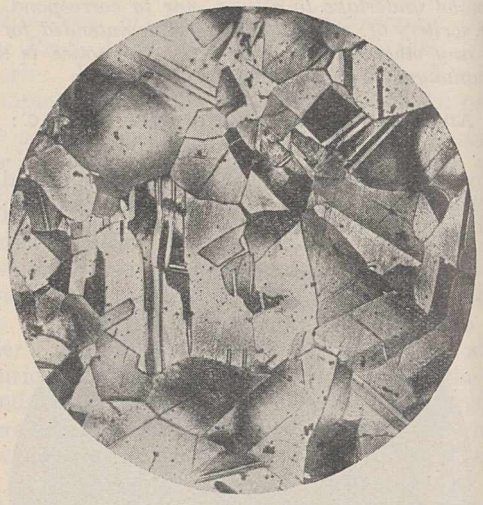

FIG. 6. ×250.

The microstructure of the re-hammered casting is shown in Fig. 6 at 250 diameters magnification. A comparison of the crystal grain size, the distortion of the twin bands, and the unevenness of the etching (which represents the coring in this photomicrograph) with the corresponding features in Fig. 5 shows that the alloy synthesised in the laboratory markedly resembled the axe-head both in microstructure and in hardness.

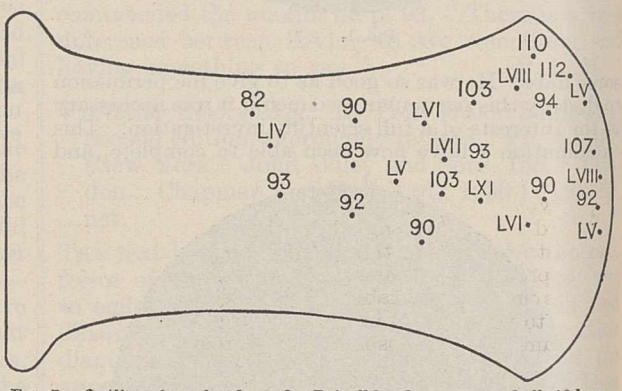

FIG. 7.—Outline of axe-head. ×¾. Brinell hardness, 1 mm. ball, 10 kgm. load. As received, Arabic numbers; annealed, Roman numbers.

The experiments all lead to the conclusion that the Egyptian axe-head was cast to shape, worked to some extent—no doubt by hammering—and annealed at about 700° C. either during or after the mechanical working. In order still further to test these deductions, the axe-head itself was annealed at 700° C. for 15 minutes and its Brinell hardness then measured. The readings which are shown in Table I. (line 2) are in good agreement with those of the annealed casting (line 5).

The hardness at various points on the surface of the axe-head before and after annealing are shown in Fig. 7. It will be noticed that the hardness of the edge, originally as high as 112 Brinell, was reduced to about 55 by annealing. It was thus approximately halved. This means that the work-hardening capacity of the alloy is high. Although the maximum hardness of the edge is somewhat surprising, considering the low

alloy content of the copper and the comparative mildness of the cold working, it is not so high as to lend support to the view that the Egyptians possessed a method of hardening copper with which we are unacquainted. The hardness of the axe-head was produced partly by alloying and partly by cold working. By a suitable choice of alloying elements and more effective mechanical treatment, much greater hardness can be produced to-day.

One further conclusion may be drawn. This investigation has made it possible to answer the question whether hardening by cold work is permanent in an alloy of this type at the ordinary temperatures. According to Mr. Brunton's view, the axe-head is more than 3700 years old. When I discussed this question with him and the extent to which this date might be in doubt, he was willing to advance it 200 years but no more. Accepting this, its age is at least 3500 years. No one, of course, can say whether it has lost any of its original hardness, but it is quite clear that it has retained a considerable amount of work hardness throughout this long period.

I wish to acknowledge the assistance of two members of my staff, Mr. C. W. Dannatt and Dr. M. S. Fisher, in the above investigation.

H. C. H. CARPENTER.

Royal School of Mines, South Kensington, London, S.W.7, March 9.

Constitution of Rhenium.

OWING to the kindness of Dr. Noddack, who provided me with a sample of the heptoxide of his recently discovered element rhenium, I have been able to obtain its mass spectrum. Re_2O_7 is a slightly volatile greenish crystalline solid. Its vapour was first admitted to the discharge like that of osmium tetroxide, but with no success. The solid was then introduced into the discharge tube and heated in the cathode ray beam, but although the volatilisation was ultimately such as to cause a visible dark layer on the surrounding walls, not the slightest sign of its mass spectrum could be obtained. The substance seemed hopeless, so I proceeded to my next investigation, which was an attempt to get the mass spectrum of gold by volatilising its chloride. This compound is unstable and, as the presence of halogens had on some previous occasions brought out the lines of other bodies in a remarkable way, it seemed just worth while to volatilise it in the discharge tube before the rhenium oxide deposit had been removed from the walls. This procedure was successful beyond all expectation. Although no lines of gold were visible, the doublet lines of rhenium appeared in great intensity and in addition were repeated 16, 32, and 48 units higher as ReO, ReO_2, and ReO_3, so giving unusually convincing evidence of its constitution.

Rhenium consists of two isotopes, 185, 187, as was expected from the general rule that complex elements of odd atomic number (above 9) consist of two odd mass numbers two units apart, but it is the first element analysed in which the heavier isotope is the more abundant. The ratio of this abundance was estimated photometrically by analogy with the mercury lines to be 1·62 : 1. The position of the line 203 due to $Re^{187}O$ in the mercury group was used to determine its packing fraction, which is -1 ± 2, the same as that of osmium. From these provisional values the atomic weight on the chemical scale works out at $186{\cdot}22 \pm 0{\cdot}07$, in good agreement with Hönigschmid's latest value of 186·31. The strongest isotope of rhenium is isobaric with the weakest of osmium.

F. W. ASTON.

Cavendish Laboratory, Cambridge, Mar. 31.

The Behaviour of Antiknocks.

IT is generally agreed that it is the metallic radicle of an organometallic antiknock compound that is mainly responsible for the delaying of the oxidation of a combustible mixture. That the metal atom is in an oxidised state before it becomes effective, was an inference made on the basis of many different experimental facts, for example, the behaviour of potassium vapour,[1] but it has not been proved directly. We have recently been able to show that a small quantity of lead tetraethyl vapour, when let into an evacuated vessel heated to 265° C. into which a charge of pentane vapour and oxygen is afterwards introduced, will not affect the course of the combustion to any great extent, and may even accelerate it, but that if some oxygen is let into the vessel before the lead tetraethyl vapour, and then this followed by the bulk of the charge, the combustion is invariably strongly inhibited. These experiments provide direct evidence that the lead must first be oxidised before it is effective as an inhibitor. It is possible that the accelerating effect is due to the C_2H_5 radicles which help to start reaction chains, but that has yet to be proven.

A. EGERTON.

L. M. PIDGEON.

Clarendon Laboratory, Oxford.

[1] See Egerton and Gates, *J. Inst. Petm. Tech.*, **13**, 244; 1927.

Pasteurised and Raw Milk.

IN NATURE of Mar. 21, p. 466, an abstract appears of a report issued by the Department of Health for Scotland on "Milk Tests in Lanarkshire Schools", by G. Leighton and P. L. McKinlay. In this experiment, nearly ten thousand school-children received a supplementary ration of three-quarters pint of milk daily for about four months. Two important tables from the report, showing the average increases in height and weight of the children, divided into 14 groups by age and sex, are reproduced.

The special point to which we wish to direct attention concerns the apparent contrast in the effects of pasteurised with that of raw milk. About half the children receiving milk consumed it raw, while the other half were supplied with milk from the same source which had been pasteurised. It is somewhat unfortunate, however, that the recipients in the same school were never so divided, the whole of the milk supplied to any one school being either raw or pasteurised. In the absence of the records from the separate schools, it is impossible altogether to eliminate the doubt which this choice of method introduces; nevertheless, the report concludes with the statement (p. 20):

"In so far as the conditions of this investigation are concerned the effects of raw and pasteurised milk on growth in weight and height are, so far as we can judge, equal."

The importance of such a conclusion, if well established, is manifest. It is, however, open to some question, for Table 12, printed on the same page, shows that of the 14 groups (by age and sex), pasteurised milk gave a greater increase in height in only 2 groups, the increases were equal in 1 group, while in 11 groups the raw milk gave the greater increase. If we may regard these as 14 independent experiments, the difference from expectation on the hypothesis that raw and pasteurised milk have the same effects, is such as would only occur once in about ninety trials, and it seems evident that the conclusion should have been that the *growth response in height to raw milk is significantly greater than that to pasteurised milk.*

In order to examine the magnitude of the difference,

we have calculated from Tables 6 and 7 of the Report the average increments in the control, raw milk and pasteurised milk groups, weighting the averages given according to the total numbers of boys and girls in each group. In this way we find an average increase in height and weight, standardised for age, for the whole group of children observed. From the average increase, the excess ascribable to milk feeding is obtained by subtraction, and the relative value of pasteurised as a percentage of the value of raw milk, as measured by increase in growth, is calculated from the two differences.

AVERAGE INCREASES IN WEIGHT IN OUNCES.

	Boys.		
	Control.	Raw Milk.	Pasteurised.
Increase . . .	10·041	13·780	12·507
Excess over control .	..	3·739	2·466
Value per cent . .	..	100·0	66·0

	Girls.		
	Control.	Raw Milk.	Pasteurised.
Increase . . .	9·755	14·315	13·907
Excess over control .	..	4·560	4·152
Value per cent . .	..	100·0	91·1

In weight the average increment ascribable to the consumption of about 10 gallons of milk is a little more than 4 ounces, being a little more for girls than for boys. In both sexes the pasteurised milk gives a lower return, the increment ratios being 66·0 per cent in the case of boys, and 91·1 per cent in the case of girls. In respect of growth in height the contrast is even more striking :

AVERAGE INCREASES IN HEIGHT IN INCHES.

	Boys.		
	Control.	Raw Milk.	Pasteurised.
Increase . . .	0·7274	0·8145	0·7707
Excess over control .	..	0·0871	0·0433
Value per cent . .	..	100·0	49·8

	Girls.		
	Control.	Raw Milk.	Pasteurised.
Increase . . .	0·7300	0·8140	0·7889
Excess over control .	..	0·0840	0·0589
Value per cent . .	..	100·0	70·1

Measured by its effect in increasing growth in height, pasteurised milk appears from these data to have only half the value of raw milk in the case of boys, and about 70 per cent of the value in the case of girls.

These results are put on record to avoid the danger that, from a superficial examination of the report, the conclusion should be drawn that this extensive experiment demonstrates the equivalence of pasteurised and raw milk. In reality the reverse is the case ; and the very marked difference in response to two materials, which in their gross nutritional contents are so closely equivalent, raises a problem of very great interest, which can probably only be cleared up by more deliberate experimentation. The contrast between the response to pasteurised milk and that to raw milk is of value also in interpreting the difference between the milk-fed and the control children, for it would evidently be extremely rash to draw from the experimental results the 'natural' conclusion, that the increases induced by milk feeding indicate that the Lanarkshire children are, in their normal diet, inadequately supplied with such nutrients as fat, protein, or sugar, which are contained equally by the raw and by the pasteurised milk.

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Rothamsted Experimental Station.
S. BARTLETT.
National Institute for Research in Dairying,
University of Reading.

Capture of Electrons from Mercury Atoms by Positive Ions of Helium.

IN a recent paper [1] we gave an account of some experiments on the determination of the mobility of ions in helium gas at a pressure of 360 mm. of mercury. We found that the mobility of the positive ions decreased when small traces of other impurities were introduced into the apparatus, and we interpreted the results as due to an 'exchange' phenomenon similar to that observed by Kallmann and Rosen in the case of high-speed positive ions. On this view, when a helium ion 'collides' with an

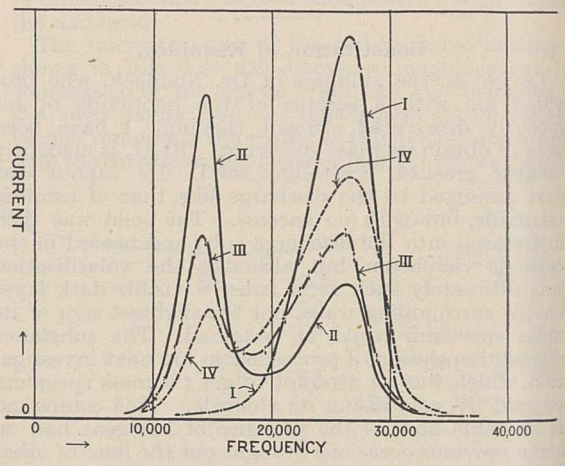

FIG. 1.

impurity molecule there is a certain probability that an electron will be captured from the impurity by the ion. The impurity ion so formed will not lose its charge in collisions with other helium atoms, because the ionisation potential of helium is greater than that of any impurity and the speed of the ions in our experiment is much too small to supply the energy required for the transition. For this reason, a very small concentration of impurity is sufficient to change completely the rate at which the positive charge is carried through the gas.

In our first experiments we had not sufficient control of the purity of the gas to identify the impurities which gave rise to ions of smaller mobility. We have now made experiments in a new apparatus in helium at 20 mm. pressure and have obtained a definite example of the exchange phenomenon from helium to mercury.

In our method of measuring the mobility of ions in gases, a peak is obtained in a current-frequency curve for each type of ion present (Fig. 1). Curve I shows the curve which we obtained for positive ions in pure helium in a baked-out apparatus, mercury vapour being excluded by liquid air traps. On

admitting mercury vapour to a concentration of one part in 30,000 of helium, Curve II was obtained. It will be seen that instead of the original single peak, two peaks are now present. The peak at the higher frequency coincides in position with the original single helium peak and is due to helium ions which have traversed the apparatus without losing their charge by interchange to mercury. The peak at the lower frequency indicates the presence of mercury positive ions which have been formed by electron capture from helium ions. On freezing out the mercury with liquid air, Curve I was again obtained. Curves III and IV are for successively smaller concentrations of mercury and show corresponding reductions in the number of mercury ions. Though some of the mercury ions may possibly arise from collisions of mercury atoms with metastable atoms of helium in the neighbourhood of the primary source of ionisation, the greater number at least must be due to electron exchange. This was shown by giving the ions a longer life before entering the analysing part of the apparatus; the relative number of mercury ions was then found to increase, roughly linearly with the age of the ions.

These results not only give an illustration of electron capture but also afford a method of determining the mobility of positive ions, other than those of helium, moving in helium gas. Thus the ratio of the mobility of a mercury positive ion in helium to that of a helium ion in helium is 0·55.

Also, by repeating the measurements with known minute concentrations of other gases, we may hope to determine the target area for electron capture presented by their molecules to helium ions of very slow speed. Experiments on these lines with hydrogen, nitrogen, and other gases as impurities are now in progress.

C. F. POWELL.
A. M. TYNDALL.
Henry Herbert Wills Physical Laboratory,
University, Bristol,
Mar. 25.

[1] Tyndall and Powell, *Proc. Roy. Soc.*, vol. 129; 1930.

Spectra of the Helium Glow Discharge.

FOR some time past we have been investigating the cold cathode glow discharge in helium with probe wires, for approximately 'normal' conditions at a pressure of about 1 mm. of mercury. The work with cathode falls in potential less than 100 volts is still incomplete, but two cases in which we have been able to correlate the spectrum with the electrical data are of some interest.

The first concerns the distribution of intensity in the arc spectrum (He I). This is well illustrated by the behaviour of the lines at 5016 A. and 4713 A., the latter being very feeble compared with the former in the negative glow, whilst the two are of comparable intensity in the anode glow. From the current-voltage characteristics of the probe wires, we find that the distribution of velocities amongst the electrons is not Maxwellian in the negative glow, but can be represented fairly closely by the superposition of several Maxwellian groups; in a typical instance, the temperatures of these were 300,000°, 54,000°, and 4900°, and the concentrations 8×10^6, 5×10^7, and 1×10^9 per c.c. respectively. In the anode glow, in another instance, a single group was present, with a temperature of 60,000°. From these numbers, we can calculate the relative intensities to be expected for the lines, from data given by Elenbaas [1] for their intensities when they are excited by electrons of definite speeds. It can be shown in this way that λ5016 would be expected to be about 17 times as strong as λ4713 in the negative glow, but only 4·5 times as strong in the anode glow, in reasonable agreement with our visual estimates. Our previous conclusion [2] that electrons with anything like the full cathode voltage are not present in at all large numbers under these conditions also receives confirmation from the extremely feeble intensity of the spark line λ4686.

The second observation is that Seeliger and Mierdel's suggestion that metastable atoms are rapidly destroyed by slow electrons [3] finds support from our measurements, if at least one of the two atoms which go to the formation of a molecule He_2 is initially in such a state. It is found, as Seeliger and Mierdel supposed, that helium bands appear only in those parts of the discharge where there is a considerable concentration of relatively fast electrons (with energy greater than 20 electron-volts) and a *small* concentration of slow electrons (with energy less than about 1 electron-volt). The kinetics of the processes involved are not clear, but the atomic process coming into play in the destruction of metastable atoms by slow electrons is possibly the converse of that which causes the sharp maximum in their excitation functions.

H. MCN. COWAN.
W. L. BROWN.
K. G. EMELÉUS.
The Queen's University, Belfast,
Mar. 28.

[1] *Zeits. f. Physik*, **59**, p. 289; 1930.
[2] *Phil. Mag.*, **7**, p. 17; 1929.
[3] *Zeits. f. Physik*, **19**, p. 230; 1923.

Isostasy.

IN scientific literature of to-day dealing with geophysical matters one frequently meets assertions that the hypothesis of isostasy is universally established. Prof. Heiskanen begins a recent article,[1] "In recent years geodesists, geophysicists, and geologists have studied extensively isostatic compensation and it can be considered as a proved fact that isostatic compensation prevails, at least in North America (Hayford, Bowie), in India (Pratt, Airy, Burrard, Crosthwait), etc.". I consider this statement far from true as regards India. Pratt and Airy, whose work is published in the *Phil. Trans. Roy. Soc.* (1854–59), had only three values of the meridian value of the deflection of the vertical on which to base their studies. Pratt *suggested* the idea of *mountain* compensation; but he did not completely satisfy the observational points. Burrard in 1901 [2] did not agree with Pratt's conclusion; later on, however, in 1918,[3] by extending the scope of Hayford's isostatic hypothesis to include compensation of density anomalies, he was able to satisfy the observational data then existent in the Himalaya and neighbouring regions by attributing appropriate depth to such anomalies. Crosthwait in 1912 [4] wrote: "Speaking generally, it would appear that isostatic conditions are much more nearly realised in America than in India". He had made the necessary calculations for the Hayford deflection at 102 latitude stations and 18 longitude stations distributed over India.

My recollection of the opinion held in 1912 in the Survey of India was that a state of isostasy did not exist in India. Later, in 1918, Burrard was inclined to think otherwise.

Since 1918, however, the results of observations at many more deflection stations have been considered (229 latitude, 19 longitude—227 azimuth). We have studied these intensively during recent years. Meantime the number of pendulum stations has increased from 118 in 1918 to 205 in 1930. The form of the geoid as traced from the value of deflection has been

supported by its accord with the pendulum anomalies. The conclusions drawn are as follows : [5]

(*a*) That in peninsular India in general, isostatic compensation definitely does not prevail. An area of 100,000 sq. miles in the Gangetic Plain shows an anomaly ranging from 1000 to 6700 feet equivalent surface rock; while north of Nagpur is an area of 50,000 sq. miles with anomaly ranging from −1000 to −3700 feet of rock.

(*b*) That in Himalayan regions there is some measure of compensation ; but the total area in which adequate observations have been made is small.

It is entirely wrong then to quote India as a region supporting the hypothesis of Hayford isostasy. Isostasy *may* prevail in the Himalaya, as Pratt suggested; but it does not prevail over the remaining portion of India.

J. DE GRAAFF HUNTER
(Director, Geodetic Branch).
Survey of India, Geodetic Branch Office,
Dehra Dun, Jan. 25.

[1] "Isostasy and the Figure of the Earth", *American Journal of Science*, vol. 21, No. 121, January 1931.
[2] Survey of India, *Professional Paper*, No. 5.
[3] Survey of India, *Professional Paper*, No. 17.
[4] Survey of India, *Professional Paper*, No. 13.
[5] Details of all the work are given in *Geodetic Reports*, vol. 1, 1-5.

Origin of Cosmic Radiation.

THE frequency ν of radiation can be deduced from its absorption μ by means of the well-known formula of Klein and Nishina,[1] which can be put in the form

$$\mu = \frac{2\pi N e^4}{m^2c^4} f\left(\frac{h\nu}{mc^2}\right).$$

This gives frequencies which agree well with experiment up to the frequencies of the hardest γ-rays ; beyond this it is impossible to test it.

The formula supposes absorption to result entirely from scattering by free electrons (N per cubic cm.). In dealing with γ-radiation, all extra-nuclear electrons are treated as free, since (in the language of classical theory) their period of oscillation is long compared with the period of the incident radiation. The nuclear electrons and protons have 'periods of oscillation' comparable with those of γ-radiation, and so must not be treated as free, except when the incident radiation is of far shorter period than γ-radiation. Cosmic radiation comes within this latter category, whence it appears probable that in deducing the wave-length of cosmic radiation by the Klein-Nishina formula, N ought to refer to all electrons, nuclear as well as extra-nuclear, and not merely to the latter. A second term ought also to be added to represent scattering by protons, but calculation shows that this is entirely insignificant. The effect of taking the nuclear electrons into account is to double, or more than double, the absorbing power of all atoms except hydrogen. It increases the absorbing power of water for cosmic radiation to eighty per cent above the value usually calculated.

The following table shows the absorption (per metre of water) calculated for the radiation produced by the synthesis of iron, and by the annihilation of 1, 2, and 4 protons and their accompanying electrons :

Process.	$\frac{h\nu}{mc^2}$.	Calculated μ.		Observed μ (Regener).
		Extra-nuclear electrons.	All electrons.	
26 H → Fe	876	0·076	0·136	..
+ − → O	1845	0·039	0·071	0·073
+ + − − → O	3690	0·021	0·038	..
+ + + + / − − − − → O	7380	0·011	0·020	0·020

The last column gives the true absorption of the two most penetrating constituents of cosmic radiation, as analysed by Regener.[2] The agreement with the figures in the preceding column is probably well within errors of observation. Although the problem is beset by every kind of uncertainty, this agreement at least suggests that the most penetrating constituent so far observed in cosmic radiation may originate in the annihilation of an α-particle and its two neutralising electrons (the components of a helium atom), while the next softer constituent may originate in the annihilation of a proton and its one neutralising electron (the components of a hydrogen atom). Such an interpretation leaves no room for radiation originating in the simultaneous annihilation of two protons and two electrons, which would result in a unit decrease in atomic number. Although this may seem surprising at first, it accords well with the marked differentiation between elements of odd and even atomic numbers, with the fact that radioactive atoms eject α-particles but never protons, with the fact that no atom of atomic weight 2 is known, and also, I think, with the general spirit of nuclear physics.

These two constituents appear to be far too hard to be produced by the synthesis of iron, while the synthesis of heavier elements would seem to be ruled out by their rarity in the universe. If the annihilation of matter is the true origin of the two hardest constituents of the cosmic radiation, it would seem likely that these and these alone form the fundamental radiation, and that all other constituents represent mere softened or degraded forms of these. No calculation I have ever been able to make seems at all friendly to Millikan's suggestion [3] that the hardest radiation of all has its origin in the synthesis of iron.

J. H. JEANS.
Dorking, April 9.

[1] NATURE, **122**, p. 398, Sept. 15, 1928.
[2] NATURE, **127**, p. 233, Feb. 14, 1931.
[3] *Physical Review*, Feb. 1931, p. 250.

Chemistry of Vitamin B_2.

A CHEMICAL study of vitamin B_2 in a cold aqueous extract of commercial liver extract (Eli Lilly, No. 343) has been made. This solution is very rich in vitamin B_2, being effective in producing good growth in young rats on a B_2 deficient diet, in a daily dose representing 40-60 mgm. of the original liver extract.

Picric acid and benzoyl chloride do not precipitate the vitamin, nor is it precipitated or destroyed by nitrous acid. It is not precipitated by flavianic acid. Neutral lead acetate partially precipitates the active material both at *p*H 4·6 and 7, while litharge does not precipitate it at all. Silver nitrate precipitates the bulk of the vitamin. Baryta does not precipitate it either in an aqueous solution or in a medium of 50 per cent alcohol. 'Norite' charcoal adsorbs the factor at the natural *p*H of the aqueous liver extract (*p*H 4·6), which, however, could not be eluted by acid, alkaline or neutral water-alcohol mixtures, or by a dilute solution of saponin. Three extractions with 30 per cent propyl alcohol appeared to extract it partially with a considerable loss of activity. Treatment with phosphotungstic acid gives an inactive precipitate and a filtrate with a small degree of activity. A combination of the two is equally unsatisfactory. Esterification with ethyl alcohol leaves the bulk of the activity in the non-esterified portion, the ester itself being almost wholly devoid of activity. Trypsin has no effect on the vitamin.

On the basis of the present evidence it appears that, if the vitamin is a single chemical entity, it is probably not a base, an acid, or a peptide, but a neutral

substance. Preliminary experiments on the electrodialysis of vitamin B_2, carried out with Mr. T. W. Birch, also appear to support this conclusion. These fractionation experiments have given the general impression that vitamin B_2 is fairly readily adsorbed by neutral precipitates. Thus, the partial precipitation by lead acetate and also by silver nitrate is probably merely due to the adsorption of the vitamin on to the precipitates formed.

Though the liver extract is potent in both vitamin B_2 and the factor specific for pernicious anæmia, they appear to be different from evidence of the methods of their fractionation and also on other grounds.

The stability of vitamin B_2 to heating under pressure in an alkaline medium shows curious discrepancies. Commercial liver concentrate and commercial yeast extract ('marmite') are both fairly stable to autoclaving at *p*H 9 at 124° C., while aqueous extracts made from brewer's yeast, fresh ox liver, and ox muscle are markedly unstable under the same conditions. The stability appears to be connected with the presence of certain protective materials in a given fraction.

The vitamin is stable to sulphur dioxide, hydrogen peroxide, and ozone.

B. C. GUHA.

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Cambridge.

Embryology and Evolution.

DR. A. PINEY, in his letter to NATURE of Feb. 28, accuses me of reviving a dormant form of vitalism, but with the deification of entelechy I certainly have no association. He says, "The sterility of vitalistic hypotheses in the past leads one to doubt their fertility in the future", but the fecundity of alternative hypotheses is not conspicuous.

Dr. Piney defines science *in modo et forma* with masterly assurance that the man of science has no concern with what lies outside his conceptual schemes, yet the actual instability of such schemes indicates that the real motive of the scientific worker is the attempt to discover what Dr. Piney himself admits may be of the greatest importance.

As biologists, whether we incline to the belief that the living cell is something self-contained and perfectly unique in the universe, or whether we suspect that it, in common with the rest of matter, is subject to obscure external forces, our confession in regard to the control of vital processes, so far, is one of ignorance. But those of us who feel that the living cell is a machine in miniature, the very life of which depends, as a familiar fact, upon its reception of electromagnetic radiations of the order 8000 to 4×10^6 A., may perhaps be pardoned for suspecting that the protoplasmic cogs are driven by external forces, even though we profess no adherence to the views of the great Nicholas of Cusa.

MALCOLM E. MACGREGOR.

Wellcome Field Laboratory,
Wisley, Surrey,
Mar. 21.

High-flying Egrets at Night.

ASTRONOMICAL and ornithological readers of NATURE may be interested to hear of a somewhat extraordinary experience I had rather early in the morning of Feb. 16 while sweeping for comets. About 12.30 A.M. I was suddenly startled to see in the field of view of my 7¾-inch reflector, using an eyepiece giving about 35 power, about twelve to fifteen large golden-coloured objects, like third magnitude stars much out of focus, and thus enlarged, crossing the field at a fair pace. At first I wondered what it could be. It was as if a star cluster like the Pleiades had suddenly taken to flight. I soon recognised as I followed the objects in the telescope that they were a flight of the little white egrets, passing a little more than a mile away, and so high up that the electric lights of the city lit up the under side of their wings, giving them a golden colour like stars. I followed them for about two minutes, first in the reflector and then in the finder, until they got out of my reach towards the west. When first I saw them they were perhaps a little to the east of the Southern Cross, and about the same altitude, say 45°–50°. They travelled west and passed 4° or 5° below Canopus, and then I lost them, as they got too far west for my balcony.

These egrets are often seen in these parts following cattle and eating the flies in their track or on their bodies. It would be interesting to know if anyone has seen such a thing at night before. They were flying in a wedge shape, and I could see the motion of their wings, probably about one mile high and one mile away. Of course, in the daytime birds have been seen crossing the sun's disc, but this was midnight.

THEODORE B. BLATHWAYT.

P.O. Box 7532, Johannesburg,
Feb. 16.

Fine Structure in the Mercury Singlet Terms: A Correction.

I WISH to direct attention to an error in the particulars I have recently given [1] of the fine structure of the line λ6234 ($7\,^1S_0 - 9\,^1P_1$) in mercury. The positions of the components *g* and *f*, given as −0·406 and −0·696 cm.$^{-1}$, are actually −0·306 and −0·544. The diagram in Fig. 2 requires a corresponding emendation. The corrected value 306 for the interval *bf* in $7\,^1S_0 - 9\,^1P_1$ now agrees reasonably well with the interval 308 (*be*) of λ5676 ($7\,^3S_1 - 9\,^1P_1$), and its previous allocation to the $9\,^1P_1$ level is thus confirmed. Further, the intervals 31, 121, 156 which occur in the $9\,^1P_1$ term are now seen to be consecutive since their sum, 308, is established as a real difference. The main conclusions reached in the paper are not affected by the error.

S. TOLANSKY.

Physics Department, Armstrong College
(University of Durham),
Newcastle-on-Tyne,
Mar. 25.

[1] *Proc. Roy. Soc.*, A, **130**, 559; 1931.

The Theory of Geological Thermal Cycles.

DR. J. H. J. POOLE'S opening paragraph (NATURE, April 4, p. 518) suggests that in my first criticism of Prof. Joly's theory I did not consider the possible effects of fusion in the production of periodicity. On the contrary, the main topic of the paper was to discuss whether fusion could have such an effect; and none was found.

I need scarcely say that I do not share Dr. Poole's doubt as to whether a fluid, with internal generation of heat, would maintain the adiabatic gradient of temperature. There is abundant theoretical reason for this, and it is in accordance with meteorological experience.

HAROLD JEFFREYS.

St. John's College,
Cambridge.

Canadian Hydro-Electric Power Development during 1930.

By Dr. BRYSSON CUNNINGHAM.

THE remarkable progress which, during recent years, has characterised the development of natural sources of water power in Canada for the generation of electricity and other industrial uses continues at an unrelaxed pace, and the two annual reports [1] recently issued by the Canadian Government contain a record of activities during 1930 which is quite up to the standard of preceding years. The present rate of development in round figures is 400,000 additional horse power a year, and as the aggregate has grown from 3¼ million horse power in January 1924 to a little more than 6 million horse power in January 1931, it is obvious that, roughly, the rate has now been maintained for a period of seven years. Taking the comparative value of coal fuel for power generating purposes at 5½ tons per annum per horse power (the most recent estimate), it can be inferred that Canada is progressively supplementing her extremely meagre resources in mineral fuel by the equivalent of a supply of about 2¼ million tons of coal per annum. Moreover, as compared with coal, water power energy has the advantage of perpetuity, for, once installed, the turbines may continue to function for an indefinite period, in contradistinction to the inevitable, though gradual, exhaustion of fuel used in thermal stations.

The precise figures of available and developed water power, as ascertained to Jan. 1 last, are set out in the table on p. 597. They may be instructively compared with the corresponding statistics at Jan. 1, 1930, which were published in NATURE on May 31 last.

It will be noted that there has been no further revision of the total available horse power, which still stands at 33,617,500 (ordinary six months' flow), although the report indicates that, in some of the more remote and less explored districts, the figures must be accepted as provisional and subject to expansion as the work of surveying and tabulation proceeds. Moreover, the present estimates are of a decidedly conservative character, as may be gauged from the fact that actual development of existing sites has produced power some 30 per cent in excess of the calculated maximum. Hence it is fairly safe to say that the total water horse power assets of Canada are of the order of 43 or 44 millions. According to information gathered from reports of the United States Geological Survey, this compares roughly with about 80 millions in the United States. The water power resources of Great Britain on this scale are insignificant: perhaps a million, or, at the outside, a million and a half.

As regards actually developed power, the aggregate increase throughout the Dominion is 397,850

FIG. 1.—Cameron Falls development, Nipigon River, Ontario (75,000 horse power), of the Hydro-Electric Power Commission of Ontario. (By courtesy of the High Commissioner of Canada.)

horse power, of which the bulk has been realised in the provinces of Ontario and Quebec, though notable progress has also been made in British Columbia, Saskatchewan, and New Brunswick. Very little change has taken place in Nova Scotia, and the other four provinces remain stationary.

The province of Ontario heads the list of increments with 136,000 horse power. The most important item in this total is a tenth unit of 58,000 horse power added to the Queenston station at Niagara Falls, bringing the aggregate capacity of the station, which is the largest in Canada, up to the imposing figure of 560,000 horse power. Almost as large an increment is the recently completed 54,000 horse power development on the Nipigon River at Alexander Landing, a short distance below the 75,000 horse power installation at Cameron Falls (Fig. 1). The Hydro-Electric Power Commission of Ontario has at present in hand, in conjunction with the Ottawa Valley Power Company, the development of Chats Falls, on the Ottawa River, at a site which lies astride the Ontario - Quebec boundary, where, forming part of a project for 280,000 horse power, eight units, aggregating 224,000, horse power, are being installed. Other important schemes have materialised at the Upper Notch station on the Montreal River, belonging to the Canada Northern Power Corporation; at the Canyon on the lower Abitibi River, under the Ontario Power Service Corporation, and at High Falls, Michipicoten River, for the Algoma District Power Company.

The Province of Quebec, with an increment of 122,700 horse power during the year, is a close second to Ontario. The additions have been contributed by five organisations. The MacLaren-Quebec Power Company has installed 90,000 horse power, out of a proposed 120,000 horse power development, on the Lievre River (Fig. 2), and contemplates the construction of a second 120,000 horse power station near the junction of that river with the River Ottawa. The Cedar Rapids Reservoir of 25 thousand million cubic feet capacity has also been brought into commission. The Shawinigan Water and Power Company has added a 25,000 horse power unit to the plant at Grand'mère and is now supplementing the station at La Gabelle with a 30,000 horse power unit, both on the St. Maurice River, farther up which an initial installation of 160,000 horse power is in hand at Rapide Blanc. Smaller installations have been effected by the Lower St. Lawrence Power Company and two other concerns.

The Province of Quebec will receive a considerable augmentation of power in the near future when the undertakings of the Beauharnois Power Corporation on the St. Lawrence River (200,000 horse power and ultimately 500,000 horse power), the Alcoa Power Company on the Saguenay River (260,000 horse power), and the joint development, above referred to, of the Ottawa Valley Power Company and the Hydro-Electric Power Commission of Ontario, on the Ottawa River, are completed. The Saguenay River project at Chute-à-Caron is actually at the point of completion. The

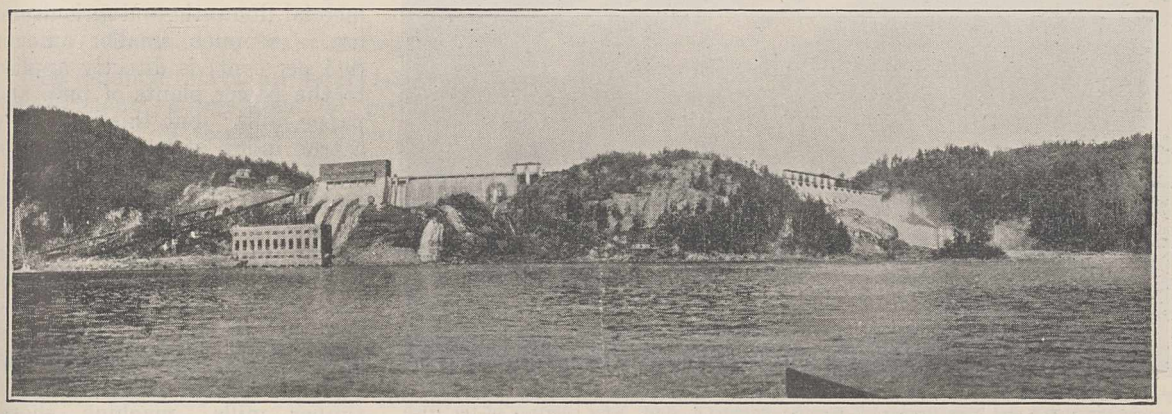

Fig. 2.—High Falls development, Lievre River, Quebec (90,000 horse power), of the MacLaren-Quebec Power Co. (By courtesy of the High Commissioner of Canada.)

Available and Developed Water Power in Canada Jan. 1, 1931.

Province.	Available 24-hour Power at 80 per cent Efficiency.		Turbine Installation. (h.p.).
	At Ordinary Minimum Flow (h.p.).	At Ordinary Six Months' Flow (h.p.).	
British Columbia	1,931,000	5,103,500	630,792
Alberta . .	390,000	1,049,500	70,532
Saskatchewan	542,000	1,082,000	42,035
Manitoba .	3,309,000	5,344,500	311,925
Ontario . .	5,330,000	6,940,000	2,088,055
Quebec . .	8,459,000	13,064,000	2,718,130
New Brunswick	68,600	169,100	133,681
Nova Scotia .	20,800	128,300	114,224
Prince Edward Island . .	3,000	5,300	2,439
Yukon and N.W. Territory .	294,000	731,000	13,199
Totals . .	20,347,400	33,617,200	6,125,012

Note.—"Ordinary Minimum Flow" is based on the averages of the flows for the lowest two periods of seven consecutive days in each year, over the period for which records are available. "Ordinary Six Months' Flow" is based on the continuous power indicated by the flow of the stream for six months in the year. The actual method to determine this flow is to arrange the months of each year according to the day of the lowest flow in each. The lowest of the six high months is taken as the basic month. The average flow of the lowest seven consecutive days in this month determines the ordinary six months' flow for that year. The average of such figures for all years in the period for which data are available is the ordinary six months' flow used in the calculation.

Beauharnois project was referred to in NATURE of Dec. 14, 1929, p. 930, at the time of the inauguration of constructional operations by His Excellency the Governor-General. It is a most important undertaking, comprising an overland canal from the St. Lawrence River, 15 miles in length, 600 ft. wide, and 27 ft. deep. The canal will extend from its intake at Lake St. Francis to a power house and locks at Beauharnois on Lake St. Louis, where a direct fall of 83 ft. will be obtained.

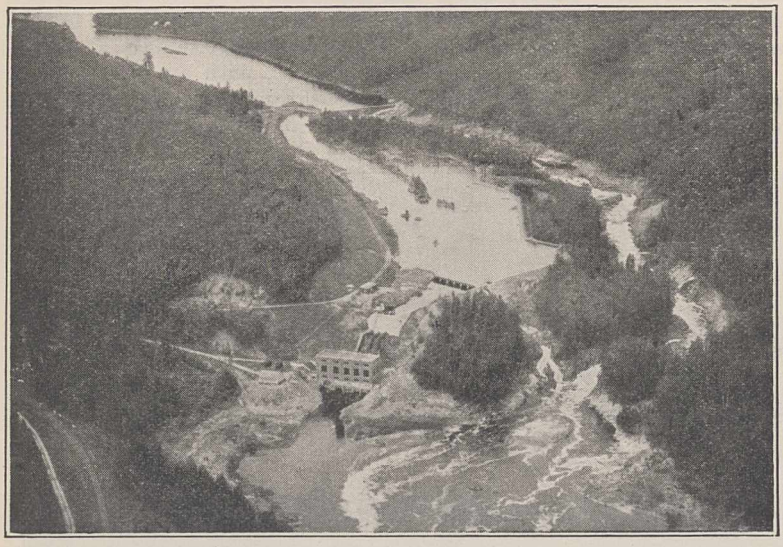

FIG. 3.—Aroostook Falls development, Aroostook River, New Brunswick (11,400 horse power), of the Maine and New Brunswick Electric Power Co., Ltd. (By courtesy of the High Commissioner of Canada.)

The financial commitments in schemes of this magnitude are necessarily of a very high order. In the aggregate, it is computed that during the past year a sum of no less than 80 million dollars (say £16,000,000) has been expended on programmes of construction at the various centres, and it is estimated that a further outlay of 300 million dollars (£60,000,000) will be incurred during the next two or three years. More than 11,000 men are at present employed in actual constructional work *in situ*, in addition to a large army of operatives engaged at factories and elsewhere in producing material and equipments.

There are many features of interest among the lesser undertakings, but space does not permit of reference to them. A picturesque view of a relatively minor development in New Brunswick is shown in Fig. 3.

A substantial part of the Report on the Water Power Resources of Canada is devoted to a detailed account of the various ways in which the developed power is utilised. The overwhelming bulk (85·1 per cent) is produced at central electric stations for general distribution for industrial, municipal, commercial, domestic, and agricultural use. A much smaller amount (9·5 per cent) is directly applied to the power plants of pulp and paper mills; but this is scarcely a true index of the demands of this industry, by far the most important in Canada, since large quantities of electricity are purchased *en bloc* from the central stations. The balance of 5·4 per cent is absorbed in general industrial undertakings, such as mines and mineral reduction works, electro-chemical plants, saw and timber mills, machine shops, pumping plants, and for electric railway operation. The total water power installed at the present date works out at 617 horse power per 1000 of population, and places Canada in an outstanding position *per capita* among water-power-using countries. The capital so far invested is estimated almost to reach the startling figure of 1,390,000,000 dollars, or nearly £280,000,000.

[1] Report No. 1462: "Hydro-electric Progress in Canada in 1930"; Report No. 1474: "Water Power Resources of Canada". (Ottawa: Department of the Interior, Canada Dominion Water Power and Hydrometric Bureau.)

Work of the Medical Research Council.

THE Report of the Medical Research Council for 1929–30 * indicates as usual the wide range of the researches carried out by members of its staff or by other investigators, assisted by grants. The value of the funds available has been enhanced by the collaboration of various public bodies with the Council in specific schemes of research and by the facilities provided for investigations by university and other laboratories. During the year, Sir Frederick Gowland Hopkins and Sir Charles Martin retired from the Council, and their places were filled by the appointment of Sir Charles Sherrington and Dr. J. A. Arkwright.

* Committee of the Privy Council for Medical Research. Report of the Medical Research Council for the year 1929–30. (London: H.M. Stationery Office, 1931.) Pp. 138. 2*s*. 6*d*. net.

CLINICAL RESEARCH AND EXPERIMENTAL MEDICINE.

During the year, University College, London, established within its Hospital a Department of Clinical Research. Sir Thomas Lewis was appointed as the first physician in charge of the Department on his resignation as a member of the ordinary staff of the Hospital. He will continue, as before, to give whole-time service to the Medical Research Council. At Leeds, Birmingham, and Aberdeen, steps are being taken to provide full-time positions for clinical research. At Aberdeen also, the professor of pharmacology is to be given charge of beds within the new Royal Infirmary, thus reproducing the conditions at

Sheffield, where Prof. E. Mellanby is both professor of pharmacology and a physician to the Royal Infirmary.

Sir Thomas Lewis and his colleagues have studied Raynaud's disease: they have shown that the malady is due, as Raynaud thought, to arterial spasm, and that the abnormal element in the reaction to cold is a direct reaction, due to a peculiar condition of the vessel wall, and is not the result of a reflex through the vasomotor nerves. In further analysis of the reaction of the body to cold, they have shown that after a finger has been immersed in cold water for 5-10 min., a vasodilatation occurs which is due to an axon reflex in the sensory nerves. This mechanism plays an important part in protecting exposed areas from excessive cooling and subsequent injury.

Biological Standardisation.

The Council plays an important part in the development of methods of precision for the measurement of therapeutic agents which cannot be estimated by direct chemical means, in the preparation of standards of reference for these assays, and in the administration of the Therapeutic Substances Act. The full value of this work is only attainable by international agreement, for which the League of Nations has set up a permanent International Commission on Biological Standards under the chairmanship of Dr. Madsen. Dr. H. H. Dale, director of the National Institute for Medical Research, is the British representative on this Commission.

The issues of samples of standards to licensees under the Therapeutic Substances Act numbered 190: 500 samples of different substances were tested for the authority administering the Act. A considerable number of these were samples of "sterilized surgical catgut", which was added to the schedule of therapeutic substances during the year. A dried antiserum for, and suitable toxin of, *B. Welchii* have been prepared and are available for issue whenever an international standard for the former has been defined.

For the past sixteen years, all the toxicity and potency tests of samples of novarsenobenzene and sulpharsenobenzene have been carried out by members of the staff of the Institute. The exact terms of the test can now be precisely defined and standards of toxicity and potency have been laid down by international agreement. It was therefore found possible during the year to direct British manufacturers to perform the biological tests for themselves, so that the Institute will gain resources of time and material for progressive research in chemotherapy.

A standard for vitamin D in the form of a solution of irradiated ergosterol was also made available during the year and supplied to twenty-eight institutions in Great Britain and in eight other countries.

Insulin.

Except for a few months immediately after its discovery, the supply of insulin has always exceeded the demand in Great Britain and has provided a growing export trade. At the same time, the home demand has continually increased; for example, the consumption in 1930 was four times greater than in 1925. But even the present consumption corresponds with much less than the present number of diabetic patients in Great Britain, so far as that can be estimated. Again, the proved benefit of insulin in the individual case is not reflected in the death-rates for diabetes as a whole, which have remained fairly steady since 1922. Both these facts suggest that insulin is being inadequately utilised.

Analysis of the death-rates, however, shows that at the earlier ages there has been a reduction since the introduction of insulin: thus the mortality of males less than 55 years of age has been reduced by 37 per cent and of females by 21 per cent since 1923. Above 55 years of age, the death-rate for males neutralises the earlier decrease and for females actually outweighs it. The increase is evidently dietetic, since the mortality at these higher ages was greatly reduced during the War: and it is in this type of case that insulin treatment is least frequently used.

Nutrition and Vitamins.

The Council has arranged a trial, among Royal Air Force personnel, of the value of regular administration of vitamin A in the prevention of colds or other ailments during the winter months, and, with the co-operation of the medical staff of the London County Council, of its usefulness in the treatment of infective middle ear disease after scarlet fever, and in the prevention of dangerous sequelæ after the common infective fevers. Prof. E. Mellanby and his colleagues have continued their work on the anti-infective action of vitamin A: it appears to improve the chances of recovery in puerperal fever, and also, administered prophylactically, to reduce the incidence and the severity of any infections which may develop. They have also found that cereals, especially the germ, will produce degeneration in the spinal cord when the body is deprived of vitamin A; administration of the vitamin will bring about rapid improvement of function. Vitamin A also prevents the neurological changes found in 'ergotism'.

The pure substance carotene has both the growth-promoting and anti-infective properties of vitamin A, although chemically it is an entirely different compound. Moore has shown that when carotene is given to rats, large quantities of vitamin A, detected by colorimetric and spectroscopic tests, can be found in their livers, indicating that carotene is converted to vitamin A in the body (see *Biochem. Jour.*, vol. 23, p. 1267; 1929: vol. 24, p. 692; 1930).

Chemical studies of vitamin D have been continued by Bourdillon and Webster and their colleagues. The mixed products of the irradiation of ergosterol have been fractionated by distillation in a high vacuum. Partial destruction occurs, but a fraction of high activity can be obtained and,

from this, active crystalline products, but the potency is not high enough to justify the supposition that the vitamin is present in pure form. Evidence has also been obtained that at least one other substance is formed as a primary irradiation product of ergosterol with the vitamin D.

Vitamin deficiencies have been found to have effects upon the heart. Carter and Drury found that bradycardia and heart block occurred in pigeons fed on polished rice: Drury, Harris, and Maudsley observed a bradycardia in rats fed on diets deficient in vitamin B, which differed from the former type in being of sinus origin and not due to vagal influence.

Mackay has found that anæmia is common in artificially fed, and to a less extent in breast-fed, infants, and is due to a deficiency of iron. The anæmia diminishes resistance to infection and retards growth. It can be prevented, and the morbidity rate simultaneously reduced, by administering a suitable form of iron salt.

Miss Durham has now completed a prolonged experiment upon the effects of alcohol on the fertility of guinea-pigs and on their offspring. No deleterious effects whatever were observed: the litters obtained from alcoholic parents, or from their descendants, were as numerous and as heavy as those from control matings and showed no excess of still-births or deformities. No transmitted defects were observed. These results therefore fail to confirm those obtained by Stockard and published in 1913.

HORMONES.

Dale and Gaddum have investigated the contractures of voluntary muscles, deprived of their ordinary motor nerve supply, which are elicited by stimulating the nerves which cause dilatation of their small arteries. The muscles also react, by contractures, to the injection of chemical substances, of which acetylcholine is the most potent. It appears almost certain that the nervous stimulation liberates acetylcholine and that the contracture is really due to the action of this substance upon the muscle fibres. Eserine enhances the action of acetylcholine: Matthes has found this effect to be due to the inhibition of the blood esterase, which hydrolyses it.

Drury has continued his work on muscle adenylic acid and yeast adenosine: both powerfully dilate the coronary arteries of the heart. Adenosine may have a therapeutic value as a vasodilatant, since it is nontoxic.

Marrian has continued his work on the chemistry of oestrin: it can be readily extracted with ether from acidified urine obtained from pregnant women and purified by saponification and fractionation with solvents (see *Biochem. Jour.*, vol. 23, p. 1233; 1929: vol. 24, pp. 435, 1021; 1930). The crystalline substance has a very high activity.

Gaddum has shown that a relatively simple polypeptide containing thyroxine, isolated from the thyroid gland by Harington by treatment with digestive enzymes, is as effective as *l*-thyroxine when injected subcutaneously into the rat, but much more effective than the latter when both are given by the mouth.

PATHOLOGICAL RESEARCHES.

In conclusion, brief reference may be made to a few of the numerous researches of a pathological or bacteriological nature. A report by the Departmental Committee of the Ministry of Health, on maternal mortality and puerperal fever, with which the Medical Research Council has been collaborating, has shown that 40 per cent of deaths are due to septic infection, 20 per cent to toxæmias, and 40 per cent to various accidental causes. The prevention of the latter needs the better application of known means; our knowledge of the toxæmias is still imperfect, but administration of large doses of alkalis has been found to have a beneficial effect in the renal complications of pregnancy. Research on the organisms responsible for puerperal fever and on methods of prevention and treatment is being actively pursued, and will be assisted by the building of a special block for septic cases at the new Queen Charlotte's Hospital at Hammersmith.

Dunkin and Laidlaw have continued their work on canine distemper. A method has been devised for measuring the progress of antibody production; the antiserum will fix complement in the presence of the virus, *in vitro*, and the reaction may be a means of estimating the potency of the virus or of the antiserum. Durable immunity to the disease can be produced by injecting the serum and the virus at the same time into another part of the body, so that the whole process of immunisation can be performed on a single occasion.

Dobell has completed some prolonged studies on the *Entamœba histolytica*, the cause of amœbic dysentery in man. The organism can now be maintained indefinitely in artificial culture and any stage in its life history can be produced at will; it can be inoculated into a macaque monkey and the infection eradicated at will by therapeutic means. Conditions affecting either host or parasite separately, or both, together can therefore be studied in detail: these researches should pave the way for a really efficient treatment or prevention of the disease in human beings.

The Paris Observatory.

IT has been decided to close the Paris Observatory and erect a new national observatory at a cost of £400,000 in the Durance region of Provence, retaining the old building as a repository for equipment not in use and the many historic instruments the Observatory possesses. It is many years since the proposal to remove the Observatory was initiated, and the present decision has been taken mainly on account of the difficulty of carrying on observations, due to the prevailing atmospheric conditions and to the vibration caused by the heavy volume of motor traffic in the neighbourhood.

Though the decision is undoubtedly a right one,

many will regret the passing of an institution which has played a prominent part in the scientific life of the French capital. Situated about half a mile south of the Luxembourg, the Observatory was built in the reign of Louis XIV. to the designs of Claude Perrault, the famous architect of the Louvre. It was begun in 1667 and completed in 1671—four years before the erection of Greenwich Observatory—and Dominique Cassini, the Italian astronomer, was appointed the first superintendent.

In spite of the eminence of its designer, the building was not well adapted for its purpose, for as Grant says, "No means were provided in the construction of the building for enabling the astronomer to observe the celestial bodies at all altitudes, by means of instruments sheltered under its roof, nor was it possible to repair the omission, on account of the enormous thickness of the walls". Neither was its organisation one which was likely to lead to the best results. Though Cassini was appointed its nominal head, no fixed sum was set apart to provide for the annual maintenance of the establishment. No definite plan of observation was drawn up, and the Observatory was available for other astronomers desirous of prosecuting their own lines of study. Cassini began his observations at the Observatory on Sept. 14, 1671, Picard his on July 9, 1673, and La Hire his in 1677. Six years later a mural quadrant of 5 ft. radius was installed and with this instrument La Hire made meridional observations for thirty years. Four Cassinis in all were successively at the head of the Observatory, their combined periods of office extending over a hundred and twenty years.

With the nineteenth century many changes were introduced, and the Paris Observatory has had a succession of directors whose names have become household words. From 1830 until 1853, Arago was the director, but it was his successor, Leverrier, who became the real organiser of the Observatory. Newcomb, who stayed in the Observatory as a guest of Delaunay during the Commune in 1870, said Leverrier's work "was not dissimilar to that of Airy at Greenwich; but he had a much more difficult task before him, and was less fitted to grapple with it". Early in 1870, Leverrier indeed had become so unpopular that he was removed from office; but in 1872, on the tragic death of Delaunay, he was reappointed director. He continued to hold office until he died in 1877, and for many years his statue has stood in the Cour d'Honneur.

The reputation of the Paris Observatory has been raised still higher under the régime of Leverrier's successors, Mouchez, Tisserand, Loewy, and Baillaud, who, as Newcomb remarked in his "Reminiscences of an Astronomer", "have known where to draw the line between routine on the one side and initiative on the part of the assistants on the other". The pages of Nature have frequently contained notes on the progress of work carried out at the Observatory.

Obituary.

Prof. Otto Wallach.

In Otto Wallach, German chemistry loses one of its organic pillars. He is almost the last to go of a great generation which believed in the serious study of materials at the laboratory bench as the prime and proper occupation of the chemist and could express itself in plain, straightforward, honest language, free from illusions and pretence. The split *p* and the proton leaning-post have changed all that: the beginner no longer learns even to determine the molecular weight of oxygen, although he is prepared to discuss the 'in'ards' of its atoms; analysis is a meaningless word to him; he is not really to be trusted to analyse anything, either by word or deed. What was a moral science is fast becoming mere superstition to the majority. The example of a craftsman like Wallach is therefore of special value. Devoting himself to the study of one of the great groups of plant products, the essential oils, he developed consummate analytical skill in unravelling Nature's most tangled mixtures, thus laying not only foundations for the future study of vital products but also contributing largely to the development of a most remunerative industry.

Wallach was born on Mar. 27, 1847, at Königsberg, Prussia; he died on Mar. 1. Educated at a humanistic gymnasium in Potsdam, his university studies were carried on at Göttingen, where he came under Wöhler, probably a greater chemist than his partner, Liebig; Fittig, a most accurate but unimaginative worker; and Hübner, a man of lesser note; he then spent a term in Hofmann's laboratory in Berlin. After taking his degree in Göttingen in 1869, he passed the winter in Berlin as assistant to Wichelhaus, becoming assistant to Kekulé in Bonn in the spring of 1870. Part of 1871 was spent in the Berlin Aktiengesells. für Anilinfabrikation. In 1872, he returned to Bonn as laboratory assistant. He became a *Privat-Docent* in 1875 and *extraordinarius* in the following year. Thirteen years later, he succeeded Victor Meyer at Göttingen.

Wallach's career therefore was neither adventurous nor rapid. He began his work on essential oils in 1884. His industry so impressed the electors that, in 1910, as all good German chemists do, he received a Nobel Prize. If an infinite capacity for taking pains be the mark of genius, he was definitely a genius; if imaginative power and a developed artistic and critical sense be the criteria, he was simply a highly competent workman: a good cook, able to serve up dish after dish in well-garnished form, scarcely a *chef* of high degree. He was not even a pioneer but took up the ball, at a propitious moment, when the development of structural and synthetic chemistry was in

full swing and help was coming in from every quarter; following it closely, happily aided by the inspired action of men like Tiemann and Baeyer, who every now and then gave to it a guiding kick, he was able to carry it forward with ever-growing advantage, the score of papers to his record being ultimately 179.

The first foundations of terpene chemistry were laid in France, especially by Berthelot. Gladstone and Wright were early in the field here but did not get very far. In the early 'seventies, Tilden and I began to revise and extend the French work but the real cause of advance was Tilden's brilliant discovery of the beautifully crystalline nitroso-chlorides and nitroso-derivatives of turpentine (pinene) and citrene. We were early convinced that the number of isomeric hydrocarbons had been greatly exaggerated. Wallach began by studying wormseed oil but soon passed into our field—without ever asking our permission, although those were days when not all were pirates as now. He scored his first real success in working with Tilden's compounds. It was therefore amusing when, in 1890, in a paper in the *Annalen* he practically accused me of having picked his brains when I had visited his laboratory shortly before. This was in connexion with sobrerol. As a matter of fact, I had been collecting the material a dozen years previously: it was in this work that Sir William Pope's crystallographic genius first became apparent.

If we ask why Tilden, who made so brilliant a beginning, did so little afterwards, whilst Wallach who had trod in his footsteps did so much, the answer is that in 1880 Tilden became the head of a new school (Mason College) and had 'fish to fry' more important than essential oils. Wallach had not a few helpers, under the German university system. The last thing Birmingham cared for then was research. Tilden had scarce a student to work with him: his men were under no Ph.D. compulsion to attempt original work. I was in a like position and, at about the time Wallach began, had three new laboratories on my hands in rapid succession. Still we kept the camphor pot boiling usefully, so that an English camphor school gradually arose; this began by doubting Kekulé. Perkin junior's synthetic terpene work stands unrivalled. Later English workers in the field have given proof that there are still craftsmen among us. Maybe, ere long we shall have to show that not a few of the conclusions of the Wallach school are unsound.

Wallach was able to accomplish his work because he was under conditions which were the outcome of centuries of loving care for the universities and a public belief in the value of education. Here, fifty to sixty years ago, even Oxford and Cambridge were scarce known to natural science. Cambridge came fairly rapidly to the fore but Oxford was slower. Meanwhile schools of university rank have been established in every considerable town in the country; perhaps some of us who have contributed to this end may prove to have done work of far more value than that on essential oils.

HENRY E. ARMSTRONG.

WE regret to announce the following deaths:

Mr. T. C. Cantrill, formerly of the Geological Survey of Great Britain, on April 3, aged sixty-three years.

Sir John de Villiers, noted especially for his work while in charge of the map room at the British Museum and his contributions to geographical and historical literature, on April 2, aged sixty-seven years.

News and Views.

THE Society for the Preservation of the Fauna of the Empire performed a great service when it persuaded the Secretary of State for the Colonies to approve of and support a general survey of the East African group of Colonies and Dependencies from the point of view of the preservation of wild life. A fortunate choice selected as observer Major R. W. G. Hingston, already well known for his natural history observations; and after a rapid survey of the land, the results and conclusions of his tour were presented on Mar. 9, in the form of a lecture to the Royal Geographical Society. Major Hingston had the advantage of discussing with Government officials and representatives of public opinion the problems which face the fauna of Africa, and on the basis of these discussions and his own observations he has submitted for the consideration of H.M. Government a scheme of nine national parks, which, if brought into being and effectively conducted, would ensure the perpetual preservation of the fauna of these territories, without undue interference with native rights or economic development. To anyone familiar with the history of wild life in Africa, the gradual but constant retreat and often final extermination of the large animals is a commonplace, but surely Major Hingston exaggerates when he states that "great and small, everything is retreating". The general experience is that cultivation of the soil *increases* the amount of wild life; only, the great animals go, and the small things that take their place, even if they do not become pests, far from compensate for the picturesqueness of the departed.

THE large animals are at the mercy of several disruptive forces. Of these, man has brought into play cultivation of the soil, the demands of special trades, and the activities of sportsmen; while Nature threatens with epidemic diseases. Not only has African wild life suffered directly from such diseases, but the suspicion that it may harbour or encourage diseases to which man is subject has concentrated a new warfare against it, so that last year 20,000 head of game, including 9000 zebra and 2500 wildebeest, were slaughtered in Zululand because it was feared that they kept alive the tsetse fly with its burden of sleeping-sickness. National parks and game reserves at present help to preserve the wild life of Africa, but the perma-

nence of the latter is uncertain, since their establishment or dissolution depends simply upon a proclamation in the local Government *Gazette*, agreed to by the Secretary of State. National parks, on the other hand, are more stable, made by Act of Parliament the property of the public for ever, to be utilised for the sole purpose of preserving the natural objects within them. "It is the belief", declared Major Hingston, "of all who desire the perpetuation of the fauna, that national parks on this rigid basis should replace the fluid reserves." Accordingly, he describes a series of nine national parks ranging from South-Central Africa to the gorilla territory of Uganda. It is important that these parks should be created before wild life approaches the stage of disappearance. Not only will delay make them less effective for their prime purpose, but also it will add to the difficulties and cost of establishing them.

Of the many inventors from whose work has gradually been evolved the modern safety bicycle, James Starley, the centenary of whose birth occurs on April 21, was one of the most successful. By his improvements, it has been said, he rendered bicycles and tricycles machines capable of general use, while to his perseverance and energy Coventry owes its position as the centre of the cycle industry. The son of a Sussex farmer and born at Albourne, he began work on the land at the age of nine and at fifteen was a gardener in the employ of the famous marine engineer, John Penn, at Lewisham. A born inventor, he abandoned gardening for mechanics, and first in High Holborn and then in Coventry was employed on the manufacture of sewing machines. On the introduction of the French 'boneshaker' bicycles into Great Britain in 1868, their manufacture was taken up by the Coventry Machinists' Company, in which Starley was a foreman, and by him quickly improved. Patenting a method of tightening the wire spokes of tension wheels, in 1870 he brought out the "Ariel" bicycle, the first attempt to produce a light all-metal machine, and from this sprang the well-known 'ordinary' or 'penny-farthing' bicycle. Starting in business for himself in 1872, he quickly gained a reputation for his machines and became known as the 'Father of the Bicycle'. He died on June 17, 1881, at the early age of fifty years, and was buried in the Cemetery, Coventry. Three years later, a monument was erected in Queen's Road bearing his portrait and representations of some of his machines. His nephew, J. K. Starley, also made notable improvements on bicycles, and in 1885, with Sutton, brought out the "Rover" bicycle, which embodied most of the features of the present safety machine.

An exhibition of British glass and glassware was held in the exhibition hall of Messrs. Selfridge and Co., Ltd., Oxford Street, London, April 13–18. The exhibition was organised by the Glass Manufacturers' Federation in order to indicate to the general public the variety and quality of the products of the glass industry. The exhibits included artistic glassware and fine crystal tableware; glass bottles and jars of various shapes and sizes; sheet-glass in different forms and plate-glass from $\frac{1}{8}$-inch in thickness to $1\frac{1}{2}$-inch; glass transparent to ultra-violet light, and glass which excludes about 80 per cent of the heat rays. The varied range of exhibits of chemical, scientific, laboratory, and medical glassware, and of fused silica glassware, gave evidence of the remarkable progress that has been made in these branches of the industry. The application of glass in the electrical industry was illustrated by wireless valve bulbs; electric lamp bulbs, which are produced by automatic machinery; a 10 kw. electric lamp, such as is used in lighthouses and in aerodrome pilot lights; photo-cells; and neon lights for decorative and publicity purposes. Two large blocks of fine optical glass were shown, and also a polished telescope disc of 24 inches diameter. Amongst the spectacle lenses exhibited were samples of specially computed cataract lenses of light weight, and trifocal lenses made by fusing as many as six pieces of glass to form the complete lens. Spun glass, known as glass silk or glass wool, was shown in skeins, and also woven into cloth and mats. This is now being largely manufactured and used for heat insulation purposes on boilers and steam-pipes. It is more efficient than many other substances used for this purpose, and, in the form of mattresses or strips, can be easily and quickly applied or removed.

At the quarterly meeting of the Grand Council of the British Empire Cancer Campaign held on April 13, the finance report showed that, including the grants approved at the meeting, the Campaign had now subsidised research centres and independent research workers, since its inception, to the extent of £157,000. Apart from this, a sum of more than £500,000 had been subscribed and is being administered by the branches and affiliated organisations of the Campaign throughout the British Empire. On the recommendations of the Executive Committee, the Grand Council approved the following grants: £2500 to the Cancer Hospital (Free) for its general research work, together with an additional sum of £500 to meet the expense incurred by the Research Institute by the appointment of its bio-chemist, Dr. J. W. Cook; £650 for one year to St. Mark's Hospital, City Road, and £2500 to St. Bartholomew's Hospital. For the sixth year in succession, the Grand Council renewed the grant of £680 to the Medical Research Council towards the upkeep of the Radon Centre at the Middlesex Hospital, which supplies a number of organisations with radon for scientific experimental investigations. Prof. W. S. Lazarus-Barlow was elected to fill the vacancy in the five nominees of the Campaign on the Scientific Advisory Committee, the other five members of which are nominated jointly by the Royal Society and the Medical Research Council. The Grand Council acceded to the request that the Glasgow Royal Cancer Hospital should be affiliated officially to the British Empire Cancer Campaign.

The "Unusual Ice Formation" described by Prof. A. Morley Davies in Nature for Mar. 7, p. 340, has also been recorded by Mr. W. B. Alexander at Reigate on the morning of Jan. 2, 1931. The latter formation consisted of a pencil-shaped column of ice $3\frac{3}{8}$ in. high

and ⅜ in. in diameter, rising vertically from a glass bowl about 4 in. in diameter and containing nearly 2 in. of water. A similar phenomenon, illustrated by a very fine photograph, was described by Mr. Basil Longley, of Crawley, Sussex, in the *Meteorological Magazine* for March 1929, and there are probably other descriptions extant. In all these cases the method of formation was probably along the lines described by Prof. Davies. Mr. Longley explains it as follows: "the water froze rapidly on top, and when the expansion took place underneath, the surface ice broke (this can be seen) and owing to the continuing pressure of the water expanding, it gradually oozed out, freezing as it came. There was a tiny hole up the centre of the column which justifies this theory." The volume of Mr. Longley's column was, roughly, one-hundredth of the ice in the bowl, of Mr. Alexander's about one-sixtieth, and of Prof. Davies' (if it was solid) about one-fifteenth; the expansion of water in freezing is about one-tenth, but the formation of the columns could not begin until a fair thickness of ice existed on the surface. The order of magnitude is approximately correct, but the formation evidently requires a high degree of cohesion between the ice and the sides of the bowl, as well as certain definite conditions of temperature, thus accounting for its rarity.

A NEW record for a long distance flight in a light aeroplane has been set up by Mr. C. W. A. Scott, who left Lympne aerodrome on April 1 and arrived at Darwin, in the Northern Territory, Australia, on April 10. His time for the journey was 9 days 3 hours 40 minutes, thus beating Air Commodore Kingsford Smith's time for the same flight last autumn by about nineteen hours. Mr. Scott's machine is a Gipsy Moth light aeroplane, specially fitted with fuel tanks carrying about a third of a ton of petrol, and the engine is a de Havilland 120 h.p. Gipsy II., the same pattern as that used by Kingsford Smith. Its cruising speed is about ninety miles an hour. According to a long communication from Mr. Scott in the *Times* of April 11, his course was from Lympne across Europe to Belgrade, on to Aleppo, then to Baghdad, Gwadar in Baluchistan, Karachi, Calcutta, Rangoon, Singapore, Bima, and then across the Timor Sea to Bathurst Island and Darwin. His longest day was 15 hours 45 minutes, covering 1450 miles, and total flying time and distance, 109 hours 50 minutes and 10,450 miles. That the aeroplane successfully withstood the strain of this flight must be very gratifying to the designers and makers of both engine and machine, while the flight itself is a noteworthy feat of personal endurance and skill.

IN a paper read before the New York Electrical Society on Mar. 19, Dr. Goldsmith discussed what he calls the "new music of electric vibrations". He illustrated it by a novel device called the electric carillon, which can send out bell tones louder than any bell in the world. A series of small steel chimes not unlike those of a household clock are struck by little electric hammers actuated by a keyboard similar to that of a piano. The sounds thus produced are only audible a few inches away but the vibrations of the steel chimes create small electric currents in devices like the 'pick-up' used in electric gramophones. These feeble currents are amplified millions of times by vacuum tube amplifiers and can be clearly heard in the largest concert hall or for miles round a church tower by means of giant amplifiers. The operator of the electric carillon not only controls the notes to be played but also can vary the volume of the tone to any desired extent. Dr. Goldsmith believes strongly in the future of electric music. In his opinion, the musical artist of the future will become more and more indispensable. The physical limitations which now weigh heavily on great artists will be largely reduced. The number of notes which the musician can play per second will not be limited by the speed of his fingers. Tones of any origin can be made to resemble those of any desired instrument by electrical methods. Each musician will be able to play not only the melody but also will be able to make it sound as if produced by any type of instrument. The new electric music will gradually evolve a new type of composer capable of utilising to the full the capabilities of emotional expression contained in electric music. Dr. Goldsmith also demonstrated the 'theremin', an electric musical instrument which is operated by moving the hands backwards and forwards in front of it. It is called the theremin, after its inventor, a Russian physicist.

In the *Engineer* of Mar. 27, Mr. H. J. Shepstone gives an account of the progress made with the scheme for supplying Palestine with electricity, generated in the valley of the River Jordan. In its passage from its source in Mount Hermon to the Dead Sea, the river has a fall of no less than 3000 ft., and it discharges more than 5,000,000 tons of fresh water into the Dead Sea daily. The entire scheme includes the provision of three hydro-electric plants, the first of which has just been completed. This station is situated at Jisr-el-Mujameh, some seven miles south of the Sea of Galilee. For the storage and control of the water two dams and two concrete-lined canals have been constructed and the first two units of 8000 h.p. each have been installed in the power-house. When the demand warrants it, two other units will be installed, while later on a second power-house will be built at Abadieh and a third at Jisir Banah Yakoub, which lie respectively south and north of the Sea of Galilee. Transmission lines will connect the hydro-electric plants with three fuel power-stations at Jaffa, Haifa, and Tiberias, and in the near future, it is hoped, every city, town, and agricultural settlement will be able to obtain electrical energy.

SMUT diseases, bunt of wheat in particular, are responsible for considerable loss of grain in England, and the illustrated bulletin (No. 24) recently issued by the Ministry of Agriculture entitled "Cereal Smuts and their Control" should prove of great benefit to the farmer. The symptoms and mode of infection of these diseases in wheat, barley, and oats are described, and methods of control, fairly simple to carry out and of moderate cost, are given in detail.

Attention is directed to the necessity for distinguishing between 'covered' and 'loose' smuts: for whereas in the former, contamination with the fungus is on the outside of the grain only, in the latter the infection is internal, and the appropriate methods of control are accordingly different in the two cases. For prevention of 'covered' smuts, of which bunt in wheat is an example, treatment or 'pickling' with formalin (1 pint of 40 per cent formaldehyde to 40 gallons of water) is recommended as preferable to the older method of steeping or spraying with copper sulphate. The advantages afforded by a dry type of treatment are obvious, and mention is made of recent successful trials of powder-pickling with copper carbonate. The control of 'loose' smuts offers a much more difficult problem, as external application of a fungicide is useless. Steeping the grain in hot water appears to be the only known remedy, but the temperature necessary to kill fungus is very close to that fatal to the grain, so that the method is attended with considerable difficulty. Copies of the bulletin may be obtained from the Ministry of Agriculture, 10 Whitehall Place, London, S.W.1. Price 5*d*. post free.

Preliminary reports on the work of the expedition of the Royal Anthropological Institute to Kharga Oasis, organised and led by Miss Caton-Thompson with Miss E. Gardiner as geologist, justify the choice of this little-explored area as the scene of the past season's work, and hold out strong hopes for the future. Thanks to the co-operation of Lady Bailey, and with the permission of the Egyptian and British Governments, an aeroplane and air-photography were at the disposal of the expedition for a period of two weeks. By this means, and with the additional assistance of camel transport, it was possible to examine the area thoroughly, and points of archæological importance were marked down for future seasons' investigations. In addition to the work of reconnaissance, the history of the springs of the floor of the oasis was investigated. This brought to light a deeply buried Mousterian culture of specialised type, showing affinities with cultures in Algeria and Tunisia. Another notable find was extensive flint workings, extending for some miles along the edge of the Kharga Scarp, the second only of its kind to be found in Egypt. A short account, with illustrations, of the results appeared in the *Times* of April 13.

The *Polar Record*, of which the first number has just appeared, is a modest journal which it is proposed to publish twice a year from the Scott Polar Research Institute at Cambridge (price 1*s*.). It is to be the official organ of that institute, and though at present merely a record of news of exploration in polar regions, it is hoped gradually to extend its scope. The first number starts well and should be full of interest to that small but growing group of explorers and students of polar regions. News is given of Norwegian work in Svalbard, Russian in Franz Josef Land and Northern Land, and German, British, American, and Danish in Greenland. There are also some details of American, Norwegian, and British work in the Antarctic, where important discoveries have been made during the last few months. The number concludes with a short bibliography of recent polar books.

The issue of the two index numbers of *Science Abstracts* completes the physics and the electrical engineering sections of volume 33 (1930). More than 200 periodicals are abstracted by 76 abstractors, most of whom are specialists in the particular branch of the subject with which they deal. The physics volume has 4165 abstracts of average length 0·267 page, and 230 pages of index; the electrical engineering volume, 2537 abstracts of average length 0·282 page, and 134 pages of index. The volumes are essential in every library consulted by physicists or electrical engineers who desire to keep themselves up-to-date.

At the annual meeting of the Gilbert White Fellowship held on April 11, Sir John Russell was elected president and Prof. E. J. Salisbury and Prof. W. H. Wagstaff were elected vice-presidents.

A memorial to Admiral of the Fleet Sir Henry Jackson, which has been placed in the crypt of St. Paul's Cathedral, was unveiled and dedicated on April 13. It is in the form of a tablet, recording the principal posts he held and referring to the services he rendered to the Navy. Sir Henry's scientific work was described in an article in Nature of Jan. 11, 1930. His chief work was a pioneer investigation into problems connected with the transmission of signals by wireless telegraphy, a piece of research inspired by some experiments by Sir Jagadis Chunder Bose on coherers. Under Sir Henry's personal supervision, this type of communication was installed throughout the Navy.

At the annual election of office-bearers of the Royal Philosophical Society of Glasgow, on Mar. 25, the following officers were elected: *President*: Prof. W. R. Scott; *Vice-President*: Dr. J. W. French; *Hon. Treasurer*: Sir John Mann; *Hon. Librarian*: Dr. J. Knight; *Hon. Auditors*: Mr. John J. D. Hourston and Mr. James A. French; *Acting Secretary*: Dr. James M. Macaulay. During the session, Sir Donald MacAlister, chancellor of the University of Glasgow; Sir C. V. Raman, professor of physics in the University of Calcutta, and Prof. F. O. Bower, emeritus professor of botany in the University of Glasgow, were elected honorary members of the Society.

According to a notice issued (in Latin) from the Vatican City on Mar. 15, the Pontifical Academy of Sciences (Nuovi Lincei) is inaugurating the broadcasting of notes and information on mathematics and the experimental sciences and their applications. In general, the language used will be Latin, but for notes referring to investigations or discoveries the author's own language may be employed, and for matters of great importance other languages may be utilised. A general invitation to supply material for this purpose is expressed, and all communications submitted will be considered by a committee of the Academy. Notes giving the results of scientific work should consist of about 300 words, and items of

information of about 100 words. Communications should be addressed "Pontificia Academia Scientiarum Comitatui pro Nuncio Radiophonico, Città del Vaticano".

AT a meeting of the Council of the Royal College of Surgeons on April 10, the Jacksonian Prize for 1930 was awarded to Mr. Edgar S. J. King, of the University of Melbourne, for his essay on "The Pathology of Ovarian Cysts and its Bearing on their Treatment". A certificate of honourable mention for an essay on the same subject was granted to Wilfred Shaw, of St. Bartholomew's Hospital. The John Hunter Medal and Triennial Prize for 1928–30 was awarded to Mr. Layton, of Guy's Hospital, for his contributions to otology and for his valuable services to the museum, particularly in connexion with the Onodi Collection. The Walker Prize for work on the pathology and therapeutics of cancer for 1926–30 was awarded to Sir G. Lenthal Cheatle. The Cartwright Prize for 1926–30 was awarded to Mr. F. W. Broderick for his essay on "The Etiology, Pathology, and Treatment of Chronic General Periodontitis (*Pyorrhea alveolaris*)".

THE twenty-first annual May Lecture of the Institute of Metals will be given on Wednesday, May 6, by Mr. William B. Woodhouse, engineer and manager of the Yorkshire Electric Power Company, on "The Progress of Power Production". Tickets for the lecture may be obtained from the Secretary of the Institute of Metals, Members' Mansions, Victoria Street, London, S.W.1. The autumn meeting of the Institute of Metals is to be held in Zurich on Sept. 13–18 by kind invitation of the Schweizerische Verband für Materialprüfung. The evening of Sept. 13 will be devoted to the formal opening of the meeting, addresses of welcome by the inviting body, and the Autumn Lecture, to be given by Mr. U. R. Evans, on "Thin Films on Metals in Relation to Corrosion Problems". The mornings of Sept. 14 and 15 will be devoted to the reading and discussion of papers, whilst for the afternoons visits have been provisionally arranged to works in Zurich and its neighbourhood. On Sept. 18 the main party will divide, one part going to Biel to visit a watch factory and leaving for England in the evening, whilst the other will go via Lötschberg to visit the new aluminium alloys rolling mills at Chippis-Siders, in the Rhône Valley. From Chippis the party will either return to London via Lausanne or Geneva, or proceed via the Simplon to Milan to take part in the International Foundry Exhibition and Congress, which continues at Milan until Sept. 27. The first congress of the New International Association for Testing Materials is being held at Zurich during the week preceding the Institute of Metals meeting.

WE have received from Messrs. A. Gallenkamp and Co., Ltd., Sun Street, London, E.C.2, their catalogues of electrochemical apparatus and colorimeters (Lists No. 80c and No. 92). In the former will be found listed apparatus for electro-analysis, the electrometric determination of hydrogen ion concentrations, and the measurement of conductivity of electrolytes. Ammeters, voltmeters, galvanometers, and thermostats are included. In the section on hydrogen ion concentration, a useful summary is provided of the use of the hydrogen electrode, with descriptions of other types, including the quinhydrone and glass electrode. In the second list, numerous types of both simple and more complicated colorimeters are detailed, including two modern patterns of the Lovibond tintometer. The catalogue gives a good idea of the range of instruments of this type which are at present on the market, and should be of use to biochemists and physiologists.

A SHORT but useful list of scientific journals and transactions of learned societies has just been issued by Messrs. Oppenheim and Co. (Rare Books), Ltd., 317A Fulham Road, S.W.10. In several cases complete sets are offered for sale.

LIBRARIANS and others interested in the Far East should obtain a copy of Catalogue No. 534, "Orientalia", just issued by Francis Edwards, Ltd., 83 High Street, Marylebone, W.1. Particulars of upwards of 1000 works are given in it relating to Burma, Ceylon, China, the East Indian Archipelago, Formosa, India, Japan, Korea, Persia, Siam, Tibet, and general works.

A GOOD catalogue (No. 364) of second-hand books, upwards of 2000 in number, has just been published by Messrs. W. Heffer and Sons, Ltd., Petty Cury, Cambridge. It ranges over the subjects of agriculture, botany, anthropology and ethnology, chemistry and chemical technology, mathematics, physics and engineering, physiology, anatomy and medicine, zoology and biology, and is strong in journals and other publications of learned societies.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A senior secretary in the Matriculation and School Examinations Department of the University of London—The Principal ("M.S.E."), University of London, South Kensington, S.W.7 (April 25). A master under the Education Department of Southern Rhodesia to teach physics and chemistry at the Boys' High School, Umtali—The High Commissioner for Southern Rhodesia, Crown House, Aldwych, W.C.2 (April 30). A chief inspector of smoke nuisances under the Government of Bengal—The High Commissioner for India, General Department, India House, Aldwych, W.C.2 (April 30). Two fellows in psychiatry at the London Child Guidance Clinic, 1 Canonbury Place, N.1—The Secretary, Child Guidance Council, 7 Buckingham Palace Gardens, S.W.1 (May 2). An assistant lecturer in chemistry at the Liverpool Central Municipal Technical School—The Director of Education, 14 Sir Thomas Street, Liverpool (May 2). An assistant lecturer in physics at the University College of North Wales, Bangor—The Registrar, University College of North Wales, Bangor (May 16). A director of the Rubber Research Institute of Ceylon—The Chairman of the Board of Management, Rubber Research Scheme, Peradeniya, Ceylon (May 30). A lecturer in tinctorial chemistry and dyestuffs at the Manchester Municipal College of Technology—The Registrar, College of Technology, Manchester (June 5).

Research Items.

Daggers with Inlaid Handles.—In *Ancient Egypt*, 1930, No. 4, Sir Flinders Petrie, referring to the recent discovery in Palestine of two examples of the dagger having a metal handle cast in one piece with the blade and bearing a plate of inlay on each side, reviews a number of examples of the type which have come into view, in various countries. These he places in six classes : (1) The butt handle, of the simplest type, with a slight curve at the end and the inlay space shallow and long. It begins about 2000 B.C. near Behistun and is found at Nineveh and Ras Shamra. (2) The pommel type, begins with the butt getting wider as in Egypt ; the distinct pommel appears in the south-west of the Caspian ; the fully developed pommel is on a dagger of Apepa III. (1600 B.C.) ; the subjects are embossed on electrum plates. This type belongs to North Syria and was brought to Egypt by the Hyksos. (3) The encased handle, begins with the deep setting of the handles as from Kasbek, Caucasus, about 600 B.C. The examples point to a primitive type of pierced bone handle. The encased inlay passed into a form like that of the deeply winged palstave. (4) To give the best grip to the handle for an upward thrust, a cusp was raised, giving the thumb and finger a more secure hold. A preliminary form appears in Hyksos times. It was a development of the tang made in shovel form to insert in a separate handle. (5) The wide blades with cross-head handles are western. The inlay is riveted on. An example of about 1400 B.C. is from Korinth, others from Knossos, Veii, Cuma, and Terni. (6) The falchion (*khepesh*, the thigh), of eastern origin, an example from Diarbekr, of 1300 B.C., has an inlay handle with the name of Hadadnirari, and another of the time of Rameses II. from Tell Retabeh.

Samoan Culture.—A detailed and exhaustive analysis of the material culture of Samoa by Te Rangi Hiroa (P. H. Buck) appears as *Bull.* 75 of the Bernice P. Bishop Museum of Honolulu. The summary of conclusions drawn is that canoes with top-sides or planks joined by right-through lashing associated with the rectangular house with wall posts and wall plate erected before the principal rafters were put up, the bow and arrow, slings, and such games as dart-slinging, bowling with discs, and string figures constitute an early culture which spread over the whole Polynesian area. Certain culture-traits such as the marae, stone figures, upright drums, and the nose-flute passed into eastern Polynesia without affecting Samoa. The striking features distinguishing Samoan culture from the general culture of eastern Polynesia are the arched houses and the flanged-plank canoes. Special efforts resulting in improved technique are closely related with class distinctions. Building and tattooing obtained their highest remuneration from the higher classes and these crafts were used to accentuate class distinction. The builders' guilds had more set rules than they had in eastern Polynesia. The Samoan system demands instant payment and immediate provision of food, as against the usual Polynesian system of reciprocal labour. Samoan material culture is uninspired.

Experimental Studies of Dengue.—Dengue is an acute, but benign, fever of 2-7 days duration and prevalent in the east. In the Philippines, the disease has recently been the subject of investigation by Majors J. S. Simmons and J. H. St. John, of the Medical Corps, and Captain F. H. K. Reynolds, Veterinary Corps, U.S. Army (*Philippine Jour. Sci.*, vol. 44, 1931, p. 1). The disease is caused by a filterable virus, and is transmitted by mosquitoes of at least two species in the Philippines, *Aedes egypti* and *A. albopictus*. It is shown that 5-10 infected mosquitoes convey the disease just as well as 150. The mosquitoes to become infected must bite the patient during the first two days of illness, but they do not transmit until twelve or more days later. It is probable that one attack of the disease confers a lasting immunity. Attempts to prepare prophylactic vaccines were unsuccessful. Attempts to transmit the disease to a number of animals failed, but evidence was obtained that two Philippine monkeys may act as reservoirs of the virus, and may be factors in the spread of dengue. A prolonged study of the blood during the course of the disease was made. An outstanding feature is a remarkable diminution in the white corpuscles at the height of the fever to one-half the normal or even less.

A Bird Census in California.—Slowly increasing numbers of bird-counts emphasise the variable size of the populations of areas of different character : there may be an average of less than a pair of birds to the acre in some places, and in others so many as fifty-four pairs—both these record areas happen to be in the United States of America. A new region in California—the Lassen Peak Region—has been intensively studied by Joseph Grinnell, Joseph Dixon, and Jean M. Linsdale, and among the many interesting observations in their 500-page monograph appears a census of the birds (*Univ. California Publ. Zool.*, vol. 35 ; 1930). The count covered an area of 6½ acres, searched daily at all hours of the day for 16 days in June, during the breeding season. Twenty-four breeding pairs were established there, not quite four to the acre. Neither casual nor regular visitors to the checked area from other areas were included. The authors consider that the average population of the whole Lassen Region is over-represented in the selected area, and from ' time ' censuses and memory impressions they would place the general average at not more than one breeding pair to the acre. The results of the systematic study of the birds themselves suggest that where individuals of a particular species are sparsely distributed and the habitat greatly interrupted, the chances for developing and perpetuating local population strains are better than in an area of contrary nature. The mammals and reptiles of the Lassen Region, as well as the birds, give many apparently good cases illustrating this point.

True's Beaked Whale in the Hebrides.—An example of this very rare whale was stranded on the Outer Hebrides in January, and has been described by A. C. Stephen (*Scottish Naturalist*, 1931, p. 37). The length of the whale was 17 ft. 6 in., and the head, which is now in the Royal Scottish Museum, possesses the single pair of teeth, set at the extreme end of the lower jaw, which is a leading character of the species. Only twice before has this whale been found in British waters, on both occasions on the west of Ireland, and two further records, from the east coast of the United States of America, complete the known appearances of one of the most elusive of whales.

Spiders of Porto Rico.—The three parts of the work of this title recently issued (*Trans. Connect. Acad. Arts Sci.*, **30**, 1-158, 159-335 ; 1929 : **31**, 1-191 ; 1930) represent the result of Prof. A. Petrunkevitch's stay as visiting professor to the University of Porto Rico during 1925–26. The spiders of the island are increased from 74 to 174 species in 100 genera ; one genus and 72 species are new, and all are very fully described, with the help of 562 detailed diagrams. A

new method of describing the appearance of a spider's leg is introduced as being more accurate than words like 'stout' or 'slender'. This consists in expressing the breadth of the patella as a percentage of the united length of tibia and patella, and is known as the 'tibial index'. Thus, for a pholcid the index is 2, for a theraphosid it is 13. A promised discussion of the Porto Rican fauna as compared with that of the other islands and of the clues as to its origin and evolution is eagerly anticipated.

Echinoderm Oogenesis.—L. A. Harvey (*Proc. Roy. Soc.*, vol. 107; 1930) discusses the cytology of oogenesis in *Antedon* and *Asterias*. The chief difference noted is that in the oocyte of the former genus, a yolk nucleus is present, but not in the oocyte of *Asterias*. Yolk appears in both under the influence of the Golgi apparatus, which consists of scale-like dictyosomes visible in the living egg in *Antedon* but not in *Asterias*. The mitochondria are early scattered in the cytoplasm and are present in large numbers. It is suggested that they are concerned in the synthesis of yolk from raw materials in the cytoplasm. Fat arises as minute droplets scattered among the yolk spherules; neither Golgi apparatus nor mitochondria are concerned in their appearance in the cell.

Observations on Tetrarhynchids.—Prof. Th. Pintner (*Sitz. Akad. Wiss. Wien, Mat.-naturwiss. Klasse*, 139 Bd., 7 Hft., 1930) gives an account of the anatomy and systematics of some little-known tetrarhynchid cestodes, with keys to the genera and species, and adds observations on the movements of the young encysted forms. In the fresh liver of the teleostean fishes *Lepidopus* and *Brama*, the young worm lies motionless in the cyst; but as soon as the liver begins to decompose, movements in the head region begin. Apparently only chemical or temperature stimuli will provoke these movements, for rough handling with a preparation needle produces no contraction. The author suggests that a stimulus would be provided in the alimentary tract of the final host (an elasmobranch) when the liver is in process of digestion and would cause the larva to strive to free itself from the cyst. The paper is illustrated by 73 figures.

Researches on Diatoms.—Miss S. M. Marshall and A. P. Orr continue their valuable researches on diatoms in their latest paper "A Study of the Spring Diatom Increase in Loch Striven" (*Journal of the Marine Biological Association of the United Kingdom*, **16**, 3; 1930). Experiments with diatom cultures and sea-water samples were carried on at the same time as the general studies. During the three years 1926, 1927, and 1928, this increase was almost wholly due to *Skeletonema costatum*, which is able to grow within wide temperature limits. There were very few other diatoms, and animals were scarce. The *p*H value and oxygen content rose and the phosphate fell with the increase in numbers of diatoms. It was found that temperature is not the direct cause of the beginning of the increase, but the density of the water which is influenced by the temperature is important, because it determines the amount of vertical mixing. The vertical currents, besides bringing up the nutrient salts, carry the diatoms from the surface layers, where there is much light, to the deeper waters, where in winter and early spring there is not enough light for photosynthesis to balance respiration. With the lengthening of the days and better weather conditions the depth at which photosynthesis may take place increases. Regarding light intensity, it is shown that in Loch Striven the date of the spring diatom increase is apparently decided chiefly by the total light, which depends both on length of day and intensity.

Crossing-over in Tetraploid *Primula sinensis*.—An interesting paper by Miss D. de Winton and Prof. J. B. S. Haldane (*Jour. Genet.*, vol. 24, No. 1) makes a comparison of the linkage relations in the diploid and the autotetraploid *Primula sinensis*. Three factors are considered—*S*, which converts pin to thrum; *B*, which converts red flower to magenta; and *G*, which produces green stigma and ovary, inhibiting red. Only *S* is fully dominant when present in one dose in the tetraploid. Six of the seven possible types of linkage between these three factors in the tetraploid have been studied. The intensity of linkage is about the same as in the diploid, but, unlike the diploid, there is no significant difference in the linkage on the male and female side. The results agree well with theory, notwithstanding that Darlington (in the same number) has found numerous meiotic irregularities in the 4*n* form. No evidence was obtained of crossing-over between more than two chromosomes of a set at one time, nor of two chromosomes going to the same pole after crossing-over. The results to be expected in the offspring of the different types of tetraploid zygote when selfed, with or without crossing-over, are given in a useful table.

'Collapse' in Australian Timber.—C. Sibley Elliot, assistant seasoning officer of the Australian Division of Forest Products, has an interesting paper in the *Journal* of the Council for Scientific and Industrial Research, vol. 3, No. 4, upon the occurrence of 'collapse' during drying of Australian timbers. This is entirely different from the normal shrinkage and swelling of timber with changing water content. Shrinkage is associated with an approach of the fibres towards one another as the timber dries, and cannot be prevented. 'Collapse', on the contrary, involves the actual breaking down of many of the microscopic tubular elements in the wood, and it is frequently accompanied by considerable distortion in consequence. 'Collapse' occurs in several of the Australian eucalypts to a considerable extent; in Australian-grown timber it occurs mainly in the young outer wood or in wood from the upper part of the tree. It may occur when the water content of the wood is still relatively high (more than 80 per cent), and has been attributed by H. D. Tiemann, of the Forest Products Laboratory, Madison, U.S.A., to the stresses set up within the wood by the continuous films of water in drying wood when air is unable to enter. Whilst shrinkage of wood is inevitable as moisture content changes, the collapse can be corrected and permanently removed by the prolonged action of steam after the timber has been previously dried to a moisture content of 10-12 per cent. This process, under the name of 'reconditioning timber', has been successfully adopted under commercial conditions in many large-scale plants in Australia.

Palæozoic Diatoms.—An illustrated account of diatoms found in deposits of Carboniferous and Permian age is given by D. Vito Zanon (*Mem. Accad. Scienze, I Nuovi Lincei*, ser. 2, vol. 14, 1930, p. 89). Some sixty species are recognised, most of which are identified with living forms.

The Atlas Mountains.—In the *Scientific Monthly* for February, Prof. H. C. Lawson discusses the origin of the Atlas mountains of Morocco. They have the characteristics of a youthful range, with narrow valleys, sharp ridges, and peaks. The torrential streams flow in trenches far above the base-level of erosion. Features such as these cannot have survived from the time of the Alpine uplift, and Prof. Lawson argues that the Atlas have undergone a rejuvenation. His

reading of the evidence, which he details in full, is that at the end of the Eocene the Alpine uplift gave rise to what he calls the Alpine Atlas, on the site of the geosyncline which occupied part of the area of the submerged peneplain that succeeded the Hercynian mountains. By the end of the Tertiary period the Alpine Atlas had been reduced to a past-mature hill range and the surrounding country to a peneplain. Then came the rejuvenation which led to the present Atlas. This was due to two movements: a broad arching which uplifted the peneplain to about 1200 metres, and a sharp orogenic upthrust between marginal faults. The degradation of the upthrust mass and consequent loss of load induced further rise by isostatic adjustment. The depressions flanking the range are explained as due to sinking of material in compensation for loss of load on the range.

The Atlantic Earthquake of 1929.—Two interesting papers on the earthquake of Nov. 18, 1929, by D. S. McIntosh and Dr. J. H. L. Johnstone appear in the *Transactions* of the Nova Scotian Institute of Science (vol. 17, pp. 213-222, 223-237; 1930. See also the letter by Prof. J. W. Gregory in NATURE, vol. 124, pp. 945-946; 1929). The cable breaks all occurred from lat. 39° 29′ to 45° 6′ N. and long. 52° 10′ to 57° 56′ W., that is, within an area of about 60,000 sq. miles, in a line with the old submerged portion of the St. Lawrence river. The depths at which the cables were broken range from 44 to 2934 fathoms, and the officers in charge of the repair work found no difference from the charted depths greater than those that might be due to errors in sounding. In many cases, the broken cable ends were found buried in mud or gravel. The ends appear as though the cable had been cut by a dull pair of heavy scissors, except at one spot (in lat. 43° 27′ N., long. 56° 13′ W.) where "the cable was found broken up in short lengths and the core twisted round the sheath. The wires of the sheath were bent back on themselves two or three times, wound around the core, and the latter twisted about the heavy galvanised steel sheath." From seismographic evidence, the epicentre is estimated by Messrs. Hodgson and Doxsee to lie in lat. 44° 5′ N., long. 55° 15′ W., which is nearly that obtained from the times of arrival of the sea-waves at Halifax and the Newfoundland coast.

Variations of the Solar Constant and Terrestrial Weather.—Dr. C. G. Abbot, in a paper entitled "Weather dominated by Solar Changes" (*Smithsonian Miscellaneous Collections*, vol. 85, No. 1) continues his studies of variations of the solar constant and their influence on terrestrial weather. He finds that periods of increasing or decreasing solar radiation are followed by changes of pressure and temperature at Washington. These changes are irregular and differ considerably in different months; but those following increasing radiation are, on the whole, opposite to those following decreasing radiation, suggesting that though difficult to understand, they are probably real. An additional test is obtained by investigating the solar constant for periodicities; by a graphical method lengths of 8, 11, 25, 45, and 68 months are found, the combination of which reproduces the original curve with reasonable accuracy. The monthly mean temperatures at Washington for the period 1918–30, corrected for annual variation, are then analysed for the same periodicities and the results, with the addition of a terrestrial period of 18 months, are combined to form a curve not unlike the original. It should be remarked, however, that Dr. Abbot does not point out that the phases of the periodicities of temperature at Washington have no definite relation to the phases of the corresponding solar cycles. Moreover, if the 18-month periodicity is omitted, the calculated temperatures have a correlation of only 0·36 with the observed figures, so that they cannot be said to be "dominated" by solar changes, and the relationship will have little value for forecasting.

Lubrication and Viscous Flow.—Several investigators of lubricating oils have found that, when such oils are allowed to flow for some time through capillary tubes of internal diameter of 0·3 mm., the tubes become clogged in a few hours. This clogging has generally been explained as due to the orientation and adsorption of the polar constituents of the oil by the walls of the tube, and in the first Report of the Lubrication Research Committee, Sir William Hardy expressed the opinion that none of the liquid between two solid surfaces is free unless it is at least 5×10^{-4} cm. from each surface. The January issue of the *Journal of Research* of the U.S. Bureau of Standards contains a paper by Dr. R. Bulkley giving an account of his measurements of the flow of oils through capillary tubes, which have been carried out with the support of the Research Committee on Lubrication of the American Society of Mechanical Engineers to test whether this adsorption by the walls takes place. He finds that when the oils are filtered through porcelain before entering the capillary tube, they show no signs of clogging even in tubes of 11×10^{-4} cm. diameter. He considers that the evidence points more in the direction of slipping of the oil at the wall, or, if there is any increase of the viscosity of the oil near the wall, that increase does not extend more than 0·02 or $0{\cdot}03 \times 10^{-4}$ cm. from the wall.

Free Radicals.—Conant, Small, and Taylor in 1925 showed that halochromic (coloured) salts of triphenylcarbinol and related substances are reduced by powerful reducing agents in appropriate solutions with the formation of the free radical (for example, triphenylmethyl). A similar result would be expected in regard to the cations of the triphenylmethane dyes, except that the resulting free radical would probably be even less stable in acid solution than triphenylmethyl. In the February *Journal of the American Chemical Society*, Conant and Bigelow show that these expectations are confirmed by experiment. The following general reactions are assumed, in which R^+ is the dye cation and M^{++} the titanous, vanadous, or chromous ion used in reduction:

(1) $R^+ + M^{++} \rightleftharpoons R$ (free radical) $+ M^{+++}$,
(2) $2R \rightleftharpoons R - R$ ('ethane'),
(3) $2R + H^+ \longrightarrow RH$ ('methane') $+ R^+$,
(4) $2R \longrightarrow R_2$ (Chichibabin compound).

Reactions (1) and (2) are reversible and rapid; (3) and (4) are irreversible. The products of reactions (2), (3), and (4) were isolated in the case of malachite green and *p*-dimethylamino-triphenylcarbinol. In order to isolate the associated free radical ('ethane'), advantage was taken of its relative insolubility in aqueous solutions of *p*H 3. The solutions absorb oxygen very rapidly, as much as 89 per cent of the amount required for peroxide formation being taken up by the crude dried material. The nomenclature used in (4) is based on the analogous formation of *p*-benzhydryl-tetraphenylmethane from triphenylmethyl, first observed by Chichibabin, although the structures of the dimers obtained, isomeric with the 'ethanes', have not been established. Their empirical formulæ show them to be dimolecular reduction products of the cations. The action of vanadous or chromous chloride on the keto-chloride of Michler's ketone is similar to the reduction of salts of the diphenyl carbinols. The electrochemistry of the reactions is to be studied.

The Invention of the Sewing Machine.

ON Mar. 8, M. Herriott, the former premier of France, unveiled a monument at Lyons to Barthélemy Thimonnier, the inventor of the sewing machine. Thimonnier applied for his first patent in collaboration with Auguste Ferrand, of the School of Mines, St. Étienne, on April 12, 1830, and the erection of the monument was the outcome of the celebration last year of the centenary of that event. The commemoration which took place in Paris in May last included meetings in the Conservatoire national des Arts et Métiers, the Sorbonne, and elsewhere, a record of which is contained in the February *Bulletin de la Société d'Encouragement pour l'Industrie nationale*, which also contains a biographical sketch of Thimonnier by M. Am. Matagrin, of Lyons.

Born at l'Arbresle, in the department of the Rhône, on Aug. 19, 1793, Thimonnier attended school in Lyons and, after an apprenticeship, set up as a journeyman tailor at Amplepuis, where he first conceived the idea of sewing by machinery. Removing in 1825 to St. Étienne, he lived in the rue des Forges, where he made a sewing machine, and, with the assistance of Ferrand and others, not only secured a patent, but also in the summer of 1830 formed a company in Paris for the construction of machines. By 1831, no fewer than eighty machines had been made, but a mob destroyed them all, and for a time nothing more was done. Thimonnier, however, continued all his life to devote much time to his invention, taking out other patents, and with Magnin forming another company, but without reaping any adequate rewards. He died a poor man, on Aug. 5, 1857. The sewing machine by then had claimed the attention of many other inventors, but at the Paris Exhibition of 1855, Prof. Willis, of Cambridge, reporting on the machines exhibited, said that Thimonnier's machine had served as a type for all modern sewing machines.

Thimonnier's sewing machine was a chain-stitch or single thread machine, in which the needle, having a notch near the point, left a loop beneath the material, through which the next stitch passed; but the machines developed by subsequent inventors were lock-stitch machines, in which one thread is fed by the needle, which has an eye, and another thread is fed by a shuttle. Thousands of patents have been taken out in connexion with such machines, but it was the work first of Elias Howe and then of Isaac Merritt Singer in the United States which brought the sewing machine into general use and provided the people of every nation with a simple, reliable machine at a reasonable price.

There was a great deal of litigation between the early inventors, and the example of a Thimonnier machine in the Science Museum was one used during the trials in the United States. If to Thimonnier the invention brought nothing but disappointment and anxiety, others were more fortunate, and Howe and Singer both amassed great wealth. Though he died, as he lived, a simple working man, Thimonnier to-day is remembered as a benefactor of his country, and the tablet marking the site of his house in St. Étienne and the monument at Lyons will for a long time recall his gallant struggle against adverse conditions.

The Climate of Sweden.*

SWEDEN lies in the region of prevailing south-westerly winds that blow along the margin of the nearly permanent area of low barometric pressure centred near Iceland. It appears from certain wind-roses, given on pages 52 and 53 of Axel Wallén's work, that it is only in the south—in Götaland—that there is a general predominance of south-westerly winds in the surface layers of the atmosphere approaching that which is to be found in the British Isles. Elsewhere, effects due to the distribution of land and water, and to the contours of the land, modify the general drift from the dominant quarter. Thus, along the eastern coast, both in January and July, the wind tends to follow the trend of the coast-line and therefore blows most frequently from southerly or northerly directions.

The mountains that cover so large a part of Scandinavia greatly alter the effects of the moist Atlantic winds on the Swedish climate. In the absence of such mountains, the climate would probably more nearly resemble that of Denmark: there would not be the great contrasts that exist between the very wet western uplands and the dry eastern coastal region. The heavy precipitation in the west leaves so much less moisture for cloud formation when the winds of the troposphere follow their usual course towards Finland and Russia; this is one of the factors that makes possible the wonderfully sunny summer climate of the eastern lowlands and of the islands off the east coast. Students of British weather are familiar with this drying process, which acts powerfully in eastern Scotland and north-east England during spells of westerly wind. These general facts come to light in the course of a careful reading of Axel Wallén's work; but there is perhaps a tendency for a rather too rigid separation of the climatic factors. This tendency makes it harder for the reader to get a grip of the broad facts of Swedish climatology, and to remember them, than would otherwise have been the case; the absence of an index and table of contents increases the reader's difficulties.

On the whole, the manner in which the different sections are handled is orthodox. More than usual attention is given to hydrology and matters of practical importance for the economic use of the abundant potential energy of the heavy rain and snow of the mountainous regions. The snowfall is of use, not only as a supply of water when it melts, but also, when lying, for the transport of felled timber by sledge to the commercial waterways. The seasonal and annual variations of the total rainfall have their usual importance, in so far as they affect the flow of water in the rivers. Sweden's extensive lakes, which occupy more than 8 per cent of the whole country, act as reservoirs capable of storing the surplus of an extra wet season. It is not inappropriate in the case of a country so dependent economically upon the potential energy of rainfall to find that these various matters occupy 30 per cent of the space devoted to a discussion of climate. There is a very instructive map (p. 61) to which the reader's attention may be directed. This shows the distribution throughout Sweden of water power, in kilowatts per square kilometre, for average conditions of waterflow.

Readers of this work who are not familiar with the physical and other features of Sweden will appreciate the very clear maps among the first few pages. These show the major and minor political divisions, the contours, the distribution of the different types of forest, facts relating to the late glacial epoch, and

* The Climate of Sweden. By Axel Wallén. Statens Meteorologisk-Hydrografiska Anstalt. Nr. 279: B. 65. (Stockholm, 1930.) 2.00 kr.

details of the principal river basins. Another excellent point is the inclusion of a short discussion on inward and outward radiation. This subject ought not to be neglected in the discussion of any climate and least of all in the case of one referring to a country placed in such high latitudes as to show very great seasonal contrasts. In the extreme north of Sweden (lat. 69°) the sun is never less than 2° below the horizon in the middle of the winter. Even in the south (lat. 56°) the solar elevation at that season does not exceed 10½°. In the middle of the summer, on the other hand, a large part of Sweden enjoys perpetual daylight. In the early summer, the average amount of cloud in the eastern lowlands falls below anything known in Great Britain and, in the islands off the east coast, reaches the low figure of 40 per cent in June. When the long day is considered in relation to these facts, no surprise will be caused by the statement (p. 12) that the mean duration of sunshine at Jokkmokk (lat. 66° 36′) in June exceeds that of Madrid or Rome in the same month. In sympathy with the large annual variation of solar radiation, temperature shows great seasonal contrasts. At Karesuands (lat. 68° 27′) the mean temperature for July is about 28° C. (50° F.) higher than that for January.

Figs. 6 and 7 are among the most interesting in the book. The former gives graphs of the radiation received at the outer limit of the atmosphere in each month in latitudes 55°, 60°, 65°, and 70°, similar graphs showing how much of this reaches the earth's surface when the sky is free from cloud; a graph of the radiation actually received at Stockholm, taking into consideration the amount of cloud, is also shown. In Fig. 7 this graph of inward radiation at the ground for Stockholm is compared with that of outward radiation at the same place. The outward radiation has, of course, much the smaller annual variation. The comparison shows that from the beginning of October to the end of March the outward exceeds the inward radiation, and that the reverse is true during the rest of the year. On the whole year it would appear that there is a gain. The reader may be referred to recent papers by Dr. G. C. Simpson, Director of the Meteorological Office of Great Britain, for a more general discussion of this subject, which is by no means free from pitfalls.

E. V. Newnham.

Afforestation Programmes of the New Zealand Forest Department.

In a recent number of Nature (Feb. 14, p. 255) attention was directed to the organisation known as the New Zealand Timber Growers' Association, of New Zealand. This body consists of a series of independent private companies engaged in afforestation work as a purely commercial proposition, with funds subscribed by the public on ordinary share-issue terms. These companies have no connexion with the official New Zealand Forest Department; but it is already apparent that they will eventually own by far the largest area of artificially formed plantations in the islands. Contrasted with the operations of these companies, already discussed in the note referred to, the Annual Report of the Director of the N.Z. State Forest presents the Government forestry position, which is equally satisfactory. On the subject of afforestation work, the Report states: "New Zealand possesses the largest area of State-owned and State-planted forests in the Empire. The State-owned indigenous forests as at March 31st, 1930, consisted of over 7 million acres. The State Softwood Plantations, in round figures, at the same date, covered 253,600 acres. The total area planted during the 12 months prior to the date mentioned was 56,630 acres. For the current year a further 54,629 acres was programmed for, which would bring the total of New Zealand's State Softwood Plantations at this present date to a figure approximating 308,000 acres. In the year ended March 31st, 1929, the State planted 60,635 acres altogether."

A contrast is then made with similar work in Great Britain. The Forestry Commission in England, it is pointed out, planted to the end of 1929, 140,000 acres of softwoods, "while the planting programme is 23,000 acres per annum; so that New Zealand is well ahead of the Mother Country, and furthermore would be justified at the present time in claiming world-leadership in annual softwood plantings under the State". Full credit may be given to the New Zealand authorities for the efficient manner in which they are dealing with this problem; but any attempt at rivalry in the rate of afforestation or in programmes with that sole end in view between the Dominion and Great Britain is most strongly to be deprecated. Many things must govern annual planting programmes; and the delicate and important operations of thinning, once the young woods have reached the size for these operations, annually increase in amount and demand the closest attention. Too often in the past have annual afforestation programmes been pressed on, to the neglect of the necessary thinning work in the young created woods, for which either the funds or the necessary labour were deficient or absent.

The commercial planting companies have planted a total area of about 220,000 acres, the species being *Pinus insignis*, redwoods, *Pinus ponderosa*, and poplar. Thus State plantings plus the planting of these afforestation companies now total approximately 500,000 acres, last year's total plantings being somewhere in the region of 100,000 acres.

Since the commercial planting companies are wholeheartedly devoting themselves to new afforestation work, it will be hoped that the Government Department is not losing sight of the important indigenous forests. There may be quite valid reasons for embarking upon a large programme of plantations of exotics in a country—in parts of our Empire we know that such valid reasons exist—but all experienced foresters hold strongly to the belief that in the long run few exotic plantations can compete in value with the indigenous forest of a country.

It is a well-established fact that the planting of large blocks of exotics, often as pure woods, leads to the danger of attacks of pests, whether insect or fungus. This factor has not been overlooked in New Zealand. Research work in forest biology has been placed on a good basis by the linking up of the research forces of the State Forest Service, the Department of Scientific and Industrial Research, and the New Zealand Timber Growers' Association, under the direction of Dr. David Miller, with whom is associated Dr. Marsden. A number of research stations under the ægis of the State Forest Service have been established throughout the Dominion, the forestry schools of the University of New Zealand making contributions to the scientific side of afforestation. Amongst studies on the commercial side of forestry, investigations into the strength of structural timbers are being carried out, and an extensive economic pulpwood survey is in progress with the object of establishing pulp and paper mills in promising localities.

It is of interest to note that Australia continues to absorb practically the whole of the timber exports of New Zealand; but, the Report says, "enquiries from the United Kingdom continue to increase".

University and Educational Intelligence.

LONDON.—Applications for grants from the Dixon Fund, for assistance in scientific investigations, must be received before May 15 by the Academic Registrar, University of London, South Kensington, S.W.7. Those for grants from the Thomas Smythe Hughes Fund, for assistance in medical research, must be received by the Academic Registrar not later than May 15.

OXFORD.—The recommendations of the committee appointed to consider and report on the provision of library facilities in Oxford have been embodied in a decree to be promulgated in Congregation on May 7. The recommendations include, as already noticed in NATURE of Mar. 28, p. 493, the enlargement of the Radcliffe Scientific Library by the addition of a new wing.

ST. ANDREWS.—The Senatus Academicus will confer the honorary degree of LL.D. on the following, among others, on June 26: Sir James Hopwood Jeans; Dr. G. M. Robertson, professor of psychiatry in the University of Edinburgh; Rev. Alfred Young, formerly fellow of Clare College, Cambridge, rector of the parish of Birdbrook, Halstead, Essex, distinguished for his mathematical work.

UNDER the will of the late Mr. John McMaster, of Harbledown, near Canterbury, who died on Feb. 10, the Ayrshire Education Authority will receive £300 a year for the establishment and maintenance of bursaries or scholarships to be known as "John McMaster Bursaries", tenable at the Universities of Edinburgh or Glasgow, and open to boys educated at Girvan Secondary School whose parents are in necessitous circumstances; and the Governors of Simon Langton Boys' School, Canterbury, £350 a year for the establishment and maintenance of scholarships to be known as "John McMaster Scholarships", tenable at the Universities of Oxford, Cambridge, Edinburgh, or London, to be awarded to boys of that school.

THE Educational Travel Association is arranging a summer holiday course in the methods of regional survey and in open-air geography, in Norway. The fiords, the subarctic tableland, and the eastern valleys round Oslo will be visited. The party will sail from Newcastle on Aug. 8. Particulars of the itinerary may be obtained by sending a 2d. stamp to the honorary secretary, E. T. A., "Noddfa", Wistaston, Crewe (or, c/o Cheshire Training College, Crewe), who will supply an illustrated booklet and map, and a programme of excursions to glaciers and various land forms, as well as to the Norwegian open-air museum, Viking ships, and Amundsen's unique collection of Eskimo tools, clothing, and kayaks. Instruction in field work in the open-air sciences will be given to members of the party desiring it.

THE League of Nations Union, in co-operation with the American School Citizenship League, has again arranged a prize essay competition open to both British and American schools. Prizes of 75 dollars, 50 dollars, and 25 dollars, known as the Seabury Prizes, are offered for the best essays in each of the following sections: (1) Open to all pupils in public and secondary schools in the British Isles, on "What Subjects in the School Curriculum are Best Adapted to Show the Interdependence of Peoples?"; and (2) open to all students in teachers' training colleges and university training departments, on "The Influence of Intellectual Co-operation in the Promotion of World Friendship". Essays, which must not exceed 3000 words and must be written on one side only of paper with a margin of at least one inch, must reach the League of Nations Union, 15 Grosvenor Crescent, S.W.1, not later than July 1 and should bear the writer's name, age, school, and home address.

A LIST of international fellowships for research, compiled by the International Federation of University Women and published in pamphlet form, gives particulars of many hundreds of stipends available for advanced study and research in countries other than the stipend-holder's own. The first and largest section relates to fellowships available only to nationals of one country. Among other interesting items in this section are 42 American-German exchange scholarships and about 170 Hungarian scholarships tenable in Vienna (40 to 56), Rome (40 to 46), Berlin (35), Great Britain (14), and elsewhere. Great Britain's place in this section is a large one and so is Sweden's. Section II. contains fellowships open to students from more than one country or irrespective of nationality. These are almost exclusively provided from British and American sources. Appended is a list of nineteen prizes open for international competition. Copies of the pamphlet can be obtained, price 1*s.* 3*d.* post free, from the British Federation of University Women, Crosby Hall, Cheyne Walk, London, S.W.3.

Birthdays and Research Centres.

April 11, 1863.—Mr. HENRY BALFOUR, F.R.S., curator of the Pitt Rivers Museum, Oxford.

I am at present investigating the stone implements of the Tasmanians, their technique and the culture-status which they suggest.

The scientific classification of primitive musical instruments and the determination of the geographical dispersal of related and analogous types would be a useful undertaking. Primary classification must be based upon the exact method or mechanism whereby the sound is initiated; the means whereby the notes may be varied being of secondary importance. In the new edition (fifth) of "Notes and Queries on Anthropology", pp. 295-308, I have suggested a scheme of primary grouping, as an aid to descriptions and diagnosis of types of instruments. Accurate description of the various means adopted for the production of the vibrations causing sound are required, in order to arrive at a satisfactory phylogenetic classification of musical instruments, and to enable the distribution of particular types to be mapped out.

April 23, 1858.—Prof. MAX PLANCK, For.Mem.R.S., professor of mathematical physics in the University of Berlin.

Die theoretische Physik ist durch die Quantentheorie etwas in Unordnung geraten. Sicher ist, dass von den bisher allgemein angenommenen Grundsätzen mindestens einer geopfert werden muss, um die übrigen aufrecht erhalten zu können. Dies vollkommen klarzustellen ist eine der wichtigsten Aufgaben der nächsten Forschung. Soweit ich sehe, gehört zu den Sätzen, welche unter allen Umständen beizu behalten sind, die Voraussetzung einer volkommenen Gesetzmässigkeit in allen physikalischen Vorgängen; dagegen zu denjenigen, welche fallen gelassen werden müssen, die Voraussetzung, dass der gesetzliche Ablauf eines Vorgangs dargestellt werden kann mittelst einer Zerlegung desselben in seine räumlichen und zeitlichen Elemente. Es ist also der Begriff der Ganzheit, der wie auf dem Gebiet der Biologie so auch auf dem der Physik eingeführt werden muss, um die Gesetzlichkeit der Natur verstehen und formulieren zu können.

Societies and Academies.

LONDON.

Geological Society, Mar. 18.—O. H. Schindewolf, On the septal development and the genotype of the coral genus *Petraia* Münster. The author, by showing that the genotype of *Petraia* is a synonym of *Petraia radiata* Münster, restricts the name to the Upper Silurian species. The Devonian species belong to Počta's genus *Alleynia*. *Petraia*, which is well characterised by its conical shape, deep calice, external ornamentation, arrangement of the septa, and, in normal specimens, by the absence of transverse tissue, has not been found outside Bavaria. W. B. R. King: A fossiliferous limestone associated with Ingletonian Beds at Horton-in-Ribblesdale, Yorkshire. The paper deals with an exposure of green felspathic grits with associated calcareous rocks in the railway cutting south of Horton-in-Ribblesdale station. The problems of general stratigraphy are discussed. There is much evidence of a general nature to suggest that although the limestone is undoubtedly of Ashgillian age, the grits with which it is associated must be considerably older. Calcareous matter occurs in two forms in the cutting; first, as the infilling between the grit blocks of a breccia, and secondly, as a crystalline fossiliferous limestone apparently interbedded with the grits. A detailed study of the limestone, however, shows that it is essentially of the same origin as the calcareous part of the breccia, since it contains angular fragments of grit and occasional flakes of roughly-cleaved green mudstone of a type exactly like the Ingletonian of the neighbourhood. The fossils show no signs of distortion by cleavage. It is suggested that this is another case of a 'Neptunian dyke'.

Linnean Society, Mar. 19.—M. Bernhauer and H. Scott: Abyssinian Staphylinidæ: systematic report and introduction, with biogeographical and ecological remarks. Dr. Bernhauer enumerates 123 species, only 11 of which had been recorded from Abyssinia before, while 56 are new to science. The affinities of the Staphylinidæ under review are mainly African, but there is a small proportion of Palæarctic species or related forms. Among many kinds of environment, special attention was paid to dead stems of tree-Euphorbias (*Euphorbia abyssinica*) and of tree-Lobelias (*Lobelia Rhynchopetalum*), and species apparently peculiar to these habitats were found.

Society of Public Analysts, April 1.—R. C. Frederick: Carbon monoxide poisoning: its detection and the determination of the percentage saturation in blood, by means of the Hartridge reversion spectroscope. The instrument is capable of giving a quantitative determination of very small percentages of carbon dioxide in a minute quantity of blood. The author has been unable to confirm Haldane's conclusions on nitrogen monoxide hæmoglobin, the reversion spectroscope showing that the nitrogen monoxide hæmoglobin spectrum is quite different from that of carbon monoxide hæmoglobin.—H. M. Mason and G. Walsh: Experiments on the hardness of fats. A simple apparatus has been devised in which the weight required to drive a plunger into the solid cake of fat of standard thickness under standard conditions is measured. The results of the hardness test have also been used to establish the identity of fats and to detect adulteration.—B. S. Evans: A new process for the determination of small amounts of bromide in chloride. Bromides are rapidly and completely oxidised by chromic acid in the presence of sulphuric acid, preferably of 8–9 *N* strength, whilst chlorides remain untouched. The liberated bromine is conveyed by means of a current of air into an absorption flask containing standard arsenious oxide solution and some sodium bicarbonate, and the excess of arsenious acid is titrated with standard iodine. For determining small percentages of bromides in chlorides, the bromine is first absorbed in a tube containing 0·5 per cent sodium hydroxide solution, and this solution is then treated with one or two drops of saturated sulphur dioxide solution, then with dilute sulphuric acid and chromic acid, and the determination completed as described.—S. G. Walton and R. G. O'Brien: The use of bromine as a reagent in the determination of alkaloids. The thalleioquin reaction for quinine has been made quantitative, the excess of bromine being removed by aeration, and the coloration compared with that given by standard solutions. An iodometric development of the method enables quinine to be determined in the presence of other alkaloids. The bromine compounds of morphine and most of the other opium alkaloids liberate iodine from potassium iodide, and methods of determination are based on the reactions. Codeine may be determined colorimetrically by measuring the depth of the red colour formed on oxidising its bromine compound with hydrogen peroxide. Colorimetric methods have also been devised for the ipecacuanha alkaloids, based on the yellow coloration formed on aerating the bromine compounds.

DUBLIN.

Royal Irish Academy, Feb. 23.—T. J. Nolan and M. T. Casey: Further studies in the pigment of the berry of the elder (*Sambucus nigra*). From the berry of the elder, two anthocyan pigments have been isolated in crystalline form as chlorides. One of these is identical with chrysanthemin, the pigment of the dark red garden chrysanthemum. The second pigment, sambucicyanin, which crystallises in long prisms, is, according to analysis, a bi-molecular compound of chrysanthemin with a pentose-glucoside of cyanidin. The two pigments are similar in their colour reactions, but sambucicyanin is more soluble in hydrochloric acid and in alcohol than chrysanthemin. No methylpentose-glucosides were isolated, and the authors are unable to confirm the observation of Karrer and Widmer that a rhamnoglucoside is present in the berry.

Royal Dublin Society, Mar. 24.—W. R. G. Atkins: Observations on the photoelectric measurement of the radiation from mercury vapour lamps and from the sun, and on the effects of such radiation on the skin. A vacuum sodium photoelectric cell, made of glass, and selective screens were used to study the radiation from a Hewettic Levick Ulviarc mercury vapour arc used for clinical work. It is generally advisable to run the arc continuously between treatments, as the maximum illumination is not reached until 6 min. after the lamp has been switched on. A subsequent slow decline is attributed to gradual over-heating, to counteract which the lamp should be switched off for a minute or two after 35-40 min.; 5 min. after switching on again the original maximum is recovered. Irregular fluctuations in the light of the arc do not seem to be caused by cooling due to draughts, and are probably due to variations in the supply voltage. The radiation from a lamp which had been in use 750 hours, and had been discarded as uneconomical of time for clinical work, was found to be 40 per cent for the blue, violet, and ultra-violet; 36 per cent for the ultra-violet, and 24 per cent for the anti-rachitic ultra-violet, as compared with a new lamp. The new

lamp may produce slight erythema in 1 minute and definite erythema in 2 min. at a distance of 60 cm. Noon sunlight (93,000 metre-candles on the potassium-carbon arc scale) produces some effect in 10 min. and definite erythema in 30 min. Beck's ultra-violet fluorescence spectroscope was useful for qualitative observations. Approximate photoelectric determinations of the ultra-violet light in daylight showed that in this respect, even at mid-summer noon, the direct sunlight is not very much more potent than the diffuse light from the sky.

PARIS.

Academy of Sciences, Mar. 2.—**H. Deslandres**: Simple relations of molecular spectra with the structure of the molecule.—**Gabriel Bertrand** and **Mme. Georgette Lévy**: The amount of aluminium in plants, especially those utilised as food. The proportions of aluminium found in a large number of edible roots, tubercles, seeds, and leaves are given.—**Jean Effront**: The fall in the rotatory power of solutions of glucides under the action of alkalis.—Charles Jacob was elected a member of the Section of Mineralogy, in succession to the late P. Termier.—**Pasquier**: The equations $s = f(x, y, z, p, q)$, integrable by the Darboux method.—**J. Schreier** and **St. M. Ulam**: A property of the unit of Lebesgue.—**A. Lokchine**: The rotating vibrations of a body limited by a surface of revolution.—**Henri Poncin**: The possible permanent movements of a heavy fluid.—**B. Hostinsky**: The theory of diffusion.—**A. Sesmat**: A new hypothesis on radiation and on the optics of bodies in motion.—**Pierre Lejay**: An arrangement allowing the amplification of weak photoelectric currents and its application to recording the light flux proceeding from the stars. The apparatus described in an earlier communication, utilising ordinary amplifying valves as electrometers, has been improved by the addition of a new type of valve. In combination with a photoelectric cell and a recording oscillograph, the apparatus can be used to record the passage of a star in meridian observations, or to measure intensities, as a recording photometer.—**Clerget**: Apparatus for observing the phenomena of injection in compressed air.—**Georges Fournier** and **Marcel Guillot**: The absorption of the β-rays by matter. The same absorption coefficients were found for liquid and solid white phosphorus, but there appeared to be a slight difference between the absorption coefficients of the two allotropic forms of phosphorus.—**F. Bourion** and **E. Rouyer**: The cryoscopic study of paraldehyde in solutions of calcium and strontium chlorides.—**J. J. Trillat** and **J. Forestier**: The structure of plastic sulphur. Threads of plastic sulphur, pulled out immediately after formation, become less transparent, lose their elasticity, and give a much higher breaking load, increasing from 70 gm. to 9 or 10 kgm. per sq. mm. The threads, which were amorphous before stretching, behave as crystalline fibres. X-rays increase the rate of crystallisation of plastic sulphur.—**A. Mailhe** and **Renaudie**: The catalytic condensation of the amylenes. Heated to 670°, in presence of silica gel, the amylenes give gases (unsaturated hydrocarbons, methane, hydrogen) and a mixture of liquid unsaturated and aromatic hydrocarbons. Benzene, toluene, and xylene were definitely identified.—**Charles Dufraisse** and **Raymond Horclois**: The application of the antioxygen effect to the problem of fire extinguishing. The negative catalysis of the ignition of carbon. As with low temperature oxidations, ignition can be hindered by negative catalysts.—**A. Grebel**: The process of combustion of pulverised coal.—**Conrad Kilian**: The genesis of the Central Sahara Massif.—**Henri Termier**: The discordances in the palæozoic series of Central Morocco.—**G. Garde**: The old course of the Allier and its affluents on the Gannat during the Upper Pliocene and Quaternary.—**A. Demay**: The prolongation of the Cevenol tectonic complex in the Louvesc mountains.—**Guilliermond**: The conjugation of the ascospores in the yeasts and some obscure points in the development of these fungi.—**Mlle. Cassaigne**: The origin of vacuoles. In most cases, the vacuoles arise spontaneously in the cytoplasm, but they can also be produced by the drawing out and breaking up of preformed vacuoles, phenomena which appear to be determined by the movements of the cytoplasm.—**Gustave Jaquenaud**: The influence of the nature of the soil and of radiations on the degenerescence of the potato.—**J. Nageotte**: The variations of the sign of double refraction in myelinic figures and connected formations.—**H. Simonnet** and **G. Tanret**: The calcifying action and the toxic action in the animal of large doses of irradiated ergosterol: an attempt to separate these two actions. It is established that the irradiation products of ergosterol contain two distinct factors, one toxic the other calcifying. The calcification is much reduced when small doses of potassium iodide are administered along with the irradiated ergosterol.

ROME.

Royal National Academy of the Lincei: Communications received during the vacation, 1930.—**G. Castelnuovo**: De Sitter's universe.—**L. Rolla**: Experiments on the concentration and isolation of the element of atomic number 61. Fractionation of the rare earths obtained from monazite sand, and spectroscopic examination of the different fractions, has failed to produce evidence of the presence of the element of atomic number 61.—**G. Barba**: Absolute geodetics of surfaces.—**B. de Finetti**: Characteristic functions of instantaneous laws.—**Luisa Pelosi**: Mean curvature of surfaces. The new expression recently evolved by Calonghi for the mean curvature of a surface may be derived by a more rapid and simple calculation.—**E. Čech**: Further considerations on Cauchy's theorem.—**S. Amante**: Resolution, in the field of complex matrices, of any analytical equation with numerical coefficients.—**L. Fantappiè**: Maxima and minima of real analytical functionals.—**S. Finikoff**: The congruence R having two 'gauche' surfaces for the two folds of its focal surface.—**E. Gugino**: The dynamic problem of any linked system reduced to the analogous problem relating to a free system.—**A. Signorini**: The finite deformations of continuous systems. An introduction, purely kinematic in character, is given to a summary of various studies on the finite deformations of continuous systems with reversible transformations, especially on those of elastic systems.—**Angelina Cabras**: Rigid motions in generalised spaces.—**A. Masotti**: Rectilinear vortex in a channel with plane parallel sides.—**A. Fresa**: Variations of the light of the variable RZ Cassiopeiæ. Investigation of the light curve of this variable reveals the existence of a well-defined secondary minimum in the neighbourhood of the maximum preceding the principal minimum; of a slight inflexion, possibly periodic, of the light curve on the descending branch; and of an increase of 0·86 second in the period of the variable.—**Seb. Timpanaro**: Waves and corpuscles.—**D. Graffi**: Considerations on the theory of the transmission of heat by forced convexion (2). From the theorem of unicity established in the previous note on this subject, a principle of superposition of effects is developed.—**A. Quilico**: The oxidation of propenyl derivatives by means of diazo-compounds. The mechanism recently suggested by Angeli and Polverini for the oxidation of propenyl compounds by diazohydrates is discussed and evidence advanced in sup-

port of it.—Clara Forti: The excision of the vessels and nerves of the ovary: total or partial excision and sexual functions (2). Experiments with rats show that the excision of ovarian vessels and nerves does not markedly disturb, even after several months, the sexual cycle. Excision of the nervo-vascular fibre of the ovary and uterus does, however, cause serious and persistent alterations in the sexual functions.

Official Publications Received.

BRITISH.

The Animal Year-Book. Issued by the University of London Animal Welfare Society. Vol. 1 (1931). Edited by Dr. C. M. Knight and C. W. Hume. Pp. 173. (London: University of London Press, Ltd.) 2s. net.

Survey of India. Professional Paper No. 26: Mount Everest and its Tibetan Names. A Review of Sir Sven Hedin's Book, by Col. Sir Sidney Burrard. Pp. ii+18. (Dehra Dun.) 8 annas; 10d.

Report of the Marlborough College Natural History Society for the Year ending Christmas, 1930. (No. 79.) Pp. 135+5 plates. (Marlborough.) To members, 3s.; to non-members, 5s.

Education (Scotland). Report for the Year 1930 by the Director on the Royal Scottish Museum, Edinburgh. Pp. 16. (Edinburgh.)

Uganda Protectorate. Summary of Progress of the Geological Survey of Uganda for the Years 1919 to 1929. Pp. ii+44+6 plates. (Entebbe: Government Printer.) 4s.

Transactions of the Institute of Marine Engineers, Incorporated. Session 1931. Vol. 43, No. 2, March. Pp. 57-112+xliv. (London.)

Memoirs of the Department of Agriculture in India. Botanical Series, Vol. 17, No. 5: Cotton Growing in India in relation to Climate. By Trevor Trought and Mohammad Afzal. Pp. 117-136. (Calcutta: Government of India Central Publication Branch.) 12 annas; 1s. 3d.

Department of Agriculture, Straits Settlements and Federated Malay States. General Series, No. 4: Reports of Agricultural Field Officers for the Year 1929. Pp. vi+94. (Kuala Lumpur.)

Memoirs of the Commonwealth Solar Observatory. Memoir No. 2: The Luminosities and Parallaxes of 350 Stars of Spectral Type B. By W. B. Rimmer. Pp. 37. (Canberra: H. J. Green.)

The Glasgow Naturalist: the Journal of the Natural History Society of Glasgow (including the Transactions and Proceedings of the Society, Third Series). Vol. 9, 1919–1930. Pp. vii+124. (Glasgow: John Smith and Son, Ltd.) 5s. 6d.

Tanganyika Territory: Department of Tsetse Research. Co-ordination Report No. 4: 1st April 1930 to 30th September 1930. Pp. 12. (Dar es Salaam: Government Printer.) 1s.

Air Ministry: Aeronautical Research Committee. Reports and Memoranda. No. 1350: Reports and Memoranda published between 1st September 1929 and 31st December 1930. Pp. 8. 6d. net. No. 1357 (Ae. 488—T. 2987): Variable Density Wind Tunnel Test Data on Models of the Hawker Hornbill Aeroplane and the AD-1 Aerofoil Section. By W. S. Diehl and R. F. Anderson. Pp. 9+11 plates. 1s. net. No. 1346 (Ae. 478—T. 2992): The Application of the Method of Operators to the Calculation of the Disturbed Motion of an Aeroplane. By L. W. Bryant and D. H. Williams. Pp. 13. 9d. net. (London: H.M. Stationery Office.)

Journal of the Chemical Society. March. Pp. iv+445-674+x. (London.)

Physical Map of the Union of South Africa and adjoining Territories. Compiled by Eric H. Banks. In 4 sheets, 40 in. × 30 in. (Pretoria: Government Printing Office.)

Report of the R.101 Inquiry. (Cmd. 3825.) Pp. 129. (London: H.M. Stationery Office.) 2s. 6d. net.

Annual Report of the Council of the Yorkshire Philosophical Society for the Year 1930, presented to the Annual Meeting, February 9th, 1931. Pp. 46+5. (York.)

FOREIGN.

Ministry of Agriculture, Egypt: Technical and Scientific Service. Bulletin No. 103: The Effects of Topping Egyptian Cotton Plants. By Dr. J. Templeton. Pp. 9+2 plates. (Cairo: Government Press.) 3 P.T.

Denkschriften der Schweizerischen Naturforschenden Gesellschaft. Band 66, Abh. 1: Die Spätbronzezeitliche Keramik der Schweiz und ihre Chronologie. Von Emil Vogt. Pp. ii+80+9 Tafeln. (Zürich: Gebrüder Fretz A.-G.)

Publications of the Kapteyn Astronomical Laboratory at Groningen. No. 45. The Secular Parallax of the Stars of different Apparent Magnitude and Galactic Latitude. By P. J. Van Rhijn and B. J. Bok. Pp. ii+24. (Groningen: Hoitsema Bros.)

Scientific Papers of the Institute of Physical and Chemical Research. Nos. 286-287: A Relation between Orthobaric Volumes and Temperature, by Jurô Horiuti; Note on the Spark Spectra of Chlorine, by Kiyoshi Murakawa. Pp. 89-109. (Tôkyô: Iwanami Shoten.) 40 sen.

Bergens Museum. Årsberetning, 1929–1930. Pp. 94. Årbok, 1930. Naturvidenskapelig rekke. Hefte 2. Pp. 170. (Bergen: A.-S. John Griegs Boktrykkeri.)

Memoirs of the College of Science, Kyoto Imperial University. Series A. Vol. 14, No. 1, January. Pp. 42. (Tokyo and Kyoto: Maruzen Co., Ltd.) 1.00 yen.

Bulletin of the American Museum of Natural History. Vol. 59, Art. 4: Fossil Turtles of Mongolia. By Charles W. Gilmore. Pp. 213-257+11 plates. (New York City.)

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 67: Air Flow through Exhaust Valve of Conical Seat. By Keikiti Tanaka. Pp. 24. (Tôkyô: Koseikai Publishing House.) 0.19 yen.

Proceedings of the Imperial Academy. Vol. 7, No. 1, January. Pp. 28. (Tokyo.)

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Ministerio da Agricultura, Industria e Commercio: Observatorio Nacional do Rio de Janeiro. Taboas das Marés para o anno de 1931 nos Portos do Rio de Janeiro, Belém, S. Luiz, Amarração, Camocim, Fortaleza, Natal, Cabedello, Tambahú, Recife, Aracajú, Bahia, Ilhéos, Santos e Paranaguá. Pp. 186. (Rio de Janeiro.)

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Koninklijk Nederlandsch Meteorologisch Instituut. No. 102, Mededeelingen en Verhandelingen, 33: Het Klimaat van Nederland. B (vervolg): Lucht- en grond- temperatuur. Door Dr. C. Braak. Pp. 78. 1.00 f. No. 108, Seismische Registrierungen in De Bilt. 16, 1928. Pp. ix+62. 1.00 f. No. 106A, Ergebnisse Aerologischer Beobachtungen. 18, 1929. Pp. iv+46. 2.50 f. (Amsterdam: Seyffardt's Boekhandel.)

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U.S. Department of Agriculture. Technical Bulletin No. 224: Habits and Economic Status of the Pocket Gophers. By Theo. H. Scheffer. Pp. 27+8 plates. 10 cents. Technical Bulletin No. 232: A Laboratory Study of the Field Percolation Rates of Soils. By C. S. Slater and H. G. Byers. Pp. 24. 5 cents. Farmers' Bulletin No. 1657: The Great Basin Fireworm in the Pacific Northwest. By M. C. Lane. Pp. ii+9. 5 cents. (Washington, D.C.: Government Printing Office.)

U.S. Department of the Interior: Geological Survey. Bulletin 823: Bibliography of North American Geology, 1919–1928. By John M. Nickles. Pp. iii+1005. 1.25 dollars. Bulletin 826: Names and Definitions of the Geologic Units of California. Compiled by M. Grace Wilmarth. Pp. v+97. 20 cents. (Washington, D.C.: Government Printing Office.)

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Scientific Papers of the Institute of Physical and Chemical Research. Nos. 289-291: Über die Polymerisierung der Methylester der höheren ungesättigten Fettsäuren, 6: Hydrierung des polymerisierten Produktes, von Kiichiro Kino; Über die Polymerisierung der Methylester der höheren ungesättigten Fettsäuren, 7: Hydrierung des Leinöles und des Methylesters der flüssigen Fettsäuren des Leinöles, von Kiichiro Kino; On the Isolation of Phytosteroline from Wheat Embryo, by Nobuzo Nakamura and Akiyoshi Ichiba. Pp. 127-141. (Tôkyô: Iwanami Shoten. 40 sen.

Journal of the Faculty of Agriculture, Hokkaido Imperial University. Vol. 30, Part 1: Studies on the Absorption of Ammonia and Nitrate by the Root of Zea Mays-Seedlings, in relation to the Concentration and the Actual Acidity of Culture Solution. By Tsung-Lê Loo. Pp. 118+1 plate. (Tokyo: Maruzen Co., Ltd.)

State of Connecticut: Geological and Natural History Survey. Bulletin No. 48: Additions to the Flora of Connecticut. By Edgar Burton Harger, Dr. Charles Burr Graves, Dr. Edwin Hubert Eames, Charles Alfred Weatherby, Richard William Woodward, George Henry Bartlett. (First Supplement to Bulletin No. 14.) Pp. 94. (Hartford, Conn.) 75 cents.

Agricultural Experiment Station: Michigan State College of Agriculture and Applied Science. Special Bulletin No. 205: Soil Fertilization for Sugar Beets. By James Tyson and M. M. McCool. Pp. 31. Special Bulletin No. 206: Types of Farming in Michigan. By E. B. Hill, F. T. Riddell, and F. F. Elliott. Pp. 83. Technical Bulletin No. 107: The Lansing Food Survey. By C. A. Scholl and W. O. Hedrick. Pp. 152. (East Lansing, Mich.)

Instituts scientifiques de Buitenzorg: "'s Lands Plantentuin". Treubia: recueil de travaux zoologiques, hydrobiologiques et océanographiques. Vol. 12, Livraison 3-4, Décembre 1930. Pp. 263-477. (Buitenzorg: Archipel Drukkerij.) 5.00 f.

CATALOGUES.

Medical Books, including Surgery, Nursing, Dentistry, Pharmacy, Anatomy, Ophthalmology, Hygiene, Homœopathy, Sexology, Pathology, etc. Pp. 44. (London: W. and G. Foyle, Ltd.)

Petrological Microscopes and Accessories. Pp. 24+20. (London: James Swift and Son, Ltd.)

The Taylor-Hobson Outlook. Vol. 3, No. 18, March. Pp. 165-172. (Leicester and London: Taylor, Taylor and Hobson, Ltd.)

Books in various Branches of Science. (No. 456.) Pp. 52. (Cambridge: Bowes and Bowes.)

Diary of Societies.

FRIDAY, APRIL 17.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS (North-Western District) (at Victoria Station, Manchester), at 9.30 A.M.

BRITISH INSTITUTE OF RADIOLOGY (at North Middlesex Hospital, Edmonton), at 11 A.M.—At 5.—Meeting of Medical Members.

ELECTRICAL ASSOCIATION FOR WOMEN (at Park Lane Hotel), at 11.30 A.M.—Annual General Meeting.—At 3.—Report from Branches, etc.

LONDON SOCIETY (at Royal Society of Arts), at 5.—Dr. D. McKenzie: Noise—a Modern Plague of London.

SOCIETY OF MEDICAL OFFICERS OF HEALTH (at 1 Upper Montague Street, W.C.), at 5.—Dr. Ethel Cassie, Dr. G. C. M. M'Gonigle, and others: Discussion on the Pre-school Child.

PHYSICAL SOCIETY (at Imperial College of Science and Technology), at 5.—A. J. Maddock: The Generation of Current Pulses of Rectangular Wave-form.—R. A. Fereday: An Improved Method for the Comparison of Small Magnetic Susceptibilities.—Dr. E. G. Richardson: Edge Tones.

NATIONAL INSTITUTE OF INDUSTRIAL PSYCHOLOGY (Annual General Meeting) (at Royal Society), at 5.

ROYAL SANITARY INSTITUTE (at Guildhall, Poole), at 5.—E. J. Goodacre and others: Discussion on Some Aspects of Municipal Sanitation.—Alderman J. C. Julyan and others: Discussion on Prospect and Retrospect.—Dr. G. Chesney and others: Discussion on Diphtheria Immunisation at Work.

ROYAL SOCIETY OF MEDICINE (Clinical Section), at 5.30.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—C. D. Gibb: Post-War Land Turbine Development.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (at Mining Institute, Newcastle-upon-Tyne), at 6.—J. Foster King: Corrosion of Oil Tankers.

COKE OVEN MANAGERS' ASSOCIATION (Midland Section) (at Sheffield University), at 6.30.—Prof. R. V. Wheeler: Rational Analysis of Coal.

SOCIETY OF DYERS AND COLOURISTS (Manchester Section) (at 36 George Street, Manchester), at 7.—Annual Meeting.

INSTITUTION OF ELECTRICAL ENGINEERS (Meter and Instrument Section), at 7.—E. W. Hill and G. F. Shotter: Current-Transformer Summations.

INSTITUTE OF FUEL (East Midlands Section) (at University College, Nottingham), at 7.—H. L. Pirie: Theory and Practice of the Gasification of Coal in Producers.

SOCIETY OF CHEMICAL INDUSTRY (Newcastle Section) (at Armstrong College, Newcastle-upon-Tyne) (Annual Meeting), at 7.30.—Demonstration of Modern Scientific Instruments and Apparatus of Special Interest.

INSTITUTE OF METALS (Sheffield Section) (in Non-Ferrous Section of Applied Science Department, University of Sheffield), at 7.30.—R. Genders: Extrusion.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—J. E. Gray: The Transmission of Gas.—T. G. Martin: The Building Requirements of Lifts.

ROYAL SOCIETY OF MEDICINE (Electro-Therapeutics Section), at 8.30.—Dr. J. C. Mottram: Secondary Radiation in Bone.—Dr. J. Halliwell: Pyelography.—Dr. C. A. Robinson: Backache in its Relation to Cervicitis, and its Treatment by Diathermy.

INSTITUTE OF BREWING (Yorkshire and North-Eastern Section) (at Queen's Hotel, Leeds).—Annual Meeting.

SATURDAY, APRIL 18.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS (Yorkshire District) (at Sowerby Bridge), at 2.

MINING INSTITUTE OF SCOTLAND (at Royal Technical College, Glasgow), at 3.—Annual General Meeting.

MONDAY, APRIL 20.

INSTITUTION OF ELECTRICAL ENGINEERS (Informal Meeting), at 7.—Alderman, R. Tweedy-Smith and others: Discussion on Everyday Commercial Risks of and Liabilities to Engineers.

BRITISH KINEMATOGRAPH SOCIETY (at Film House, Wardour Street), at 7.45.—J. Ree: The Fidelytone Sound Recording System.

ROYAL SOCIETY OF ARTS, at 8.—Dr. N. A. V. Piercy: The Present Position in Aeronautics (Howard Lectures) (2).

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Major R. A. Bagnold: Journeys in the Libyan Desert: 1929 and 1930.

ROYAL SOCIETY OF MEDICINE, at 9.15.—Dr. C. Wilson: Some Aspects of Alpine Climbing.

TUESDAY, APRIL 21.

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

INSTITUTE OF FUEL (North-Western Section) (at 17 Albert Square, Manchester) (Annual General Meeting), at 7.—C. A. Seyler: Fuel Technology and the Classification of Coal.

ILLUMINATING ENGINEERING SOCIETY (at Royal Society of Arts), at 7.30.—W. G. Mackenzie: Some Aspects of Street Lighting in the United States.

WEDNESDAY, APRIL 22.

GEOLOGICAL SOCIETY OF LONDON, at 5.30.—Dr. H. H. Thomas and W. Campbell Smith: Xenoliths of Igneous Origin in the Trégastel-Ploumanac'h Granite, Côtes-du-Nord, France.—C. I. Gardiner and Prof. S. H. Reynolds: The Loch Doon "Granite" Area; Galloway.

SOCIETY OF CHEMICAL INDUSTRY (jointly with British Association of Chemists and Institute of Chemistry) (at Technical College, Derby), at 7.—Dr. A. Bramley: Diffusion in Solids.

ROYAL SOCIETY OF ARTS, at 8.—Prof. Major Greenwood: The Work of the London School of Hygiene and Tropical Medicine, followed by a demonstration by Prof. J. G. Thomson of a Malaria Film.

BRITISH PSYCHOLOGICAL SOCIETY (Medical Section) (at Medical Society of London), at 8.30.—Dr. H. V. Dicks: A Clinical Study of Obsession.

THURSDAY, APRIL 23.

LONDON MATHEMATICAL SOCIETY (at Royal Astronomical Society), at 5.—Discussion on Recent Work in the Additive Theory of Numbers, to be opened by Prof. G. H. Hardy, followed by E. Maitland Wright: New Partition Problems.—A. E. Ingham: The Method of Brun and the Theorem of Schnirelmann.—Dr. A. E. Western: Computative Work Connected with Waring's Problem.—Other speakers: Prof. L. J. Mordell, S. D. Chowla, Dr. T. Estermann, and Prof. J. E. Littlewood.

COKE OVEN MANAGERS' ASSOCIATION (Northern Section) (at Three Tuns Hotel, Durham).—Discussion.

FRIDAY, APRIL 24.

ROYAL SOCIETY OF ARTS (Indian Meeting), at 4.30.—Sir William Foster: John Zoffany in India.

ROYAL SOCIETY OF MEDICINE (Disease in Children Section) (at Westminster Hospital), at 4.30.

INSTITUTE OF MARINE ENGINEERS, at 6.—Annual General Meeting.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Sixth Report of the Marine Oil-Engine Trials Committee.

INSTITUTION OF ELECTRICAL ENGINEERS (London Students' Section), at 6.15.—J. Dunbar: The Design and Manufacture of Electrical Apparatus.

SOCIETY OF CHEMICAL INDUSTRY (Chemical Engineering Group) (Annual General Meeting) (at Waldorf Hotel, Aldwych), at 6.45.—At 7.30.—Sir Richard Gregory, Bart.: Science in Industry.

BRITISH ASSOCIATION OF CHEMISTS (Scottish Section) (at Central Halls, Glasgow), at 7.30.—Annual General Meeting.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Sir Philip Hartog: Joseph Priestley and his Place in the History of Science.

SATURDAY, APRIL 25.

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS, at 2.30.

PUBLIC LECTURE.

TUESDAY, APRIL 21.

GRESHAM COLLEGE, at 6.—W. H. Wagstaff: Geometry. (Succeeding Lectures on April 22, 23, and 24.)

DISCUSSION.

APRIL 17 AND 18.

GENERAL DISCUSSION ON PHOTOCHEMICAL PROCESSES.

FARADAY SOCIETY (in Department of Chemistry, Liverpool University).

Friday, April 17, at 10 A.M.—Molecular Spectra in Relation to Photochemical Change.

Introductory Paper. Prof. R. Mecke.

Ultra-violet Absorption Spectra of Acetylene and Formaldehyde. Dr. G. Herzberg.

The Absorption Spectra and the Optical Dissociation of the Hydrides of the Oxygen Group. C. F. Goodeve and N. O. Stein.

The Photochemical Properties of the Carbonyl Group. F. W. Kirkbride and R. G. W. Norrish.

Friday, April 17, at 2.30.—Photochemical Kinetics in Gaseous Systems.

Introductory Paper. Prof. M. Bodenstein.

The Reaction between H_2 and O_2 under the Influence of Photochemically-produced H Atoms. The Relation of its Mechanism with that of the Explosive Gas Reaction at High Temperatures. Dr. W. Frankenburger.

The Photochemical Union of Hydrogen and Chlorine at Low Pressures. J. B. Bateman and H. C. Craggs.

The Photosensitised Decomposition of Nitrogen Trichloride by Chlorine, and the Induction Period of the Hydrogen-Chlorine Reaction. J. G. A. Griffiths and R. G. W. Norrish.

The Photosensitised Formation of Hydrogen Peroxide in the System Hydrogen-Oxygen-Chlorine. R. G. W. Norrish.

The Photochemistry of Mixtures of Chlorine Oxygen and Carbon Monoxide. Prof. G. K. Rollefson.

The Mechanism of the Photo-Oxidation of Gaseous Alkyl Halides. J. R. Bates and R. Spence.

A Comparison of the Efficiency of Photochemical Reactions and Similar Reactions Produced by Gaseous Ions. G. R. Gedye.

Saturday, April 18, at 10 A.M.—Photochemical Change in Liquid and Solid Systems.

Introductory Paper. Prof. A. Berthoud.

The Photochemical Temperature Coefficient. D. W. G. Style.

The Acceleration of the Electrolytic Deposition of Hydrogen and Oxygen by Light of Short Wave Length. Dr. F. P. Bowden.

The Photochemical Decomposition of Chlorine Dioxide in Carbon Tetrachloride Solution. Y. Nagai and C. F. Goodeve.

The Photochemical Oxidation of Potassium Oxalate by Iodine in Aqueous Solution. Prof. A. J. Allmand and K. W. Young.

A Comparative Study of the Photographic Process under Different Experimental Conditions. Prof. J. Eggert.

The Latent Photographic Image. New Methods of Investigation and Results. Prof. F. Weigert.

Sensitisations of the First and Second Type. Prof. F. Weigert.

Saturday, April 18, at 2.30.—Photosynthesis.

Introductory Paper. Prof. E. C. C. Baly.

The Application of the Einstein Law to Photochemical Processes in Living Cells. Prof. O. Warburg.

The Measurement of the Physiologically Active (Erytheme forming) Ultra Violet by means of the Photochemical Formation of Dyestuffs from the Leuco-Compounds of Triphenyl Methane Dyes. Edith Weyde and W. Frankenburger.

CELEBRATION.

APRIL 22, 23, AND 24.

TEXTILE INSTITUTE (Coming-of-Age Celebrations) (at Midland Hotel, Manchester).

Wednesday, April 22, at 7.30.—Reception.

Thursday, April 23, at 10.30 A.M.—Lectures.
At 2.15.—Visit to Shirley Institute.

Friday, April 24, at 10.30 A.M.—Lectures.
At 2.15.—Visit to Manchester Ship Canal.
At 8.—Public Lecture (in Houldsworth Hall).