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CONTENTS.

	PAGE
The Future of the British Patent Office.—II.	157
Technical Problems of the Painter's Art. By Dr. A. P. Laurie	160
Geophysics in France. By Dr. C. Chree, F.R.S.	161
Modern Entomology. By C. W.	163
Industrial Research in Cotton. By F. P. S.	164
French Science and Philosophy. By F. S. M.	165
Electrodynamics and Radiation. By G. H. L.	166
Our Bookshelf	167
Letters to the Editor:	
The Fluorescence of Cadmium Vapour.—W. Kapuscinski	170
The Band Spectra associated with Carbon.—Prof. Raymond T. Birge	170
Sensitive Jets and Flames.—Dr. E. G. Richardson	171
Science and Intellectual Freedom.—Most Rev. Charles F. D'Arcy, Archbishop of Armagh; Prof. Henry E. Armstrong, F.R.S.	172
Changes in the Ultra-violet Absorption of Gelatin.—T. Thorne Baker and L. F. Davidson	172
The Oogenesis of Lumbricus.—Prof. J. Brontë Gatenby	172
Regions of Tension and Continental Drift. By Dr. J. W. Evans, F.R.S.	173
The Nutrition of Cattle	175
Current Topics and Events	177
Our Astronomical Column	181
Research Items	182
The International Astronomical Union at Cambridge	184
The Field Museum of Natural History, Chicago. By Dr. F. A. Bather, F.R.S.	185
The Sixth International Conference of Pure and Applied Chemistry. By Prof. C. S. Gibson	186
Wheat Supply and Demand	187
Symbiotic Micro-organisms	187
University and Educational Intelligence	187
Early Science at Oxford	189
Societies and Academies	189
Official Publications Received	192

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The Future of the British Patent Office.

II.

IN investigating in Great Britain the novelty of an invention, the Patent Office confines its search to British specifications published within the previous fifty years, and we have suggested that the search should be extended to cover text-books, periodicals, and foreign specifications, the period of search being restricted to twenty years except in the case of British specifications and text-books. The foreign specifications to be considered would be those published in the Dominions, France, Belgium, Germany, the United States, and Switzerland, for few inventions of serious importance will fail to be protected in one or other of these countries. We have now to estimate the increase of staff and of cost which this innovation would involve, and to show that the expense can be met by practicable means.

The machinery for the present search amongst British specifications was evolved by the scientific section of the Patent Office staff after many trials, and its success suggests that the devising of extended machinery must be left in the same hands. In order, however, to estimate what is involved in the present proposals, it will be necessary to consider in outline the form which that machinery would probably take. The characteristic feature to which the British search owes its thoroughness is the use of abridgments, so that the first step would be the abridging of the specifications published within the prescribed period in the countries we have mentioned, with the exception of New Zealand, Australia, and Belgium, for which countries abridgments are already available. Since the same inventor will often protect his invention in several different countries, many duplicates will be found: in order to sort these out and bring them together, by the aid of the inventor's name, the title, and the general aspect of the drawings, a small clerical staff would be necessary. For the actual work of abridging specifications in French and German the use of translators is to be deprecated, for it is both uneconomical and unsatisfactory in its results. Each class of subject-matter should preferably be indexed and abridged by the examiner, or syndicate of examiners, familiar with that class, so that it will be necessary for each syndicate to contain some one familiar with French and German. This should not be difficult, since most scientific men already know at least one of these languages.

As regards literature, text-books and year-books present little difficulty as they are usually provided with indexes, and examiners would soon become familiar with those which relate to their particular classes. Weekly and monthly periodicals and irregular publications such as bulletins are, with few exceptions, devoted

to a very restricted range of subject-matter: the examiner concerned with any such periodical would make extracts from it for his card index, the shorter extracts by means of manuscript notes and the longer extracts by means of underlined press-cuttings. The more general periodicals would have to be circulated to a number of examiners, but in most cases it would be sufficient to arrange that a single primary examiner should read each issue, passing on to the appropriate colleague any subject-matter for which he could not himself account satisfactorily.

We have now to estimate the increase in staff which would be necessary in order to carry out a search of the extent and thoroughness proposed. Let us consider first the state of things which will prevail when all preparatory work has been completed and only current work is being dealt with. We must compare the work of dealing with the specifications published annually in the countries we have mentioned with the annual work done on British specifications by the present staff, and for this purpose we shall assume that an examiner spends one-fifth of his time in abridging and indexing, one-fifth in actually searching, and the remaining three-fifths in general examination, attending to amendments, interviews, and provisional specifications, preparing for hearings, improving the classification of search material, studying law reports and technical literature, and other miscellaneous duties. We shall assume further that the time spent in reading, indexing, and abridging a specification would be halved in the case of foreign specifications, for since no general examination is to follow in their case, a far less meticulous reading would suffice than in the case of British applications; and we shall assume that the rate of searching could be increased by increasing the number of sub-headings under which inventions are classified. There are no statistics to support these assumptions and they are open to debate, but it can be said in their favour that they appear reasonable, and further, that the actual time spent in these tasks can be controlled, since the standard of thoroughness is necessarily somewhat arbitrary.

These assumptions, then, give us a measure of the additional staff necessary to abridge, index, and search through a given number of additional specifications, and we must turn next to the statistics of specifications published abroad. In doing so, however, we must allow for duplicates, for (to give only two examples) 65 per cent. of Canadian patents are granted to residents in the United States, 7 per cent. to residents in Great Britain, and only 16 per cent. to Canadians: while of British patents 58·5 per cent. are indigenous, 28·5 per cent. are granted to residents in the other countries we have mentioned, and the remaining 13 per cent. are granted to residents in Sweden, Holland, and other countries not mentioned. (These figures relate to the year 1922.) It is safe to assume that every applicant will have applied for a patent in his own country, so that in estimating the number of foreign specifications per annum we may eliminate duplicates by counting only indigenous patents. The resulting figure will be a little too small, but sufficiently accurate for our present purpose. The latest complete statistics are for the years 1921 and 1922, and taking the mean of these two years as a basis, the annual output of unabridged indigenous published specifications is as follows: Canada 1610, South Africa (estimated) 340, India 263, France 10,394, Germany (estimated) 14,500, United States 33,941, Switzerland 1907, total 62,955. This total we must compare with the mean number of specifications abridged annually by the present examining staff during the same period. This figure is not accurately known, as not all specifications which have been abridged are published, but it cannot be far short of 19,000. At this rate the new material to be abridged annually will be about 3·3 times the material at present abridged annually, so that on the basis already explained we must increase the staff by 33 per cent. on this account.

New Zealand publishes about 360 indigenous patents per annum, Australia 2600, and Belgium 6000, but as these are already abridged the work of indexing them, at the rate of about 1 per fortnight per examiner, need not be taken into account. As regards the time spent in searching amongst foreign patents, the search material would be increased by the specifications published in the countries mentioned during the previous twenty years, the total being about 1,750,000, but to allow for duplicates this must be reduced, in the general ratio of indigenous to total patents, to 1,250,000. The latter figure must be compared with the number of British patents at present in the search files and covering a period of fifty years: that number is about 550,000, so that the search material will be increased by about 228 per cent., and on the basis we have adopted this means a further increase of 23 per cent. in staff to allow for the extra time spent in searching.

As regards literature, we pass over text-books and year-books because, as has already been pointed out, the staff can take these in its stride. Of the 1759 weekly, monthly, and irregular periodicals taken by the Patent Office Library, a considerable proportion is devoted to non-patentable subject-matter. Of those which contain search material it has been estimated that there are very roughly 18,000 issues per annum, a number of the same order as the number of British specifications filed per annum. To determine the average content of an issue would require a very elaborate research, for some periodicals, such as papers on wireless, contain a good deal of subject-matter, while others, such as agricultural

papers, rarely contain any reference to invention, and mere quotations from specifications could, of course, be ignored. On the whole, we shall be fairly safe if we say that one average issue contains as much subject-matter as one average specification, and at this rate we must allow a further increase in staff of 10 per cent. on account of indexing periodicals and 7 per cent. on account of searching them for the past twenty years. This gives a total increase of 73 per cent. in the staff, if we make no allowance for time to be spent in visiting factories.

We turn next to the preparatory period which must elapse before a universal search could be undertaken. The preparatory work would include (1) the improvement of the classification by increasing the number of headings; (2) the training of the new staff and reorganisation of the staff as a whole; (3) the abridging and indexing of the periodicals and foreign specifications published during past years. The last item is the most serious, and is the only one which we shall take into consideration here. If merely the additional 73 per cent. of staff were to be engaged some time before the institution of the search for the purpose of carrying out the work of preparation, there would be a delay of 12 years before the search could begin; so that in addition to increasing the establishment by 73 per cent. it would be necessary, in order to shorten this delay, to engage a temporary excess of, say, 23 per cent. of the then establishment. This would enable a search to be begun five years after the engagement of the new staff and covering a period of thirteen years: three and a half years later the full period of twenty years could be searched, and there would then be a redundant staff of 23 per cent., which would be absorbed by normal wastage in six or seven years. If a larger excess staff were engaged in the first instance the search could be undertaken at still shorter notice, but the capital cost would, of course, be increased. Against this capital cost must be set off, in any case, the saving due to the fact that the new staff would enter the office on the lowest rung of their salary scale.

Great Britain is spending some 466,000,000*l.* in the relief of unemployment, largely by methods admittedly uneconomic. Little is being spent in the relief of unemployment by the stimulation of new manufactures: on the contrary, the inventor has to pay for the whole cost of the patent system and to pay upwards of 75,000*l.* a year in addition, in relief of general taxation, whereas in 1924, the United States thought it worth while to spend on her patent office 408,602 dollars out of her exchequer. These facts must be borne in mind in considering the question of the annual cost of the proposed extended search. The chief item will be the annual salaries of the additional staff, and we must estimate these not at the initial rate of salary at which new entrants will take up their duties, but at the average taken over their whole official career, which will be considerably higher. We may assume that this average will be equal to that for the present examining staff, so that if we take the aggregate salary of the latter, excluding Hearing Officers, and multiply it by 0·73, we shall arrive at the normal increase in annual expenditure on this account. The result, as estimated from the Comptroller's Report for 1924, amounts roughly to 106,400*l.* per annum, and to this we may add 3000*l.* for clerical and other supplementary staff, 5000*l.* for purchase of documents, and 7000*l.* for buildings, furniture, and maintenance, giving a total of 121,400*l.* per annum.

How is this additional expenditure to be met? We may put aside for the moment the suggestion that the whole cost of the patent system might be transferred to a tax on the sale of patented articles, and turn to more conventional sources of revenue. In the first place, the Patent Office makes a profit of 75,000*l.* a year. There is no justification whatever for this profit: it is a direct tax for the discouragement of invention, and only persists because it has been no one's business to attack it effectively. We may assume, then, that this profit can be abandoned, as the community's contribution to the cost of a scheme which is to benefit it considerably. Next, the maximum normal life of a patent might be extended to twenty years instead of the present sixteen. For the older patents the yield from renewal fees in respect of the nth year is given in pounds sterling by the formula $1{\cdot}7 \times 10^{5-0{\cdot}072n}$ with such accuracy that we may venture to extrapolate for the four years following. We thus find an additional yield of 32,000*l.* per annum from this source, leaving 14,400*l.* still to be found. As some 17,000 patents are sealed per annum, the addition of 1*l.* to the sealing fee is consequently the only increase in fees which would be necessary in order to balance the Patent Office budget.

In order to justify the preceding calculations it is necessary to examine rather carefully the effect of an increase in fees on the annual output of inventions. It may be supposed that such an increase will tend to diminish the output of inventions, while the enhanced value of the patent when granted will tend to augment it, so that some doubt arises as to the net effect. All experience goes to show, however, that a small change in fees has a negligible effect. When the present very limited British search was introduced in 1905 and at the same time the sealing fee of 1*l.* was added to the cost of the British patent, no change at all took place in the annual number of applications, while, on comparing the triennium 1902–4 with the triennium 1906–8, we find that the annual number of complete specifications increased by 17·5 per cent., and the annual number of

patents sealed increased by 6 per cent. In the United States the application fee was increased in 1922 from 15 dollars to 20 dollars, the final fee of 20 dollars remaining unchanged and no *quid pro quo* being offered by way of increased value in the patent: yet if we compare the preceding years 1919–21 with the following years 1923–4, we find that before the change the United States had 2·54 times as many applications as Great Britain, and after the change 2·50 times as many, a drop of only 1·6 per cent.

Then again, the scales of fees are very different in Great Britain, Germany, and the United States; yet the output of inventions per head of the population is roughly the same in each of these countries. Thus in Great Britain there is an application fee of 1*l.*, a "complete" fee of 3*l.*, and a sealing fee of 1*l.*, or a total initial fee of 5*l.*, followed by an increasing scale of renewal fees for the fifth and later years. In Germany there was until recently an application fee of 6 gold marks and an examination fee of 8 gold marks, or a total initial fee of 14 gold marks (about 14*s.*), followed by an increasing scale of renewal fees from the second year onwards. In the United States there is an application fee of 20 dollars and a final fee of 20 dollars, or a total of 40 dollars (8*l.*), but there are no renewal fees at all. It might be expected, therefore, that the output of specifications would be very different in the three countries, yet if we take the official figures on this subject for the year 1923 and compare them with the populations as given in the latest Whitaker's Almanack, we find the following result: Applications per thousand of the population in Great Britain, 0·69; in Germany, 0·75; in the United States, 0·76. Complete specifications filed per thousand of the population in Great Britain, 0·40; in Germany, 0·38; in the United States, 0·39. All these figures go to show that within reasonable limits fees have very little effect on the output of inventions.

Mr. Churchill has said that an overwhelming case can always be made out for doing nothing. To institute an extended search such as we have described would be a large undertaking, and one which is sure to encounter the opposition of a good deal of natural inertia. Yet at the present time the British patent system is like an unfinished house, and if the figures we have given are of the right order, there is no serious reason why it should not be provided with its roof. We have shown that if a substantially universal search be undertaken within five years, the Patent Office can still balance its annual budget without increase of fees, except for the addition of 1*l.* to the sealing fee. It is for those who would benefit by the institution of such an extended search to press upon the Government the importance of this method of stimulating invention and industry.

Technical Problems of the Painter's Art.

Papers of the Society of Mural Decorators and Painters in Tempera. Second volume, 1907–1924. Edited by John D. Batten. Pp. v+134+6 plates. (Brighton: Printed for the Society by the Dolphin Press, 1925.) 10*s.* 6*d.*

THE Society of Mural Decorators and Painters in Tempera is to be congratulated on having produced a volume of fascinating interest to those who are intrigued by the practical problems of the painter. The trouble is that it suggests so many queries, criticisms, and comments and opens up so many lines of inquiry that it requires a volume rather than a brief article for adequate treatment.

The painter of pictures and of wall decorations of to-day is in the unfortunate position of having lost invaluable studio traditions and having to rely on obscure and doubtful records of old methods of painting. The Tempera Society is, therefore, on the right lines in trying to bring together the experience of the painter, the information to be obtained from ancient records and the critical examination of old pictures, and in addition, the knowledge of the man of science. When all this has been done, the difficulty remains that there are many problems that can be solved only by the study of the slow but inevitable action of oxygen, of moisture, of light, and possible internal changes in the materials themselves through long periods of time.

All the publications in this volume are not new to those who are closely in touch with the subject, but they are none the worse for being reprinted, the papers by Mr. Neol Heaton on the frescoes at Knossos and by the late Sir George Beilby on lime putty being of special interest. Mr. Tudor Hart is also to be congratulated on his excellent recipes for preparing egg and size emulsions. He has had much experience in the use of these mediums. The systematic and scientific study of emulsions which is at present in progress in many laboratories must ultimately prove of the utmost value to the painter in the egg or tempera medium, and the modifications of it produced by the addition of drying oils and varnishes.

There are two urgent problems before the painter to-day. One is the problem of wall decoration under modern conditions of air laden with coal smoke and oxidation products of sulphur dioxide. It is admitted that painting with selected pigments mixed with water on wet lime has proved the most permanent method of wall decoration under suitable conditions, and it has an æsthetic value which is not obtainable by an oily medium no matter how much the oiliness of oil is suppressed by the addition of wax; but it

is obviously peculiarly liable to attack and injury under the atmospheric conditions existing in our modern cities, and it is at any rate open to question whether the northern tradition was not in favour of the use of oil, as shown by the early records of the purchase of painting materials both at Westminster and Ely. Mr. Tristram, who has been cleaning the tombs at Westminster, gives his verdict in favour of size either emulsified with or afterwards varnished with oil. I had the opportunity of examining some tiny samples from the Westminster tombs and can confirm the presence of oil, which shows that in the north there was no objection to an oil effect on decorated stone. I also found azurite, the native copper carbonate blue, and in that connexion a curious technique, namely, a layer of white lead in oil next the stone covered with a gesso containing vegetable fibre, suggesting that it was considered necessary to protect the azurite from any possibility of damp coming from the stone.

I am disposed to think we should boldly accept an oil technique for wall decorations under modern conditions. Where Buon Fresco can be used safely, it is supreme; and if we ultimately adopt scientific methods of heating, its revival should be possible even in the cities of this country. But even in this technique there are still unsolved problems. Pliny and Sir Arthur Church both agree in throwing doubt upon the use of certain yellow ochres in Buon Fresco. Mr. Burton suggests Perigord Ochre, but further inquiry and research are necessary.

The other problem facing the painter to-day is the correct use of the oil medium in the painting of pictures. Artists complain of premature cracking which occasionally occurs, and more generally of a lowering of tone from which some painters suffer much more than others. The Tempera Society in its return to the egg medium of the Italian painters of the thirteenth, fourteenth, and fifteenth centuries, represents a revolt from oil, which, owing to its facile easiness as a medium, leads to reckless use and consequent trouble.

The researches of Prof. Eibner, of Munich, have done much to put us on the right lines for solving the problem of cracking. The lowering of tone is due to the neglect of the study of the optical properties of the dry oil film of increasing age, and the reaction of these optical changes on the optical properties of the pigments. When we possess as complete a knowledge and mastery of the optical as well as of the chemical properties of the oil mediums as was possessed by Van Eyck and his followers, we shall find the solution to both these problems.

By a return to the combined tempera and oil technique, along with a thorough understanding of the optical properties of the oil film and its effect on pigments, and the obtaining in addition of a reliable backing for our pictures, better than canvas primed in the usual way, will be found, I hope, a way out of our difficulties.

In the meantime, all praise to the Tempera Society for its courageous attack on these problems. My only criticism is that they are not availing themselves sufficiently of the services of the chemist. The excellent work done, as revealed in this publication, by Burton, Noel Heaton, and Beilby, shows how much more we could do in the way of advice, criticism, and caution, and we are all anxious and willing to help.

The Society has already widened its remit so as to include wall decoration. Might not room also be found for the contemned oil medium?

A. P. LAURIE.

Geophysics in France.

Traité d'électricité atmosphérique et tellurique. Publié sous la direction de E. Mathias par J. Bosler, Dr. P. Loisel, Prof. R. Dongier, Prof. Ch. Maurain, G. Girousse, Prof. R. Mesny. (Comité Française de Géodésie et de Géophysique : Publications de la 6e Section.) Pp. xx + 580. (Paris : Les Presses universitaires de France, 1924.) 40 francs.

THE U.G.G.I. (Union Geodétique et Géophysique Internationale) is a post-War body which meets normally once in three years, and has for its props and feeders national committees of geodesy and geophysics in the countries which give their financial support. The Union is subdivided into sections, of which one known as T.M. and E. deals with terrestrial magnetism and electricity. The French national committee, being a business-like body, has corresponding sections, each apparently with its president and secretary. The section answering to T.M. and E. is known as No. 6. Its president is M. D. Berthelot, membre de l'Institut, and its secretary Prof. E. Mathias, director of Puy de Dôme Observatory. The president contributes an eloquent preface of seven pages to the volume. He explains that it represents a labour undertaken by the section at the suggestion of Prof. Mathias. The completion of so comprehensive a treatise would, as he says, require enormous labour and profound erudition on the part of any one man, and during the years required to write it fresh knowledge would accumulate. Common sense thus dictated co-operation, and in M. Berthelot's words, "Une pléiade de spécialistes distingués ont bien voulu nous prêter leur bienvaillant et désintéressé concours." The general arrangement and supervision fell to Prof. Mathias, whose devotion

to his self-imposed labours merits all respect. The production of such a work must have been costly. It is thus interesting to note that a subvention was received from the Caisse des Recherches Scientifiques, the president of which is M. A. Lacroix, permanent secretary of the Academy of Sciences. An enumeration of the several authors and their contributions will give, it is hoped, some idea of the wide compass of the volume.

Prof. R. Dongier treats of the earth's electric field, the instruments used in measuring it and the results obtained. In a short note later in the volume, he discusses the theory of the quadrant electrometer. Prof. C. Maurain, Director of the Geophysical Institute, Paris, writes on loss of charge, ionisation and conductivity of the atmosphere, and on atmospheric currents and conduction. Dr. P. Loisel discusses radio-activity of the air, with subsections on the radio-activity of the earth and of wells, and he treats of the relations of radio-active substances to the earth's internal heat. Prof. R. Mesny deals with radio-telegraphy and atmospherics. M. J. Bosler, Director of Marseilles Observatory, discusses earth currents (of natural origin). M. G. Girousse, Director of Triphasé (Nord-Lumière), deals with earth currents of artificial origin.

The longest contribution, by Prof. Mathias, Chap. I. of Part II., is a discussion of electric discharges in the atmosphere. Besides St. Elmo's fire, lightning of various kinds, and lightning conductors, he includes also aurora. Prof. Mathias also supplements the work of Prof. Maurain by a discussion of the mobility of ions in the atmosphere, and the various laboratory ways of measuring it. Further, he discusses rainfall electricity, and writes three supplements at the end of the volume. The first and last of these, devoted respectively to the so-called black flash and to Vegard's recent work on the spectrum of aurora, are very brief. The second gives an account of the writer's own recent speculations on thunder and lightning.

As to the other contents, there is a copious bibliography at the end of each section, and at the end of the book an authors' index. As evidence of its completeness, it may be mentioned that under the heading "Elster et Geitel" there are 39 references, and the same 39 references appear on the same page under the heading "Geitel et Elster." There is no subject index, but there is a very full table of contents.

A few words must suffice for comment on the several contributions. M. Dongier's account of instruments for measuring potential gradient is well illustrated. Chauveau is quoted as to the great superiority of photographic recorders as compared with the Benndorf electrograph. In this we concur, but we should associate the former type rather with the name of Kelvin than that of Mascart. Many important practical details are mentioned, including the reduction to the infinite plane. Diurnal variations are represented, perhaps somewhat superficially, by numerous diagrams.

The articles of Profs. Maurain and Mathias on ionisation and conduction show little overlapping, and form an excellent discussion of the subject.

Dr. Loisel commences with a general discussion of radio-active transformations and then passes to atmospheric phenomena, including the ionisation in closed vessels. In discussing Messrs. Campbell and Wood's observations he accepts their assumption that the diurnal variation of potential gradient has the same character at Cambridge as at Kew. This wants confirmation. Dr. Loisel gives a large number of data for the radio-activity of rocks and of mineral wells. The bibliography at the end of his article has 122 entries.

In his discussion of thunder and lightning, Prof. Mathias devotes considerable space to lightning conductors, and to a historical discussion of Franklin's discovery that lightning is an electrical phenomenon. The meteorological aspects, frequency and diurnal variation of thunder, are scarcely touched on. Aurora is not a prominent "meteor" in France, and the survey made of it is somewhat rapid. It refers, however, to Störmer's height measurements, and to the results of his mathematical calculations.

In his discussion of rainfall electricity, Prof. Mathias treats very fully of Dr. Simpson's observations at Simla, and inclines to the opinion of Nolan and Enright that "la théorie préconisée par Simpson est pleinement compétente pour expliquer les phénomènes électriques observés des orages à foudre" (p. 381). Another research to which he devotes special attention is the interesting recent work of Norinder on the electric field during thunderstorms.

M. Mesny, after discussing the apparatus and methods of radio-telegraphy, gives much valuable information about the variation in the facility of propagation of electric waves of various lengths, about variations of azimuth, and about atmospherics. In the latter topic he has many references to the work of Mr. Watson Watt.

M. Bosler narrates the historical development of our knowledge of earth currents, and describes the means of recording them employed at the observatories of Parc St. Maur and the Ebro. He discusses the diurnal variations observed at these two stations and Weinstein's results for Germany. Contrasting the records of earth currents and magnetic variations at Parc St. Maur, he infers apparently that the latter are largely

a consequence of the former, so far at least as irregular changes are concerned.

M. Girousse's discussion of artificial earth currents requires some knowledge of electrical engineering for its full comprehension, but the general conclusions are easily followed. What specially interests M. Girousse is apparently the financially important question of the electrolysis of underground pipes.

Taking the volume as a whole, British workers have no reason to complain of lack of recognition—except perhaps in the case of the thunderstorm work of Prof. C. T. R. Wilson—and their names are usually tackled successfully. Lennan, however, without the "Mac.," p. 286, has a somewhat Bolshevist appearance. In view of the present cost of printing, a similarly comprehensive work in English seems a remote contingency for years to come. Physicists of the older generation owed much to the works of Deschanel and Ganot, and present-day geophysicists who read French easily will find the treatise under notice of great assistance in their studies. C. CHREE.

Modern Entomology.

(1) *Anatomy and Physiology of the Honeybee*. By R. E. Snodgrass. (McGraw-Hill Agricultural and Biological Publications.) Pp. xv+327. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1925.) 17*s*. 6*d*. net.

(2) *A General Text-book of Entomology: including the Anatomy, Physiology, Development and Classification of Insects*. By Dr. A. D. Imms. Pp. xii+698. (London: Methuen and Co., Ltd., 1925.) 36*s*. net.

IN 1910 the United States Bureau of Entomology issued a Bulletin by Mr. Snodgrass on "The Anatomy of the Honeybee," which immediately attracted attention, and has since maintained its place as the authoritative work on the subject. The present volume, as its title implies, has a wider scope, and contains a greater proportion of matter derived from the researches of others. The additions are judiciously selected and well presented. Nothing is final, but the book may stand as a fairly complete statement of our present knowledge of the morphology and physiology of this important insect, and the hope of the author that our ideas of the bee may hereby be placed "on a surer scientific basis than before" is amply justified.

An interesting section deals with the senses of the bee. There is no evidence that bees hear, but the senses of sight and smell are fully discussed, results published by investigators so recently as 1924 being duly incorporated. As regards smell, perhaps too much space is accorded to the rather crude experiments of M'Indoo, which led him to deny to the antennæ any great importance as olfactory organs. Justice is done, however, to the more convincing work of von Frisch, who was careful to use non-irritant odours under some approach to natural conditions, and who not only reinstates the antennæ, but also considers that the pore-plates of the last eight segments are the special organs of smell.

The illustrations are for the most part admirable. Many are, of course, retained from the original Bulletin, and some of these have become very familiar from their recurrence in all manner of zoological text-books. But there are many new figures of an equally high standard of excellence. One of the least satisfactory bears the legend, "Isle of Wight disease mites," but there is no reference to these parasites in the text. Mr. Snodgrass is not of course concerned with pathology, but if he finds room for Dr. Rennie's Acarapis, it might be useful to indicate the particular tracheæ to which it is always confined.

In typography and clearness of arrangement the book is all that it should be, and Mr. Snodgrass has a lucid and pleasing style without a trace of transatlantic idiom, so that we need not complain if he conforms to his country's idiosyncrasy in the spelling of certain words.

(2) Dr. Imms has broken new ground in his "General Text-book of Entomology." The multitude of insect books published in English during the last fifty years have for the most part fallen into one of two categories. There is the Nature-study variety, chatty and discursive, and drawing largely from the incomparable J. H. Fabre, and there is the collector's hand-book variety, concerning itself entirely with the adult insect, and designed to aid the young collector in the identification of his pinned specimens. Few have dared to deal with the vast subject of entomology as a whole, and if this was a staggering task fifty years ago, what is it now, in view of the tremendous annual output of more or less original material? Thirty years ago Dr. David Sharp remarked that insects were the most numerous in species and individuals of all land animals, and estimated the number of known species at about 250,000. According to Dr. Imms, 450,000 species have now been described.

Just about a century has elapsed since W. Kirby and W. Spence completed—in four volumes—the first edition of a work which was destined to enjoy a great vogue for many years. The seventh edition appeared in 1856 as a single volume. This work, written in the epistolatory style, was distinctly of the Nature-study order, and was deservedly popular for its store of information concerning the habits of all manner of insects.

In 1885 W. F. Kirby published an "Elementary Text-book of Entomology" dealing with the subject from an entirely different point of view, and doing what was possible, in the space of 240 pages, and with the aid of some excellent plates, to enable the budding entomologist to find his way among the orders and families of insects at that time recognised. The second edition appeared in 1892. Then, at the close of the century, came two remarkable works. The first portion of Dr. David Sharp's treatise on insects in the "Cambridge Natural History" appeared in 1895, and the concluding part in 1899. Meanwhile, in 1898, Dr. A. S. Packard published in America his "Text-book of Entomology."

Dr. Packard's work was entirely morphological, and appealed—and still appeals—to the advanced student of comparative anatomy. Dr. Sharp's treatise was, we believe, the first serious attempt to deal with the subject from all aspects, and, so far as was possible in the space at his disposal, he succeeded triumphantly. It is surprising how often workers in the most varied fields find in his volumes precisely the kind of information they require.

But Dr. Sharp cared not at all for applied entomology. The threatened extermination of a rare insect excited his indignation, but the too great abundance of a common species left him cold. His sympathy was distinctly on the side of the insects.

Now, during the present century, the number of workers in the economic field has vastly increased. It is even true to say that a large proportion of our recent advance in entomological knowledge is directly due to them. What did we know of mosquitoes or of fleas before their proved connexion with malaria and bubonic plague? Consider the condition of our acquaintance with Hymenopterous parasites before their importance in the control of crop pests was recognised. Dr. Imms dedicates his book to teachers, advanced students, and those engaged in research, and we feel sure that in the last category he had specially in mind that body of economic entomologists of which he is himself a distinguished member. If we add the fact that in a subject attracting so many workers, books a quarter of a century old are necessarily in many respects out-of-date, we see that a new venture was urgently called for, could any one be found sufficiently equipped and sufficiently daring to undertake it.

By what criteria must Dr. Imms' work be judged? Originality, except in the general scheme of presentation, would be a positive blemish. The essential points are that the selection of matter, necessarily very rigorous, should be well balanced and clearly presented; that the latest—not always the latest propounded, but the latest approved—conclusions should be incorporated, and that the student should be put on the track of further information on the point which especially interests him.

On the whole, the book before us stands these tests extremely well. The bibliographies at the end of each section are most valuable, and the chances are that a "research worker," to use Dr. Imms' term, consulting the work on any particular point, will find a concise and trustworthy statement of what is known, and an indication of the sources whence more detailed information may be obtained.

We note that Dr. Imms does not cater for the medical entomologist, who, he doubtless considers, is well provided with his own special entomological text-books. We may instance the short chapter on fleas, which includes no figures of internal structure, and presents a scheme of classification not too recent and referring only to British species.

We congratulate Dr. Imms on the production of a book which will be valuable to a large number of students and indispensable to not a few.

C. W.

Industrial Research in Cotton.

Shirley Institute Memoirs. Vol. 3, 1924. Pp. vi + 362 + iv. (Manchester: British Cotton Industry Research Association, 1924.) n.p.

THE volume under notice includes twenty-seven original papers in cotton research and an excellent summary of the literature on the action of light on dyes applied to cotton fabrics.

Our knowledge of the botany of the cotton plant is already very extensive, and it is of more than passing interest to find in these pages a further advance in the study of the cytology of a plant so long cultivated. A count of the chromosome numbers in many varieties of Old and New World cottons has shown that the numbers fall into two groups of 26 and 13 chromosomes, the former comprising the cottons of the New World and Egypt, and the latter those of Asia. Unsuccessful attempts to cross American or Egyptian with Indian cottons have often been made, and a possible explanation of the difficulty is thus established.

The effects on cotton of the mechanical action of several processes through which it passes in the spinning mill have been thoroughly investigated, and although tendencies in modern industrial practice are in the main justified, the precise information obtained is invaluable. The necessity for the control of the atmospheric conditions in testing and in many technical processes is strikingly demonstrated by investigations on the influence of humidity and temperature on the elastic properties of cotton hairs and the absorption of moisture

by raw and soda-boiled cottons. Recent botanical views on the micellar structure of cotton have been strengthened by further and more trustworthy information on moisture hysteresis in cotton, which extends to 1·8 per cent. and not to zero relative humidity as was formerly found. Using the Anderson capillary formula, the calculated diameter of the smallest pores (or the smallest distance between the micelles) is of the order of 13×10^{-8} cm.

Micro-analytical methods for the examination of small quantities of waxes are described and the main constituents of the waxes extracted from some American and Egyptian cottons are very similar. The phosphorus and nitrogen contents are consistently greater in Egyptian than American cottons, and in spite of environmental variations the phosphorus content can be used to distinguish between them. It is not possible to say how these results can be utilised in the improvement of the physical properties of cottons, but there are hopeful indications that their application may provide the grower with a means for controlling the quality of the crop. The cotton breeder is badly in need of information in a utilisable form on manufacturing quality, and those who dream of a cotton industry including the grower as well as the spinner may yet see their dreams realised.

A study of the swelling of cotton cellulose in potassium hydroxide solutions, following an investigation into the action of solutions of sodium hydroxide (the reagent used commercially in mercerising), has produced interesting results of a purely scientific nature. The increase in diameter of the cotton hair is less than half that attained in sodium hydroxide solutions, and maximum swelling obtains in the solution of maximum electrical conductivity. It is tentatively suggested that the action of the metallic ion on the swelling of cotton cellulose is consistent with the ionic theory of the swelling of colloids.

On glancing through these twenty-eight researches, one is struck by the number of positive results obtained. The keen practical man should welcome this precise information even though its immediate commercial application may be subject to modification by industrial limitations. Those only interested in the commercial usefulness of the knowledge, who have experienced difficulty in reading the earlier volumes in this series, will have no cause for complaint on this ground. Each paper in this volume is preceded by a short abstract in which the possible industrial applications of the results are written in terms which should be easily understood. Those who have not access to these memoirs, which are not purchasable, will find all these researches published in the Journal of the Textile Institute. F. P. S.

French Science and Philosophy.

Histoire de la nation française. Par Gabriel Hanotaux. Tome 15 : *Histoire des sciences en France.* Deuxième volume : *Histoire des sciences biologiques,* par Prof. Maurice Caullery ; *Histoire de la philosophie,* par René Lote. Pp. 619+12 planches. (Paris : Plon-Nourrit et Cie, 1924.) 50 francs.

Histoire de la nation française. Par Gabriel Hanotaux. Tome 14 : *Histoire des sciences en France.* Premier volume : *Introduction générale,* par Émile Picard ; *Mathématiques, mécanique, astronomie, physique et chimie,* par Henri Andoyer, Prof. Pierre Humbert, Prof. Charles Fabry, Prof. Albert Colson. Pp. xx+619+12 planches. (Paris : Plon-Nourrit et Cie, 1924.) 50 francs.

THE fifteenth volume of M. Hanotaux' " Histoire de la nation française " is devoted partly to a history of the biological sciences by M. Maurice Caullery, partly to the history of philosophy by M. René Lote. It is a great book in both senses of the term. Each author is extremely well qualified for his task and each has taken great pains in its performance. The proportion of space allotted to science speaks well for the understanding of the general editor, for there is another volume on physical and mathematical sciences, and M. Caullery is careful to lay down at once the right principle for dealing with science or philosophy in such a national work as this. " One cannot write a ' national history ' of any science. The history of all the sciences is essentially international. . . . What can be done, and has been attempted here, is to take a particular country as a centre of observation and trace the connexions of the scientific movement there with the general march of thought."

France has a distinguished place in both parts of this volume. Cuvier, Lamarck, Claude Bernard, and Pasteur are a series which will bear comparison with the biologists of any other nationality, and in general philosophy the quality of French thought is well brought out by M. Lote when he speaks of the equilibrium of the French spirit—" raisonnable sans froideur, imaginatif sans fantasmagorie."

The work has been very well done, especially the letterpress, which would command a still larger sale if produced in two small volumes. The illustrations, which are abundant, will arouse more mixed feelings. They are mostly drawings—not executed with the highest French finish—of portraits, tombs, houses, connected with names in the text. The present reviewer finds the black and white drawings not unsatisfactory, but would be happier without the coloured plates.

The fourteenth volume, containing the history of mathematics, physics, and chemistry, came to hand

after the above was written, but it fully bears out the judgment we have expressed and is in some ways better than the fifteenth. M. Émile Picard writes a general introduction describing the characteristics of the French contribution to science and advocating some teaching of the history of science as part of the lycée course. On both subjects he is enlightening and impressive. The general quality of French scientific and philosophic thinking is admirably illustrated by the section on the history of mathematics by MM. Andoyer and Humbert. Vieta, Descartes, Fermat, Bernoulli's, Lagrange, Laplace, Cauchy; it is a magnificent series with which no other nation can compete. If science consists in "mathematising" knowledge, the French have done most in the modern world to advance it, and it is they and not the Germans who come nearest to the rôle of the Greeks. But these French volumes are conceived and executed in as great a spirit of impartiality as is consistent with the general idea of a national history; no great name is omitted, whether it be British, Italian, or even German, though the portraits and other illustrations are almost entirely French.

It is an eloquent testimony to the intellectual elevation of our neighbours that so large a share of a general history of the country should be given to science and philosophy and that the work should be done so well. There is certainly no parallel in any English history, and the two volumes together form perhaps the best extant sketch of the history of science, complemented by M. Lote's section which treats philosophy from the scientific view-point. This also is a feature more common among the French than with us. We heartily congratulate both them and M. Hanotaux on a valuable contribution to scientific synthesis. F. S. M.

Electrodynamics and Radiation.

Scientific Papers, mainly on Electrodynamics and Natural Radiation: including the Substance of an Adams Prize Essay in the University of Cambridge. By the late Prof. Samuel Bruce McLaren. Pp. vii+112. (Cambridge: At the University Press, 1925.) 8*s.* 6*d.* net.

THIS small volume of the papers written by the late Prof. McLaren before he met an untimely fate in the War, and now collected together by some of his friends, will undoubtedly be received with somewhat mixed feelings. The pleasure that we experience in reading and re-reading his delightful analyses of questions which have been the subject of such ardent discussions and are still far from settled, can scarcely be separated from the thoughts of the great loss which science suffered by his death.

The papers themselves are preceded by a short biography of Prof. McLaren, written by Prof. Hugh Walker, which gives an insight into the very human side of McLaren's personality. Then follow the papers on radiation and gravitation drawn up by Dr. J. W. Nicholson. Here we find the classical argument, developed, however, with exceptional analytical power and considerable elegance, against equi-partition and Newtonian mechanics, the conclusion being, as usual, that if we regard the normal oscillatory co-ordinates as being all statistically equivalent, then Newtonian mechanics involves equi-partition. It would, of course, be surprising if the result were otherwise, but the fault is not necessarily with the mechanics; the independent probability argument is capable of bearing at least some of it.

In the later parts of these papers McLaren branches off into highly speculative proposals. Taking the ether —with the electromagnetic equations to define its activity—and assuming that matter in its smallest element (electron) is merely a small spherical sink in the ether, much as a perfect conductor would in fact be, he develops a formal electromagnetic scheme which includes the usual hydrodynamical attractions between sinks as a possible gravitational force. Any such theory is, of course, open to the usual objection that it either assumes too much or results in too much, but it is here developed by McLaren with an attractiveness which compels attention.

In the second set of papers, edited by Prof. Hassé, these ideas are pushed further to include a theory of magnetism. Here the magneton is introduced as a ring sink in the ether—a perfect conducting circuit with a current in it—and calculations of the associated energy and momentum are made and compared with fundamental data. The revolving electron theory of the magneton is rejected as being incapable of explaining paramagnetism on the lines developed by Langevin, the idea being that since the mechanical force exerted on an electron by a magnetic field is at right angles to the direction of motion of the electron, it can never do the work which is required for the orientation of the orbit. There appears to be a slight confusion of thought in this criticism. When a circuit carrying a current moves in a magnetic field, the magnetic forces acting on the contained electrons have a double effect. The components at each point perpendicular to the main direction of the current flow balance the mechanical reaction forces acting on the element there, and the other components balance the electrical or other forces driving or retarding the current. The energies associated with these two actions are, in the usual circumstances, equal in amount but opposite in sign, so that the total is zero, and the only

effective result of the action of the magnetic field is a redistribution of the energy as between the mechanical and internal types.

In the last paper, not previously published, and now edited by Prof. Havelock, McLaren discusses the propagation of a disturbance in a dispersive medium by the Fourier method. Here he proves that the mathematical difficulties, which at first appear to be inherently involved in the method, do not in fact present themselves, and that results are obtained which are fully consistent, so far as it is possible to follow them, with the physical ideas of propagation by waves and wave groups.

This short review will perhaps give some idea of the scope of McLaren's work, which was all accomplished in the short space of three or four years. The book into which it is now all collected will serve as a worthy memorial—it is produced by the Cambridge Press in their usual excellent style—to a fallen colleague, and it can be recommended to every one interested in the subjects with which it deals. They will find in it an interesting and still to great extent novel discussion of matters in which alternative points of view are still more than welcome. G. H. L.

Our Bookshelf.

Pygmies and Bushmen of the Kalahari: an Account of the Hunting Tribes inhabiting the great arid Plateau of the Kalahari Desert, their precarious Manner of Living, their Habits, Customs and Beliefs, with some reference to Bushmen Art, both early and of recent date, and to the neighbouring African Tribes. By S. S. Dornan. Pp. 318+16 plates. (London: Seeley, Service and Co., Ltd., 1925.) 21*s.* net.

THE lower the savages, the more difficult it is to make observations among them—to endure the adverse climate or conditions of their habitat, to follow their shifting, unsettled mode of life, to overcome their diffidence. Our literature about the pygmy race and the so-called primitive food-gatherers is as scarce as it is important for anthropology. The recent additions by trained scientific field-workers—the books of Prof. and Mrs. Seligman on the Veddahs, of Dr. Radcliffe-Brown on the Andamanese, of the Rev. W. Koppers on the Firelanders—have aroused great interest and already influenced anthropological argument. About the Bushmen we know, in spite of some good older accounts, only too little, and the present volume is welcome, written as it is carefully, in a clear attractive style, and by one who can claim that "for the opinions expressed in the book the author alone is responsible." It represents mainly the writer's own experiences with the Bushmen and Bechuanas.

The bulk of the volume and its most valuable part consists of Chaps. v.-xxii., on the Bushmen of the Kalahari. The descriptive pages are good, especially when they refer to tangible objects—clothing, household goods, implements, weapons and such like; or the typical pursuits—the chase, warfare, trekking and fishing, which, surprising as it sounds, exists in the arid desert of the Kalahari. The sociology of these nomadic savages is given but in a cursory manner, as is natural from an amateur ethnographer. Even in a chapter with the promising title, "Organisation of Family and Clan," there are, for six descriptive pages on physical appearance, only one page and a half on sociology—and this very slightly treated. Some interesting information about the tests in hunting skill and endurance necessary for marriage are given in Chap. xiii. ("Family life—Marriage, Children, etc."), but the remarks about sexual relations, family life and kinship ties do not go beyond generalities and will be of little use for the comparative sociologist.

The most interesting passages of the book are detailed statements of personal experiences of the writer, as they throw some light on the mentality of the natives and on their conduct in ordinary life. What Mr. Dornan has to say about "Food and Feeding" (Chap. xii.), about personal relations, about their beliefs and folklore (Chaps. xv.-xix.) is often quite good. The chapter on "Knowledge of the Veld and its Lore" shows us the native as a good observer, capable of empirical conclusions and logical argument. It should be helpful in dispelling the myth of "savage prelogical mentality." B. M.

In Southern Seas: Wanderings of a Naturalist. By Dr. W. Ramsay Smith. Pp. xviii+297+16 plates. (London: John Murray, 1924.) 16*s.* net.

IN this attractive little book a naturalist at ease and in his holiday mood gives us his impressions and personal opinions on several subjects, which he has treated at other times professionally and of which he takes now a bird's-eye view during a recreation trip through New Caledonia, the New Hebrides and Northern Australia. The flippancy of style, which seems to be considered a matter of duty in such books, does not interfere substantially with the serious purpose of the book, directed mainly to the study of native races. The traveller in the South Seas is naturally led to melancholy musings about the appalling extent of depopulation, the decay of native culture and custom—and he is made to reflect upon the cause of it all. "The total effect of all well-intentioned or ill-meaning interference with long-established customs and observances, which were evolved with the race itself and were necessary for its existence and well-being, has too often been to break up the social fabric and destroy physical vigour; it has meant degeneracy or death or both." Dr. Ramsay Smith asks the question which must have occurred time and again to every anthropological field-worker and to any thinking and sympathetic white man in contact with natives: "Why should it be considered essential to interfere with such customs?" Above all, it might be added, why should we try to destroy all which the natives hold sacred and important, their beliefs, rites, morals, and that while our own religion, which we try to force on them, becomes but its own travesty once it has been grafted upon stone-age mentality. "There is no guarantee that the oil or even the Lord's anointed will not turn rancid in some of these places," says the author, and indeed some reflection might have warned us that they are bound to; experience teaches always the same lesson—that they turn

rancid and poisonous, and that in spite of the best intentions.

The five chapters on Australian aborigines are instructive, especially where the writer deals with problems of race and physical anthropology. It is a pity that no references to other authorities are given, while the information is obviously not all based on personal field-work. About the Melanesians there are certain extraordinary statements, such as that "the savage lord of creation does little or no work except to make his wife or wives work" (p. 52). Those of us who know the Melanesian at first hand will feel astonished how any one who has visited the islands even on a flying trip could have carried away such an impression.

B. M.

Nauka Polska: jej Potrzeby, Organizacja i Rozwój. Tom 5. Pp. vi+553. (Warszawa: Im. Mianowskiego, 1925.)

La science polonaise: ses besoins, son organisation et ses progrès. Résumé français des articles parus dans le volume 5. Pp. 36. (Varsovie: J. Mianowski, 1925.)

FROM the French résumé of the articles in the larger work in Polish we can learn in outline the needs, organisation, and progress of science in Poland. This is the fifth annual volume which has been issued by the Caisse J. Mianowski, an institute for the encouragement of scientific work. Earlier volumes have dealt with the more urgent scientific needs of Poland, proposals for the allocation of funds, and a report of a congress on scientific organisation. Some of the more pressing problems concern agriculture, health, education, sociology, and geological survey. There are six universities—Warsaw, Cracow, Leopol, Lublin, Wilno, and Poznan, and local scientific societies at Plock, Thorn, Przemysl, and Sandomiez. Conferences have been held on physiography, on museums, on education. There are some foundations, the Academies at Wilno and Zamosc and the astronomical observatories at Vilno, Poznan, Cracow, and Warsaw, and a monument to Copernicus at Warsaw. Information has been collected as to the organisation of science in other countries — in France, Italy, Denmark, Czecho-slovakia, and Finland. M. J. Wojciechowski contributes an article on "The co-operation of the state and of industry in scientific researches in England," with references to the articles by J. W. Williamson and Dr. Kenneth Lee in NATURE for November 15 and December 6, 1924. There is an evident willingness to co-operate with work abroad. Relations have been cultivated with France, Italy, Belgium, England, the United States, Switzerland, and Czecho-Slovakia; Poland has been represented at some forty international conferences. Polish savants — about two hundred — have been encouraged to travel. Scholarships are offered to foreign students. Contact has been made with the League of Nations Committee on Intellectual Co-operation.

It appears that, although with restricted finance, an endeavour is being made to prepare the conditions for a scientific advance. For this reason it may be increasingly important to watch the future volumes of this annual. The French abstract is already a useful interpreter. Perhaps in the future English and German abstracts could also be offered.

H. R.

The Mineralogy of Scotland. By the late Dr. M. Forster Heddle. Edited by J. G. Goodchild. Reprinted under authority of Alex. Thoms by the Council of University College, Dundee, assisted by D. E. I. Innes. Vol. 1. Pp. lviii + 148 + 51 plates + 4 maps. Vol. 2. Pp. viii + 250 + plates 52-103 + 7 maps. (Dundee: Frank Russell, 1923–1924.) 15*s.*

BY the publication of these two handsome volumes at so moderate a price, Mr. Alexander Thoms and the Council of University College, Dundee, deserve the thanks of all interested in the mineralogy of Scotland. Heddle's well-known work has, since its appearance in 1901, been an indispensable book of reference for mineralogists and petrographers, and it is satisfactory that so valuable a compilation has not been allowed to suffer the common fate of a mineral index and go permanently out of print.

It is unfortunate, however, that the opportunity has not been taken of removing some of the defects for which the original edition was criticised. The book possesses no adequate index, the first requisite in a work of this character, and in consequence the labour of tracing the descriptions of the minerals and their occurrences throughout the text is as long and irritating as it should have been unnecessary. The complete disregard of recent published work is also to be regretted. Thus, the interesting contributions made to the mineralogy of Scotland by the officers of H.M. Geological Survey working in Mull are not mentioned, and, as a result, the accounts of the mineral occurrences in that island are incomplete and sometimes erroneous.

Despite these blemishes, the book remains a lasting memorial of the enthusiasm and ability of the late Prof. Heddle. It is well printed and produced, and the illustrations are of excellent quality; but it is necessary to warn the reader that not a few of the drawings are examples of artistic crystallographic draughtsmanship rather than actual representations of the crystallography of Scottish minerals.

Substation Operation. By Prof. Edwin Kurtz. Pp. xiii + 261. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1924.) 12*s.* 6*d.* net.

THIS book is intended to help the workman to understand the principles of substation operation. It is a good attempt at giving somewhat advanced technical knowledge in such a way that it can be readily assimilated. Very little theory is given, and much of the information has been compiled from official American sources. We were interested to read of the care that is taken to protect the operator from shock and burns. Not only has he to wear rubber gloves, but he has to wear leather gauntlets over them. He has also to blow in the gloves to see whether there are any holes in them. In addition he has to put on a leather coat, which must be kept scrupulously clean, and when working with high tension switches he must stand on a stool thoroughly insulated from earth and so constructed that it cannot possibly tip over.

Full instructions are given to revive a man when he has had a shock. The patient is then to be given some stimulant, "such as one teaspoonful of aromatic spirits of ammonia in a small glass of water, or a drink of

hot ginger, tea or coffee." We are told not to use water to put out a fire at a substation before the station has been made completely "dead." The reason given for this is that the operator would receive a shock if he directed a jet of water on to a "live part." This may be true for very high voltages, but it is not true at low voltages. This book will interest station engineers in Great Britain.

Physiologische Pflanzenanatomie. Von Prof. Dr. G. Haberlandt. Sechste, neubearbeitete Auflage. Pp. xvii+671. (Leipzig: Wilhelm Engelmann, 1924.) 22 gold marks.

THIS work, originally published in 1884, is best known to English students from Prof. Drummond's translation of the fourth German edition. A fifth edition appeared, during the War, in 1917. The latest edition has been brought more up-to-date, especially by additions to the "notes" at the end of each chapter, the most useful feature being the references to recent German research. Some of the rather dogmatic statements of earlier editions have been modified, and it is acknowledged that modern cytological work has reopened questions, such as those relating to the origin of the chloroplastids and other chromatophores, which have previously been regarded as answered. By deletion of some less important passages the size of the book has been very little increased, though room has been found for brief accounts of such new discoveries as those of Merl and Czaja on the mechanism of the Utricularia bladders. Possibly owing to the lack of access to recent literature, English and American work appears to have been almost entirely ignored. Thus the account of mycorrhiza is very incomplete. Prof. Haberlandt realises that the subject will soon require a more basic revision than can be given without rewriting the whole book, but declares it is not possible for him to undertake this.

Fuel: Solid, Liquid and Gaseous. By Prof. J. S. S. Brame. Third edition. Pp. xv+388. (London: E. Arnold and Co., 1924.) 18*s*. net.

PROF. BRAME points out that the second edition of his book was published in 1917, when no large amount of revision was possible; since the issue of the first edition there has been very considerable extension of our knowledge of fuels for internal combustion engines, of the use of powdered coal as fuel, of the ignition points of fuels of all classes, on the velocity of combustion of gaseous mixtures, and on problems of low temperature carbonisation. All these subjects have been revised, and the chapters on liquid fuels for internal combustion engines have been re-written. Additional material on the composition and the coking properties of coal has also been included. The author has made full use of the publications of the Fuel Research Board, and has evidently found them of great value.

Metallurgy: an Elementary Text-Book. By E. L. Rhead. New and revised edition. Pp. xii+403. (London: Longmans, Green and Co., 1924.) 7*s*. 6*d*.

MR. RHEAD'S little book on metallurgy was first published thirty years ago, and has been through many editions. The copy before us is a new and revised edition published late last year. Considerable additions have been made throughout the book, especially in the metallurgy of iron and steel, copper, silver, gold, and nickel. Certain processes which have become obsolete or the importance of which has diminished have either been deleted or condensed into smaller compass. The author, however, has wisely retained certain other processes which, although obsolete or much modified, make clear the principles underlying their modern successors. Elementary metallography has been introduced, and we think he has done wisely in taking this step. There is no better method of emphasising that all metals and alloys at whatever stage of their manufacture, provided they are solid, have a definite structure. H. C. H. C.

The Marketing of Metals and Minerals. A Series of Articles by Specialists. Edited by Josiah Edward Spurr and Felix Edgar Wormser. Pp. xii+674. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1925.) 30*s*. net.

THIS work consists of a series of articles, each written by a specialist, describing the methods of commercial dealing in the metals, ores and non-metallic minerals produced by the labours of the metallurgist and the miner. The economic side of the great mineral industries has been generally neglected in literature, and the present work will be welcomed by a large circle of readers. Unfortunately for us, it refers almost exclusively to American conditions, and whilst therefore of very great value to any one connected with the mineral industry in the United States, its usefulness in Great Britain will be limited to the relatively few people who deal with the United States in mineral products. A companion volume dealing with British conditions and methods would be of very great value, especially at the present moment.

Laboratory Manual of Organic Chemistry. By Dr. Harry L. Fisher. Second edition. Pp. xii+338. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1924.) 11*s*. 6*d*. net.

DR. FISHER has introduced some improvements and additional experiments into the second edition of his excellent book. The principal feature is the thoroughly practical character of the information, and the innumerable hints and details given in the descriptions of preparations and experiments will be found of the greatest value to students and demonstrators. References to important new work are frequently given. The section on elementary analysis is very detailed, and is perhaps the best account in existence.

A Class-Book of Chemistry. By G. C. Donington. Part 5: *Organic Chemistry.* By Prof. T. M. Lowry and Dr. P. C. Austin. Pp. vi+531-706. (London: Macmillan and Co., Ltd., 1925.) 3*s*.

THIS volume is a continuation of Donington's well-known class-book, and a further volume on physical chemistry is promised. The treatment is clear and accurate, and several good experiments are included. The book is suitable for medical and pharmaceutical students, and provides generally a useful introduction to organic chemistry. Recent work (*e.g.* on the structure of sugars and starch) is included.

Letters to the Editor.

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The Fluorescence of Cadmium Vapour.

IN the course of the study of band spectra of cadmium and zinc, the question arose whether the vapours of these metals show a fluorescence analogous to the well-known green fluorescence of mercury vapour. To decide this problem, the following experiment was made.

A quartz bulb was thoroughly evacuated, adsorbed gases being removed by heating it to a high temperature for some days. Then a few milligrams of pure cadmium were distilled into the bulb, which was finally sealed off from the pumps. The bulb being put into a nichrome-wire furnace, a beam of exciting light from a condensed spark, an arc, or a mercury lamp was projected through the bulb by the aid of a quartz lens.

It was found that the fluorescence of cadmium vapour, in the form of a blue-coloured beam of light, strictly limited to the path of the exciting beam, makes its appearance and continues over a considerable range of temperature and density of vapour. By increasing gradually the temperature of the furnace, first traces of the fluorescence appear about 450° C.; with further increase of temperature the intensity of the fluorescence is augmented, and from 600° to about 750° it is very pronounced. At a still higher temperature the direct observation of the fluorescence is impeded by the bright glow of the furnace. Using a blue glass screen to cut out the red glow of the furnace, however, the fluorescence can be observed up to a temperature of about 950° and more, its intensity being considerably diminished.

In order to determine the exciting wave-lengths, various sources of light were employed: a condensed spark with the electrodes of cadmium, zinc, aluminium, magnesium, copper, lead, tin, carbon and iron; iron, cadmium and carbon arcs, and also a mercury lamp. Almost all these sources gave a more or less intense fluorescence. Especially strong fluorescence is produced by the cadmium spark; a very faint one by the magnesium spark; the carbon arc does not produce any fluorescence at all.

The excitation of the fluorescence being produced by such different sources of radiation proves the spectral extent of its excitation to be rather broad. It lies at any rate below 3000 Å.U., as not only a thin sheet of glass, but of uviol as well, put in the path of the exciting beam extinguishes the fluorescence completely.

An addition of small quantities of other gases seems also to have a destroying influence upon the fluorescence, as proved by the following experiment: The bulb, showing a very intense fluorescence, was heated by the Bunsen flame for fourteen hours. It was found then that its fluorescent property disappeared totally. This is probably due to the diffusion of hydrogen from the flame through the red-hot quartz into the bulb. To demonstrate the presence of hydrogen in the bulb, the latter was excited at room temperature by the electrodeless discharge of a Tesla transformer. In the spectrum were found some hydrogen lines, which were absent before the heating.

In order to examine separately the influence of temperature and density upon the fluorescence, a quartz cylinder provided with a side-tube and having two plane-parallel windows was used. The cylinder and the tube could be heated independently in two separate furnaces. First of all it was noted that during the rapid evaporation of metal drops condensed on one of the windows, the fluorescence appears particularly intense. However, the existence of fluorescence in the bulb, where a permanent distillation does not take place, proves that the evaporation is not an indispensable factor in the appearance of fluorescence.

The study of the spectrum of the fluorescence is rather difficult owing to the long exposures (several hours even when a spectrograph of small dispersion was used) which are necessary on account of a comparatively small intensity of light. It is also difficult to remove the exciting light scattered by the walls of the bulb.

The photographs of the spectrum and the curves got from these by a self-registering microphotometer show, however, that the spectrum has the appearance of a broad continuous band extending approximately from 5000 to 3950 Å.U. The decrease of intensity, especially towards the more refrangible end of the spectrum, is very gradual. The maximum of intensity falls about 4630 Å.U. This type of spectrum is analogous to the fluorescence spectrum of mercury vapour.

Further detailed investigations of the phenomena described are in development.

W. KAPUSCINSKI.

Warsaw,
Physical Institute of University,
June 1925.

The Band Spectra associated with Carbon.

THERE are now so many as thirteen band groups associated with carbon and its compounds. Some of these, such as the violet CN group, have been studied exhaustively, both empirically and upon the basis of the quantum theory. I have endeavoured to arrange in progressions and to assign vibrational quantum numbers to all of these groups, where such work has not yet been done, and several interesting new relations have resulted.

Lemon (Proc. Nat. Acad. Sci., 11, 41, 1925) has found that the first negative group and the comet-tail bands (low pressure CO bands) appear and disappear under the same experimental conditions, and Blackburn (*ibid.*, 11, 28, 1925) has made a quantum analysis of the former group. Simultaneously, Baldet (*Comptes rendus*, 180, 271, 1925) published measurements of the four heads of each of the 30 bands of the comet-tail group. Using the data for all four heads, I find that the first head is given by the equation

$$\nu = 20485{\cdot}4 + (1550{\cdot}46n' - 14{\cdot}07n'^2 + 0{\cdot}043n'^3) - (2198{\cdot}6n'' - 15{\cdot}00n''^2).$$

The remaining three heads are then given by substituting for the constant term 20471·6, 20359·1, and 20346·1 respectively. Using the older data quoted by Jevons (*Phil. Mag.*, 47, 586, 1924) as well as Blackburn's data, I obtain similarly for the heads of the first negative group

$$\nu = 45655{\cdot}4 + (1704{\cdot}42n' - 29{\cdot}3n'^2 + 0{\cdot}7n'^3) - (2197{\cdot}03n'' - 15{\cdot}17n''^2).$$

The assignment of the final vibrational numbers (n'') is very certain in the case of each of these groups, and it is evident that well within limits of error both groups correspond to the same final state, and are therefore due to the same molecule. The experimental evidence indicates that the comet-tail bands are due to CO, while, as the name indicates, the first

negative group is probably due to an ionised molecule. Hence it is probable that both groups are due to ionised CO.

The assignment of values of n' for the comet-tail bands is slightly uncertain, that adopted neglecting the $\lambda 5281$ band given only by Baldet. This band is very weak and 3A out of position. If included, it must be the 0,0 band of the group, an unlikely but not impossible state of affairs. The intensity distribution is such as to favour the initial states ($n'=0$ to 11, while $n''=0$ to 3 only), quite an unusual distribution. However, the distribution of intensity among the values of n', as observed by Fowler (M.N. Roy. Astron. Soc., 70, 484, 1910) and by Baldet (*loc., cit.*), is definitely a high temperature distribution, while the quite different distribution observed in a helium mixture, by Merton and Johnson (Proc. Roy. Soc., A, 103, 383, 1923), is equally definitely a low temperature distribution.

The high pressure CO bands found by Fowler (*loc. cit.*) form a single n'' progression ($n''=0$ to 5, while $n'=0$, presumably). Within the very large limits of error, this set of final states is the same as the set of initial states of the comet-tail bands. Much more accurate data for the high pressure bands are needed in order to settle the question definitely, but the experimental conditions needed for the production of these bands favour the identity, I believe.

The third positive group is well worth a detailed remeasurement and quantum analysis, the successive minima observed by Wolter (*Zeit. wiss. Phot.*, 9, 36, 1911) doubtless corresponding to the origins of successive bands of a sequence. Accurate data (by Wolter) are available now only for the six heads of the first band of each sequence. The resulting $f(n'')$ is closely similar to that of the common nitrogen progression, but is definitely not the same.

The triplet bands measured by Merton and Johnson (*loc. cit.*) have the same unusual intensity distribution noted for the comet-tail bands ($n'=0$ to 6, $n''=0$ and 1 only). The single resulting n'' interval ($\Delta\nu=1714$) is practically identical with the corresponding interval for the third positive group, but no conclusion can be drawn without known values of other intervals. The $f(n')$ for this group is not related to any other.

The fourth positive group is very extensive and is noteworthy in corresponding to a very *slow* initial vibration ($\Delta\nu=500$, approx.) and a very *rapid* final vibration ($\Delta\nu=3000$, approx.). No other new relations between the progressions of the various carbon groups have been found, so that at present no further inferences as to the identity of the emitters can be drawn from this line of evidence.

RAYMOND T. BIRGE.

Department of Physics,
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June 8.

Sensitive Jets and Flames.

MANY types of sensitive flame have been described from time to time, and measurements of the range of pitch and of the pressure at which they are sensitive have been made, but I have not seen any quantitative record of the variation of the length of such a flame or jet. In this connexion some experiments made recently by Mr. E. Tyler and myself with jets of coloured water flowing into still water seem to be relevant. At a certain distance from the nozzle from which it is issuing the stream suddenly breaks down into general turbulence. Measurements of the continuous length of the jet, L, under different heads of pressure were made, and hence a curve of velocity of efflux, V_0, against L obtained. Two of these are shown in Fig. 1; they have the form of rectangular hyperbolæ; a similar curve was obtained with a jet of air mixed with smoke.

The shape of these curves can be accounted for on similarity principles. The point at which the jet breaks up is taken to be that at which the Reynolds' criterion VD/ν (D = diameter of jet and V = mean velocity at this point, ν = kinematic viscosity) has reached that value at which the motion becomes turbulent. If the initial velocity at the nozzle be increased, the critical velocity, V, will be reached at a point nearer the nozzle; L will therefore become smaller as V_0 is increased. The effect of altering D_0 or ν may likewise be predicted. Introducing L into the "criterion" in the form of a function of D_0/L,

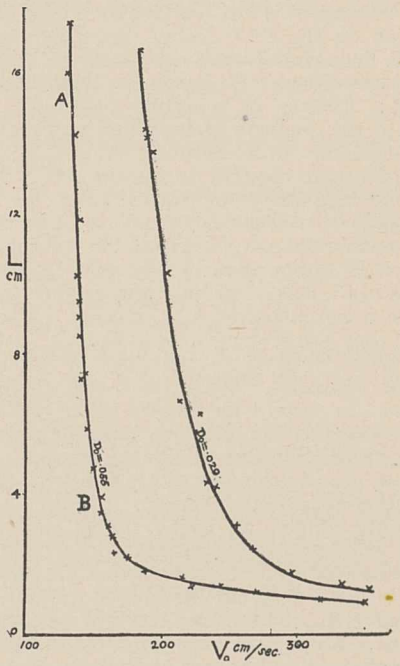

FIG. 1.

D_0 being the diameter of the nozzle, one obtains $V_0 = K\frac{\nu}{D_0}.f\left(\frac{D_0}{L}\right)$. Expanding $f\left(\frac{D_0}{L}\right)$ as a linear function, and retaining two terms only of the expansion, since D_0 is small compared with L in sensitive jets, we get $V_0 = K_1\frac{\nu}{D_0} + K_2\frac{\nu}{L}$, that is, LV_0 is a constant for a given nozzle and gas.

Further, Kohlrauch and also Krüger have shown (*Ann. der Phys.*, 1881 and 1920) that, in a jet issuing from a circular nozzle, vortices are produced periodically with frequency n, given by V/nd = a constant, d being a linear dimension dependent on the bore of the nozzle. The jet should respond most readily to tones of this frequency, or sub-multiples thereof, and a high-velocity jet to sounds of high frequency. When a jet of gas is ignited, the combustion complicates matters, as the visible part of the jet lengthens at first as the velocity increases; but Rayleigh showed that, over the range for which they are sensitive, such flames behave in most particulars like unignited jets, the progress of which is made visible by smoke. Experiment showed that a sudden small increase in the velocity of the gas feeding a sensitive flame brought the turbulent point—visible as a "flare"—nearer to the nozzle.

The other common experience with sensitive jets

and flames, that they are sensitive only over a small range of gas pressure, and, therefore, of efflux velocity, is shown by the curves and by theory. It is a consequence of the hyperbolic relation between L and V_0, that at a certain value of the latter a small increase in velocity due to aerial disturbances causes a large change in length, so that in using a sensitive flame it is necessary to work on the part AB of the curve.

E. G. RICHARDSON.

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Science and Intellectual Freedom.

ON my return from abroad a few days ago, I found your letter of June 30 awaiting me. Allow me to express regret that circumstances prevented an earlier reply. Perhaps it is not too late for a brief statement of opinion on the controversy raised by the trial of Mr. J. T. Scopes of Tennessee.

Two questions of supreme importance have emerged: Liberty of scientific research; and the bearing of the doctrine of evolution on religion.

It is certainly an astonishing thing that, after the history of human thought during the last two hundred years, the legislatures of States which lay claim to some degree of civilisation should be found restricting science within limits prescribed by special interpretations of Holy Scripture. It does not seem to have occurred to these good people that, on such conditions, scientific research becomes impossible. Nor do they see that they are seeking to restore that very state of things which delayed the advance of human knowledge for centuries. They have still to learn that truth must be sought for its own sake.

Again, they are mistaken in thinking that the doctrine of evolution is anti-Christian. To my judgment, exactly the opposite is the fact. Evolution teaches the unity of all creation: it reveals an organic relationship among all living things, making us all akin: it enables us to form a conception of the Creator as One who is not remote from us in some transcendent sphere, but is Life of our life and continually at work in the universe. These are Christian ideas: they may be said to be among the essential ideas of Christianity.

As to the early chapters of Genesis, their sublime accounts of the beginnings of things lose all their true value if we regard them as scientific statements. They are full of meaning if we view them as the expression of fundamental religious principles in the language and imagery of the age to which they belong.

CHARLES F. ARMAGH.

THE Tennessee trial has given the readers of NATURE an amusing motley of opinion, but are we not, perhaps, treating the rejection by "Main Street" of the much over-advertised Mr. Scopes too seriously and missing the real significance of the occasion? Is not a lesson of profound social importance behind it all? We are talking glibly of interference with "freedom of thought." Is there any such thing — even in the ranks of our boasted "science"? Are not the teachers, for the most part, just repeating what they have been told, without exercising any thought? Is the Pauline injunction, *Prove all things, hold fast that which is good*, in any way followed? If it were, societies would have no difficulty in meeting costs of publication. Whatever may be the case in biology, it certainly is not on the physical side. We mostly use the "Main Street" method but are at the disadvantage that we have no bible holding our faiths which can be put into the hands of the public. Consider our Press, consider our politicians—the Cabinet, even our Public Schools, are not all these located in "Main Street"?

Scientific method, the method of proving all things, is only known to and used by the few who are real makers of knowledge—science factors. The scientific, like all artistic gifts, we must recognise to be an "inborn error of metabolism." Our text-books are as dogmatic as is the great book used of "Main Street." This not only has the advantage of great beauty of language but also a concealed authority behind it—Man's innate belief in a superior being—which we cannot command. The "Aunt Susans" who teach it do so with a thoroughness and sense of conviction which we can in no way match.

Any one who wishes to gain some inkling of its power should study Ruskin's "Modern Painters"—the work of an arch critic gifted with a mind of transcendent power, not an obscurantist. The practical achievements of the scientific mind are blinding us to our failure to teach and use scientific method in our ordinary affairs. We need be in no hurry to force our speculations into the schools—better not. We do need to teach all to respect our method, though, maybe, it is that used only in the best circles. We need, on all possible occasions, to make clear, to ourselves and others, the significance of the assertion, to which Sir Bryan Donkin and Sir E. Ray Lankester directed timely notice recently, made by the late W. K. Clifford—*It is wrong always, everywhere and for any one to believe anything on insufficient evidence*—let alone teach it as truth, as is so often done in our classes. We have gradually to repave "Main Street" with such doctrine: our difficulty is that most of us are born to live in it—as it is. Yet when Bishops can write as do those of Birmingham and Durham, we need not altogether despair—though these also are probably "metabolic errors."

HENRY E. ARMSTRONG.

Changes in the Ultra-violet Absorption of Gelatin.

IN some investigations on the ultra-violet absorption of gelatins, we have discovered that the absorption spectrum changes in a characteristic manner according as the gelatin is on either side of the iso-electric point, indicating that the different P_H values are associated with a definite change in the chemical constitution. Taking the iso-electric point as 4·7, when the P_H value of a gelatin rises above this, there is a characteristic increase in absorption from about 3500 Å.U. towards the red end, while with a fall in P_H there is an increase in absorption in the region of *shorter* wave-lengths. These very marked changes in ultra-violet absorption would appear to provide a valuable means of investigating minute changes in the constitution of gelatins.

T. THORNE BAKER.
L. F. DAVIDSON.

The Oogenesis of Lumbricus.

REFERRING to Dr. Graham Cannon's letter in NATURE of July 18, I may be permitted to remark that the reason why it is not only inadvisable but even unprofitable to discuss oogenesis in general, on the basis of work done on a single species of one order, is that, unlike the chromosomes, the Golgi bodies and mitochondria are variable in behaviour in different orders, and even within a single family. This is the most important fact which recent researches on the cytoplasmic inclusions have revealed, and, of course, throws a clear light on the question of the status of these bodies in heredity.

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Regions of Tension and Continental Drift.[1]

By Dr. J. W. EVANS, F.R.S.

IN many areas the earth's crust has been subjected to compression manifesting itself in folding, cleavage, thrust-faults, and certain types of igneous activity. Such compression may prevail over an extensive region, or may be of a purely local character. In the former case, it is usually attributed to the progressive contraction of the earth's interior, although this has been disputed by some authorities. In the latter, it is merely an incident in the development of more extended structures. The results of compression have long been studied, but comparatively little attention has been given to the occurrence of tension in areas where it has left evidence of its existence in the form of joints, normal or slip-faults, occasionally replaced by monoclinal folds, dykes, and other characteristic igneous phenomena.

. . . . . .

The distribution and direction of the jointing, the slip-faulting, and the dykes of western Europe of post-Hercynian date, are all due to tension, producing stretching, fracture, and separation, and together they imply relative movement, or drift, in the rocks with which they are associated.

The most prevalent strike of these fractures in the British Isles and western France is from north-north-west to south-south-east, implying a drift from east-north-east to west-south-west, or *vice versa*. However, in the Devon-Cornwall peninsula there appears to be a general downward slip to the south-west, modified later, it would seem, by a movement towards the north-west. In Skye the faults posterior to the igneous activity seem to show a similar change in the direction of the tension. In the north-west of Connaught, of Ulster, and of Sutherland the faults appear to strike as a rule north-east and south-west, implying the presence of a drift to the north-west, but in western Ulster, and in Mayo, this appears to have been preceded by an earlier tension directed towards the south-west or south-south-west, indicated by the north-west and south-east or west-north-west and east-south-east basic dykes.

Closely connected with the drift of the surface-blocks must be the stretching of the presumably plastic zone beneath. Indeed, it would seem that it is this stretching or slow flow which is the immediate cause of the minor fissuring of the crustal rocks. The blocks which are thus formed are then so disposed relatively to one another as to cover, so far as possible, the extended space. This may happen in two ways:

In the south-western peninsula of England and other localities the fault-fractures had originally considerable hade, usually directed to the region of weakness, and the extension took place by the downward slip of the block on the upper side of each fault.

In Skye and elsewhere the hade of the fissures seems originally to have been practically vertical; but the blocks between the faults were afterwards inclined, so that the beds which were formerly nearly horizontal now dip in a direction opposite to the faults. In this case the covering of the extended area is effected by the tilting of the blocks. It is probable that in such cases the underlying magma has, it is suggested, flowed in the direction of the hade of the faults.

The volcanic activity in the west of Scotland and in the north-east of Ireland commenced, on the evidence of plant-remains, early in the Eocene, and may have continued for a great portion of that period. The faulting which has been described must have been of still later date. It is indeed impossible to fix any limit to the continuance of the tension. How far it was present in Mesozoic times we cannot say with certainty, but it apparently had a beginning in the Permian.

The drift towards the west (south-west or north-west) in western Europe seems to have been widespread, though greater in some regions than in others, but everywhere east-and-west distances appear to have been increased.

We are not in a position to estimate the total amount of this extension. It could only be calculated if we knew the width of each joint, the hade of each fault-plane, the direction and amount of the movement in it, and the thickness of each dyke. It does not, however, seem likely that the total relative change of distance between Central Europe and western Ireland has exceeded, say, 6 to 12 miles (10 or 20 km.) since Triassic times.

The true significance of this drift becomes evident on examination of a depth-chart of the North Atlantic. It is at once seen that the approximately north-west and south-east strike of different forms of fracture that is so prevalent in the British Isles and western France is related to the ocean-deep of which the north-eastern boundary runs roughly south-east and north-west, parallel to the French coast of the Bay of Biscay, out into the open Atlantic; and that the north-east and south-west strike which is found in the north-west is apparently similarly related to the edge of the trough that extends from south-west to north-east beyond the Hebrides. The drifts to the south-west and north-west seem to be towards these abysmal regions of deep water, the crustal blocks being carried forward by the flow of the plastic region beneath. The formation or widening of these deeps cannot have greatly preceded the drift towards them, which seems to have culminated in Tertiary times. From what has been stated, there would seem to be reason to suppose that the development of the oceanic deep on the north-west of the British Isles was of a later date than that on the south-west.

The doctrine of the balance or "isostasy" of different areas of the earth's surface, which now seems to be firmly established, requires that the continents should be composed of lighter materials than the floor of the deep sea. The former consist mainly of granite (including the foliated granite more usually described as granitoid gneiss) and of sedimentary rocks which, though widespread at the surface, form only a comparatively small part of the whole. These are together conveniently referred to as sial. The ocean-beds must, on the other hand, be composed of heavier rocks made up of the silicates of iron, manganese, magnesium, and

[1] From the presidential address delivered to the Geological Society of London at the anniversary meeting on February 20.

calcium—the sima of Suess. This conclusion is confirmed by the greater "magnetic permeability" of the ocean-floor compared with the continents, indicating in the former the presence of ferrous oxide.[2]

The distinction between sial and sima appears to be the result of a primeval magmatic differentiation of the outer zones of the earth into a lighter acid portion consisting mainly of silica with alumina, the alkalies, and much water and other volatile constituents—that is to say, the typical magma of acid rocks such as granites and rhyolites—and a heavier basic portion corresponding to the magmas of dolerites and basalts, passing doubtless below into that of the still more basic peridotites.

There seems to be no doubt that Suess was right in supposing that the sima extends everywhere below the sial of the continents. There is, however, considerable difference of opinion as to the thickness of the continental sial. Wegener[3] supposes it to be so much as 63 miles (100 km.). This is founded largely on Hayford's level of isostatic equilibrium or uniform density, which he placed at a depth of 71 miles (114 km.). It was afterwards reduced by Bowie to 60 miles (96 km.), which, however, appears to represent the depth of the sial forming the downward extending folds of the Rocky Mountains. Doubtless in the Himalayas it would be still greater, but in plains and plateaux the thickness may perhaps range from 9 to 40 miles (15 to 64 km.).[4] It would depend on the altitude of the land and on the density of the sial. Nor is the depth to which the sial extends necessarily the same as that of the depth of uniform density. In the older parts of the continental shields the latter is probably considerably less than the former.

The idea that ocean-depths are the result of foundering is wholly opposed to the doctrine of isostasy, for it implies that the rocks which form the floor of the oceans are of the same composition as those of the neighbouring continents.

The only alternative is to conclude that the continental masses of sial can, under the action of continuously applied external forces, slowly drift through the sima, and that they have thus moved apart and left the ocean-deeps between them.

The magma of the granite of the sial must, on account of the large amount of water and other volatile constituents that it contained, have cooled to a comparatively low temperature, say 600° C., before it crystallised. These constituents were, however, eliminated and lost, so that it would thereafter require a much higher temperature to melt or even soften the rock, and the sedimentary constituents of the sial would (as a rule) prove equally refractory.

The basic rocks that constitute the sima, especially if they are rich in iron, are on the other hand less affected by the loss of volatile constituents. We may therefore expect that, at a temperature corresponding to comparatively moderate depths, they would become to some extent plastic.

The principle of isostasy appears in fact to depend on the circumstance that, given sufficient time, by no means very long from the geological point of view, the sima acts as a whole as a fluid in which the sial floats, to use Airy's simile, like a log in water, or in Wegener's words, like ice-floes in the sea, although, it need scarcely be said, the viscosity of the sima (even at a fairly high temperature) is many thousands of times that of water. There is therefore nothing surprising in the blocks of sial making their way through the sima, accompanied, it may be, by crystallised sima adhering to their lower surfaces.

It is to the major fissures of the earth's crust, which are represented by the ocean-deeps, that we must look for the fundamental cause of igneous activity in regions of tension. As the fissure opens, the underlying sima magma will rise, in order to re-establish a condition of isostasy. This will be facilitated by the fact that the accompanying release of pressure will render the magma fluid, and at the same time cause it to expand. This expansion will be all the greater, on account of the volatile constituents in the magma. Its density will of course diminish correspondingly, and it will rise higher in the fissure than it would otherwise have done.

In the course of time, however, a large proportion of the volatile constituents will escape, crystallisation commence, and the density increase, so that the column will sink to a certain extent.[5]

Some idea of the depth from which the sima of ocean-deeps rises can be gathered from the temperature of igneous magmas. Dr. H. H. Thomas, from an examination of the metamorphism of the xenoliths in the Loch Scridain magma-reservoir, arrived at the conclusion that it was initiated at a temperature of nearly 1400° C.[6] This figure rests on experiments with dry metals, and must, he thinks, be reduced, if the presence of water under pressure be taken into account. Some heat may have been lost while the magma was rising, and during the course of its intrusion; but there may have been a slight accession of temperature from oxidation or radio-activity. We may, however, assume for purposes of illustration that the temperature in the original position of the magma was in the neighbourhood of 1400° C.

According to the calculations of Prof. L. H. Adams, which appear to rest on a sound basis,[7] this temperature would be ordinarily found at a depth of about 72 miles (115 km.). This actual figure is, at best, a conjectural estimate; but it would seem probable that some parts at least of the magma of igneous intrusions must come from a depth that cannot have been very much less. It would therefore seem that the formation of these major fissures presents the most probable means by which material from great depths has reached the neighbourhood of the surface, a conclusion which is of some importance in considering the source of the metalliferous ores.

Before the opening of a fissure, differentiation at such depths would be impossible, on account of the extreme viscosity of the magma under heavy pressure, but the release of pressure due to the opening of the fissure

[2] A. Wegener: "The Origin of Continents and Oceans," 1924, pp. 32-33.
[3] *Ibid.* p. 37.
[4] H. S. Washington's estimate is from 15 to 20 km. (9 to 12½ miles), Journ. Washington Acad. Sci., vol. 14 (1924), p. 437.
[5] An incidental effect of the formation of rifts would be the lowering of the level of the sea. The area of the deeps lying below 15,000 feet (4573 metres) is about a third of that of the whole ocean. If, then, a tenth of these came into existence as rifts about the same time, in consequence of an average sinking of 7500 feet (2287 metres), the surface of the sea would be lowered by about 250 feet (76 metres). These figures are, of course, only intended to show that the effect would not be negligible.
[6] Q.J.G.S., vol. 78 (1922), pp. 250-54, and "Island of Mull," Mem. Geol. Surv., 1924, p. 278.
[7] Journ. Washington Acad. Sci., vol. 14 (1924), p. 468.

would result at once in an increase of fluidity. The first differentiation would be, in all probability, a repetition of the primordial process of differentiation into basic and acid magmas already mentioned, for the sima would appear to be capable of yielding another but smaller crop of an aqueous acid magma. This would be followed by further differentiation by crystallisation due to cooling as well as to loss of volatile constituents, with the result that ultimately a wide range of igneous rocks would be evolved.[8] Before, however, differentiation had advanced very far, a series of lateral intrusions from the major fissures would have commenced. The flow of the deep sub-crustal sima towards the fissure would cause a temporary sinking of the adjoining crust, simultaneous with the rise of the magma in the fissure, with the result that, for a portion at least of the length of the column filling the fissure, the pressure of the magma would exceed that of the surrounding rock, so that intrusion would take place.

As differentiation proceeded in the intruded magma, the progress of the segregated acid magma would be retarded by local viscidity, caused by the loss of a portion of the volatile constituents and by cooling at the surface of contact with the adjoining rock. This would not be the case with the ultra-basic and basic magmas below it (which would form by far the greater portion of the whole), as they contain less volatile constituents, and are less dependent on them for their fluidity. The ultra-basic and basic magmas would, therefore, progress more rapidly than the acid magma. In so doing they would let down the still fluid portion of the acid magma above them until the latter reached the level of their flow. Here it would be protected from loss of volatile constituents, and the temperature of the surrounding rock would by this time have become little less than that of the magma itself. The acid would therefore follow the basic magma in the channel of intrusion, a succession which corresponds very closely to the order of intrusion of plutonic magmas in the west of Scotland and at the Lizard.[9]

How far this lateral penetration will extend, and what form it will take, depend on the nature and structures of the rocks, and the earth-movements that may supervene. A magma may travel a considerable distance horizontally, or with a gentle inclination upwards—without any manifestation, other than the filling of fissures at right angles to the prevailing tension—until it meets with an obstacle, such as deeply-rooted mountain-folding, when it may form a tumefaction in the nature of a laccolith which will become a centre of igneous activity, and give rise to radiating and concentric structures as well as plutonic rock-masses, or it may well out in fissure-eruptions. Its progress and manifestations will be due partly to the hydraulic pressure to which it is subjected, and partly to the expansive force of its volatile constituents, and these will be assisted in some cases by faulting, bringing the magma into contact with rocks under less pressure, into which it will penetrate along joint- or fault-planes.

Of all these manifestations of igneous activity, it is the occurrence of parallel dykes that is usually the most widely extended, both in space and in time, and affords the most satisfactory evidence of the area throughout which a subterranean magma has spread —so far at least as it is accompanied by a prevalence of tensional conditions above it.

[8] That the first stage of the differentiation of igneous rock is into an acid and basic magma is, to my mind, abundantly proved by Dr. W. A. Richardson and G. Sneesby's analysis of the frequency of igneous magmas of different silica percentages. This clearly shows two distinct peaks, one acid and the other basic, *Min. Mag.*, vol. 19 (1922), pp. 303-13.

[9] I have long advocated such an explanation of the order of intrusion of plutonic rocks in my lectures at the Imperial College of Science and Technology. I may add that the ultra-basic magma would move more rapidly than the basic: for, on account of the excess of the density of the basic magma over that of the adjoining rock, the maximum difference of pressure will occur below it.

(*To be continued.*)

The Nutrition of Cattle.

THE subject of the feeding of cattle assumes importance from the large part their products play in human dietaries. An accurate knowledge of their metabolism and nutritive requirements, apart from its intrinsic scientific interest, may lead both to more economical methods of feeding and at the same time to an improvement in the quality and quantity of the products, meat and milk, obtained from them. In this survey a brief account will be given of some recent work on the energy, protein and mineral requirements of these animals, with special reference to the production of milk in dairy cows.

The measurement of the energy requirement resolves itself into the problem of estimating the heat given out by the animal, since to maintain the body in equilibrium a similar amount of energy must be taken in in the food. The output of heat can be measured directly by placing the animal in a calorimeter, or chamber in which the heat emitted is measured by the amount absorbed by a current of cold water circulating through the chamber; the analysis of the ingoing and outgoing air at the same time will give the consumption of oxygen and output of carbon dioxide during the experimental period. The method requires the use of elaborate apparatus, so that in practice the indirect method of determination of the heat output is more frequently employed. In this the output of carbon dioxide and consumption of oxygen are determined over a short period, and from these data, together with the value of the respiratory quotient, *i.e.* the ratio of carbon dioxide produced to oxygen consumed, a value can be found for the heat production which is sufficiently accurate for most purposes. The respiratory quotient conveys information as to the types of foodstuffs which are being oxidised in the body, and this information is essential since the heat produced varies according to the type of foodstuff, protein, fat or carbohydrate utilised.

The problem of estimating the heat output in the case of cattle has been still further simplified by W. W. Braman (*J. Biol. Chem.*, 1924, vol. 60, p. 79): the only data required are the output of carbon dioxide and the amount of food taken. In a large number of experiments he has found that the ratio heat/carbon dioxide is highest in starvation and falls steadily with increase in the amount of food eaten, the heat production increasing more slowly than the carbon dioxide formed.

The change is due to the fact that in starvation most of the heat produced comes from the oxidation of fat, which has a high calorie value, whereas the food is chiefly carbohydrate with a relatively low calorie value. These experiments enable an investigator, by estimating the carbon dioxide production and noting the food consumption, to determine the approximate heat output by applying the formula given by the author or by reading from the graph relating the ratio heat/carbon dioxide to the food consumption, which is approximately a straight line. The heat output thus calculated agrees closely with that actually observed in a calorimeter.

A more elaborate, but more accurate, indirect method of estimating the heat output of cows has been utilised by J. A. Fries, W. W. Braman, and D. C. Cochrane (U.S. Dept. of Agricult., Bull. No. 1281, 1924). The method depends on the fact that in an animal which is maintaining its weight, the heat output must equal the energy of the food actually utilised by the body during the experimental period. Of the food taken, some is not absorbed and some is excreted in an incompletely oxidised form. The digestibility of the food is usually estimated by taking the difference between the amount eaten and the amount excreted in the fæces, but the authors point out that in cattle, bacteria in the intestine play an important part in digestion. At the same time, one of the products of their fermentative action is a gas, methane, whilst the process itself is accompanied by an output of heat. The methane produced has been estimated in the respiration calorimeter, and the heat of fermentation from the ratio of methane to carbon dioxide in the products of fermentation. The results show that whereas the digestible portion of the food appears to be about 66 per cent. of that taken by estimation by the usual method, by taking account of the above two factors also, only about 50 per cent. of the food consumed is actually absorbed and available for energy and heat production. The actual energy of the food was determined directly by the bomb calorimeter, and thus the actual energy available to the body is known. Nearly all this energy is available for maintenance, growth (or increase of protein or fat in the body), work, and the production of milk, about 10 per cent. being lost in the processes of digestion and in the formation and elimination of the excreta. The authors have compared the heat production calculated from the available energy of the food with that actually observed during the same period in the respiration calorimeter and have obtained a very good agreement. The result indicates, in their opinion, that this method of "indirect calorimetry is sufficiently accurate for purposes of research in the feeding of farm animals."

Of the energy available to the body in the food, about half is required to maintain the body-weight constant: the remainder can be utilised for increase in body weight or for milk production. The data show that a larger proportion of the energy available is found as energy in the milk than in any increase of body weight; the process of milk formation appears to be more economical than that of body tissue and fat formation. The result suggests that the food materials are available directly for milk formation and do not have to become body tissue first and milk later. Of the available energy, 90 per cent. or more can, under certain conditions, be utilised in milk production.

It is of course essential that the conditions of the experiment should be kept as constant as possible in different experiments. One factor which may introduce a disturbing element is the relative amount of time spent by the animal in the standing and lying positions. This subject has been considered in more detail by J. A. Fries and M. Kriss (*Amer. Journ. Physiol.*, 1924, vol. 71, p. 60). They found that allowance must be made for the taking up of heat by the floor on which the animal lies in the respiration calorimeter, this heat being afterwards given up when the animal stands, making the heat output of this period too high. The magnitude of this error can be ascertained by estimating the carbon dioxide output and assuming that the ratio heat/carbon dioxide is a constant. Making this allowance, it was found that the heat output of a 400 kgm. cow increased by about 25 calories per hour on standing. The authors recommend that the heat production be calculated to a standard day of twelve hours lying and twelve hours standing, so as to obtain uniformity in the expression of the results obtained by different observers.

It is of interest to note that in the later stages of gestation, a cow appears to require about 2 per cent. more food for maintenance than a non-pregnant animal of the same weight.

The utilisation of protein in milk production has been considered by J. A. Fries, W. W. Braman, and M. Kriss, and also more recently by E. B. Forbes and R. W. Swift (*Journ. of Dairy Science*, 1924, vol. 7, p. 11, and 1925, vol. 8, p. 15). The two sets of experiments agree fairly well in showing that in well-fed animals the utilisation of protein for milk production is about 40 per cent. of that available for this purpose (that is, the digestible protein of the food less that required for maintenance). With decrease in the protein intake, however, the former authors found that a larger proportion of the available protein, up to 85 per cent., became available for milk production, since the nitrogen excretion falls *pari passu* with the drop in nitrogen intake, whilst the nitrogen in the milk remains almost constant. With a higher percentage utilisation, however, the amount of milk produced tends to fall off, being increased again with increase in the protein intake. The optimum nitrogen intake was an amount of available nitrogen about 10 per cent. greater than the nitrogen found in the milk produced. The animals maintained their weight, whereas with a larger protein intake the animals gained in weight by the deposition of fat, together with an increased formation of body tissue. The fact that with low nitrogen intakes the quantity of milk produced tends to fall off in a cow producing a large amount daily, suggests that the level of optimum intake of nitrogen as regards the nitrogen of the milk is not the optimum level for the production of a large quantity of milk, which contains both fats and carbohydrates as well as protein, and therefore that the animals should be well fed, if the best results as regards milk production are to be obtained.

In addition to the proteins, fats and carbohydrates present in milk, account should also be taken of its vitamin and mineral content in estimating its quality. Ultimately these factors come from the food, in which

they should therefore be present, but the amounts passed into the milk may be greater than can be absorbed in the food, leading to a depletion of the animal's own stores. This appears to occur especially in the case of the calcium of the milk. During liberal milk production on winter foodstuffs there may be a definite loss of calcium from the body; on fresh foodstuffs this loss is less or may be absent (E. B. Forbes, Washington Government Printing Office, 1924). This effect is quite probably to be related to different amounts of vitamin A present in the dry and fresh green foodstuffs, but it seems to be clear that the cow should be encouraged to store as much calcium as possible in her body during her dry periods by the giving of calcium, for example, in the form of bone meal, in addition to an adequate supply of fresh green foodstuffs. It is possible also that the addition of sodium phosphate to a dried ration may increase the milk yield after parturition, suggesting that this food may be deficient not only in calcium but also in phosphorus, or that the availability of these elements present in the food is impaired by a deficiency in the fat-soluble vitamin A.

The general result of all these investigations is that a dairy cow should be fed on an abundance of fresh green food, containing a supply of protein, etc., which is sufficient to maintain both the quantity of the milk produced at a high level as well as its protein, mineral and vitamin content. If this be done, the supply of energy will certainly be adequate also.

Current Topics and Events.

SCIENTIFIC aspects of national life were honoured by the attention and interest given to them on two occasions last week by the King and Queen. On the afternoon of Wednesday, July 22, their Majesties visited the Royal Society and examined with much interest many of the exhibits arranged for the annual conversazione of the Society held on the evening of the same day. They were also present at a lantern lecture by Mr. F. E. Smith, Director of Research at the Admiralty, upon the subject of navigational devices. On Thursday, July 23, the King and Queen visited the Royal Observatory, Greenwich, in connexion with the celebration of the 250th anniversary of the foundation of the Observatory. They were received in the Octagon Room by Sir Frank Dyson and conducted round the Observatory. A number of members of the Board of Visitors and delegates from abroad of the International Astronomical Union had the honour of being presented to their Majesties.

A SLIGHT anticipation of dates was made in the celebration of the 250th anniversary of the Royal Observatory, Greenwich, on July 23, in view of the presence in England of the large body of foreign astronomers who had come for the meeting of the International Astronomical Union at Cambridge. Actually the foundation stone of the Observatory was not laid until August 10, 1675, and Flamsteed did not come into residence until July 1676. However, an exact adherence to dates is seldom possible in these commemorations, and the circumstances amply justified the anticipation. The celebration was honoured by the presence of the King and Queen, this being the second visit of a British sovereign to the Observatory since its foundation; the previous one was by George III. Although Charles II. showed so much interest in its foundation, there is no record extant of his having actually visited it. Their Majesties were conducted round the principal domes by the Astronomer-Royal, and later expressed the interest and pleasure that they had derived from the visit. It may be well to remind younger readers that our "Sailor King" has been through the complete course of a naval officer, and commanded a destroyer, so that he has a full knowledge of nautical astronomy. The prime object of the foundation of the Observatory was to aid navigation; this end has been kept in view up to the present, as we see in the rating of chronometers, the dropping of time-balls at Greenwich, Deal and elsewhere, and the continued observation of the positions and motions of sun, moon and fundamental stars. The evolution of the chronometer could be traced by the visitors, since the three earliest timepieces of Harrison were exhibited. Two of them have lately been restored, and were actually going, so that they could be compared with a large number of modern chronometers.

THE sudden death on July 26, at the age of sixty-five years, of Mr. W. J. Bryan, orator, politician and Fundamentalist, has come as a shock to all who followed the course of the trial at Dayton, Tennessee, of Mr. J. T. Scopes, who was convicted of breaking the State law against teaching the truth of evolutionary theory. Mr. Bryan conducted the prosecution ably, but during his examination by the defence, he made some remarkable statements as to the precise dating of events in the Biblical record. The Flood was fixed as probably having taken place in 2348 B.C., while the confusion of tongues at the Tower of Babel was assigned to 2230 B.C. Mr. Bryan conceded that the six days of creation must be regarded as periods of time. A further admission that the creation might have continued for millions of years may perhaps open the way to some sort of accommodation with geological evidence; it might even admit of an adjustment with the one hundred and thirty thousand years or so which at least seem to be demanded for man's existence on this earth by the evidence of the stone implements of Lower Palæolithic Age—to say nothing of those of earlier date. In putting to Mr. Bryan the evidence for the existence of civilisation in China before the Bible creation 6000 years ago, counsel was perhaps on somewhat uncertain ground, although the Shu-king begins with a record of the days of Yaou (2355 B.C.) and Shun, who brought to a close the second patriarchal dynasty of China, founded by Foh-hi in the year 2943 B.C. On the other hand, Mr. Bryan's fellow-countryman, Mr. Pumpelly, estimated that the beginnings of the neolithic stratum which he excavated at Anau in Turkestan dated back somewhat before 8000 B.C.

ALTHOUGH archæologists are inclined to regard Mr. Pumpelly's dating at Anau as too early, and display the same hesitation in accepting the very high dating of M. de Morgan for the early civilisation he found at Susa, the results of recent excavations in Mesopotamia are of considerable interest in relation to the question of early datings. The work both at Kish and at Ur and the neighbouring site of Tel el-Obeid in the last two or three years has considerably extended the period of antiquity of which the dating may be considered to have been fixed with a reasonable degree of accuracy. At Kish, for example, an inscription of Lugul-ud, king of Kish prior to 3100 B.C., has been discovered, and below the floor of the building in which it was found lie 15 feet of debris, which on a conservative estimate would place the early occupation so far back as 4500 to 5000 B.C. At Tel el-Obeid a marble socket of a gate has been found which bears the inscription of a king of the first dynasty at Ur. According to Babylonian tradition, this dynasty was the third to rule after the Flood. This discovery vindicates the existence of the dynasty, which had hitherto been regarded as mythical like its two predecessors, and if the dead reckoning estimate of its beginning in 4600 B.C. is too high, 4000 B.C. or 3900 would be a not unreasonable date. In Egypt, as is well known, astronomical data are available, though gaps in the records give some uncertainty to early dates. On the lowest estimate, however, the accession of Menes, the first king of the First Dynasty, is assigned to 3400 B.C., while the calendar was introduced in 4241 B.C.

IN a speech delivered at a luncheon of the British Optical Instrument Manufacturers' Association on Thursday, July 23, Mr. F. Twyman, the president, gave an instructive and encouraging review of the present technical condition of the optical instrument industry of Great Britain. It is well known that the industry has suffered enormously during the financial and commercial decline of the past few years. It is not so well known, however, that these years have been for the industry a period of experiment and development, of prolonged and successful effort towards improving its products, inventing and putting new products on the market, and increasing its equipment for producing. The experimental and research work carried out continuously by members of the industry has resulted not only in an increase in the range of products, but also in developments of real scientific importance. From many examples quoted, it would seem probable that most of the research of the world, in certain fields of prime importance in modern physics, is being done with British-made instruments. The growing use of optical instruments for the control of industrial processes, and for maintaining a high and uniform standard of quality in the productions of important industries, has undoubtedly been encouraged by the fact that these industries have been able to obtain from British optical firms suitable instruments, often very complex and designed with great inventive ability to achieve the particular end desired. The technical advances and achievements in regard to the design and production of optical instruments, enumerated by Mr. Twyman, give evidence that the industry is active in invention and development and in the application of the results of scientific research conducted by it or on its behalf. The result is seen in its ever-improving position in the race for technical supremacy.

A MEETING, called by the Optical Society to consider the desirability of arranging an Optical Convention in 1926, was held at the Royal Society of Arts on Tuesday, July 21. Sir Herbert Jackson presided, and there were present representatives of all branches of the optical and scientific instrument industry, together with representatives of cognate scientific and technical societies, and others interested in the theory and practice of optical science and in the use of optical instruments. The chairman intimated that the object of the proposed Convention was to bring before the notice of the scientific and general public the many and important developments which had taken place in recent years in British optical apparatus and instruments, and to show that the products of the optical glass industry and the optical instrument industry of Great Britain were well able to compete with those of foreign competitors. It was for the manufacturers to decide whether the time was opportune for holding such a convention. Several of those present spoke in favour of the proposal, and it was resolved that a British Optical Convention be held at the Imperial College of Science and Technology, South Kensington, in July 1926, and that a guarantee fund of 2000*l.* be raised, if possible, before October 1, 1925. It was announced that the Council of the Optical Society had already agreed to contribute a sum of 200*l.* towards such a fund. Thereafter, a general committee consisting of those present was formed, and an executive committee nominated, with powers to make the necessary arrangements. Detailed proposals will be published with regard to the scope and scheme of the Convention as soon as the executive committee has considered the various matters involved.

THE second of the annual conversaziones of the Royal Society was held in the Society's rooms on July 22. The majority of the exhibits arranged for the occasion were also shown at the first conversazione (NATURE, May 23, p. 819). Among the fresh exhibits were six models of early locomotive engines, pieces of apparatus used by Sir William and Sir John Herschel and a replica of an early Egyptian astronomical instrument. This instrument, the "Merkhet" of the Egyptians, and the "ὡρολόγιον" of the Greeks, was used to lay out a meridian line and to note the meridian passage of stars for determining the time in connexion with temple ceremonies. The original in Berlin dates from about 700 B.C., but the instrument was in use very much earlier. These exhibits were shown by the Science Museum. Mr. W. Bateson and Mr. R. J. Chittenden (John Innes Horticultural Institution) showed examples of root-cuttings and plant-chimæras in Pelargonium. Plants raised from buds formed on roots may differ from those

raised from shoots, demonstrating the existence of an inner component. The plant may be (1) male only, (2) female only, (3) sterile, whereas the inner component is in each a normal hermaphrodite. The distinction is probably in epidermis alone. Zonal Pelargoniums raised by cross-fertilisation between green and albino tissues show the artificial formation of chimæras. Rothamsted Experimental Station had an exhibit illustrating the inoculation of lucerne with nitrogen-fixing bacteria (Mr. H. G. Thornton and Prof. N. Gangulee). A motile stage has been discovered in the life-cycle of *Bacillus radicicola*, the organism forming nodules on the roots of leguminous plants within which nitrogen is collected and utilised by the plant. This stage is connected with the spread of the bacteria through soil. The results have been applied, with some success, to the practical problem of inoculating the lucerne crop. The National Physical Laboratory showed a Guild colorimeter for fundamental investigations in colour vision (Mr. T. Smith). Light from a single source, after passing through gelatine filters of three selected colours arranged symmetrically about the circumference of a circle, is brought to a common axis by a rotating prism. The mixture thus obtained is presented side by side with the colour to be measured by means of a photometric cube.

AT the Conference of Women in Science, Industry and Commerce, held at the British Empire Exhibition on July 15-18, Miss C. U. Kerr read a paper on the effect of welfare work upon health and efficiency. Miss Kerr outlined the history of the welfare movement and pointed out that the earliest experiments in welfare work were initiated in engineering factories. The chief branches of welfare were considered and a special plea put forward for the adequate provision of food for the workers. Many firms are still without canteens, and those which do have them often fail to see that the food is interesting and appetising. The proper selection of workers was discussed and an interesting suggestion made that many operations could be well performed by people not of robust physique, provided that the conditions were good. The advantage to a delicate person who finds his job and knows he can do it well cannot be calculated only by his efficiency at work; the mental effect is probably the cause of the improvement related by the writer in connexion with a tobacco factory. One would like to see the engineering metaphor disappear from these discussions. The writer of this paper quotes the phrase "Human Engineering" as an apt description of welfare work and calls "food for the producers," "fuel for the human machines." These phrases stand for a mechanical interpretation of life which has been, and still is, the cause of no little trouble in the industrial world. A machine is a means to an end: Can that be true of a human being?

MR. GOYDER, of Mill Hill School, has maintained two-way radio communication with the leader of the MacMillan Expedition in the Arctic. When communication was first established on July 18, the *Bowdoin*, with Captain MacMillan on board, was at Hopedale, Labrador, but on July 24 she was crossing the Arctic Circle. The two ships, the *Peary* and the *Bowdoin*, are proceeding to their base at Etah in Greenland, and it is hoped to make an aeroplane base at Cape Thomas Hubbard in Axel Heiberg Land. Mr. Goyder works with a 250-watt Mullard valve on a wave-length of 40 metres. He only uses a single wire Hertz aerial, but he receives on a special circuit devised by Mr. Reinartz, who operates the radio apparatus on the *Bowdoin*. The messages are received best between midnight and six o'clock in the morning. Mr. Goyder has himself transmitted to America several messages from the explorers to their friends. It will be remembered that he was the first to maintain two-way communication between Great Britain and New Zealand. Mr. Goyder is to be congratulated on his success, which will raise the status of British amateur radio-telegraphy.

AT the annual general meeting of the Marconi International Marine Communication Co., Ltd., held on July 24, Senator Marconi gave an interesting sketch of the lines on which radio signalling is developing on board ship. During the past two years, numerous experiments have been made to find out how far radio telephony is desirable and practicable in the mercantile marine. Trials were made in trawlers as well as in liners, both between ships and between ships and shore. The results obtained prove that there is no technical difficulty in the way of accomplishing a satisfactory service of duplex radio telephony between ship and ship when they are on the high seas and away from the areas of congested radio-telegraphic traffic. In one instance a range of nearly 400 miles was covered. If a demand arises by ship's commanders and passengers, it can easily be met. There is, however, no likelihood at present of radio telegraphy at sea being superseded by radio telephony. When financial matters are less stringent, it is probable that shipowners with the collaboration of the Post Office will give facilities for conversation between passengers and shore stations. The Board of Trade has recently made a regulation under which the use of a radio automatic calling device is made compulsory for all ocean-going vessels the crews of which number less than 50. Shipowners, however, are appealing against this regulation as they consider that the present time is inopportune for increasing their financial burdens. Senator Marconi said that there has been a rapid increase in the demand for his company's direction finder, which has proved of great value to navigation, especially in foggy and rainy weather. A ship fitted with this device is able to assist other ships in its neighbourhood by sending them their positions.

SINCE the War, France has paid particular attention to securing its economic independence of other nations. Great attention has therefore been paid to developing "la houille blanche," or water power, so called to distinguish it from "la houille noire," or

coal, from which thermal power is developed. As the total possible power output of the mountain torrents of the Pyrenees and the Alps and of the Rhone, the Garonne, and the Rhine is several times greater than the power equivalent of the present French output of coal, there is plenty of scope for industrial development. In connexion with the present exhibition of "La Houille Blanche" at Grenoble (May–November) the *Revue Scientifique* has published an excellent historical and industrial account of the state of the art of hydro-electrics. It is interesting to remember that Fourneyron in 1837 installed at Saint-Blasien in the Black Forest small water turbines 31 cm. in diameter, producing 60 horse power, the fall being 114 metres. The efficiency of the machines was no less than 80 per cent., which is quite comparable with that of the best modern machines. In the historical survey an account is given of the work in hydrodynamics done by Pascal, D'Alembert, Lagrange, Laplace, Poisson, Cauchy, and others down to Poncelet and Girard. Interesting portraits are given of the French scientific workers. In the technological section illustrations are given of the chief steam- and water-power stations in France, and methods are indicated for accelerating the development of industry by distributing electric power over wide areas. H. Parodi, the engineer to the Compagnie d'Orléans, contributes a thoughtful paper on the different policies adopted by the various countries of the world with regard to railways operated by electric traction, and more particularly those which utilise water power through the medium of electricity. The curves he gives indicate clearly when electric traction becomes a commercial proposition.

THE River Pollution Committee of the Ministry of Agriculture and Fisheries, having learned that the impression prevails in many quarters that the Committee is antagonistic to the use of tar in the preparation of road surfaces, is anxious to correct this impression. The Committee is concerned solely with the question of river pollution from the point of view of the fishery interest. The constituents of tar, if they find access to a river, are most injurious to fish and their food, and the Committee earnestly advocates the avoidance of the use on any road, the washings from which are likely to find their way directly into a stream, of any road dressing containing tar or tar products. Washings from bituminous surfaces are, however, innocuous to fish and their food, and the Committee has advocated the use on roads in proximity to streams of bituminous dressings. Obviously, the roads with which the Committee is concerned constitute only a small fraction of the total roads of the country. The Committee's policy has been solely to urge upon all road authorities that care should be taken to avoid the use of tar at what are the danger points from the point of view of pollution. The Committee has examined a number of preparations for road-surfacing, and is prepared, if consulted by road authorities or other persons concerned, to advise them as to the suitability for use in proximity to streams of such preparations as they have examined.

HEATHFIELD HALL, Watt's residence at Birmingham, where he lived from 1769 until his death, is now in course of being demolished to make way for new buildings which are to be erected on what was once his estate. Fortunately, however, all the machines, tools, benches, etc., from Watt's workshop have been presented by Major Gibson Watt to the Science Museum at South Kensington, where on the ground floor of the new building, not far from three of the engines which were built by the firm of Boulton and Watt between 1777 and 1797, an accurate reproduction of James Watt's workshop has just been completed. The present owners have generously presented the door, windows, flooring, etc., of the old room, so that it has been possible to produce a replica of the old attic, and in it to arrange the contents as they were at the time of Watt's death. The two copying sculpture machines, the lathe, and benches, boxes of tools, tables, etc., take up too much space for the public to circulate in the room, but a large plate glass window in one of the walls allows the workshop and its contents to be seen readily.

THE following officers of the Institution of Electrical Engineers have been elected:—*President*, Mr. R. A. Chattock; *Vice-Presidents*, Lieut.-Col. K. Edgcumbe, Prof. W. M. Thornton; *Hon. Treasurer*, Mr. P. D. Tuckett.

AT the annual general meeting of the Royal Society of New South Wales, held on May 6, the following officers were elected:—*President*, Prof. R. D. Watt; *Vice-Presidents*, Mr. J. Nangle, Mr. E. C. Andrews, Mr. C. A. Sussmilch, and Dr. C. Anderson; *Hon. Treasurer*, Prof. H. G. Chapman; *Hon. Secretaries*, Mr. R. H. Cambage and Dr. R. Greig-Smith.

SIR ERNEST and LADY RUTHERFORD left Great Britain for Australia and New Zealand on July 25, on the s.s. *Ascanius*, bound for Adelaide. While their main object is to visit their parents and relatives in New Zealand, Sir Ernest has also promised to deliver lectures on aspects of modern physics in some of the chief cities of Australia and New Zealand. They hope to return to England in January 1926.

AT the annual meeting of the Museums Association held at Exeter on July 7, the following resolution was passed:—"That the Museums Association desires to place on record its opinion that the present reckless destruction of animal and plant life by collectors and others will, if continued, result in a deplorable loss to posterity." Mr. J. Bailey, late of the Circulating Department of the Victoria and Albert Museum, London, was elected president of the Association for the year 1925–26. The next conference will be held at Bournemouth in July 1926.

PROF. A. A. MICHELSON, professor of physics in the University of Chicago, has been appointed to the first of the distinguished service professorships which have been established in that University. These professorships form part of a development scheme which, we learn from *Science*, has been instituted with the view of raising a new endowment fund of 6,000,000 dollars. Special efforts were made to obtain funds

in sums of 200,000 dollars, the incomes from which would be devoted to professorships such as that now conferred on Prof. Michelson. The present professorship is due to the generosity of Mr. M. A. Ryerson, of Chicago, formerly president of the board of trustees and donor of the Ryerson Physical Laboratory of the University.

THE autumn meeting of the Institute of Metals is to be held at Glasgow on September 1-4, under the presidency of Prof. T. Turner, Feeney professor of metallurgy in the University of Birmingham. The proceedings commence with the fourth autumn lecture, by Sir John Dewrance, who will take as his subject "Education, Research and Standardisation." Sixteen papers on various aspects of the constitution and properties of metals and alloys are to be submitted for discussion at the meeting. The lighter side of the programme announces visits to works and places of interest in the neighbourhood of Glasgow, and special arrangements are being made for the entertainment of the ladies present. Railway vouchers enabling members of the Institute and their friends to purchase return railway tickets to Glasgow at the rate of a single fare and a third can be obtained from the secretary of the Institute of Metals, 36 Victoria Street, London, S.W.1.

THE Council of the Institution of Electrical Engineers, which took an important part in founding the Society of Radiographers in the year 1920, and, under that Society's constitution, has up to now nominated six out of the eighteen members of the Society's Council, has withdrawn its nominees and terminated the Institution's connexion with the Society. This action has been taken because the majority of the Council of the Society of Radiographers has resolved upon certain alterations of the Society's articles, with which the Council of the Institution of Electrical Engineers is in entire disagreement, as in the Council's opinion these alterations will materially lower the professional status of non-medically qualified radiographers.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned: An advisory agricultural economist at the Seale-Hayne Agricultural College, Newton Abbot—The Secretary and Bursar (August 4). A second assistant in botany in the University of Aberdeen—The Secretary (August 19). An assistant lecturer in physics at the University College of Wales, Aberystwyth—The Secretary (August 30). A laboratory assistant for the Veterinary Research Department of the Government of Uganda—The Crown Agents for the Colonies, 4 Millbank, Westminster, S.W.1, quoting M13/800.

Our Astronomical Column.

THE JULIAN DAY.—A matter that excited much interest was settled by the International Astronomical Union, after a long discussion, by a considerable majority. When it was decided that the astronomical day should begin at midnight, instead of noon, a diversity of view was manifested as to whether the Julian day should follow suit, or begin at noon, as heretofore. Speaking broadly, the former view was held in America, the latter in Europe. The matter is of especial importance for variable-star observers, since it has for long been the custom to use the Julian day both for the elements of these and for recording observations.

It was further pointed out that the whole point of the institution of the Julian day system was to have a method of recording time that should be independent of all changes of style or calendar changes, and that once established such a system should not be lightly broken. It was, indeed, admitted that there had been a change of two hours since its institution; its beginning was then noon at Alexandria, afterwards altered to Greenwich noon. However, a change of two hours applied to comparatively rough early observations is of little moment compared with a change of twelve hours in accurate modern observations. Many of the Americans, including Prof. Shapley, admitted the force of these arguments, and supported the retention of the noon- beginning, which was afterwards confirmed by the Union as a whole.

An endeavour was also made to agree on a name for the new astronomical day that begins at Greenwich midnight. A very large section expressed disapproval of continuing to use the phrase Greenwich Mean Time for the new system, but no alternative was found that commanded general assent; it was agreed to leave the matter open, as being comparatively unimportant, provided one made clear what time-system one was using. The title "Universal Time" met with most support, and the Astronomer-Royal said he would endeavour to get this name inserted in the Nautical Almanac as a second title, Greenwich Mean Time continuing to be the first title.

PERTURBATIONS OF MINOR PLANET 944, HIDALGO.—Discovered by Dr. Baade of Bergedorf in 1920, Hidalgo is one of the most interesting of the minor planets, being near the orbit of Mars when in perihelion, and near that of Saturn when in aphelion. Its period, $13\frac{2}{3}$ years, does not differ greatly from that of Jupiter; its orbit is inclined to the ecliptic at the high angle of 43°, the greatest of any minor planet. However, its passage of the descending node takes place not more than half a unit from Jupiter's orbit, and the question of the perturbations by the latter is of interest. Mr. K. Jantzen investigates the secular perturbations by Jupiter in Bulletin of Vilno Observatory, No. 5, using the method given by Hills in vol. 1 of the Amer. Ephem. Papers. The circle of eccentric anomaly was divided into 192 parts, this large number being necessary owing to the near approach to Jupiter's orbit, which occurs when $E = 83°$.

The final values of the secular perturbations of the elements are, $e + 14''{\cdot}4$, $i - 16''{\cdot}2$, $\Omega - 26''{\cdot}5$, $\pi - 65''{\cdot}3$, $L + 57''{\cdot}6$. The method of special perturbations would have to be used at the time of a near approach of the two bodies; there was actually a fairly near approach (less than an astronomical unit) in 1922. This was probably the closest in the last century or thereabouts.

Some authorities are inclined to rank this body as a comet rather than a planet. It seems, however, better to limit the term comet to bodies showing nebulosity. Hidalgo always appeared stellar.

Research Items.

THE "LOST CITY OF NEVADA."—Dr. M. R. Harrington, of the Museum of the American Indian, Heye Foundation, contributes to the *Scientific American* for July an account of the excavation of the Pueblo Grande de Nevada, also known as the "Lost City," which began in November last. This settlement is probably one of the oldest in North America, north of Mexico, antedating the cliff dwellings of New Mexico and Arizona. It lies scattered along the banks of the Muddy River over a distance of five or six miles, with a greatest breadth of a mile. About thirty houses have been uncovered. On the floors and in graves have been found implements of bone and stone, pottery and ornaments of shell and turquoise. The inhabitants gathered wild natural products, but also farmed, raising corn, beans and squashes. They had no domesticated animals except the dog, and hunted deer, mountain sheep, and the jack rabbit, though the bones of game animals are not numerous. Considerable progress had been made in weaving and dyeing. The pottery has a general resemblance to Pueblo but belongs to an early period, while the dwellings are of the primitive type, consisting of an oval pit two or three feet deep, which must have had a superstructure of poles and matting. The development in type of the dwelling shows that Pueblo Grande belongs to the close of the pre-Pueblo and the beginning of the Pueblo period.

DECORATIVE DESIGNS ON CARVED WOODEN FOOD-BOWLS, PORTUGUESE EAST AFRICA.—Some interesting notes on the origin of the decorations on carved wooden food-bowls among the Va-Lenge and Va-Chopi of Portuguese East Africa are contributed by Miss E. Dora Eady to Vol. 11, Part 2, of the Annals of the Transvaal Museum. Both peoples have an elaborate system of hair-dressing, varying with the great social events and crises of their life. The food-bowls, generally circular in shape, when turned upside down are regarded as human heads, and the little plaitings of the hair which are grouped together in a triangular shape are reproduced on them as incised triangles. A notched arrangement, forming a series of lozenges at the base of each triangle, is also copied from the hair, though on the bowls the place of the lozenge is sometimes taken by a chevron. The absence of the chevron or lozenge on the bowl pattern represents the hair of widows and uninitiated girls. If the lozenge is very small it indicates an initiated girl or one ready for marriage. The chevron means that the woman's husband is ill, some think recently deceased. A hair-parting encircling the head is also reproduced on the bowl, where by some it is said to represent the line of scalping or decapitation followed formerly when the Va-Chopi were head-hunters.

AMERICAN OAKS.—The twentieth volume of the Memoirs of the National Academy of Sciences (U.S.A.) is devoted to a monograph by Dr. Wm. Trelease of the oaks inhabiting the New World. Although the oaks of the United States and Canada have been reviewed from time to time by Sargent and other American botanists, no such comprehensive work as this, which deals with the genus Quercus as represented on the entire continent, has appeared before. The region occupied by the American oaks extends from Canada southwards to the Columbian Andes and Cuba, the greatest aggregation of types occurring in the highlands of Mexico. Dr. Trelease divides them into three main sections, namely, the white oaks (Leucobalanus), the red oaks (Erythrobalanus), and a small intermediate oak (Protobalanus). These sections are subdivided into numerous groups, for each of which a detailed general description is provided, the individual species being differentiated by one or more leading characters only; but new species, of which the author has made a considerable number, are described in full. The geographical range of each group and species is defined, and an adequate, though not necessarily complete, synonymy is given. The real value of such a work as this can only be appreciated of course by long and continued use, but there can be no doubt that it has simplified for the student the very intricate and difficult problem of the American oaks, and brought into convenient compass a vast amount of exact information concerning them. The introductory essay, dealing with the history of the genus, details of structure in stem, leaf, flower, and fruit, taxonomy, geographical distribution, hybridity, and the fossil botany of oaks, is admirably written. For the purpose of preparing this monograph, which is illustrated by 420 plates, the author has studied the material in all the great herbaria of the world.

LEAF SHAPE.—The factors controlling leaf shape are undoubtedly various and differ under different conditions, but Dr. W. H. Pearsall and Miss Alice M. Hanby seem to throw some light upon them in the experimental study of *Potamogeton perfoliatus*, which they report upon in the *New Phytologist*, vol. 24, No. 2. Using Pond's method of enclosing the root system in one culture solution and the submerged shoot system in another, they are able to analyse the effect of different solutions upon growth. Their results make clear the great importance of the ratio of calcium to potassium and sodium ions in the solution upon the relative length and breadth of the leaf, whilst their analysis of this difference shows it must be attributed to a different activity of the meristem when growing in solutions which vary in the relative proportions of these ions. Their conclusion is that with this variable species, changes in leaf form are usually determined under natural conditions by the calcium content of the soil and to a less extent by light.

ON AMMONITES VIA NAUTILUS.—A paper by Martin Schmidt entitled "Ammonitenstudien" (*Fortschr. Geol. und Paläontol.*, Hft. 10) covers a far wider field than its title would indicate. The first portion, illustrated by an excellent plate, treats of new and little-known Ammonites from the Schwabian Lower Lias. The second portion contains a general summary of what is known concerning Nautilus, including a histological section by Max Rauther, followed by an attempt to apply that knowledge to the study of the Ammonites. The author favours the idea that the Ammonites were plankton feeders and their successive modifications and destruction were entailed by the altered habits and extinction of their food.

PALÆONTOLOGICAL HISTOLOGY. — The Nigerian Government has published (Geological Survey of Nigeria, Occasional Paper No. 2) an account by Baron Nopcsa of some fragments of fossil reptiles from Sokoto. These are for the most part Crocodilian or Deinosaurian, but are too fragmentary to yield much information beyond the suggestion that the beds in which they occur are Lower Eocene in age. The chief interest in the paper lies in the application of histological methods to palæontology, whereby it seems possible from the structure of the Haversian canals to distinguish Crocodilia from Deinosauria.

Further investigation along these lines should lead to interesting results.

ARCHÆOPTERYX.—Dr. Petronievics has continued his investigations on the genus Archæopteryx, which he began upon the specimen in the British Museum, by a study of the example in Berlin. From a comparison of the two he comes to the conclusion that, so far from being the same species, they represent two different sub-classes of birds. For the British Museum specimen he retains the name Archæopteryx, and calls the Berlin one Archæornis. The first is considered to be a primitive ratite and the second a primitive carinate. In general Archæopteryx shows the more primitive characters of the two. The author comes to conclusions, which are certainly not those of the text-book, that the ancestor of birds is to be sought in a primitive group of the Lacertilia and that the resemblances which have led investigators to see some affinity between birds and the Deinosaurs are to be interpreted as due to convergence. The paper is published in the *Annales Géologiques de la Péninsule Balkanique*, vol. 8, 1925.

THE MINERAL IDDINGSITE.—The red-brown alteration product of olivine known as iddingsite has become very familiar to petrologists during the last thirty years, but hitherto its nature and properties have been only vaguely realised. C. S. Ross and E. V. Shannon have now presented a careful study of the material in the Proc. U.S. Nat. Museum, vol. 67, No. 2579, 1925. They conclude that iddingsite is not a product of weathering, but is the result of metasomatic processes associated with the later stages of a cooling magma. It forms from olivine soon after the close of crystallisation under conditions of oxidation and hydration: MgO is abstracted, FeO is oxidised to Fe_2O_3 and water is added; and the resulting product has a formula of the type $MgO . Fe_2O_3 . 3SiO_2 . 4H_2O$. The optical properties are distinct and different from those of any other described mineral, including serpentine, which differs in mode of origin, chemical composition, and physical properties. Iddingsite is therefore regarded as a definite mineral species.

THE GEOLOGY OF NORTH LONDON.—Under this title the Geological Survey of Great Britain issues an explanation of one-inch Sheet 256 England, by C. E. N. Bromehead, with contributions by H. G. Dines and J. Pringle. The area comprised includes London north of the Thames, and the surrounding country as far north as Watford and Enfield. The whole ground has now been surveyed on the six-inch scale, but a large proportion of the area has been built over and more is still "under development," so that there are few open sections available for study. Save for brief allusion to the older rocks the formations dealt with range from the Upper Chalk to the Alluvial. Despite the evidence of palæontology, the Glacial deposits are still placed at the beginning instead of the close of the Pleistocene period, and though many of the Pleistocene mammalia are duly chronicled, we miss all reference to *Rhinoceros tichorhinus*, a fine skull of which, now in the British Museum (Natural History), was found at Perivale in the Brent valley, and recorded so far back as 1913.

PERIODIC CHEMICAL CHANGES.—A further paper on periodic chemical phenomena by E. S. Hedges and J. E. Myers appears in the Journal of the Chemical Society for May. Typical periodic reactions have now been investigated from an electrochemical point of view. In the case of activated metallic couples dissolving in hydrochloric acid or ammonium chloride, the potential difference between the couple as a whole and the solution, and that between the two components of the couple, undergo periodic fluctuations which synchronise with the periodic evolution of gas. A potential difference exists between the active and inactive forms of a metal. The periodic deposition and dissolution of iron on magnesium in an acid solution is investigated, together with a few other similar cases. A corresponding oscillation of the electropotential occurs, and often there is a periodic evolution of hydrogen. Examples are given of "autoperiodic" reactions, where one electrode serves both as the reacting metal and as the activating agent. The results are correlated with those of previously published investigations.

A VACUUM THERMO-ELEMENT.—A number of instruments have recently been described for spectroscopic observations, and for the direct measurement of the radiation of the stars, in which a thermo-element, consisting of two thin wires of different metals soldered together with a small receiving plate attached to the junction, is mounted in a vacuum. Messrs. W. J. H. Moll and H. C. Burger criticise this arrangement in the *Zeitschrift für Physik* of June 5, pointing out that it is slow in action, owing to the mass of solder necessarily added at the junction. They describe a method in which the edges of two plates of constantan and manganin a few millimetres thick are soldered together with silver, and then rolled out in the direction of the soldered junction to about 1 μ thickness. The result is a long thin ribbon of foil, one-half of constantan and the other of manganin, soldered together along the length of the ribbon by a thin line of silver. Narrow strips at right angles to the length can be cut from this, and it is even possible by etching to obtain a small receiving disc about the junction, with narrow strips of foil on either side, which can be soldered to the supporting wires. Such an element can be mounted in an evacuated bulb of glass or quartz, which can be sealed off permanently; and when this is enclosed in a double copper vessel with small windows, it makes a very sensitive and rapidly adjusted instrument.

STANDARDISATION OF SIEVES.—In an article in the June issue of *State Technology*, Mr. P. E. Masters directs attention to a difficulty under which British manufacturers who require to sift fine material labour, owing to the absence of any satisfactory standard to which sieve makers can work. A sieve of 80 meshes to the linear inch may be made of wire of gauge from 38 to 42 according to the will of the maker, and the user of the sieve only discovers a change of gauge by some serious modification of the properties of the sifted material. The proposals of the Institution of Mining and Metallurgy for standard sieves involve the use of wires not of standard gauges, and the sieves are so difficult to manufacture that high prices are quoted for them. The author proposes that the standard relation between the diameter d of the wire and the distance D of the centre lines of consecutive wires apart shall be $D = 2 \cdot 7d$. This gives as the proper wires for 10, 20, 30 and 40 meshes to the inch, gauges 19, 25, 29 and 33 respectively, for 60, 80, 100, 120, 140 and 160 meshes, gauges 37, 40, 42, 44, 45 and 46 respectively, and for 200 meshes, gauge 47 wire.

ERRATUM.—In NATURE for July 11, p. 61, col. 1, paragraph 2, line 13, the words "It is also a genus long known only from Europe" should refer to Balanocrinus.

The International Astronomical Union at Cambridge.

WELCOMED by Lord Balfour, Chancellor of the University of Cambridge, who dwelt on the value of international co-operation, by Dr. J. H. Jeans, president of the Royal Astronomical Society, who dwelt on the revolutions that astronomy has compelled in human thought, and by the Astronomer-Royal, who gave a short account of the manifold activities of the Union since its birth in 1919, the conference made a happy and successful start on July 14 in the Senate House of the University. In his address at the opening meeting of the general assembly of the Union, at which there were present more than 200 national delegates, members of the Union and invited visitors, the president, Prof. W. W. Campbell, reminded the Union that it is charged with the care of international co-operation in astronomy wherever it is necessary or useful. The principal fields of astronomical activity are represented by more than a score of committees; their reports refer to great pieces of work in which there are many students, where co-operation is required to secure a fairly homogeneous system over the entire field. He illustrated the point by a short historical account of the study of the variation in latitude. We have now a very good knowledge of the conditions that are requisite for success in astronomical co-operation, and in launching fresh schemes, as the Union must do from time to time, we must beware of starting on new and untried work with too ambitious a programme. Prof. Campbell added a strong and evidently welcome tribute to the work that the general secretary of the Union, Prof. A. Fowler, has done for it since its foundation.

Dr. G. Abetti, Dr. H. Chrétien, Lieut.-Col. F. Stratton, and Dr. F. Henroteau were appointed recorders for the meeting, and Dr. A. Wolfer was appointed vice-president for the meeting in the absence of Prof. K. Hirayama.

It was announced that Norway, Spain, Portugal and Switzerland are now full members of the Union, and the adherence of Sweden has been officially notified. There are now 22 countries in the Union, and 20 of these were actually represented at the conference. After considerable discussion, resolutions submitted by constituent bodies of the Union were submitted to committees, save one from the United States. This was a proposal that the Committee on Selected Areas should be invited to reorganise itself under the auspices of the Union. The motion was deferred until such time as Germany becomes an adhering country of the Union, a necessary condition which the American committee had hoped to see fulfilled at the Cambridge meeting.

The Union then dissolved itself into 27 committees, which for the next four days dealt faithfully each with its appropriate portion of the 122 pages of the report prepared by Prof. Fowler. It is impossible here to do more than mention very briefly some of the more important resolutions of wide interest which were ultimately adopted by the General Assembly of the Union.

The committee on standard notations appointed a sub-committee to report to the Union at a later date on a revision of the boundaries of the northern constellations. Different systems adopted by earlier writers have led to an annoying confusion in the double names allotted to stars near the boundaries of constellations.

It was agreed that for all telegrams transmitted from the Bureau at Copenhagen, mean places should be adopted, referred to the equinox at the beginning of the year. Where desired, adequate descriptions of newly discovered objects should be given.

A grant of 250*l.* a year for three years was made to Prof. De Sitter to carry out a programme of observations of azimuth at an equatorial station and at northern and southern stations, for the determination of fundamental declinations; the instrument and the observer are to be found by the Leyden Observatory. A revised list of stars to form, or to be developed into, a *fundamental* list was also adopted and recommended for as continuous observation as possible. The further study of the variations of refraction at different hours of the day and in different parts of the sky was also recommended. It was announced that Greenwich, the Cape and the Naval Observatory at Washington are to co-operate with the German astronomers in the observation of reference stars in connexion with the coming opposition of Eros in the year 1930–31.

With regard to solar physics, it was agreed to arrange that additional observations of the sun as nearly continuous as possible should be made at or about the time when magnetic storms are in progress or expected. There would have to be organised some service to supply the necessary information to the co-operating observatories. The view was expressed by M. Deslandres and adopted by the Union that it is important for the variation of the solar constant, announced by Dr. Abbot, to be studied in other countries, especially in reference to accompanying changes in meteorological elements. Strong support was given to the suggestion that a Solar Physics Observatory should be established in Japan. With regard to apparent changes in solar rotation, Dr. St. John announced that the Snow telescope as used by Adams would be reconstituted to compare its results with those given by the 150-foot tower telescope.

Several important resolutions were adopted as to standard wave-lengths. Of these the most important was the following:

The primary standard of wave-length, λ6438.4696 of cadmium, shall be produced by high voltage electric current in a vacuum tube having internal electrodes. The lamp shall be maintained at a temperature not higher than 320° C., and shall have a volume not less than 25 cubic centimetres. The effective value of the exciting current shall not exceed 0·05 ampere. At room temperature the tube shall be non-luminous when connected to the usual high voltage circuit. So long as the lamp used is capable of giving well-defined interference fringes with retardations of at least 200,000 wave-lengths, it is not, however, necessary to specify the volume of the tube serving as lamp. The primary standard should always be produced in a lamp which is ascertained to give retardations of at least 200,000 wave-lengths.

General Ferrié announced that the world scheme for the wireless determination of longitudes as approved at Rome has been worked out in further detail; experiments of considerable interest with diverse optical instruments have been carried out at Paris to check the conflicting views as to the relative success of small field instruments and large observatory transit circles. A number of resolutions as to the details of the scheme were adopted. Some preliminary experiments are to be carried out during the two months commencing October 1, 1926.

A strong wish was expressed by the Union that the U.S. Coast and Geodetic Survey should re-establish the latitude station at Gaithersburg so as to renew its co-operation in the study of the variation of latitude. The help of meridian observers in securing fresh

determinations of the declinations of the stars involved in this work was also strongly urged.

A research survey for all the minor planets, giving a record of available fundamental investigations on the perturbations of minor planets, was approved by the Union on the suggestion of Prof. Leuschner.

Observatories with suitable instruments were asked to arrange to secure annually photographs of the meteors of the three annual showers, the Perseids, Orionids and Geminids.

Welcome news was given by Prof. Turner as to the progress of the *Carte du Ciel*. France and Italy hope to complete their zones in eight years' time or sooner. The chief delays are at Tacubaya and Sydney, and the Union appealed to the two governments concerned for more rapid prosecution of the work.

In parallax work it was recommended that observers of trigonometric parallaxes should shape their programme, so far as possible, to meet the needs for spectroscopic and dynamical determinations. Faint stars of large proper motion are especially important. It was also agreed that photometric observers should be urged to determine carefully the magnitudes and colour equivalents of these stars.

Prof. von Zeipel reported through the Committee on Photometry that at Upsala it is proposed to determine the photographic and photovisual magnitudes of the 11,700 stars in the A.G. catalogue between $+35°$ and $+40°$.

A grant of 6000 francs was made to Dr. Aitken at the Lick Observatory for the clerical work of the Double Star Bureau, in connexion with the extension of Burnham's General Catalogue. The use of the reversing prism in determining position angle in double stars was also approved.

During the meeting co-operative work on the important Cepheid variables was arranged. As to notation, the Union supported that of Chambers—André—Nijland. A list of variable stars needing special attention, drawn up by Prof. Nijland, was published in the report of the Committee on Variable Stars.

It was agreed that a new catalogue of the brighter and larger nebulæ should be drawn up, illustrated by plates and including globular clusters. The system to be adopted for classification is to be purely descriptive. It was also recommended that in published work on nebulæ the N.G.C. or I.C. number should always be used, and that steps be taken to divide the sky into zones allotted to different observatories for work on agreed lines on nebulæ. It was also agreed that observatories should be encouraged to publish, whenever possible, copies of their best spectrograms. This would be of assistance for the next stage in stellar spectral classification. A small catalogue of some 20 to 25 stars is to be prepared to serve as standards in radial velocity work.

Important resolutions were adopted amending the forms, times and modes of emission of radio time signals. For the international time system at certain times it was agreed to replace the present three dashes by six dots.

The above brief summary of the more interesting resolutions indicates that a large volume of work was got through in the various committees. In addition, much valuable material is incorporated in many of the reports of the committees, especially in the accounts of recent work. It is to be hoped that the volume of proceedings may shortly be available to the public. The reports of the committees were for the most part taken without discussion at the general assembly in its closing meetings, the one fight being over the question of the hour of commencement of the Julian day. By a large majority it was agreed that this should remain at noon. The failure of the International Research Council at its recent meeting at Brussels to make any change in the statutes governing the conditions of national adherence led to a number of statements being made by the various national delegations. The United States, Italy, Japan, Spain, Denmark, Sweden, and Canada urged that all restrictions should be removed, while Belgium, France, Poland, Czecho-Slovakia, Portugal, and Rumania contented themselves with asking the International Research Council not to block the admission of the Central Powers when they became members of the League of Nations.

The next meeting of the Union was arranged, on the invitation of the Dutch government, to take place in Holland in 1928. The committees of the Union were appointed for the next three years, including new committees on stellar statistics and on solar parallax. Officers of the Union for the next three years were elected as follows :—Prof. De Sitter (president) ; Profs. Cerulli, Deslandres, Hirayama, Eddington, and Schlesinger (vice-presidents) ; Lieut.-Col. Stratton (general secretary).

A very successful meeting closed on July 22. Generous hospitality was shown throughout by the Colleges. Amongst many interesting points referred to in the side meetings was an announcement that Prof. Adams has measured the Einstein shift in the spectrum of the companion to Sirius. The result is consistent with the theoretical view already announced, that this star, though 2000 times as dense as platinum, obeys the gas laws.

The Field Museum of Natural History, Chicago.

THOSE connected with museums in Great Britain generally read the annual reports of museums in the United States with some envy. This is partly because those reports are produced in a style to interest the reader and to do credit to their institutions, partly because of the vigorous work they reveal. The chief factors, no doubt, are brains and enthusiasm, but these cannot operate without the other factor—sufficient funds. The report of the Field Museum of Natural History, Chicago, for 1924, which is just to hand, illustrates these points. It consists of 115 pages, of which half give a readable account of progress, and it is illustrated by 16 photogravure plates prepared in the Museum, as are all the Museum publications. That is how it is possible for the volume to bear the date January 1925.

The Field Museum corresponds to our own Natural History Museum plus a department of anthropology. Its scientific staff, exclusive of the Director, numbers only twenty, but its expenditure last year was about 117,370*l*. The expenditure of our Natural History Museum for last year was about 97,925*l*., and the scientific staff numbers forty-three permanent and thirteen temporary members.

The extension work of the Field Museum in public schools, the reproduction of living plants in models, and the pensions to employees are provided for by separate funds. Setting those activities aside, one notes that about 5000*l*. was spent during the year on expeditions ; then there are three guide-lecturers, who, besides conducting visitors, give regular lectures illustrated by lantern and cinematograph ; the printing has already been mentioned, but it should be added that this includes a large number of coloured posters

and advertisement folders. Such are a few of the lines of work in which British museums of similar size and character cannot compete. This expenditure, however, cannot be regarded as wholly unproductive, for it must certainly attract a large number of subscribing members. In Great Britain most museums are maintained by compulsory imposts, and free gifts of money are harder to come by. Whatever may be the relative advantages or disadvantages, it is certainly creditable to the citizens of the United States that they support so many admirable museums by private generosity.

From the body of the report a few items may be selected as continuing the contrast. Leakage through the roof of the top-lighted halls has been remedied in drastic fashion by coating the 38,500 square feet of skylights with a double thickness of Celotex overlaid with Ruberoid roofing. This has involved a change in the lighting of the halls from daylight to electric light. Making a virtue of necessity, it is claimed that artificial lighting is more suitable for the exhibited material because the illumination is more uniform and avoids the fading effects of sunlight. Since many American museums have long surpassed those in Britain in the use of electric light, we may be sure that some of the "dazzle headlight" effect recently introduced into one of our largest metropolitan museums has been avoided; but we are not so sure about the fading.

A somewhat full account is given of the re-erection of two Mastaba tombs from Egypt. The blocks arrived in 206 cases weighing 96 tons. The lower courses and missing stones have been replaced by cement blocks. The stones are bedded in lead, joined by dowels and metal clamps, and each secured to a bracketed upright steel channel. The ceiling has been raised 18 in. above the walls, and hidden lights are in a trough on the top of the wall. Every care has been taken to prevent humidity, and the room at the back of the tombs is mechanically ventilated. These and other details are given in the report "in the hope that the information may prove useful to other institutions." The use of terms unfamiliar, at least in Great Britain, and the absence of illustrations will, it is to be feared, frustrate this hope.

A poisoning and storage room, apparently in five sections, for the preservation of perishable material, has been constructed of compressed steel and equipped with storage bins of cedar wood. Formaldehyde candles have been used for poisoning with good success.

Many British provincial museums have long experienced the popularity of a wild flower exhibit, but none of them has attempted to show living and growing wild plants on anything like the scale attempted last year in the Field Museum. The case was a kind of large flower-box, and soon proved so successful that it was replaced by one four times the size, permitting of an approximately ecological grouping, which ranged from sand-dune plants to water plants. During the season about 500 species were shown, with full labels and guide leaflets.

Though not of such interest to the public, the numerous paragraphs revealing what careful attention is paid to storage, unpacking, sorting, and general office equipment will be read with appreciation by all museum curators. Nothing is more difficult to impress upon governors, committees, architects, and providers of funds than the fact that the life of a museum is in its workrooms and workshops, and that in any plans for development the first attention should always be paid to those unseen but indispensable offices. What is a banqueting hall without its kitchen? We can better dispense with the toastmaster than with the cook. F. A. BATHER.

The Sixth International Conference of Pure and Applied Chemistry.

SOME seventy foreign delegates, representing twenty different countries, attended the conference which was held recently in Bucharest. The decoration of railway stations and of public buildings and the more than generous hospitality provided by private individuals, public officials and organisations throughout the duration of the conference, indicated how important the event was considered in Roumania, and demonstrated the sympathetic attitude of its people towards chemistry.

The actual business of the conference was transacted on June 22 - June 25 under the presidency of Sir William Pope, and the other British delegates were Prof. J. C. Drummond and Prof. C. S. Gibson. The prestige of British chemistry can scarcely be said to have been adequately maintained since Denmark, the United States, Spain, France and Italy were each represented by a larger number of delegates than Great Britain. At the opening official reception, H.R.H. the Crown Prince of Roumania was present and, later, representative delegates were entertained by their Majesties the King and Queen at the Royal Palace at Sinaia.

Apart from the work of the special committees which met in the mornings and afternoons, a discussion on "The Nitrogen Problem," in which Prof. F. Giordani of Naples and Prof. D. Staehelin of Bucharest took part, was of special interest in connexion with the natural resources of Roumania. Public lectures were also delivered by Prof. Charles Moureu and Prof. Ernest Fourneau on "Autoxidation and Catalytic Phenomena" and "The Relationships between the Chemical Constitution of Substances and their Physiological Properties" respectively.

At the closing meeting, Prof. Ernst Cohen of Utrecht was unanimously elected president of the Conference in succession to Sir William Pope, who, like his predecessor, Prof. Moureu, has held this important office during three years. Mr. Jean Gérard was re-elected secretary and the following were appointed vice-presidents for the ensuing year: Profs. Bertrand (France), Minovici (Roumania), Nasini (Italy), Norris (America), Pictet (Switzerland) and Swarts (Belgium). The invitation from the United States to hold the next conference in Washington in September 1926, on the occasion of the fiftieth anniversary of the American Chemical Society, was cordially accepted.

An unique opportunity of seeing something of the enormous natural resources of Roumania was afforded to the delegates by the visits to the factories at Medias and Diciosanmartin, where natural methane is used not only as a source of heat and power, but also for the production of cyanamide. At the present time, the economic development is in its infancy, and there are still great possibilities for the scientific exploitation of methane of 99 per cent. purity issuing from the earth at a pressure of 20 to 30 atmospheres. The oil refinery of the Steaua Romana Company and the famous salt mines at Slanic were also inspected, and at all these places the same kindliness and hospitality were freely extended to the delegates.

The Bucharest conference was a model of efficient organisation, and Prof. Minovici and his committee have earned the sincere thanks of those privileged to attend and to join in the excursion to Constantinople, which was a *grand finale* to a most wonderful experience. C. S. GIBSON.

Wheat Supply and Demand.[1]

THE three issues of "Wheat Studies" noticed here form the preliminary instalments of a monthly series which the notice states is "designed to give a sound, impartial review of the world wheat position and outlook, based upon careful analysis of the various elements in the situation, with due recognition of economic conditions in exporting and importing countries." Numbers 1 and 3 form a continuous record of the vagaries of the wheat market over a period of seventeen months, when the market situation changed from that of being a buyers' to that of a sellers' market, thus allowing of contrasting conditions being compared equitably under almost uniform conditions of exchange and dietary habits.

No. 2 is a bibliography of the sources of the data upon which the main thesis is based.

The cause of low prices in 1923–24, the rise toward the end of the year, the reasons for export by Soviet Russia though crops were insufficient for home needs, and the cause of a marked increase in Oriental demand are all passed under review, and in a quite untechnical manner are explained.

Many interesting and important facts are deduced from the mass of statistics handled by the authors. Dietary changes due to better conditions among the artisan class since the War are having a significant influence upon the *per capita* consumption of wheat. In Great Britain the direction is downward, more meat being eaten, but in Scandinavia the same underlying cause promotes an upward movement owing to the falling off in rye consumption.

Figures are quoted showing that imports are not governed so much by the state of the home crop as by the state of the market. Abundant crops at home and abroad in 1923–24 were accompanied by a large increase in imports into Great Britain. Japan and China were attracted by low prices and consumed a quantity of wheat which is not likely to be a standard demand under the conditions which developed at the end of 1924. One of the most interesting sections of the survey is that explaining the effect of crop prospects changes, political disturbances of the nature of presidential elections, and geographic considerations such as the closing of navigation on the Great Lakes, on the course of wheat prices at Liverpool, Winnipeg, Chicago and Buenos Aires. A remarkably close correlation can be traced in almost all cases.

The series is the result of team-work, and very little time elapses between the data becoming available and the publication of the analysis. Under such conditions the readableness and accuracy of "Wheat Studies" are all the more praiseworthy.

[1] "Wheat Studies of the Food Research Institute, vol. i. (Stanford University, California). No. 1, The World Wheat Situation, 1923–24: a Review of the Crop Year; No. 2, Current Sources concerning Wheat Supplies, Movements and Prices: a Select List with Comments; No. 3, Developments in the Wheat Situation, August to December 1924.

Symbiotic Micro-organisms.

IN an article in *Scientia* (April 1925) Prof. U. Pierantoni, of Turin, who has taken a leading part in the investigations on physiological symbiosis, points out that recent researches in this domain have revealed the existence of micro-organisms which are not only useful but also, in the majority of cases, necessary for the life of the superior organism in which they occur, and they are transmitted from parent to offspring. These researches have also made known a new category of organs—termed mycetomes—which owe their functions to the presence in the protoplasm of their cells of symbiotic organisms, so that these by their specific activity determine the action of the organ. These symbiotic organs are glands the protoplasm of the cells of which, instead of elaborating products of secretion, foster micro-organisms which produce secretions useful to the organism.

The author states that the useful species of micro-organisms outnumber the pathogenic species. Among the examples of symbiotic organs to which Prof. Pierantoni refers are the luminous organs of cephalopods (Heteroteuthis, Rondeletia, Sepiola) which he has investigated, and the luminous organs of certain fishes (Anomalops, Protoblepharon) investigated by Prof. E. N. Harvey. He points out that these organs are simply cutaneous invaginations which harbour the micro-organisms, and that the thin walls in contact with rich vascular networks protect the cultures while the blood provides the nutrient material required by the micro-organisms. The latter multiply and produce continually new luminous substances which replace those expelled from the organ to the exterior by muscular action under nervous stimulation. In some cases, reflectors and refractors are formed from the neighbouring tissues; these render the light emitted more brilliant.

Another important group of symbiotic organs is the mycetomes in the wall of the intestine and associated organs—*e.g.* in larval and adult insects which feed on wood and blood, and in ticks—which elaborate ferments that facilitate the digestion of wood, cellulose, chitin, etc. A third group of these symbionts is chromogenic. The author observed in 1912 that in certain homopterous insects the symbiotic organ exhibited a bright colour which he attributed to the contained micro-organisms. Other investigators have recently found that the red lac of India produced by the coccid *Tachardia lacca* results from the activity of a micro-organism, allied to the Blastomycetes, which has been isolated and cultivated. The absorption spectrum of red lac exhibits an affinity with that of carminic acid (from cochineal, also the product of a coccid) and of the red products of the chromogenic *Bacillus prodigiosus*. Prof. Pierantoni believes that we are only at the beginning of a line of inquiry likely to be rich in results in pure and in applied science.

University and Educational Intelligence.

BIRMINGHAM.—Applications are invited for the Walter Myers Travelling Studentship in Pathology, value 300*l*. Information concerning the studentship can be obtained from the Dean of the Medical Faculty of the University. The latest date for the receipt of applications is September 1.

BRISTOL.—In connexion with the recent meeting of the British Medical Association at Bath, the honorary degree of LL.D. has been conferred on Sir Humphry Rolleston, Bart., Regius professor of physic in the University of Cambridge and president of the Royal College of Physicians.

DURHAM.—At a meeting held on July 27 the Council of Armstrong College, Newcastle-upon-Tyne, appointed Prof. J. W. Bews, of Natal University College, Pietermaritzburg, to be professor of botany in succession to Prof. M. C. Potter, retired. Dr. Bews is a native of the Orkney Islands, and was educated at Kirkwall and at the University of Edinburgh. He has been a lecturer in botany at the Universities of Manchester and Edinburgh, and since 1910 has been professor of botany at Pietermaritzburg. His publications include "Grasses and Grasslands of South Africa" (1918), "Flora of Natal and Zululand"

(1921), "Plant Forms and their Evolution in South Africa" (1925), and numerous papers dealing with plant distribution in South Africa.

EDINBURGH.—At the Graduation Ceremonial on July 22 the following were among the honorary degrees conferred:—*LL.D.*: Brig.-General the Hon. C. G. Bruce, chief of the Mount Everest Expedition; Prof. A. S. Eddington, Plumian professor of astronomy and natural philosophy in the University of Cambridge; Prof. R. Muir, professor of pathology, University of Glasgow; Principal C. Grant Robertson, University of Birmingham; Sir H. J. Stiles, Regius professor-emeritus of clinical surgery in the University of Edinburgh.

The degree of *D.Sc.* was conferred on the following:—Mr. A. C. Aitken (Thesis—"The Graduation of Observational Data"); Dr. F. J. Browne (Thesis—"Observations on Still-Birth and Neonatal Death, their Causes, Pathology and Prevention"); Mr. A. T. Cameron (Thesis—"Contributions to the Bio-Chemistry of Iodine and the Thyroid and Related Problems"); Mr. G. Harrower (Thesis—"A Study of the Hokien and Tamil Skull"); Mr. J. B. Shoesmith (Thesis—"The Influence of the Nature and Position of Atoms in Organic Compounds on the Reactivity of other Atoms in the Molecule").

LONDON.—Mr. J. S. Huxley, fellow of New College, Oxford, and senior demonstrator in the Department of Comparative Anatomy, has been appointed to the University chair of zoology tenable at King's College. Prof. Huxley was educated at Balliol College, Oxford, where he was Brakenbury Scholar, and also studied at the Stazione Zoologica, Naples, and at Munich and Heidelberg. From 1913 until 1919 he was assistant professor of biology in the Rice Institute, Texas, where he entirely organised the Department of Biology. He helped to organise and took part in the first Oxford Expedition to Spitzbergen in 1921, and in 1924 he visited numerous universities in Canada and the United States. His publications include: "The Individual in the Animal Kingdom" (1911), "Essays of a Biologist" (1924), and numerous papers in the Philosophical Transactions and Proceedings of the Royal Society, the *Quarterly Journal of Microscopical Science*, and in other scientific journals; he is also assistant editor of the *British Journal of Experimental Biology*.

Dr. L. Rodwell Jones, Cassell lecturer in commerce in the London School of Economics, has been appointed to the University chair of geography tenable at the School.

Mr. E. C. Titchmarsh, senior lecturer in mathematics at University College, has been appointed to the University readership in mathematical analysis tenable at the College. Mr. Titchmarsh had a distinguished career in mathematics at Balliol College, Oxford, and is the author of numerous papers in the Proceedings of the Royal Society, London Mathematical Society, and the Cambridge Philosophical Society.

The title of reader in medical protozoology in the University has been conferred on Mr. J. G. Thomson, lecturer in protozoology at the London School of Tropical Medicine since 1914, in respect of the post held by him at the London School of Hygiene and Tropical Medicine. He has held the following posts:—Durning Lawrence Research Fellow, 1909, and Clinical and Pathological Research Fellow, 1913, Liverpool School of Tropical Medicine; Beit Memorial Fellowship, 1914; Protozoologist, Central Laboratory, Alexandria, 1915; Pathologist, 17th General Hospital.

The Degree of D.Sc. in botany has been conferred on Mr. Krishnadas Bagchee (Imperial College—Royal College of Science), for a thesis entitled "Cytology of the Ascomycetes. *Pustularia bolarioides* Ramst. I. Spore Development."

THE Association of University Teachers announces in the June number of the *University Bulletin* the constitution of a Joint Standing Committee and inquiry office for promoting co-operation between university libraries. The inquiry officer is Mr. L. T. Oldaker, The Library, University, Edmund Street, Birmingham. Another interesting announcement which appears in the *Bulletin* is that the Council of University College, Reading, has decided, following the example set by Birmingham and already followed by Armstrong College, to form a standing Research Board to take responsibility for the promotion of research and the allocation of available funds. Evidence of the strength of the movement for promoting associations of university *alumni* and *alumnæ* is afforded by the announcement that the membership of the Leeds University Old Students' Association has increased since February 1924 from 500 to 1000.

THE Air Ministry announces that seven hundred aircraft apprentices, between the ages of fifteen and sixteen and a half years, are required by the Royal Air Force for entry to the Aircraft Apprentice School at Halton, Bucks, in January next. These apprentices, who must be well educated and physically fit, will be engaged as the result of two examinations, one an open competition conducted by the Civil Service Commissioners, and the other a limited competition carried out by the Air Ministry in conjunction with the local education authorities throughout the country. Since the aircraft apprentice scheme was inaugurated in 1920 approximately 2000 boys have completed their training and are now at work in service squadrons both at home and abroad, while approximately 3000 boys are now regularly undergoing training. Application to sit in the open competition must be made to the Secretary, Civil Service Commission, Burlington Gardens, W. 1, not later than September 3. Candidates for the limited examination should make application, if they are still at school, to their headmasters with the view of securing a nomination from the education authority responsible for the school. If they have left school, application should be made to the Advisory Committee for Juvenile Employment in their area. Applications must be received by the Air Ministry from nominating bodies by October 6. The syllabus for both examinations consists of mathematics, experimental science, English and a general paper. Copies of the regulations for entry (A.P. 134) can be obtained on application to the Secretary (M. 1), Air Ministry, Kingsway, W.C.2.

EDUCATIONAL research in America is greatly helped and stimulated by the publication by the Bureau of Education at short intervals of up-to-date bibliographies. We have just received a 30-page pamphlet giving some 500 references on higher education. There are no less than twenty references on the application of intelligence tests to candidates for admission to college and to undergraduates. In Columbia College intelligence tests have been used continuously since 1919 and have been found very useful. The Thorndike test of intelligence for high-school graduates has been found the best single criterion for admission to the college, and the Thorndike special intelligence test, used in the Columbia Law School, predicts success in the school better than the average college grade does. These and other similar data were published in an article by the assistant professor of educational research in Columbia University contributed to the March issue of *School Life*.

Early Science at Oxford.

August 5, 1684. A Discourse of Sir William Petty's, concerning Land Carriages, was read.

A Discourse concerning Digestion, and ye ferment of ye stomach, drawn up by Mr. Lee of Brazennose College, was read, and will be printed in a little time.

Some Seawater sweet'ned lately by Dr. Plot, Mr. Lee, and Mr. Musgrave, was shewn ye Society, and judged to be not in ye least salt to ye tast, and fit for use.

Dr. Plot presented ye Society with some of ye *Pindes*, from ye Coast of Guinea; of which substance ye inhabitants make their bread, and severall meats; it seems to be a round seed: He also comunicated some sawdust of a wood from Jamaica (ye name of which as yet wee know not) which being put into cold water, did in some few minutes, tinge the water of a delicate mulberry color.

Dr. Gibbons gave ye Society an account of a well near Cambden, ye water of which (as he is informed) tinges with galls, a day, or two, after it is taken from ye spring, then intermits for eight or ten days, and after that tinges again: he promises a more full account of this matter. An Account of ye weather ye last month, taken (as usually) according to Dr. Lister's scheme, was brought in by Dr. Plot.

The Society was informed, that Mr. Lee of Brasenoze College has lately received a letter from a friend of his in Lanchashire, who lived severall years at Tangier, and assures him, that, during ye time of his stay there, he enquired into ye nature of ye current at ye Streights Mouth, by letting fall lines with weights at ye end of them, and that, which way soever ye upper Current went, ye lines were driven outwards; of which he sent this account to Mr. Lee, takeing ye occasion from what he finds printed by Dr. Smith in ye Transactions concerning this Subject; This matter will be farther enquired into, and (if possible) a relation of it be had under ye gentleman's hand.

August 12, 1684. Ye Minutes of ye Dublin Society, from June ye 9th, to July ye 21st, 1684, being read distinctly, and considered, it was ordered that Mr. Ash, and Mr. Molineux be desired to impart their observations on ye last solar ecclipse, to be printed with those made at Greenwich, and Oxon.

It is also desired, that Mr. K— would be pleased to comunicate an account of his Mesolabe. Ordered that Dr. Pitt be desired at his leisure to draw up, and communicate to this Society, his thoughts concerning Digestion.

Sr Wm. Petty's paper of Land carriages, read ye last Meeting, enquiring into ye reason of ye Dishing of cart-wheels, Mr. Walker was pleased to communicate these lines concerning it. (*One* reason of ye Dishing of Cart-wheels seems to be this; when one wheel falls into a Hole, or deep cartrut, so that most of ye weight lyes upon it, then ye lower part of that wheel stands more perpendicularly to ye plain of ye Horizon, and consequently bears ye weight better than if ye wheel were plain, and not dish't.)

A letter from Dr. Turberville of Salisbury was read, it gave an account of ye three following cases.

1 The *Bursa Oculi*, which was in ye white of ye eye, under ye upper lid, an empty purse, no matter in it, and hung flagg about ye length of a thumb nail.

2 Another had no visible disease in his eyes, but could not see at all without squeezing his nose with his fingers, or saddling it with narrow spectacles, and then he saw very well: him ye Doctor carried to Mr. Boyl. 3 Another from Banbury, a Maid of 22 or 23 years old, could see very well, but no color, besides black and white. She saw Scintillations by night, that much terrified her.

Societies and Academies.

LONDON.

Royal Anthropological Institute, June 9.—Shams-ul-ulama Dr. Jivanji Jamshedji **Modi**: The daily life of a Parsee of the seventeenth century, as described in the Persian Farziât-nâmeh of Dastur Darab Pâhlan. The daily religious duties began with early rising at the crowing of the cock (a sacred bird, not to be killed for food, and even requiring a kind of sacred burial), followed by a recital on, or very near, the bed, of Ashem Vohu, a sacred formula of prayer in praise of Asha (Sanskrit *rita*; English, right). This was followed by the application, on the exposed portions of the body, of *nirang* or *gaomiz*, *i.e.* the urine of a cow (*gao*), held by the ancient Aryans as a purifying substance. The application was followed by an ordinary ablution or, in special cases, by a bath. This was followed by a prayer, and there were five periods during the day for such obligatory prayers. The ablution or bath was accompanied by the untying and re-tying of the *kusti*, or sacred thread, which a Parsee had always to put on, on a sacred shirt, as symbols of his religion. The ablutions with the requisite ritual were required after calls of nature and before meals, which began with the recital of grace. A morsel was set apart for the dogs of the house or street, semi-sacred animals useful for various purposes. For his daily diet meat may be used as little as possible, and, for that purpose, not healthy but weak animals were to be killed. It was his duty to kill noxious creatures such as serpents, scorpions, mice, and the like. All kinds of scepticism in religious matters were to be avoided. A serious and solemn view of all daily actions had to be taken, and recitals of prayers for the blessing of God upon them were required. The day ended with a recital of prayers.

Linnean Society, June 11.—W. **Bateson**: Pelargoniums and the production of bud-sports. Sports are probably due to the emergence of a distinct, previously existing component, originally formed by somatic segregation at an early stage. Not very rarely the hidden component, perhaps most often a dominant, forms the central core of a periclinal system, emerging regularly in buds formed adventitiously on roots of inverted plants. Not improbably the whole root belongs to the inner component. Mosaic chimæras with islands showing a dominant also occur. A growing point arising in such an island forms a periclinal with the dominant external. The core on emergence is frequently still mosaic.—F. **Eyles**: Remarks on the flora of Southern Rhodesia. The type occupying a larger area than any other is the open forest, with trees widely spaced, not often exceeding 50 ft. in height, with a sparse undergrowth. From the ecological point of view, water is the chief controlling factor: the edaphic influence is also considerable; while temperature has less effect on distribution, owing to the relatively small degree of local and seasonal variation. Rainfall occurs in two clearly defined seasons, namely, six months of wet season and six months of dry season; therefore all perennials must be adapted to face and survive six months of drought every year. This necessity is met in the usual way.—W. **Garstang**: On the origin of the crustacean carapace. The cephalic shield is regarded as having arisen as a larval organ, in response to larval needs. It is assumed that the proximate ancestors of Crustacea, prior to the development of a cephalic shield, were essentially trilobites of lower Cambrian type, and that the larvæ were discoidal and fitted only for

flotation. Thus the so-called "typical" nauplii of Copepoda, etc., with powerful rowing antennæ, are less primitive than the discoidal small-limbed nauplii of Limnetis and Cirripedia. On the development of post-cephalic segments, the trunk-rudiment sinks below the plane of the head, and the head repairs the breach in its suspensory disk by an outgrowth from behind. This is claimed to have been the origin of the carapace—a larval adaptation to lengthen the pelagic phase. Finally, on the larvæ sinking to the bottom, the carapace, as a result of its successive adaptations to pelagic conditions, was a structure big enough to be made use of for a variety of modes of adult life.

Mineralogical Society, June 16.—A. **Hutchinson**: (1) The use of the stereographic protractor for the interpretation of Laue crystal photographs. By a slight modification, the stereographic protractor previously designed by the author can be used for the interpretation of Laue photographs. (2) The use of alignment charts in crystal optics. The alignment charts in common use amongst engineers can be applied to the calculation of refractive indices measured on the total refractometer.—H. E. **Buckley** and W. S. **Vernon**: The crystal-structures of the sulphides of mercury. The powder method of X-ray analysis showed that the precipitated black sulphide is cubic, with the symmetry of the natural metacinnabarite and with an arrangement of atoms like that of zinc blende, $a = 5{\cdot}85$ Å.U., d (Hg-S) $= 2{\cdot}54$ Å.U. In cinnabar the arrangement of the mercury and sulphur atoms is a rocksalt one, slightly compressed along the trigonal axis and with a slight readjustment of atoms parallel to the basal plane, $a = 4{\cdot}16$ Å.U., $c = 9{\cdot}54$ Å.U., $c/a = 2{\cdot}291$. The type of movement in best agreement with the symmetry is D_3^4. In cubic mercuric sulphide each atom has four oppositely charged neighbours at a distance of 2·54 Å.U., while in cinnabar two neighbouring atoms are situated at a distance of 2·54 Å.U., as in the cubic mercuric sulphide, and two others at a distance of 2·91 Å.U. These facts indicate an eccentricity of the mercury atom if the sulphur atoms are regarded as spherical. In cinnabar, in accordance with the circular polarisation, sulphur atoms run down through the structure in trigonal spirals.—Edmondson **Spencer**: Albite and other authigenic minerals in limestone from Bengal. The limestones of Cuddapah age near Raipura, Bengal, contain well-formed crystals of pure albite, apparently authigenic in origin. The crystals are tabular on the brachy-pinakoid and are lozenge-shaped. They are twinned on Carlsbad and albite laws similarly to those of the well-known Roc-tourné type, but of different habit. Accompanying the albite are phlogopite, tourmaline, and quartz crystals, all believed to be authigenic. Comparisons are instituted with similar occurrences of felspars in limestones from various European localities.—Robert **Campbell** and J. W. **Lunn**: Chlorophæite in the dolerites (tholeiites) of Dalmahoy and Kaimes Hills, Edinburgh. The dolerites of Dalmahoy and Kaimes Hills are exceptionally rich (up to 15 per cent. or more) in chlorophæite, which occurs as a vesicle mineral, as veins, and as pseudomorphs after fayalite. The mineral has a refractive index 1·498, hardness 1·5, and density 1·81; it has no cleavage and is isotropic. It shows on exposure a striking colour change from bright olive-green to black, due to rapid oxidation. From its physical and chemical characters the mineral is regarded as of a colloidal nature.—L. J. **Spencer**: Tenth list of new mineral names; with an index of authors.

Royal Meteorological Society, June 17.—J. E. **Clark**, I. D. **Margary** and R. **Marshall**: Report on the phenological observations in the British Isles from December 1923 to November 1924. In this thirty-fourth report, 365 sets of records are discussed, compared with about 120 before 1922; the N.W. half of Ireland and most of West and North Scotland are still practically bare. The year was described officially as "Dull and very wet with a very cloudy summer." Again it began mild, the four weeks to February 10 averaging 6° warmer than the succeeding four. Sudden heat-bursts again raised false hopes, and made the records of plants, insects and birds again erratic. Almost everything was much later than in 1923, and on the 30 years' average, flowers in the E. and S.E. were one to two weeks late; N. England and Scotland still more. Yet the hazel was early; blackthorn, eleven days behind in S. Britain, latest of all. Insects, appearing later, ranged from 18 days late for the honey bee to three only for the Orange Tip, with the Meadow Brown in June a week early; so too the migrants. Vegetable growth was exceptionable, and little troubled by insect plagues, though slugs, snails and fungoid troubles were bad. Tree fruit was scarce and of poor quality. Grain and hay were saved with difficulty; potatoes were often diseased, but green crops and roots were some compensation.—D. N. **Harrison** and G. M. B. **Dobson**: Measurements of the amount of ozone in the upper atmosphere. Following the general method of Fahy and Buisson, the amount of ozone present in the atmosphere has been measured by spectroscopic means. A marked connexion is found between the amount of ozone and the general pressure distribution at the surface, and a still closer connexion with the conditions at about 10 km.—J. **Baxendell**: Meteorological periodicities of the order of a few years, and their local investigation; with special reference to the term of 5·1 years in Britain. The following meteorological periodicities seem to be established: 5·1, 3·1, 2·8, 2·4, 2·2, and 1·63 years. Working on foreign and feebler English cycles, several of the shorter terms appear to be exact half-harmonics of certain of the longer ones; while there are also third-harmonic components. The 5·1-year term was found at Southport in the 'eighties, and has since been independently detected by five investigators elsewhere, two of whom have traced it back for three centuries. It is especially pronounced in the frequency of the colder wind-directions, in Lancashire and at Greenwich; but values for the term in rainfall, temperature, air pressure, severe winters, and other data, are also given.

Geological Society, June 24.—W. J. **Sollas**: On a sagittal section of the skull of *Australopithecus africanus*. Sagittal sections of the skulls of the anthropoid apes, the Hominidæ, and the Taungs skull, show that the last-named presents numerous and important characters, by which it differs from the anthropoids and makes some approach towards the Hominidæ. The claims of Australopithecus to generic distinction are justified.—D. **Parkinson**: The faunal succession in the Carboniferous Limestone and Bowland Shales at Clitheroe and Pendle Hill. The rocks form that portion of the south-eastern limb of the Clitheroe anticline which is included between the Twiston and Clitheroe faults, along with most of the scarp-face of Pendle Hill. The lowest beds appear to be of Z age, but the junction of Z and C is an uncertain horizon. The knoll-limestones pass laterally into shales and crinoidal limestones. The Worston Shale series is overlain by the *hodderense* goniatite-band, which forms a constant feature along the foot of Pendle Hill. The Pseudobilinque zone terminates below the Pendle Grit, where another goniatite (possibly *H. leion*) appears, and forms a continuous horizon just below the grit. It is suggested that the

base of the Upper Carboniferous should be drawn here. The Worston shales appear to have been deposited on a very uneven sea-floor, the irregularities being due to the mode of accumulation of the limestones, and not to interformational uplift and erosion.—Miss J. M. M. **Dingwall**: Cyathoclisia: a new genus of Carboniferous corals. Certain Tournaisian corals of limited range, which are fairly abundant in certain localities in the south-west of England and South Wales, are described. These forms agree with Clisiophyllum in their general features, but differ so markedly from the Viséan species of the genus in structural details that it has been assigned the new generic name, Cyathoclisia, suggested by Dr. W. D. Lang. The members of this genus are simple rugose corals. One species, *C. tabernaculum*, shows remarkable variability; it appears to have a limited distribution, both horizontally and vertically. So far as is known, it is confined to the south-western province of the Carboniferous Limestone. Cyathoclisia may have been developed from Palæosmilia.

PARIS.

Academy of Sciences, June 29.—A. **Lacroix**: The meteorites of Tuan Tuc (June 30, 1921) and of Phu Hong (September 22, 1887) in Cochin China. In the Tuan Tuc fall there were two meteorites found at a distance of 40 kilometres apart. These were similar, being olivine and hypersthene chondrites. The Phu Hong meteorite was a chondrite containing olivine and bronzite.—H. **Deslandres**: Complementary researches on the structure and distribution of band spectra.—G. **Bigourdan**: The topographical influences which affect the pendulum corrections employed at the B.I.H.—A. **Haller** and R. **Cornubert**: The constitution of dimethylcyclopentanone and of dimethylcyclohexanone in which alkyl groups have been introduced by the sodium amide method.—Gabriel **Bertrand** and M. **Mâchebœuf**: The proportions of cobalt contained in the organs of animals. Cobalt is found along with nickel in the organs of man and animals. Numerous data are given, together with the methods adopted for the determinations. The mode of distribution of the cobalt in the various organs is approximately parallel to that of nickel.—Charles **Richet**, Eudoxie **Bachrach**, and Henry **Cardot**: The hereditary fixation of acquired characters, proved by the stability of the displaced thermal optimum. After cultivating the lactic ferment over a long period in a medium containing a large proportion of potassium chloride, a lactic bacillus is obtained possessing two new characters; resistance to potassium chloride is increased and the thermal optimum is strongly displaced in the direction of a higher temperature. These acquired characters have proved to be stable.—Rollet de l'**Isle**: The method of elaboration and of publication of international scientific and technical vocabularies.—R. H. **Germay**: The periodic integrals infinitely near partial differential equations of the first order.—Armand **Cahen**: The continued fractions attached to operations about one unit above or below.—Léon **Pomey**: The determination of the integrals of differential equations by general initial conditions.—J. L. **Walsh**: The position of the roots of integral functions of genus one and zero.—D. **Menchoff**: The summation of series of orthogonal functions.—G. **Fayet** and A. **Schaumasse**: The next return of Borrelly's periodic comet (1905 II. = 1911 VIII. = 1918).—André **Planiol**: The calculation of the yield and heat balance of explosion motors.—Louis **Breguet**: The output from apparatus utilising the energy of the wind.—G. **Bouligand**: An approximate method for studying the movement of certain vortex rings.—A. **Marcelin**: Superficial solutions and the law of Gay-Lussac.—René **Delaplace**: The extension of the law of Gay-Lussac to superficial solutions.—L. **Riéty**: The electromotive force of filtration. Aqueous solutions (1 per cent.) of various iron salts, forced through a glass tube under a pressure of 25 atmospheres, gave rise to potential differences between −0·070 volt and +0·21 volt. The results are discussed from the point of view of the rules given by Perrin. The solubility of the glass and the hydrolysis of the salts employed influence the sign of the electric charge.—E. **Delcambre** and R. **Bureau**: The propagation of short (Hertzian) waves. Details of the peculiarities noted for distances between 1500 and 10,000 kilometres in the propagation of short waves emitted by a transmitting station installed on the vessel *Jacques-Cartier*.—A. **Perot** and M. **Collinet**: The variation of the wave-length of the absorption lines of iodine with the density. The same weight of iodine was placed in two tubes of the same diameter but of different length, both being heated in the same electric furnace to 180° C. The variation of the wave-length was measured by a new interference method.—Pierre **Daure**: The determination of Avogadro's constant by means of the light diffused by ethyl chloride. The value found was $N=(6\cdot5\pm0\cdot65)10^{23}$.—R. de **Mallemann**: The diffusion of light and Kerr's constant.—L. **Meunier** and André **Bonnet**: The fluorescence of fisetine in Wood's light applications. Certain bark extracts taken up on acetyl cellulose give a characteristic fluorescence in Wood's light. The reaction has applications in analysis.—J. **Laissus**: The cementation of iron alloys by chromium.—R. **Hugues**: The annealing of electrolytic iron in a vacuum. The iron was heated in an electric furnace specially designed to reduce leaks due to porosity. Data are given showing the amount and composition of the gases evolved, and changes in magnetic and mechanical properties.—Gérard H. **Lafontaine**: Contribution to the study of the equilibrium of magnesium carbonate in ammoniacal solutions.—A. P. **Rollet**: The solution of nickel in sulphuric acid under the influence of the alternating current.—J. **Errera** and Victor **Henri**: The quantitative study of the ultra-violet absorption spectra of the dichlorethylenes. The *trans* derivative absorbs more than the *cis*, and the difference increases for the shorter wave-lengths. The absorption differences are the same in the pure liquids as in solution in hexane or in alcohol.—L. **Royer**: The regular joining of crystals of different species.—E. **Rothé**, J. **Lacoste** and Ch. **Bois**: Seismological observations made on the occasion of a violent explosion. Advantage was taken of the detonation of 3250 kilograms of high explosive in a mine to carry out seismological observations with two types of apparatus, a seismograph of the Mainka type installed in a mine five kilometres from the place of the explosion, and a 19-ton pendulum recently set up in Strasbourg seismological station 142 kilometres from the explosion. The latter instrument gave 2600 metres as the velocity of wave transmission.—P. **Lavialle**: The nutrition of the embryonic sac in *Knautia arvensis*.—Raoul **Combes**: The migration of nitrogenous substances from the leaves to the stems in the course of autumn yellowing.—F. van **Gaver**: Concerning the bony head and dentition of a young Asiatic elephant.—Emile F. **Terroine**, Mlle. S. **Troutmann** and R. **Bonnet**: The energy yield in the growth of micro-organisms as a function of the concentration of the nutritive substances of the medium and the food excess present.—Mme. L. **Randoin**, J. **Alquier**, Mlles. **Asselin** and **Charles**: The food equilibrium and relative proportions of mineral salts and glucides of a ration.—L. J. **Henderson**: The application of the nomographic method to the study of the

respiratory phenomena in the blood.—**Caridroit** and **Pézard**: The autonomous testicular growth in the interior of autoplastic ovarian grafts in the domestic fowl.—S. **Kostytschew** and A. **Ryskaltchouk**: The products of the fixation of atmospheric nitrogen by *Azobacter agile*. The experiments lead to the conclusion that the Azobacter produces ammonia by the direct reduction of atmospheric nitrogen: the ammonia is afterwards utilised for the synthesis of amino acids.—A. **Blanchetière**: The colour reactions of tryptophane with aldehydes.—Raymond **Hamet**: A new case of inversion of the effects of adrenaline.—René **Fabre** and Mlle. E. **Parinaud**: Study of the dissociation of the salts of narcotine and the best conditions for the extraction of this alkaloid in toxicology. It is possible to extract with organic solvents the whole of the narcotine from solutions of its salts. This is due to the marked dissociation of the salts in solution.—**Vernadsky**: The pressure of living matter in the biosphere.—L. **Fage** and R. **Legendre**: The swarms of a polychetal annelid (*Polyophthalmus pictus*) observed while fishing with a submerged light.—Arthur **Grimberg**: The treatment of external tuberculosis by a colloidal extract of Koch's bacilli. Details of the treatment are given; it has cured more than 50 per cent. of the cases and improved the condition of a further 25 per cent.—Et. **Burnet**: The differentiation of Paramelitensis by flocculation under the action of heat.

CALCUTTA.

Asiatic Society of Bengal, May 6.—C. J. **George**: Root sucking aphids of Coimbatore.—C. **Chilton**: The Amphipoda of Tale Sap. This is an instalment of the "Zoological Results of a Tour in the Far East." Eleven species are examined. Of these nine are the same as those from the Chilka Lake. One species is described as new. Two additional species from other localities are included in the report: one, *Grandidierella gilesi* from Patani River, a short distance to the south, on the same coast as Tale Sap; the other, *Colomastix pusella*, from Port Weld, on the other coast of the Peninsula.—D. N. **Majumdar**: The traditional origin of the Hos, together with a brief description of the chief Bongas (Gods) of the Hos.—Hem Chandra **Das-Gupta**: A few types of sedentary games prevalent in the Central Provinces. The plays described are *atharaguliala teora, dash-guli, gol-ekuish, kaooa*, and *sat-gol*, and the description is based chiefly on the information gathered from a few villagers of Gosalpur, in the district of Jubbulpur.—H. **Chaudhuri**: A study of a disease of garden peas (*Pisum sativum*) due to *Sclerotium rolfsii*. The causal organism was isolated from the soil and the plant tissues. Infection occurs through wounds only, and especially through wounds in the collars. The fungus was grown in various media, the P_H value ranging between 5 and 7·8; range of temperature, between 10° C. and 33° C. Light is not an important factor in sclerotium formation, but dry atmosphere is favourable. Perfect sterilisation was obtained by autoclaving soil in pots (30 lb. for ten minutes).—Satya Churn **Law**: Local names of some birds of the Manbhum District.

SYDNEY.

Linnean Society of New South Wales, March 25 (Jubilee Meeting).—R. H. **Cambage** (Presidential address): Need for a botanical and soil survey of New South Wales. The growth and distribution of native plants are regulated by many factors, and therefore it is not possible to say definitely what a soil may produce without knowing all the facts governing its situation and accompanying conditions. Subject to climate, the geological formation is a most important factor in regulating the growth and distribution of plants, and this is made manifest by the accordance in the changes of plant associations and of the rock formations. For ages the native flora has investigated the chemistry and physical characters of the soil in Nature's laboratory, and the result is available for our study and our benefit in the indigenous vegetation which for so long has been allowed to work out its own destiny unmolested by invasions of either fresh fauna or flora. Full advantage of the information at our disposal can be best achieved by a careful botanical and soil survey of our State so far as is reasonably possible.—W. F. **Blakely**: The Loranthaceæ of Australia. Part VI. Deals with 10 species and 8 varieties belonging to the subgenus Dendrophthæ; two old species are rehabilitated, and 1 species and 4 varieties are offered as new.—G. D. **Osborne**: Geology and petrography of the Clarencetown-Paterson District. Part III. A study of the main glacial beds at Seaham. The total thickness of strata is measured at 1890 feet. Some structures, produced by the dragging force of moving ice, are characteristic of glacial beds developed close to an ice-front, in contrast with the facies exhibited by glacial deposits laid down at a distance from the ice-front.—Ida A. **Brown**: Notes on the occurrence of glendonites and glacial erratics in Upper Marine Beds at Ulladulla, N.S.W. The glendonites occur in the Ulladulla mudstones, the lowest beds of a marine series, on a horizon which may be correlated with the Huskisson beds farther north. They occur in mudstones closely associated with fossil beds, but have not been found in overlying mudstones which do not contain abundant fossils.—A. **Philpott**: On a remarkable modification of the eighth abdominal segment in *Lindera tessalatella* Blanch., with a description of the male and female genitalia.

VIENNA.

Academy of Sciences, April 30.—F. **Werner**: New or little-known snakes in the State Museum of Natural History at Vienna. Four new genera and eight new species of Colubridæ are included.—C. **Doelter**: The effect of pitch-blende on mineral colours. Radium produces effects in a few days, while pitch-blende requires some months.—R. **Kreman** and K. **Zechner**: On the influence of substitution in the components of binary solution equilibria. (xlviii.) The binary systems of azobenzol with acids. (xlix.) The binary systems of cinnamic aldehyde and salicylic aldehyde with phenols. (l.) Binary systems of acids and amines by R. **Kreman**, G. **Weber** and K. **Zechner**.—R. **Kreman** and A. **Hrasovec**: Electrolytic conduction in molten metal alloys. Attempts at repression of diffusion of metals in quicksilver by means of continuous current.—G. **Weissenberger** and F. **Schuster**: Organic molecular compounds. (x.) Vapour pressure curves. (xi.) Dolezalek's theory. (xii.) With H. **Pamer**. (xii.) Chloracetic acids and penta-chlor-ethane.—J. **Zellner**: Contributions to the comparative chemistry of plants. (x.) Chemistry of barks. Elm, alder, walnut, plane-tree have been examined. (xi.) F. **Stern** and J. **Zellner**: On *Sonchus arvensis*.—W. **Konrad**: Time curves of the Tauern earthquake of November 28, 1923.

Official Publications Received.

Scientific Papers of the Institute of Physical and Chemical Research. No. 28: On the Doublets and Triplets in the Spectra of different Elements. By Yoshikatsu Sugiura. Pp. 31. 35 sen. No. 29: Sur la toxicité du thiophène pour le nickel catalyseur et une autre action du cuivre catalyseur. Par Bennosuke Kubota et Kiyoshi Yoshikawa. Pp. 33-50. 20 sen. No. 30: A Classification of Enhanced Lines of various Elements. By Masamichi Kimura and Gisaburo Nakamura. Pp. 51-69 +4 plates. 45 sen. No. 31: Classification of Enhanced Lines of various Elements. 2: Spectra of Intermittent Arc shunted by a Condenser. By Masamichi Kimura. Pp. 71-79+1 plate. 20 sen. (Tokyo: Komagome, Hongo.)