NATURE

SATURDAY, DECEMBER 11, 1926.

CONTENTS.

Editorial and Publishing Offices:
MACMILLAN & CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.

Telephone Number: GERRARD 8830.
Telegraphic Address: PHUSIS, WESTRAND, LONDON.

NO. 2980, VOL. 118]

The China Indemnity.

ALTHOUGH the situation in China is now such that the present would scarcely seem an opportune occasion for the discussion of methods of educational development, a note of optimism and reassurance is not absent from the Report of the Advisory Committee established under the China Indemnity (Application) Act 1925, which was presented to Parliament last week.[1] This Committee, it will be remembered, was constituted to advise the Secretary of State for Foreign Affairs on the methods of applying the so-called Boxer Indemnity to purposes "beneficial to the mutual interests of His Majesty and of the Republic of China." When the Committee took up its duties at the beginning of 1926, it decided to send a delegation of six of its own members—three English and three Chinese—to investigate conditions on the spot. The report of this delegation occupies four-fifths of the report of the Committee.

The report of the delegation is in many respects an illuminating document. While it does not, indeed, deal with matters not strictly germane to the inquiry, it serves to throw light on many of the political, social, and economic difficulties of the moment. Although it bears witness to the courtesy and assistance the delegation received at the hands of the Chinese, official and other, not the least of the difficulties encountered arose from the suspicion prevalent among the Chinese that the motives of Great Britain were not disinterested. This attitude was undoubtedly due to a misunderstanding, and the delegation thought it expedient to publish an explanatory memorandum with the object of removing it. So strong, however, was the impression made on the members that they recommend that the future management of the fund should be in the hands of a board of trustees established in China, who will supersede the advisory committee. In this way, it is considered, it will be possible best to fulfil the desire to administer the fund according to Chinese ideas. The board will consist of eleven members, of whom six will be British and five Chinese. After 1945, British members may be replaced by Chinese as vacancies occur.

Before the delegation left England, a memorandum had been drawn up by the chairman of the Committee, Lord Buxton, for the guidance of the members. This had received the approval of the Chinese members. In this memorandum it was assumed that the purposes for which the indemnity was to be used were entirely educational. There was, however, a reference to the

[1] Report of the Advisory Committee, together with other Documents respecting the China Indemnity. (London: H.M. Stationery Office, 1926.) Price 3s. 6d. net.

fact that an influential body of opinion had urged that a considerable portion of the fund should be used for railways, or public works. The members of the delegation themselves were, indeed, much impressed by what they saw of the importance of agriculture and the peasant in the social and economic conditions of China, as well as by the need for improved methods of cultivation.

It is essential that these facts should be kept in mind in judging the weight of the considerations which have guided the delegation in framing its recommendations. It must be remembered that while education was the primary consideration, the needs of China as a whole, and not a section of it, as well as the desires of the Chinese themselves, had to be taken into consideration. The delegation wisely decided that provision should be made for carrying on the work now to be initiated after 1945 when the annual payments come to an end. The total fund, amounting to about 11,000,000*l.*, accruing between 1922 and 1945, is to be divided into two parts: [(*a*) an annual sum of about 350,000*l.* (out of an annual average amount of about 500,000*l.*) for immediate expenditure, and (*b*) capital for the formation of an investment fund, for which provision is to be made by raising a sum not less than 3,500,000*l.* and not exceeding 5,200,000*l.* for permanent investment. It is suggested that this be applied for some useful national reproductive undertaking, such as railways or river conservation, or if they do not provide adequate security, gilt-edge securities. This first course would ensure the desire of the Chinese that advantage should accrue from the fund to objects of national importance other than education. On the amortisation of the indemnity fund, the proceeds from the investment fund are to be applied to the continuation of the educational and other work. These proposals are endorsed by the Committee so far as the twofold allocation of the indemnity fund is concerned; but caution is recommended in dealing with the investment fund. It is calculated that the latter will produce rather more than five millions.

Turning to the proposals for immediate expenditure, it is recommended that the annual sum be applied in the following proportions:

Agricultural Education and Improvement (including 5 per cent. for famine relief and rural credit) .	30 per cent.
Scientific Research . . .	23 per cent.
Medicine and Public Health . .	17 per cent.
Other Educational Purposes . .	30 per cent.

While a number of interesting suggestions are made under each of these heads, they are in no way mandatory, and considerable discretion is to be left to the trustees in allocating the fund. These suggestions, when examined in the light of the detailed information given in the body of the report, can only be regarded as the outcome of a very clear view of the needs and possibilities of the situation. In agriculture, for example, agricultural colleges are to be established, scientific study of the culture of the silk-worm is suggested, and an Institute of Rural Economics is proposed. Under the heading of scientific research is suggested the establishment of a National Research Institute. It is generally acknowledged that provision for research is one of the greatest needs of China in higher education, and it may be noted that provision for research is also suggested as one of the objects of the subsidy for university education.

In considering the claims of what is here called "direct educational purposes," the delegation had before it a serious problem in relation to elementary education. The funds at the disposal of the trustees will be far too small to admit of any subsidy on a large scale. Further, it was felt that it was not expedient that they should assist elementary education, which is a national duty. Secondary education, however, and particularly secondary education for girls, is recognised as of importance and is to be encouraged so far as possible in the matter of staff and equipment. In university education, the provision of professorships, equipment for library, laboratory, and research are among the objects mentioned. It is interesting to note that an endowment for a chair in Chinese at the School of Oriental Studies, London, and similar provision at Oxford, Cambridge, and elsewhere, are recommended.

Some stress has been laid from time to time on the advantage in increased understanding which would accrue from the education of selected students in England. This, however, the delegation does not recommend, at least on any large scale, and the experience of the Japanese and American schemes leaves little room for doubt that this decision is sound.

Taken as a whole, the report is a document which summarises the present educational situation in China with a remarkably clear view of essentials. The work has been well done. The claims of the more urgent needs of the country have been carefully weighed and the various interests nicely adjusted. Some disappointment may be felt by those who hold that so small a sum relatively might have been better employed in an existing or new institution of university rank. Possibly, however, its wider dispersion through more numerous channels may serve the greater good in the long run by stimulating public effort in a larger number of directions when China once more becomes an organised State.

The Training of a Sociologist.

My Apprenticeship. By Beatrice Webb. Pp. xiv + 459 + 12 plates. (London: Longmans, Green and Co., Ltd., 1926.) 21*s.* net.

AMONG the various kinds of people in the world, certainly the most interesting are those who have tried to understand the meaning and purpose of human life, and express their conclusions in word and deed. It is rather astonishing to reflect how few these are, and how diverse their results. The complexities of human behaviour are such that most investigators appear to belong in some measure to the kingdom of the blind, finding only the tail or trunk of their elephant instead of the whole beast. Mrs. Webb is not without limitations, but the extent of her knowledge and the breadth of her comprehension place her among the foremost living sociologists, the more to be admired on account of the practical results of her activities. Becoming a sociologist, she also became a socialist, but of a plastic opportunist type rather than a rigid Marxian.

How all this happened to a young woman of good social standing, intended to grace the halls of conventional society, is told at length in "My Apprenticeship." In the very dawn of life and during the years of development Herbert Spencer was a significant factor. When only twenty-four, Spencer had made the acquaintance of Mr. and Mrs. Potter—Mrs. Webb's parents. They made an extraordinary impression on him, and he recorded that they appeared to him the most admirable pair he had ever seen. Spencer said of Mr. Potter: "He is, I think, the most lovable being I have yet seen. . . . I must say I felt so strongly the beauty of his disposition as contrasted with my own, that I felt more dissatisfied with myself than I have done for a long time past." The friendship thus begun lasted as long as life, and Spencer was "the philosopher on the hearth" at the Potters', in spite of the fact that Mr. Potter never could interest himself in the synthetic philosophy. When Spencer died, it was Beatrice Potter, already married to Sidney Webb, and holding opinions strongly opposed to those of the philosopher, who ministered to his broken spirit. She records in her diary of December 1903: "My old friend passed away peacefully this morning. . . . 'My oldest and dearest friend,' he has called me these last visits. 'Let us break bread together,' he said on Monday, and insisted on a plate of grapes being set on the bed and both of us eating them. 'You and I have had the same ends,' he repeated again; 'it is only in methods we have differed.'"

The contact with Spencer, and with other intellectual men who came to the house, could not fail to have potent influence. The diary of 1881 records: "Mr. Spencer's visits always interest me and leave me with new ideas and the clearing up of old ones." Growing up in such circumstances, endowed with a keen mind and a warm heart, it is not surprising that Beatrice Potter came to question the accepted views of conventional society and orthodox religion, and was much perplexed about her duty and conduct. In this state of mind she might have been converted to some religious or political faith, and have gone through life a fanatical advocate of a particular brand of salvation. Instead of this, she sought relief in contact with realities, in experiences which might reveal to her the hidden meaning of the maladjustments which she could clearly perceive.

That Miss Potter took the scientific rather than the emotional path may well have been due to her early scientific contacts; but the revelation of the workings of her adolescent mind, given with the utmost frankness, should interest any psychologist. There were certain notable limitations; thus she says: "Owing to a mental defect, which I believe is not so uncommon as it is unrecognised and unrecorded, the whole realm of poetry was closed to me: I was poetry blind, as some persons are colour blind." Yet she was not at all devoid of feeling; indeed her diaries indicate rather an excess of sensitiveness with regard to her own personality and affairs. The abandonment of orthodox religion left her with "not even an affirmation by the intellect of the existence of a spiritual power with whom man could enter into communion, but an intuitive use of prayer as, for one of my temperament, essential to the right conduct of life . . . by prayer, by communion with an all-pervading spiritual force, the soul of man discovers the purpose or goal of human endeavour, as distinguished from the means or process by which human beings may attain their ends."

Gravitating toward the field of practical sociology, Miss Potter in 1883 conceived the plan of what she now calls "a sentimental journey." Her mother's family, the Heyworths, had come from among the working classes of Lancashire and Yorkshire. The old nurse, affectionately called 'Da,' used to visit at Bacup, where some of the variously remote cousins still lived and belonged to the 'working classes.' Why not go to visit them? But, said the nurse, they are not accustomed to such grand folk. "'Oh,' cried I, jumping up with the delightful consciousness of an original idea, 'I wouldn't be Miss Potter, I would be Miss Jones, farmer's daughter, near Monmouth.'" It was so arranged, though it was difficult to break the nurse of the habit of calling her 'm'am.'

The visit was very successful, and was repeated in following years. Miss Potter was attracted by the earnest simplicity of the people. She says:

"In living amongst mill-hands of East Lancashire, I was impressed with the depth and realism of their religious faith. It seemed to absorb the entire nature, to claim as its own all the energy unused in the actual struggle for existence. Once the simple animal instincts were satisfied, the surplus power, whether physical, intellectual, or moral, was devoted to religion. Even the social intercourse was based on religious sympathy and common religious efforts. It was just this one-idea'd-ness and transparentness of life which attracted my interest and admiration. For a time it contrasted favourably with the extraordinarily complex mental activity arising in the cosmopolitan life of London—an activity which in some natures tends to paralyse action and dissipate thought."

The great opportunity and experience came to her when Charles Booth, at his own expense, undertook his investigation of the conditions of life and labour of the London people. This extended over seventeen years, and the results were published in a series of volumes which have ever since been recognised as of classic importance. Through participating in this inquiry, Miss Potter came to understand the practical problems of urban life in all its details, and also to appreciate the importance of intensive work in this field. The opinions she formed, like those developed by Booth himself, were gradually matured in the presence of an ever-increasing mastery of the facts. Charles Booth was a wealthy captain of industry, "conservative in politics and strongly anti-socialist in temper and economic views," yet he emerged from his long study with "proposals the very reverse of individualist." He conceived that it was the duty of the State to take over the control of the lives of the very poor, under a socialistic type of administration, while leaving the more capable section of society to its own devices, with individualism dominant.

Beatrice Potter had now become a well-known social investigator, and thought of this work as her chosen calling. She studied the 'sweating' problem, deciding that the real sweater is not some malevolent Jew, but the nation itself. She took up the history and results of the co-operative movement, and in the course of these studies found herself in need of certain information. "'Sidney Webb, one of the Fabian essayists, is your man,' casually remarked a friendly woman journalist. 'He knows everything; when you go out for a walk with him he literally pours out information.'" In February 1890, the diary records: "Sidney Webb, the socialist, dined here to meet the Booths. A remarkable little man with a huge head and a tiny body, a breadth of forehead quite sufficient to account for the encyclopædic character of his knowledge. A Jewish nose, prominent eyes and mouth, black hair, somewhat unkempt, spectacles, and a most bourgeois black coat shiny with wear. But I like the man. There is a directness of speech, an open-mindedness, an imaginative warm-heartedness which will carry him far."

So it came about that the apprenticeship of Beatrice Potter came to an end, and her long and happy partnership with 'the other one' began. Concerning that, we may hope to hear full particulars at some later date.

T. D. A. COCKERELL.

The Diphtheria Bacillus and Related Organisms.

Annals of the Pickett-Thomson Research Laboratory. Vol. 2, No. 2, July 1926. Pp. iv+29-203+50 plates. (London: Baillière, Tindall and Cox; Baltimore, Md.: Williams and Wilkins Co., 1926.) 42*s.* net.

THIS volume is almost entirely devoted to a study of Corynebacteria (diphtheria bacillus and 'diphtheroids'), with special reference to the importance of microphotography as an aid to their classification and identification. The writers are the Director and Pathologist of the Pickett-Thomson Research Laboratory, Drs. David Thomson and Robert Thomson.

The greater part of the letterpress is given up to a comprehensive review of the literature of the genus. Much of this of necessity covers ground very adequately dealt with in the monograph on diphtheria published by the Medical Research Council (1923), to which acknowledgment is made. A feature of the present survey which will be found very useful for reference is an alphabetically arranged list of probably all the named diphtheroids to be found in the literature, together with a short account of each and the authors' comments on the records. Chapters are also devoted to the distribution of the genus, to the pathogenicity, and to previous attempts at classification. The latter show the great complexity of the subject, the confusion resulting from the unavoidable inadequacy of the earlier attempts, and the difficulties still encountered in the present state of bacteriological knowledge.

In the system of classification advocated in this memoir, the importance of photographic records of the organism in both microscopic preparations and cultures is emphasised, though other cultural and biochemical characters are detailed. Seventy-two varieties of diphtheroids are described, with plates of each, but the total number of strains examined is not stated, and in some of the varieties the fermentation reactions are not recorded.

The routine recommended by the authors in examining a diphtheroid is as follows: The macro- and microscopic characters of the growth are observed on

standard solid and liquid media. These cultures and stained microscopic preparations are compared with photographs of diphtheroids previously examined. If the organism under investigation does not correspond with any of the existing records, it is itself photographed and added to the collection. Afterwards the fermentation reactions are examined, and in most cases the pathogenicity of the strain for the guinea-pig is tested.

From the character of the growth on testicular agar a preliminary division into five groups is made :

Group I. Non-chromogenic, profuse growers, aerobic or facultative (22 varieties).

Group II. Non-chromogenic, profuse growers, anaerobic (4 varieties).

Group III. Non-chromogenic, delicate growers, aerobic or facultative (25 varieties).

Group IV. Non-chromogenic, delicate growers, anaerobic (5 varieties).

Group V. Chromogenic, profuse growers, aerobic or facultative (16 varieties).

The variety is determined by ancillary cultural characters and morphology. The fermentation reactions give the type.

The authors agree with the writers of the diphtheria monograph in deprecating the naming of individual members of the genus and suggest that individual strains be designated by a Roman numeral indicating the group, a fermentation formula showing the type, and a number giving the variety.

Whilst a study of the authors' plates and accompanying descriptions shows that much time and labour have been expended on the work, the mass of detail is so great that the general impression given is one of great complexity. Indeed, the authors themselves at times seem to have some difficulty in deciding the position of a strain. They appear to desire to emphasise the great variety of diphtheroids encountered in routine examinations. Few, if any, modern bacteriologists will dispute this point, but what those who have had most experience of the genus will feel is that, owing to the variations, especially in morphology, to which the genus is liable, any method of identification in which morphology and minor cultural characters play an important part must hold the possibility, nay, the certainty, of many errors, especially if, as the authors seem to contemplate, the organism is 'placed' on the evidence of a single examination.

It is claimed by the authors that this difficulty can be overcome by the use of a satisfactory medium, but this we are inclined to doubt. Whilst the more obvious cultural characters, such as thickness or thinness of growth, on which the authors base their primary grouping, will, as a rule, remain constant on any given medium properly prepared, variation in the finer points may occur even on the same batch of medium, and morphology is notoriously variable. A sentence in the Medical Research Council's monograph would seem to be conclusive on the latter point. "When different portions of the same serum slope are examined, very great differences may be detected in the proportion of the different (morphological) types." The reference is to the diphtheria bacillus and not to diphtheroids, but though it is true that in many diphtheroids the number of morphological types present is smaller than in *C. diphtheriæ*, in others considerable pleomorphism exists. Indeed, many such are shown in the authors' plates.

The book is well printed and the great majority of the photographs well reproduced. The latter, with the accompanying notes, are of considerable value in demonstrating the great variety of morphological and cultural characters to be found among Corynebacteria.

The volume also contains a further note by Dr. David Thomson on the pleomorphic Gram-negative bacillus associated with measles, and a paper on the etiology of tuberculosis in relation to satisfactory immunisation in cattle by Dr. J. J. Thomson.

M. M. B.

British Late Palæolithic Industries.

The Upper Palæolithic Age in Britain. By D. A. E. Garrod. Pp. 211+3 plates. (Oxford: Clarendon Press; London: Oxford University Press, 1926.) 10*s.* 6*d.* net.

THIS book indeed fills a gap. Not since 1897, when the second edition of Evans's "Ancient Stone Implements . . ." appeared, has there been any attempt to study systematically the palæolithic history of Britain. The present volume only deals with a small portion of the story, but it is to be hoped that the author will not stop short and that further work on the other periods will appear later to complete the picture.

Miss Garrod has learnt her subject in France under the Abbé Breuil and others, and her terminology and indeed her whole thought is French. The reader who is not familiar with the French classifications may find himself now and then at sea, but clearly the present volume is intended rather as a book of reference for the student of the subject than as arm-chair reading for the casual inquirer. As such it amply fulfils its purpose. There are numerous illustrations.

Britain is divided into geographical areas, each of which is dealt with in a chapter, but Miss Garrod is careful to point out that this method is only employed for convenience' sake and that no idea that each area shows a different culture is implied.

After a charming little preface in French by Breuil and a short introduction, Devonshire finds are discussed, and, as will be expected, Kent's Cavern is given a foremost place and occupies the lion's share of the chapter. This is the first time that the most important British cave site has ever been systematically described. Except for a note on Bench Cavern, Brixham, other palæolithic finds of the county are omitted. Neither the Tor Bryan Caves situated near Denbury, nor the Happaway Cave, Torquay, nor the cave at Cattedown near Plymouth, where human remains were found, appear, though they are all mentioned by Evans. Would it not have been well at least to have catalogued them, even if unimportant?

The next area discussed is South Wales. Here comes an excellent condensed account of Paviland. Some notes on several other small caves in the district follow. A few pages (with figure) on King Arthur's Cave in the Wye Valley form the third chapter, but as this district is at present being investigated by the Spelæological Society of the University of Bristol, it is probable that a second edition will show a considerable amplification here.

An account of the Mendip region follows, including Aveline's Hole, Gough's Cave, Wookey Hole, Hyena Den, etc. Although the first of these has been published by the Spelæological Society of the University of Bristol in its *Proceedings*, it has not attracted hitherto all the attention it deserves.

The North Welsh caves are next passed under review, and this chapter is all too short; the district calls for further investigation in the field.

After a note on the Victoria Cave, Settle, Yorkshire, the Derbyshire caves are described. Creswell Crags take naturally chief place. Mr. L. Armstrong's recent and still unfinished work there has revolutionised our ideas on the industries found. To a certain extent, therefore, Miss Garrod's account is necessarily an epitome of that published in the *Journal of the Royal Anthropological Institute* for January 1925, but none the less, here as elsewhere, she has carefully studied the finds in person.

The book concludes with a second part containing notes on a few open-air finds that are possibly Palæolithic in culture, followed by a short sketch on some transitional industries, and finally a general summary and conclusions, bibliography, etc.

The treatment of the earlier part of this section is perhaps too slight. Surely any account of the open-air sites in eastern England should form part of a much larger discussion on the whole problem of the surface finds of East Anglia, some of which may be quite possibly Upper Palæolithic in age. Lastly, may one dissent from the use of the term 'Creswellian' for those late Palæolithic cultures occurring on the edge of the Magdalenian world, which, though derived from the same basal Neanthropic stock, did not actually develop into the Magdalenian culture. Late developments of the Aurignacian culture are found all round the periphery of the Magdalenian world, and show more or less influence from the splendid Magdalenian culture of France. There is a danger that the name of a species would be given to the genus and that the term 'Creswellian culture' would become on a par with the term 'Cromagnon race'—that unfortunate use of the name of a site where one modification of the Neanthropic race was found, for the race itself.

One can only conclude by hearty congratulations to Miss Garrod. Her book is the first systematic account of the Upper Palæolithic cave cultures in Britain that has appeared in the light of modern knowledge, and she may justly be proud of the result.

M. C. BURKITT.

Vinegar.

Vinegar: its Manufacture and Examination. By C. Ainsworth Mitchell. Second edition, thoroughly revised. Pp. xvi+211+5 plates. (London: Charles Griffin and Co., Ltd., 1926.) 10*s*. 6*d*. net.

VINEGAR or 'Alegar,' as the body when derived from beer was originally called, has been in household use from early times; it has been the subject of organised manufacture for generations; and for 250 years in Great Britain was an object of taxation for revenue purposes—a policy which still exists in some other countries. There is therefore a wealth of interesting historical material from which Mr. Mitchell has been able to draw in this manual on vinegar.

The early story of vinegar and its manufacture, the legislation affecting it, the theories advanced to account for acetic fermentation, as well as illustrations of the apparatus in use a century ago, some of it surviving in a few cases to-day, form a considerable part of the book. But modern processes of manufacture have not been overlooked, and on this portion the author speaks with the authority of an experienced worker.

The manufacturing details and the treatment of the crude vinegar show how the factors used by chemists a quarter of a century ago for determining the purity of a vinegar, as well as the definition of what is understood by vinegar, need revision. An effort has, indeed, recently been made in a Bill before Parliament to lay down a definition of vinegar, but the author does not refer to this although he gives the proposals on the same point put forward by the Vinegar Brewers' Association in 1908.

The methods for the examination of vinegar are on

the whole fairly complete, although reference has to be made to the appendix for some of these. A full description of the method for the determination of arsenic by the Marsh zinc and acid method described in a report to the Royal Arsenical Commission in 1901, is included, but it would have been as well to record that the Commission had also before it the electrolytic method which is now very largely used.

It is unfortunate that the appendix has been used to describe several pieces of modern work, instead of their inclusion in the text in this 'revised' edition. Thus, in reading the account of the manufacture of acetic acid in Chap. v., there is a sense of loss that no reference is made to the synthesis from acetylene. This, however, is given in the appendix, together with other matters such as the modern classification of acetic bacteria suggested by the American Society of Bacteriologists in 1920. The book would have been more clearly up-to-date if these had been included in their relevant places in the text.

The appendix also gives a list of the import duties of different countries on vinegar and acetic acid, presumably as a guide to intending exporters. It would have been of advantage to give also the definitions for the various types of vinegar which have been adopted by some of these countries with which imported vinegar must conform.

The book is, however, a very useful addition to technical literature.

Our Bookshelf.

Zoologie im Grundriss. Von W. Stempell. Dritte Lieferung. Pp. 337-512. 6·90 gold marks. Vierte Lieferung. Pp. 513-688. 6·90 gold marks. Fünfte Lieferung (Schluss des Werkes). Pp. xx + 689-900. 10·50 gold marks. (Berlin: Gebrüder Borntraeger, 1926.)

THE early portion of the third part of this text-book contains the remainder of the general account of the structure of the Vertebrata. The few pages on development might have been extended with advantage, and the systematic accounts of the classes of vertebrates also suffer from undue compression—the elasmobranchs are dealt with in 40 lines, the Dipnoi in 20 lines, and the Rhynchocephalia in 10 lines.

The succeeding section is devoted to physiology and development. A brief account of the principal inorganic and organic substances met with in animals is followed by a consideration of the various aspects of metabolism, and (continuing into the fourth part) excretion, with short accounts of pigments and animal coloration. The transformation of food into energy and the production of electricity and light are considered, and an account is given of the sense organs—especially eyes and statocysts, which are concerned in directing movement, and of the general relationships of the neurones in the central nervous system concerned in reflexes. The last section of the part deals with reproduction and development and here again the difficulties due to compression are apparent.

The fifth part opens with a brief account of heredity, followed by a section on the relation of animals to their environment and on evolution, concluding with a short chapter (9 pp.) on the descent of man. A list of books and of journals is given for the use of those who wish to pursue their studies further.

A concise summary is provided so that the student can review, by reading some fifteen pages, many of the important matters which have been dealt with in the volume.

The diagrammatic figures are for the most part good and helpful, but some of the others scarcely fulfil their functions, *e.g.* the figure of Archæopteryx would have been of much more use to the reader had its parts been lettered. At the end of the volume are one hundred reproductions of photographs made chiefly by the author, and there is an excellent index.

The book as a whole is very condensed, but the student who works through it and grasps the facts and principles set forth, if he is at the same time developing his knowledge of comparative anatomy, embryology, and microscopical structure by sound work in the laboratory, will have received an all-round introduction to the study of animal life.

Business Economics. By Sir William Ashley. Pp viii + 71. (London: Longmans, Green and Co., Ltd., 1926.) 2*s.* 6*d.* net.

NOTWITHSTANDING the growing attention which is being paid to-day to the importance of the study of economics, there is as yet no real assurance that its teachings are having any deep effect upon the minds of the great mass of business men. It may be that it is yet too early to look for this result. While economics is slowly winning its rightful place in the syllabuses of many professional examinations, it is doubtful whether either the younger or the older practical business man ever has its claims brought before him in a manner which both attracts and ensures his attention. If this end is to be achieved, it can only be through the influence of books specially written with this purpose in view, and it is within this sphere that Sir William Ashley's little book on "Business Economics" has a particular claim. It consists of a reprint of three lectures delivered by him this year at the Commercial College at Copenhagen. Its main purport is to emphasise the importance of overhead charges or expenses in the determination of business policy.

Much of the dislike and the distrust that a practical man of affairs shows towards economics spring from the difficulty he has of finding within the written page any immediate help towards the solution of the practical problems with which from time to time he is faced. Such a man seeks a definite answer to a definite question, and all he can find in the text-book is a broad answer to a broad question. His interest in economic literature is therefore never likely to develop until some practical link is established between general theories on one hand and particular problems on the other. By analysing the influence of overhead costs, Sir William Ashley makes an important contribution towards forging this essential link. He shows

how and why 'dumping' arises. He considers its reaction on the wage policy. He discusses the advantages and disadvantages of integration and vertical combinations, and also of the policy of broadening the basis of business. The relation of dividends to profits, with the corollary of reserves, also receives attention, and a few words are devoted to the question of publicity.

The field of business economics calls, as Sir William Ashley notes in his concluding lines, for much further investigation, and we venture to hope that he will pursue his studies and so develop this side of knowledge that it will, in his own words, "contribute to the training of efficient men of business . . . form in itself an interesting body of knowledge and . . . be a genuine mental discipline." W. H. C.

Handbuch der Pflanzenanatomie. Herausgegeben von Prof. K. Linsbauer. Lief. 15. Abteilung 2, Teil 2: Pteridophyten und Anthophyten. Band 9: Das abnorme Dickenwachstum. Von Dr. H. Pfeiffer. Pp. xii+273. 19·50 gold marks. Lief. 14. Abteilung 2, Teil 2: Pteridophyten und Anthophyten. Band 10: Anatomie der Angiospermen-Samen. Von Prof. Dr. Fritz Netolitzky. Pp. v+364. 27 gold marks. (Berlin: Gebrüder Borntraeger, 1926.)

THESE two volumes, forming part of a comprehensive series dealing with all aspects of plant anatomy, contain a wealth of detail useful to the specialist and, expecially in the case of Pfeiffer's book, not without considerable interest to the general botanist. Pfeiffer deals essentially with the various types of anomalous secondary thickening found in lianes and perennial storage organs, the detailed consideration of which, arranged under numerous headings, occupies the greater part of the book. The introductory section includes a brief summary of the present views as to the causal interpretation of the phenomena concerned and a useful oversight in tabular form of the occurrence of the different types of anomalies in the various Phanerogamous families. The treatment of a large mass of (in part) rather unconnected facts has been successfully accomplished, but a rather fuller consideration of fleshy roots might have been useful. The illustrations are somewhat scanty—in particular figures showing successive stages in development of anomalous structure might have been more freely included.

Netolitzky's treatise on the anatomy of Angiospermous seeds, which traverses a very large body of literature, deals with the subject-matter essentially from the systematic point of view. Seed structure is considered family by family and the data are summarised in a table at the end of the book. One misses, however, anything of the nature of a synopsis giving the distribution of the various seed characters in families and genera, such as would facilitate identification of a seed of unknown affinity. The numerous illustrations may help to some extent to remedy this defect.

Le pH intérieur cellulaire. Par Dr. Paul Reiss. Pp. 135. (Paris: Les Presses universitaires de France, n.d.) n.p.

THIS monograph provides an excellent summary of the literature in a field of experimental biology which is beginning to attract great attention. After a very summary statement of the theoretical physico-chemical basis from which conclusions may be drawn as to the significance of hydrogen ion concentration to the behaviour of protoplasm, a brief chronological summary is given of the main investigations in which an attempt has been made to determine a *p*H of biological interest. As the author says, when placed chronologically, these investigations do not show a growing improvement in the technique of determination of *p*H, the difficulties grappled with in earlier papers often being completely neglected by later workers.

The intention of the author is to avoid this in future by a comprehensive study of the literature of *p*H determinations of significance in biology, and a very valuable section follows in which a critical discussion is given of the use and limitations of both indicator and potentiometric methods when applied to living organisms. A brief but very suggestive discussion of the tentative suggestions as to the significance of *p*H, for example, as an internal regulatory mechanism in the organism, completes a very concise monograph that should be of real value to the experimental biologist.

The bibliography covers English and American work as well as continental, and cites a number of papers published so late as 1926. It is an additional advantage that this little monograph discusses somewhat fully the suggestive work of Prof. Vlés and his pupils, both in the development of methods of determination of *p*H and as to the significance of external *p*H on the behaviour of mixtures of protein ampholytes with different iso-electric points.

Die Tierwelt der Nord- und Ostsee. Herausgegeben von G. Grimpe und E. Wagler. Lieferung 4. Teil 7, c_1: *Bryozoa*, von Ernst Marcus; Teil 12, c.: *Pisces, Allgemeiner Teil*, von H.M. Kyle und E. Ehrenbaum; Teil 12, g_1: *Teleostei Physoclisti*, 1-5, von Georg Duncker und Erna W. Mohr. Pp. 100+104+44. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1926.) 18 gold marks.

THE present part of the "Tierwelt der Nord und Ostsee" maintains the useful character of the preceding numbers, the section by Marcus on the Bryozoa being particularly well done, comprehensive, and embodying all recent work. It receives treatment on the lines already laid down, which are to be followed throughout the whole work in dealing with each group. The full account of the habitats of the species, and a detailed key, together with figures elucidating the morphology of a large number of species, will be very valuable to zoological workers.

The general introduction to fishes given here by Kyle and Ehrenbaum comprises a rapid survey of their systematics, morphology, and biology; though necessarily brief, it is good. Systematists will find Kyle's views on classification and the phylogenetic scheme which places the Cyclostomata amongst the Chondrichtyes on a level with the elasmobranchs provocative and stimulating. Of greater service to the naturalist are the artificial keys to the families and to the eggs of North Sea species so far as they are known. Detailed descriptions of the families, species, and of their life histories are to be given in the systematic portions as they appear; the scombresociformes, syngnathiformes, Plectognathi, atheriniformes, and ammodytiformes occurring in the present volume.

Letters to the Editor.

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

The Supposed Law of Flame Speeds.

AT the general discussion upon explosive reactions in gaseous media, held in London on June 14 under the auspices of the Faraday Society, Prof. R. V. Wheeler and Dr. W. Payman presented a paper on the uniform movement during the propagation of flame, in which they emphasised their supposed 'Law of Flame Speeds,' claiming it to be applicable to all conditions of flame propagation. They added that "there is a considerable amount of evidence available that the relative speeds of the uniform movement of flame obtained under the specified experimental conditions are directly proportional to the speeds under other conditions, except during the detonation wave"; also, that the law of speeds applies to the rate of development of pressure in complex mixtures of gas with air (*Trans. Faraday Soc.*, **22**, pp. 301-306).

In a written contribution to the general discussion (*ibid.* pp. 314-320) I expressed doubts as to the general validity of this supposed 'law,' and stated that for some time past experiments had been in progress in my laboratories to test it from the point of view of the behaviour of complex mixtures of certain hydrocarbons with hydrogen and oxygen, containing an excess of combustible gases, and that we hoped to be able to publish a detailed account of the results of these experiments before the end of the year, when we would discuss further their bearing upon the 'law.'

The basis of the experimental test to which we have subjected the 'law' is one which the authors of it themselves have accepted. For in their recent paper at the Faraday Society (*loc. cit.* pp. 304-305) they said: (1) "that if a complex mixture is made by blending a number of mixtures of air with simple combustible gases all of which have the same speed of uniform movement of flame, then this complex mixture will also have the same speed of flame provided that all the mixtures are of the same type, all containing excess of oxygen or all containing excess of inflammable gas," and that (2) "an important deduction from the law of speeds is that during the propagation of flame in a complex mixture of combustible gas and air mixtures of the type we have just considered (all with the same speed of uniform movement of flame), the combustion can be regarded as involving the simultaneous but independent burning of a number of simple mixtures of the individual gases with air, in which the proportions of inflammable gas and air are such that each mixture, if burning alone, would propagate flame with the same speed as does the complex mixture." They also reported having found experimentally that complex mixtures of methane-hydrogen-and-air, containing insufficient oxygen for complete combustion, fulfil such conditions.

The experiments which have been in progress in my laboratories during the past two years upon the behaviour at atmospheric temperature and pressure of such complex mixtures as those of acetylene-hydrogen-and-oxygen, and of ethylene-hydrogen-and-oxygen, containing an excess of combustible constituents, are now completed, and the results thereof will in due course be communicated to the Royal Society. Meanwhile, I desire it to be known that in neither case have the observed flame speeds fulfilled the requirements of the 'law.' In the case of the acetylene-hydrogen-oxygen mixtures they diverged from it considerably; and for the ethylene-hydrogen-oxygen mixtures they were entirely inconsistent with it. Indeed, we have arranged an experiment, which can be shown to any one who will come to see it, affording visual evidence that the behaviour of such complex mixtures of ethylene-hydrogen-and-oxygen are irreconcilable with the requirements of the 'law.'

I am, therefore, convinced from my own experiments that, whatever degree of validity there may be in the conclusions which Prof. Wheeler and Dr. Payman have drawn from theirs, they are not universally applicable to all explosive mixtures, and therefore they cannot be vested with the authority of a natural law.

WILLIAM A. BONE.

Imperial College of Science and Technology,
South Kensington, London, S.W.7,
November 29.

Rainfall Interception by Plants.

THE work of Marloth ("Results of Experiments on Table Mountain for ascertaining the Amount of Moisture deposited from the South-east Clouds": *Trans. S. A. Phil. Soc.*, **14**, 403-408, 1903, and "Results of Further Experiments on Table Mountain for ascertaining the Amount of Moisture deposited from the South-east Clouds": *ibid.*, **16**, 97-105, 1905) on the subject of deposition of moisture from the south-east clouds on Table Mountain, has attracted much interest in meteorological circles.

Marloth used two 5-in. gauges, one bearing a 12-in.-high frame of mesh wire and 4 vertical wire supports, through which seventeen Restionaceous stems were drawn, the other being an ordinary open gauge. In 56 days the control catch totalled nearly 4 in., the vegetation-screened catching nearly 80 in., representing an *interception gain* of about 1500 per cent. During ordinary precipitation the *interception gains* were 300-400 per cent., but during misty weather they rose to 1000-1200 per cent.

de Forest ("Rainfall Interception by Plants: An Experimental Note": *Ecology* 4 (4), 417-419, 1923), working in Maryland, employed three 3-in gauges: the first bore a wire-mesh frame 12 in. high; the second bore a similar frame and in addition ten 12-in.-long imitation (tin) reeds, standing about 1·5-3 mm. apart, bent lengthwise to form interior angles of about 135°; the third served as a control. In four months (26 days measurable rainfall) the reed-clad gauge registered an *interception gain* of nearly 30 per cent.

The writer, working at Deepwalls, Knysna, South Africa (1725 feet elevation; Lat. 33·9 S., Long. 23·16 E.), has employed two 5-in. gauges 4 ft. high, standing within three yards of one another on the level ridge of an exposed hill. The first gauge bore a 12-in.-high frame of wire mesh identical with that used by Marloth; through the mesh four single branchlets of the broad-leafed conifer, *Podocarpus Thunbergii* Hook., were drawn, about thirty leaves (of 2-3 in. × ⅛ in.) being borne by each branchlet. The branchlets were arranged so that the foliage was held firmly in position, and the apex of each branchlet was placed ¼ in. below the top rim of the frame; thus an evenly spread mosaic of leaves was exposed round the gauge. Care was taken to preserve the spread and density of the foliage-screen, the leathery, persistent nature of the latter necessitating very slight adjustment during the twelve months of the experiment.

The rainfall registered by the two gauges was as follows :

Month	Control Gauge.	Vegetation-screened Gauge.
June 1925	3·96 in.	7·95 in.
July	2·66	2·73
August	3·59	6·81
September	9·04	19·49
October	6·03	12·46
November	3·91	7·20
December	4·88	7·95
January 1926	3·37	6·34
February	3·41	3·32
March	5·62	10·54
April	3·43	6·60
May	2·12	3·17
Total	52·02	94·56
Percentage	100	181·7

Summarising: (1) In one year the control registered 52 in. only, the vegetation-screened, 94 in. (2) For every month except February 1926, the vegetation-screened gauge registered the higher catch—the reason for the higher catch by the control in February being that few hydrometeors occurred, the precipitation taking the form of normal and of heavy showers. (3) A classification of rain types for the period June 1925–May 1926, shows—

79 per cent. of the rains to have been of fine, misty nature (*Nebelreissen*).

13 per cent. of the rains to have been normal showers.

8 per cent. of the rains to have been heavy downpours.

(4) Detailed readings indicate that the greater catches registered by the vegetation-screened gauge occurred as the result of the *Nebelreissen*.

The *Nebelreissen* are responsible for the deposition of large amounts of moisture upon the exposed crowns of the Knysna Forest trees, and to a lesser but still appreciable extent upon the foliage of the two 15-ft.-high Macchia or *Fijnbosch* ; the forests are usually dripping wet during *Nebelreissen*, while the ground immediately beyond their margins is comparatively dry.

The subject of *interception loss* due to vegetation has been studied by Horton (" Rainfall Interception ": *Mon. Weath. Rev.*, 47, 603-623, 1919), and by de Forest (*loc. cit.*). Horton working in Albany, N.Y., with trees and field crops, concludes that rainfall interception represents a loss of rainfall which would otherwise be available to the soil, and shows that the interception loss is greater in forests than in fields. In the summer of 1918 he found the *mean interception loss* under eleven species of trees to be about 40 per cent. of the total rainfall.

The writer has studied the interception loss in the Knysna forests as the result of the taking up of moisture by the foliage, branchlets, branches, and boles of the trees, and as the result of evaporation of thin films of moisture occurring on these parts. In one experiment two 5-in. gauges 4 ft. high were employed—the first being placed under canopy of climax high forest (*Podocarpus elongata* L'Herit. and *Olea Laurifolia* Lamk. being the dominants), the second being set under full exposure, about 200 yards distant. The elevation was 1500 feet, and the aspect southern. The results of the experiment may be summarised as follows :

(1) For the period February 1, 1923–January 31, 1925 the total catches by the gauge under canopy and by the control were 65·98 in. and 85·0 in. respectively ; that is, there was an interception loss of about 22·4 per cent.

(2) The total number of days on which 0·01 in. or more was registered, was 58 days less under canopy than in the open.

(3) Interception losses were greater during Nebelreissen or fine rains, owing to the foliage, branches, and boles taking up so much of the moisture ; heavy downpours lowered the interception loss considerably.

Observations are showing that while there is this well-marked interception loss below the trees, within their crowns the actual total catch of moisture is far greater (30-80 per cent.) than at equivalent heights in fully exposed sites.

It is hoped that those interested in the fascinating subject of rainfall interception by plants will place on record any information they may have accumulated concerning the relative importance of interception losses and interception gains. JOHN PHILLIPS.

Forest Research Station,
Deepwalls, near Knysna,
South Africa, September 26.

The Occurrence of Helium and Neon in Vacuum Tubes.

IN a letter recently published in NATURE of October 30, 118, p. 625, Prof. Baly and Dr. Riding gave an account of their more recent experiments on the appearance of the rare gases in electric discharge tubes. Under certain conditions they found both neon and helium in the residual gas, and they record one instance in which pure helium was obtained. These results confirm their earlier observations, as well as those of Collie, Patterson, and Masson (1915). The authors incline to interpret their results as due to a disintegration by the electric discharge of the nitrogen atom, the experiments having been performed in mixtures of oxygen and nitrogen, or with nitride electrodes.

Whatever may be the true interpretation of these experiments, their importance cannot be denied, for they undoubtedly reveal a phenomenon in electric discharge work the significance of which has not hitherto been adequately appreciated. There can be no doubt that the results can not be interpreted as arising from a simple air-leak, for positive results have been obtained under a great variety of conditions, and elaborate precautions have been taken to avoid contamination from outside. Nevertheless, the possibility of the diffusion of atmospheric helium and neon through the walls of the apparatus, first suggested by Lo Surdo (*Atti Linc.* (5), 30, I. p. 85, 1921), does not seem to have received the attention it deserves in the interpretation of such experiments, and it is the purpose of this note to indicate that the effect is by no means negligible.

That helium and neon diffuse through heated quartz and glass is a well-established fact, though most of the experiments on the phenomenon have been performed with these gases in a state of comparative purity, and at appreciable pressures. The effect is much greater with helium than with neon. According to experiments of Williams and Ferguson (*Am. Jour. Sci.*, 44, p. 2160, 1922), the permeability of fused silica glass to helium is proportional to the pressure and increases exponentially with the temperature, and with Pyrex glass at 610° C. the effect is about 5 per cent. of that with fused silica at the same temperature. Furthermore, O. W. Richardson and R. C. Ditto (*Phil. Mag.* (6), 22, p. 704, 1911) have shown that at 1000° C. helium diffuses from the air through fused silica more rapidly than neon.

In their remarkable work on the transformation of hydrogen into helium, F. Paneth and K. Peters (*Ber. d. D. Chem. Ges.*, 59, p. 2039, 1926) have also directed attention to the passage of helium and to a lesser extent of neon through heated glass. Even at normal temperature they were able to detect the presence of helium in their apparatus after the lapse of about a week, their arrangement being so sensitive that they could detect about 10^{-8} c.c. of helium. For this reason, in experiments of long duration they immersed their apparatus in water, when the presence of helium was not detected even after a period reckoned in months.

In experiments by Dr. J. S. Hawnt and myself, it has frequently been necessary to test our apparatus for atmospheric contamination, and in the course of this work we have also established the diffusion at room temperature of helium from the air into our apparatus, which is constructed of glass, with an attached quartz discharge tube. Thus, after the apparatus had stood evacuated for a fortnight, during 36 hours of which part of the discharge tube was heated locally by means of a sand bath at 200° C., we found, after removal of hydrogen and absorption by charcoal, that the residual gas was helium, no trace of neon being evident. The volume of helium (at N.P.T.) so obtained was greater than 10^{-7} c.c., our apparatus being capable of detecting 10^{-8} c.c. or less. In the spectrum of the excited residual gas the mercury lines and $H\alpha$ were feebly developed, but the helium lines were strong, and the colour of the discharge was that characteristic of helium in the capillary of a vacuum tube containing helium at reduced pressure. The following helium lines were well developed: 6678, 5876, 5016, 4922, 4713, and 4471.

It is well known that in heavy unidirectional induction coil discharges in vacuum tubes, particularly at low pressure, the glass walls of the bulb surrounding the cathode become very hot. Moreover, in heavy condensed discharges (with spark-gap) the capillary becomes strongly heated, whereas the bulbs remain relatively cool. In the latter case, also, if the pressure of the contained gas be increased, a greater spark-gap is necessary to get the same amount of heating in the capillary. Now these are precisely the conditions under which Baly and Riding have obtained helium and neon in their discharge tubes, and it seems practically certain that in experiments of from 60 to 100 hours duration helium in appreciable quantity, and to a lesser extent neon, will diffuse from the air through the heated parts of their discharge tubes. It would be interesting if the experiments were repeated with the bulb and the capillary respectively immersed in a jacket containing mercury or through which water was continuously flowing during the discharge. The non-appearance of the rare gases in such cases would be proof that these gases had previously diffused from the air into the discharge tubes. It should also be pointed out that by enclosing the discharge tube in an evacuated glass vessel the entrance of helium will not be prevented, for the double walls will probably both be hot at the cathode end in the ordinary discharge, and the diffusion will only be retarded owing to the greater thickness of glass through which the helium (and neon) must now diffuse.

Should the occurrence of the rare gases in electric discharge tubes really be due to their diffusion through the heated glass from the air, it is rather surprising that helium is not always more abundant than neon in the residual gas. It seems not unlikely that some other cause may also be involved in the case of neon, for neon is often present in greater quantity than helium.

Paneth (*l.c.*) has pointed out that glass has the ability of selectively adsorbing helium from a helium-neon mixture, and this may in part explain the occasional relative abundance of neon as compared with helium. A further contributory cause may be adduced from the fact that in a helium-neon mixture subjected to electric discharge, helium disappears more readily than neon, presumably due to absorption by the electrodes, sputtered metal, or the glass walls. Thus Claude (*C.R.*, 156, p. 1317, 1913) found that with 1 per cent. helium in neon the helium disappeared by absorption during the passage of the discharge, whereas in a mixture containing 1 per cent. neon in helium the neon did not disappear.

ROBERT W. LAWSON.

The Physics Laboratory,
The University, Sheffield,
November 16.

A Possible Connexion between the Wave-Theory of Matter and Electro-Magnetism.

IN de Broglie's theory a particle of matter travelling with velocity v has associated with it a phase-wave travelling with velocity c^2/v. It seems that this theory may have some connexion with Sir J. J. Thomson's theory of moving lines of force if we interpret v as a velocity of the electric line and c^2/v as the velocity of the magnetic line.

In this theory, as I understand it, a possible velocity v for a line of electric force satisfies the equation

$$H = \frac{1}{c}[v \times E],$$

where E is the electric and H the magnetic force. A possible velocity w for a line of magnetic force is, on the other hand, given by the equation

$$E = -\frac{1}{c}[w \times H].$$

Eliminating H and making use of the equation $(w.E) = 0$ we find that

$$(v.w) = c^2.$$

When v and w are in the same direction, this equation gives $w = c^2/v$. In the later developments of Thomson's theory (see, for example, H. Bateman, *Phil. Mag.* vol. 34 (1917), p. 405), expressions of type

$$H_x = \frac{\partial(\psi, \tau)}{\partial(y, z)}, \quad E_x = \frac{1}{c}\frac{\partial(\psi, \tau)}{\partial(x, t)},$$

are adopted for the components of E and H and the equations of a moving line of magnetic force are

$$\psi = \text{constant}, \quad \tau = \text{constant}.$$

Adopting also expressions of types

$$A_x = \tfrac{1}{2}\left(\psi\frac{\partial\tau}{\partial x} - \tau\frac{\partial\psi}{\partial x}\right), \quad \ldots \quad \Phi = -\frac{1}{2c}\left(\psi\frac{\partial\tau}{\partial t} - \tau\frac{\partial\psi}{\partial t}\right)$$

for the potentials, we remark that if ψ and τ both satisfy de Broglie's equation

$$\frac{\partial^2\psi}{\partial x^2} + \frac{\partial^2\psi}{\partial y^2} + \frac{\partial^2\psi}{\partial z^2} - \frac{1}{c^2}\frac{\partial^2\psi}{\partial t^2} = \frac{m^2c^2}{k^2}\psi, \quad k = \frac{h}{2\pi},$$

then we have the usual relation

$$\frac{\partial A_x}{\partial x} + \frac{\partial A_y}{\partial y} + \frac{\partial A_z}{\partial z} + \frac{1}{c}\frac{\partial\Phi}{\partial t} = 0.$$

If we assume simply (P. A. M. Dirac, *Proc. Roy. Soc.*, vol. 112 (1926), p. 670)

$$\psi = e^{i\frac{E}{kc^2}(vx - c^2t)} f_1(y, z), \quad \tau = e^{-i\frac{E}{kc^2}(vx - c^2t)} f_2(y, z),$$

$$E = mc^2\left(1 - \frac{v^2}{c^2}\right)^{-\frac{1}{2}},$$

the electromagnetic field turns out to be independent of the time,[1] but according to the above rules the lines of magnetic force can be regarded as moving with velocity c^2/v parallel to the axis of x, and the lines of electric force with velocity v in the same direction. If our function ψ can be regarded as a constant multiple of Schrödinger's ψ and τ as its imaginary conjugate, then, whenever we have an expression such as

$$\psi = \Sigma A_n e^{2\pi i \nu_n \left(t - \frac{x}{c}\right)},$$

the only frequencies which appear in the electromagnetic field are the differences $\nu_n - \nu_m$ of the fundamental frequencies.[2] We are not bound, however, to make ψ and τ conjugate complex quantities. If, for example, we put

$$\psi = \frac{hec}{Er} e^{\frac{iEt}{h}}, \quad \tau = ie^{-\frac{iEt}{h}},$$

where r is the distance from the origin, both ψ and τ satisfy de Broglie's equation and we have

$$E_x = -\frac{ex}{r^3}, \quad E_y = -\frac{ey}{r^3}, \quad E_z = -\frac{ez}{r^3},$$

$$H_x = 0, \quad H_y = 0, \quad H_z = 0.$$

The field is thus that of a simple electric pole.

H. BATEMAN.

California Institute of Technology,
Pasadena.

Patent Law and Unemployment.

THE writer of the article on the above topic has provided, in NATURE of November 13, p. 695, a very valuable graph of the number of British patents kept in force for the fourteen years' term, and has supplied useful figures of the number of foreign patents granted in Great Britain from 1900 to 1909; but I dissent from his conclusions. The former shows an almost continuous rise in the number of the fourteen-year enduring patents from 1897 onwards. This cannot be due to the retrospective action of the 1902 Act. It supports my contention that the rise is due to external industrial conditions. If the writer of the article compares his graph with the list of the numbers of foreign inventions patented here he will see that the rise or a fall in the latter is reflected in a corresponding rise and fall in the graph.

Hence I again urge that an official inquiry should be made to ascertain whether these foreign patents were taken out for the purpose of fostering or obstructing British industries. This is more material, as it is known that since the year 1900 or thereabouts British capital has gone abroad in increasing quantity (cf. Hobson, "Export of Capital"), and this fact, while it makes for national wealth, accentuates the problem of unemployment. I agree with the writer that foreign inventions patented here represent the cream of foreign inventive talent. I was wholly opposed to the foolish Act of 1919 which for a time acted as a deterrent to the foreign inventor. My contention is that if it is wished to induce the foreigner to introduce his industries here, we must stop threatening him and must offer him such better terms as will induce him to come over and help us.

E. WYNDHAM HULME.

Littlehampton, November 14.

MR. HULME'S contention that there is "an almost continuous rise in the number of fourteen-year enduring patents from 1897 onwards" can be tested numerically. For the period 1885 to 1896 the average number of such survivors was 498 per annum, the mean deviation being 4·9 per cent. and the maximum deviation 9·4 per cent. For 1899 and 1900 the figures are 509 and 508 respectively, and the deviation from the previous average, namely 2 per cent., was thus so well within the previous mean deviation that the rate of survival may be regarded as steady down to 1900 at least. Nor is the rise really great for the next two or three years. Practically the whole transition took place over the period 1904–1906, and by 1907 the figure had become so steady again that for the period 1907–1912 the mean deviation from the new average of 1210 was only 2·3 per cent., and the maximum deviation only 5·4 per cent. It is difficult to think of any cause for such a change other than the enhanced prestige conferred upon patents by the Act of 1902, as a result of increased confidence in their validity.

The rate of survival is no doubt affected by the number of patents granted to foreigners. There are other factors, however, which swamp the correlation in question, and it does not seem to be very close.

Mr. Hulme more than any one else can claim credit for having directed attention in recent years to a principle which is in real danger of being forgotten, namely, the principle that the value of a patent system must be measured by its success in fostering the establishment of new manufactures within the realm. But surely if a capitalist is to risk his capital on a manufacture which has been patented, he wishes to feel some assurance that his patent is a valid one. In proportion as his confidence is increased in this respect will he be willing to risk the necessary outlay in experimental work, plant, organisation and publicity. He has to create a new demand; and he needs to be assured that when he has done so he will not be robbed of his reward by the competition which invalidation of his patent would make possible.

THE WRITER OF THE ARTICLE.

The Oogenesis of Lumbricus.

THE letters by Mr. L. A. Harvey and Prof. V. Nath in NATURE of November 27 and December 4 require comment. With regard to Parat's 'Vacuome Theory,' I have little of value to say. Some of my associates have a leaning towards the vacuome theory, and Prof. Nath does not mention Nassonov's Protozoa work, which is certainly in its favour. One of my most valued pupils, Dr. Bhattacharya, of Allahabad, after studying in Paris, embraced Parat's views, and naturally this has had some influence on me. In the oogenesis of Patella, a form investigated by Ludford, Woodger, Rodgers Brambell, and myself, it does seem that it is the sphere-substance and not a vacuole, which forms the fat globules. Reinvestigation of this form, in view of Parat's claims, might yield interesting results. If Mr. Harvey really wants to see Golgi bodies forming yolk and fat, I commend him to Patella, where the phenomenon is very clear.

I think that the evidence for Parat's views is getting stronger, but I do not care to commit myself to any more definite expression of opinion at the present moment. I consider that Prof. Nath's very interesting attempt to co-ordinate Parat's results, and his own valuable investigations on yolk formation, should be weighed carefully by future workers on the cytoplasmic inclusions.

Mr. Harvey is ill advised to reopen a controversy on his paper. I have no intention of repeating here the substance of our reply to Mr. Harvey's paper, which Dr. Nath and I have published in the recent issue of the *Q.J.M.S.* The reader of this letter should refer to that journal.

[1] This may be avoided by using the type of solution employed by L. de Broglie, NATURE, Sept. 25, 1926.

[2] This was suggested by the remark at the end of Schrödinger's paper, *Ann. d. Phys.*, Bd. 79 (1926), p. 734.

Now, regarding Mr. Harvey's letter, it should be pointed out that my Saccocirrus work, the only paper published on annelid oogenesis before Mr. Harvey's paper, was merely quoted by him in the bibliography. It is clear that Mr. Harvey had not taken the trouble to read my work before he published his criticisms. This was a pity.

Mr. Harvey points out that his paper was more in the nature of a critique of the methods of argument used by my school. Years ago, when I had already published several papers in the *Q.J.M.S.* under Sir Ray Lankester's editorship, that great worker wrote to me a good many letters of advice. In one of these he said, "Collect as many facts as you can, avoid discussion." If Mr. Harvey will take this piece of advice to heart, it will be all to the good.

Mr. Harvey complains that I have called into question his technique and powers of observation. This is true. Mr. Harvey quotes Dr. Cowdry. I know Dr. Cowdry's work: it is very fine, but it has no bearing on Lumbricus. Dr. Cowdry has worked on vertebrate mitochondria and chondriocontes. I am dealing with the eggs of the common earthworm.

Mr. Harvey says that "Prof. Gatenby and his school are content to accept the view that yolk is a general term covering anything in the cell which cannot otherwise be identified." On the contrary, Prof. Gatenby and his school are *not* prepared to accept everything and anything, as Mr. Harvey now realises clearly. Mr. Harvey goes on to say, "Is it not time that cytologists made some attempt to bring the observations on oogenesis to as orderly state as are those on spermatogenesis?" Such an attempt has already been made by Rodgers Brambell, Nath, and myself. Mr. Harvey should read these papers *carefully*, and then sit down quietly and try to help by adding facts himself.

I am grateful to the editor of NATURE for an opportunity of seeing the letters of Prof. Nath and Mr. Harvey. I have no wish to continue this controversy.

J. BRONTË GATENBY.

Trinity College, Dublin,
November 6.

Chromosome Complements in Grasses.

THE hybridising and genetical study of grasses has reached a stage when information on their nuclear constitution is not only of general interest, but may also give guidance in elucidating problems of inheritance.

So far, we have had no recorded evidence of chromosome counts having been made in grasses, as apart from cereals.

I obtained, through the kindness of Mr. T. J. Jenkin, of the Welsh Plant Breeding Station, Aberystwyth, the use of grasses of known pedigree to carry out cytological investigations. This work was commenced in the summer of 1923 on *Lolium perenne* (Perennial ryegrass), *Lolium perenne* var. *multiflorum* (Italian ryegrass), and the hybrids derived from these two.

Anthers were selected as the organs most likely to yield the best results in the matter of chromosome counts. They were studied partly by means of microtome sections, and partly by means of the iron-aceto-carmine (Belling's) method.

The whole series of events in sporogensis was followed from the initiation of the meiotic divisions in the pollen mother-cell to the end of the homotype division.

Seven univalent chromosomes were so clearly distinguished in several phases of the reduction and homotype divisions that I can state with confidence that this number represents the haploid complement in *Lolium perenne*, *Lolium perenne* var. *multiflorum* and their hybrid progeny. The diagrammatic disposition of the seven bivalents on the nuclear plate, forming a regular hexagon with a chromosome at each angle and one in the centre, is remarkable. It is of interest to mention that I found the divisions in the pollen mother-cells of the hybrids to be quite regular, except that 'lagging' chromosomes were occasionally found.

In studying mitoses in the root tips of *Festuca elatior* (probably var. *arundinacea*) (= Tall fescue), I discovered that the exact diploid number of chromosomes was difficult to determine, since the cell is comparatively small and the crowded chromosomes fill it to a great extent. However, from my counts the full complement appeared to be in the region of forty.

The anthers of this grass were investigated later, and the reduced number of chromosomes was determined, with a fair degree of certainty, to be twenty-one.

From a preliminary study of *Festuca elatior* var. *pratensis* (Meadow fescue) I have strong evidence that the haploid number in this case is seven.

The iron-aceto-carmine method applied to the anthers of this grass was such a striking success that I was able to make a large number of counts in individual anthers.

It would thus seem that polyploidy obtains in genera of grasses, as in cereals.

GWILYM EVANS.

Agricultural Education Department,
County Offices, Dolgelley,
October 28.

The Planet Mars.

IN NATURE of November 13, p. 709, I notice the following sentence: "An objection frequently brought by M. Antoniadi against the objective reality of the canals, based on their being drawn straight when far from the centre of the disc, is answered by a careful observation of the canal Amenthes-Thoth on October 19 and 20, 1924."

This passage scarcely represents the facts, for I have shown in numerous writings since the opposition of Mars in 1909 that, in the place of Schiaparelli's *canali*, the surface of the planet very often shows either (1) complex dusky streaks; or (2) jagged edges of half-tones; or (3) isolated, irregular dark spots. Amenthes-Thoth being a Schiaparellian marking, the probabilities, according to my views, are that, in its position, there exists an irregular streak. The Thoth I saw very broad, strong, and jagged in 1911, and insisted on its abnormal conspicuousness, considered it real, and discovered the fact that its changes are not seasonal—a fact that observation has fully confirmed since. (See my Mars Report for 1911–1912, of the British Astronomical Association, pp. 116-117.)

As the writer of the note on p. 709 refers to the 1924 appearance of the Amenthes-Thoth, and as I have represented that marking in 1924 as a winding, complex, dusky streak (*Bulletin of the Astronomical Society of France*, 1925, p. 82), it is only natural that it should obey perspective. The suggestion that the marking in question is illusive is thus completely answered.

Furthermore, Prof. Pickering did not mention me in connexion with his above observation, as the text on p. 709 seems to suggest.

My position is perfectly clear: there is no geometrical network on Mars, since I have shown (1) that the linear canals vanish in a large glass

when much more delicate detail is quite plain; (2) that they disobey the laws of diffraction; and (3) that they often disobey perspective. Mr. E. W. Maunder, whose wonderful insight led to the theoretical solution of the canal question fifteen years before my observations of 1909, had already pointed out in 1894 that the linear 'canals' appear sometimes unduly straight near the limb of the planet; and I have further given a graphic demonstration of the illusive character of such appearances by the construction of spherical projections. I must continue therefore to refute any attempt to represent, as real lines, markings disobeying natural law, and I wish to express the view that the 'canal' question, in its present stage, is past serious scientific discussion.

E. M. ANTONIADI.

15 rue Arsène Houssaye,
Paris, 8e, November 15.

The "H and K" Bands of Carbon.

IN discussing the negative bands of carbon, Deslandres mentions (*Comptes rendus*, 137, p. 460, 1903) the two strong bands λ2883·86 and λ2897·11 which "are very intense, are diffuse on both sides, are of a different structure and otherwise very curious," and suggests that they may probably be due to oxygen. These bands have also been noticed by Prof. Fowler while studying the comet-tail bands, but he makes no mention of them in his papers. He calls them the "H and K" bands of carbon because of their striking resemblance to the two solar lines H and K. In a recent paper Johnson (*Proc. Roy. Soc.*, A, 108, p. 343, 1925) observes that each of these bands is resolved into two components, and he has allocated two of them to the regular negative band system. This allocation seems to be of a rather doubtful nature, for the structure of these bands is peculiar and they can be obtained alone, unaccompanied by the other members belonging to the same system.

While experimenting on the spectrum of neon under a low pressure, these two bands were prominently obtained on a photograph. The tube contained carbon and oxygen impurities, as was evidenced by the presence of the strong lines belonging to them. The bands were seen only in the uncondensed discharge, and no other bands were to be seen at all. The structure of these bands is remarkable. Each consists of three lines, a central sharp line bounded on each side by a diffuse line, the less refrangible diffuse to the red and the more refrangible diffuse towards the violet. The writer had the opportunity of examining the old plates of Prof. Fowler and verifying the wave-lengths. In those plates, however, the resolution was not sufficient to warrant accurate measurements. The following table gives the wave-lengths of the lines measured on a plate taken with a large Hilger quartz spectrograph that gave a dispersion of about 14 Å.U. per mm. in this region.

Deslandres. λ I.Å.U.	Johnson. λ I.Å.U.		Present Measures. λ I.Å.U.	ν (vac.)
	2897·15	R (3)	2897·23 d.r.	34505·61
2897·00 (10)			2896·25	34517·28
	2895·5	V (4)	2895·35 d.v.	34528·00
	2883·6	R (2)	2883·74 d.r.	34666·97
2883·75 (10)			2882·84	34677·79
	2882·25	V (2)	2881·97 d.v.	34688·26

A. S. GANESAN.

University College,
Rangoon.

The Anomalous Dilatation of Invar.

IN NATURE of November 6, p. 662, Prof. F. Zernike describes an experiment claiming to be a repetition of our dilatation measurements of invar. This experiment, however, presents considerable differences regarding the method and thermal circumstances used as well as the state of the metal.

The wire now used being 0·5 mm. in diameter has a section only 0·09 times the one used by us (diameter 1·65 mm.). Consequently, the time—about 3 minutes—during which the intermedial changes were observed by us (before contraction set in on heating) must have been a considerably reduced one. Further, on account of the wire being heated by the passage of an electric current, this time must be shortened still further. Now, such electric heating—in spite of giving necessarily a definite temperature gradient in a radial direction—may be all right for the later observations; at the very beginning, however, when a rather uniform temperature is indispensable, the temperature distribution along the specimen necessarily is a non-uniform one (say parabolic). This must reduce the intermediate dilatation as observed by us, and render the observation more difficult. The comparatively high stress of about 1 kgm. as applied by Prof. Zernike will also act in the direction of lessening the effect observable.

On the other hand, it is well known that the dilatation properties of a 36 per cent. iron-nickel alloy are dependent to a considerable degree of the thermal and mechanical treatment; it can scarcely be considered as invar when not in the original well-seasoned state. On account of this we deemed it necessary to investigate the ('geodetic') wire in its original state, using merely the heating (to 50°) necessary for the experiment. Prof. Zernike, on the contrary, has examined a wire which after the original treatment had been severely cold-worked, in one case "after annealing at a red heat." After such a treatment the alloy is certainly not strictly comparable to the original invar wire, as used by us.

In these circumstances we cannot consider that the experiments made by Prof. Zernike "in order to repeat" our work, really fulfil this purpose, and we await a repetition more nearly equivalent to our method before taking the work up again.

CARL BENEDICKS,
PER SEDERHOLM.

Metallografiska Institutet,
Stockholm, November 13.

Science and the Press.

IN reference to the leading article on "Science and the Press" which appeared in the issue of November 27, it may interest readers of NATURE to know what action has been taken in Glasgow in this connexion. A publicity campaign, under the auspices of the local section of the Institute of Chemistry, has been in operation for the past four years, and during that time 125 articles of column length have been published at regular intervals in the *Glasgow Herald*. These articles deal with the applications of chemistry in a popular fashion, and several have been written at the special request of the editor. The evening papers have also opened their columns, and about 175 short articles have appeared there. The scheme is still in operation and has been eminently successful. The experience of the *Glasgow Herald* may perhaps influence other newspapers to make a special feature of similar popular scientific efforts.

W. M. CUMMING.

The Royal Technical College,
Glasgow, C.1, November 30.

Critical Potentials of the Vapours of Mercuric Halides.

STUDYING the losses of energy suffered by slow electrons in mercury vapour by the methods of Lenard (velocity distribution) and Franck and Hertz, we came across a rather sensitive arrangement for detecting the inelastic collisions of smaller probability (V. I. Pavlov, *Jour. Russ. Phys.-Chem. Soc.*, Phys. Sect., v. 58, p. 369, 1926). Applying this combined method to the investigation of the vapours of mercuric halides, we found for mercuric chloride at least four values for critical potentials: 1·6 v., 2·7 v., 3·9 v., and 6·6 v.; for mercuric bromide: 1·5 v., 2·9 v., 6·6 v., and 8·9 v.; for mercuric iodide: 1·4 v., 2·7 v., 6·2 v., and 7·8 v. The same method for iodine yielded the values: 1·2 v., 2·3 v., 3·8 v., 5·1 v., and 7·5 v. Some of these data seem to be in agreement with the observed absorption by the vapours of light of corresponding quanta.

It may be hoped that the results obtained will lead to the building up of a system of energy levels of the molecules investigated and will give some knowledge of the various possible ways of dissociation with excitation.

V. I. PAVLOV.
A. I. LEIPUNSKY.

Physical and Technical Laboratory,
Leningrad, November 18.

Optical Excitation of the Vapours of Mercuric Halides.

IN the course of an investigation on the optical excitation of salt vapours I have found that vapours of mercuric chloride, mercuric bromide, and mercuric iodide of low density, when illuminated by the spark, give a bright visible fluorescence; this is green for mercuric chloride, blue for mercuric bromide, and violet for mercuric iodide. The fluorescence consists of a system of bands with a somewhat abrupt maximum of intensity at respectively 5600 Å.U., 5000 Å.U., and 4400 Å.U., and there is a continuous falling of intensity down to about 4000 Å.U.

The lines which stimulate these bands are strictly confined to the following rather narrow limits: 1900-1850 for mercuric chloride, 2100-1900 for mercuric bromide, and 2200-2100 for mercuric iodide. A detailed analysis of the structure of these bands, together with further experimental work, will give, I hope, some information upon the underlying mechanism,

A. TERENIN.

Optical Institute, Leningrad.

Sir William Crookes and Spiritualism.

IN the leading article in NATURE of November 20, it is stated that Sir William Crookes closed the spiritualistic chapter for the rest of his life for reasons which, owing to the deliberate destruction of the necessary documents, it is impossible to gauge.

I am in a position to throw light on this matter, and as what I have to say is purely historical, and does not touch on the marvellous, it will perhaps not be considered to fall under the ban of the editorial closure.

Sir William Crookes, on a visit to my parents in August 1894, engaged in conversation with my grandmother, the second Lady Rayleigh, on this subject. I listened with attention. The conversation was substantially as follows:

Lady R. Have you had any recent spiritualistic experiences?

Crookes. No, unfortunately not. The difficulty is that I have not been able to get into touch with any suitable medium lately.

Lady R. Well, that is unfortunate; but after the wonderful things that you have seen perhaps you may fairly be satisfied.

Crookes. I do not know that. When one has had a good dinner one day, one none the less wants another the next day.

The last sentence is quite clear in my recollection.

RAYLEIGH.

Terling Place, Chelmsford, Essex,
November 26.

Behaviour of Silicic Acid Gel during the Drying-up Process.

IN a note published in the *Proceedings of the Indian Association for the Cultivation of Science* (vol. 9, Part 4, p. 328, June 1926), I described an observation made by me more than two years ago (in April 1924), namely, that when silicic acid gel is treated with a concentrated solution of potassium chloride and is then allowed to dry up, the salt exudes from the surface of the gel in the form of thin white, glistening fibres. I attributed this to the pressure that is exerted upon the capillaries of the gel, as the gel continually loses water and experiences contraction. A photograph of the growth was also published there. It was further pointed out that an X-ray examination of those fibres of potassium chloride might reveal their true nature. As indicated before, this phenomenon seems to be very general, and should therefore be observable with various gels and salts.

The note referred to was written long ago, but its publication was delayed, as I intended to study the phenomenon further.

In a paper on the "Structure of Silicic Acid Gels," communicated by Messrs. Fells and Firth to the *Proc. Roy. Soc.* (112 A, Sept. 1926, p. 468), the authors describe interesting experiments on the same phenomenon. Apparently my previous note was not noticed by them.

K. KRISHNAMURTI.

Ramsay Chemical Laboratories,
University College, London.

The Reaction to Flea Bites.

PROF. E. A. BOYCOTT, in NATURE of October 23, says: "Some persons who are extensively flea bitten seem to become immune." This is, in my case, true of other insect bites. In January 1885 I suffered the most terrible agony from bites of Australian sand-flies (I do not know the specific name). Some seven years afterwards I was again in a sand-fly-infested neighbourhood and was completely immune from effects, and was so ever since.

In January 1906 I spent four or five days fishing in New Zealand, where I suffered misery from the bites of the New Zealand "sand-fly." (This is quite a different insect from its Australian namesake.) Returning again in January 1907 I suffered almost as much. I visited the same spot for four or five years later, and, though attacked as much as before, never felt any effects.

Similarly the mosquito, which was once a terror to me, now does no more than leave a painless mark. It is perhaps curious that the 'gruelling' I had from the Australian species has conferred immunity in Europe.

ERNEST I. ROBSON.

Oxford, November 2.

Biology and Human Life.[1]

By Prof. J. S. HUXLEY.

SCIENCE advances by the search for knowledge for knowledge's sake, but the knowledge spills over into practice as the years advance. Our business is to see how in recent years biological knowledge has been applied to practice, and what new advances may be expected.

The first spectacular applications of modern biology have been in the realm of disease prevention. Pasteur followed up his final demonstration that spontaneous generation does not occur with the discovery of its corollary—to wit, that infectious diseases, such as typhoid, diphtheria, and pneumonia, are caused by living organisms, or, as they are sometimes styled, disease germs.

Hand in hand with this went our knowledge of parasitology. In the first place the life-histories of many of our larger parasites were unravelled, with the result that it has been possible in many cases to break the weak link in the life-chain and to stamp out that particular disease and discomfort. That is true in civilised countries for tapeworm, roundworm, and trichina; and the hookworm and other enemies of the fullness of human life are following in their wake. But later it was found that there was frequently an association between some parasite or other noxious animal and the microscopic agent of some disease. Rats harbour fleas of a particular sort, the fleas harbour the bacilli of plague, and so is plague spread throughout mankind. Ticks spread spotted fever, mosquitoes give malaria and 'yellow jack,' flies may infect our food and our persons in a dozen ways.

So arose what for brevity's sake may be called the germ theory of disease. Any given disease was supposed to be due to a given organism, large or small, animal or plant; if you could exterminate or weaken the germ, you could get rid of the disease. The triumphs of serum therapy—vaccination, and other forms of immunisation—again largely due to Pasteur and later to Ehrlich, showed how the enemy might be circumvented even when it was impossible to annihilate him; and a period of optimism dawned.

The particular brand of optimism based on the germ theory is passing away. The pioneers had forgotten that as it takes two to make a quarrel, so it takes two to make a disease. They had left out of account the human organism.

We now know that the reaction of the organism is as important as the nature of the parasitic 'germ.' We all of us seem to harbour the bacillus of tubercle; but only a small percentage develops tuberculosis. Measles, with us an unpleasant disease of childhood, wiped out whole populations when first introduced among the South Sea Islanders. Why? Because their natural inborn resistance was less than ours. We now know that to every disease germ there are very different grades of inborn resistance; and further, that any of these grades may be increased or lowered by outer circumstances.

While some diseases may therefore be totally eliminated by the extermination of the disease germ itself, or, more usually, by breaking a link in the chain by which the germ is transmitted, there are others in which, so far as we can see, it will for ever be impossible to destroy the microscopic and elusive bacillus; and if we wish to prevent and not merely to cure, we have to rely on the raising of resistance.

The first method has, however, had its notable triumphs. Malaria, smallpox, yellow fever, bubonic plague, sleeping sickness—there we have a few of the plagues which have been almost expelled from the civilised world and will slowly but surely fade from the uncivilised as well.

As an example of what may be done in the economic field by intelligent control, we have only to look at the past and present of the gipsy moth. Two years ago I was in the United States, and one day went motoring along Cape Cod. Dead trees were standing everywhere in the woods. My host told me that these had been killed by the gipsy moth. Not only that, but for some years there were no leaves on any tree in all that neighbourhood, and the caterpillars came down, when they had stripped the trees, to eat the grass and flowers. On a still day the woods were full of a sinister rustling—the munching of a million jaws, and rattle of the million pellets of undigested food continuously extruded by the destroying army. Hundreds of thousands of dollars a year were spent by the State in spraying and other curative measures, but with only meagre results.

Eventually biology came to the rescue. Entomologists studied the gipsy moth in its original home and discovered just what natural enemies it had there. They imported these enemies—a beetle that devours the eggs, another, larger, which attacks the caterpillars, and a hymenopteran the brood of which, deposited as eggs in the caterpillar, devours the growing animal from the interior. These keep the gipsy moth in check, so that to-day the countryside is green again, and the moth, though not exterminated, is become only a minor annoyance. Without the meticulous knowledge of the ways and life-histories of a thousand and one apparently useless beetles and flies and moths, amassed often just for the sake of knowing, such control could never have been accomplished.

We can do a great deal to ameliorate human suffering by getting rid of tangible enemies to health; but that is not enough. Remove all the living enemies to health in the world, all the germs, all the parasites, all the venomous creatures, and men will not necessarily be healthy. Health is a living, active principle which needs fostering on its own account. Body and mind must be used, the gifts of sun and wind not despised, and food and drink be properly regulated in quality and moderated in amount. It all sounds so simple; but to be simple does not necessarily mean to be easy. At least, however, we are released from the false optimism of the germ theory period, and reminded that healthy living, like all living worth the name, is an art.

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With regard to the biology of human population, two problems confront us, the one immediate and

[1] From the Norman Lockyer Lecture for 1926 of the British Science Guild, delivered on November 23.

pressing, the other more complex and less instantly urgent. They are the problems of birth-control and of eugenics. The regulation of the numbers of population, in some form or another, has been practised by the great majority of the human race. As Prof. Carr-Saunders has shown in his remarkable book on the population problem, every savage and primitive people of which we have any knowledge, almost every people of the early civilisations, and many peoples of the civilisations of to-day, deliberately regulate their numbers. Famine and wars are not and never have been sufficient. Either infanticide, or abortion, or various restrictions upon or regulations of marriage, have been practised, with the effect of preventing or slowing the natural increase of population. At present 20 per cent. of the population in Great Britain gives rise to 25 per cent. of the next generation; and the average of this 20 per cent. is neither physically nor mentally so good as that of the other 80 per cent. We are thus confronted with a process which is retrograde in its effects—dysgenic instead of eugenic.

Before we can talk about eugenics, we must prevent this unequal multiplication. There is no prospect whatever of inducing the upper classes to abandon birth-control; our only hope is to equalise the increase throughout society by making birth-control general and starting afresh on the new level. Opponents of birth-control sometimes speak of the sacred right of the child to be born. There is of course no sacred right of a child to be born, but it is remarkable how often the prejudices on such intimately biological matters as birth-control, when not caused by mere ignorance of the facts of Nature, are due to a desire to force natural phenomena into such unnatural categories of the human imagination.

The whole trend of evolution from lower to higher has been towards diminishing the number of offspring, but increasing the parental care, both before and after birth, which is bestowed on them. I think I am right in saying that biologists are almost unanimous in demanding a rational birth-control as one condition of social advance.

Closely linked with this subject, as will at once be seen, is eugenics. A rational birth-control is the necessary prelude to a rational eugenics. We have to make up our minds to a new step in human history: to the conscious control of reproduction. This is being done individually with birth-control; it must be done socially by what we might call mating-control. When we know that men or women are not only the embodiments but also the bearers of hereditary taint and defect, we have no more right to allow them to reproduce than to allow a child with scarlet fever to be visited by all his school friends. We are told that this infringes the sacred rights of the individual and prejudices the idea of personal liberty. Such utterances are but another example of the unfortunate tendency, apparently inherent in the primitive human mind, of demanding and pretending to find absolute sanctions for ideas which are not in any sense absolute.

If we once made up our mind to it, this negative, weeding kind of eugenics could be easily practised. It must be confessed, however, that positive eugenics, or the raising of the upper level, is not so easy. In the first place, though we can be perfectly sure that the same general principles apply to human inheritance as to inheritance in other animals, we know very little about the details, and cannot solve any of the more difficult problems so long as we cannot control human matings for the purpose; and this, even if it were desirable, is certainly not at present practicable. In the second place, any selection which we could practise, in any state of society at all resembling the present, would produce its results extremely slowly and inefficiently.

In human society as at present organised, mass selection would be the only possible method to adopt. To attempt to reproduce the race wholly from a few thousand, even a few ten thousand, individuals, would for the present be unthinkable. We can do something, but very little, and that little only by running counter to some of the most cherished sentiments of our democratic age. We have got to stop pretending that comfortable mediocrity is our ideal, and that the average man is the god to whom the rest of the world must bring their sacrifices.

Another matter connected with eugenics is the control of sex. Here, in spite of the mystery with which the subject has in the past been surrounded, all now seems plain sailing. The mystery is in its essentials no longer a mystery. We have been able to see in the diversity of plant and animal forms almost every conceivable stage of the evolution of sex; we understand in broad outline its *raison d'être*, its biological function; and we know the mechanism of its determination in higher animals.

Sex is determined, in man as in all other mammals, by the sperm of the male. There are two kinds of sperm, one larger and one smaller; the larger is female-determining, the smaller is male-determining. Artificial fertilisation is perfectly practicable; it was successfully employed in mammals by the Abbé Spallanzani in the eighteenth century. It remains now only to separate the two classes of sperm according to their size, and sex-control would be an accomplished fact. I cannot believe that this separation would present great technical difficulties—certainly none so great as were involved in the construction of an efficient phonograph, or a modern aeroplane. Yet these inventions were perfected in a few decades. I will venture to prophesy that in the matter of sex-control it will be only a few decades before the invention reaches the practical stage.

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A democracy of material opportunity freely surrendering itself to the guidance of an aristocracy of thought—that seems to me to sum up pretty closely the biological ideal for society. But we are far from it yet.

There are scores of other ways in which biology can now, or will eventually, affect practical life. The science of genetics, an infant but an infant Hercules, is bound in time to change the practices of stock-breeders; the present pedigree system has its many advantages, but it has its genetic and economic absurdities, in the emphasis on an old aristocratic pride of ancestry *qua* ancestry, irrespective of scientific analysis, and in the fantastic prices given for pedigree prize-winners.

Greater knowledge of physiology will doubtless

enable us to modify the processes of our bodies more in accordance with our wishes—to stimulate our faculties when we need high-tension work, but without evil after-effects; to relax them without the use of harmful soporifics. It seems clear that temperament, even more important than pure intellect in achieving success, is largely an affair of the balance of the various glands of internal secretion—thyroid, pituitary, reproductive, adrenal, and the rest. It may well be that the applied physiology of the future will discover how to modify temperament.

But I must close. Let me emphasise that while pure science will make discoveries so long as she exists, while technology will apply those discoveries so long as profit is to be made out of their application, it is in the long run the average man and woman who decide *how* that application shall be made. Whether the discoveries of science will in the ultimate event be beneficial, as those of us trust who believe in progress, or whether they are leading the human race to destruction, as many sincere and many far-sighted men assert—that will be decided by the use to which the human race decides to put them. In themselves, apart from their intense personal value to their discoverers, and to others on the plane of pure intellect, they are, like any other tool, neutral.

Developments in the Use of Echo-Sounding Apparatus.

THE use of compressional waves in water for the measurement of the depth of the sea beneath a vessel now lacks the novelty which it possessed some years ago, when practical schemes for using them in navigation were first put forward. Briefly, all such schemes reduce to three essential parts—the source of the compressional impulse, the receiver of the echo from the ocean bed, and the mechanism for recording the time interval between the emission of the original disturbance and the moment of receipt of the echo, or, in some cases, the direction of the returning wave front. Small explosive charges dropped into the water, automatic hammer-blows on diaphragms, and diaphragms which are caused to vibrate electrically are used as sources of compressional disturbances within the audible range and form parts of actual sounding sets which are obtainable commercially. Microphones attached to diaphragms exposed to the sea are in general use for receiving the echo and for transforming the sound energy into electrical power. Various mechanisms, some of which are simple and ingenious, while others appear, from their descriptions in technical papers, to be unduly complicated and too delicate for continued sea-going use, are favoured by different firms who have embarked on the manufacture of echo-sounding gear. A typical echo-sounding apparatus for use in shallow water was described in NATURE in an article dealing with the use of the method in navigation.[1]

All the systems of sonic echo sounding covered by the remarks in the preceding paragraph involve the creation of an audible disturbance, but there is one system in which the initial disturbance has a frequency which lies above the upper limit of the range of frequencies audible to the normal human ear. The practical form of this apparatus is described in a recent publication issued by the International Hydrographic Bureau,[2] and the principles of its operation have already been described in these columns,[3] where it was observed that this 'supersonic' or 'ultra-sonic' system was of great scientific interest. It is clear that much skill and ingenuity have been expended in the design of the mechanisms embodied in the gear as now manufactured.

For sounding installations from which nothing more is demanded than an accurate measure of the depth of shoaling water beneath a ship, it appears that sonic systems are capable of answering navigational requirements, but the merit of the supersonic system lies in its ability to locate comparatively small objects, such as wrecks or rocks, in shallow water. This advantage is gained by the supersonic system because the energy is transmitted through the water in a beam the direction of which can be altered, whereas the sonic impulses are more nearly in the form of spherical waves spreading through the water without marked directionality. The supersonic gear cannot, however, be relied upon to detect projections which are small in comparison with the breadth of the beam, and at great depths therefore this system cannot be expected to show much greater power than the sonic gear to resolve discontinuities in the depth of water, unless either the size of the oscillator, or the frequency of its oscillation, is increased so as to make the beam sharper. There are limits beyond which both of these courses become impracticable.

Judging from published descriptions of the supersonic gear as manufactured by the Société de Condensation et d'Applications Mécaniques, the equipment must be decidedly costly and must require skilled operators and attention in case of defects. For these reasons it is to be expected that the simpler and less costly forms of sonic gear will be more popular and that the use of the supersonic apparatus will for some time be limited to special purposes where the sonic gear fails. On the other hand, disappointments with the echo-sounding gear must be anticipated and be looked upon as certain to come. The final form of every new thing is reached by stages, and it may be years before the defects which are bound to occur in existing echo-sounders are all eliminated and so great a mass of evidence for the reliablity and usefulness of the gear becomes available that the wholesale adoption of this invention is inevitable. It is scarcely necessary to quote examples in which events have followed a course similar to that which may be anticipated in the case of echo sounders, but the gyro-compass and the use of directional wireless in navigation may be mentioned. Both these aids to navigation 'hung fire' for years and the gyro-compass is only now coming into general use, while the application of directional wireless is still somewhat under a cloud, owing to errors in the readings taken, which are partly due to the effect of the ship's structure on the apparatus and partly to imperfectly understood effects such as the apparent coastwise refraction of the electric waves. One cannot blame the experienced navigator, upon whom the onus of a disaster falls, if he is chary about accepting the claims

[1] NATURE, March 29, 1924, pp. 463-65.
[2] Special Publication No. 14 of the International Hydrographic Bureau, Monaco, August 1926.
[3] NATURE, May 9, 1925, pp. 689-90.

which well-informed people are making for sonic-sounding gear, but one is fully justified in urging that the method should not be condemned on the evidence of a few initial failures.

Further experiments, of which no detailed description has yet been observed in the English scientific press, have been made in France by the Société de Condensation et d'Applications Mécaniques with a supersonic transmitter for guiding ships along a channel. In these experiments, according to newspaper reports, a supersonic oscillator is fixed at the entrance to a channel and arranged so that its beam may be projected horizontally and rotated in azimuth. In order to obtain the bearing of a vessel, the transmitter may, as in the well-known wireless beacon system, be rotated at a constant rate, or may be made to emit signals corresponding to the bearing of the oscillator. Alternatively, wireless signals might be used to indicate the instantaneous bearing of the beam. A vessel entering the channel would be swept intermittently by the beam and would thereby be informed of its bearing with respect to the transmitting station. The distance of the vessel from the transmitting station could easily be obtained by recording in the ship the difference between the times of arrival of the wireless and sound signals, the principle being the same as that which is used in the radio-acoustic system of position-finding at sea.

The value of such an installation in fog is obvious, for the underwater beam does not suffer from those extraordinary effects of reflection and refraction which make aural observation of the direction of a fog signal or siren station so unreliable in these circumstances. On the other hand, it would be necessary to fit each vessel using the system with a special receiver of high-frequency oscillations, since hydrophones and other instruments which are suitable for use with submarine bells or oscillators of the Fessenden type, are useless as detectors of the ultra-audible vibrations which compose the supersonic beam. The press accounts of the actual system used by the Société de Condensation et d'Applications Mécaniques are not very precise in the description of the manner of obtaining the ship's position relative to the transmitting station, but it is clear that the position might be obtained without the use of any underwater gear in the ship itself. The ship, in fact, acts as reflector of the supersonic beam, so that the operator of the shore station, hearing an echo, would know that a ship was on a certain bearing from him, while the range of the ship can clearly be deduced by the measurement of the 'echo-interval' as in ordinary depth sounding. This information could then be signalled to the ship by wireless telegraphy.

Judging from the cold reception which was given to the leader gear system by shipping companies, it is feared that development of the underwater beam system of guiding ships into harbour is unlikely to be hailed with enthusiasm, and that masters of vessels will prefer to wait for clear weather rather than trust the indications of apparatus of which only a part is under their immediate control. The difficulties which stand in the way of the general adoption of any new schemes such as these are undoubtedly great, and the real trouble is to form a body of opinion in favour of their general use.

Echo-sounding gear of the sonic type has been used also for the determination of the height of an airship above the ground in fog or darkness. The apparatus which was tried for this purpose in the ZR.3 before her journey across the Atlantic in 1924 was almost a replica of that which is used in one of the commercial systems of sonic echo sounding. The source of sound was a small explosive charge, and the time interval was recorded by a spring-driven wheel which was started and stopped by the outgoing shock and the returning echo respectively. It is clear that a machine which is capable of giving the pilot of an aeroplane or airship a continuous record of his height above ground would add greatly to the safety of aerial navigation, and experiments which have already been made indicate the possibility of attaining this end. It is probable that any apparatus which proves suitable for underwater sounding would require to be redesigned before being applied to aircraft, not only because of the necessity for cutting down weight, but also because diaphragm oscillators of the kind used at sea are incapable, when working in air, of delivering enough energy to be effective over any useful distance. The explanation of this is, of course, similar to that given by Stokes, in his classical paper on the communication of vibrations from a vibrating body to a surrounding gas, of Leslie's observation, made in 1837, that the sound of a bell vibrating in hydrogen is exceedingly feeble compared with the sound of the same bell vibrating in air.

Apart from its use as a navigational instrument, sonic-sounding gear has already been found valuable in making rapid hydrographic surveys in deep water. A large number of 'sections' have been made during the past year by vessels of the United States Navy in the course of ordinary voyages, and the results are believed to be in good agreement with charted depths when comparison is possible. The British Admiralty has made a fresh survey of the Challenger Bank using the Admiralty sonic-sounding installation in a survey vessel, and it is understood that a deep-water sounding set has been fitted in a recently built cable-laying vessel for oceanic use.

As an aid to hydrographic, hydrological, and fishery research the sonic sounder has already proved its importance, and it is noted that the German Research Vessel *Meteor* was equipped with no less than four sets of echo-sounding gear. A recently published account [4] of rather less than eight months' work in the Atlantic shows that some twenty thousand soundings were taken, the maximum depth recorded being 6110 metres. In a series of 89 comparisons between echo and wire soundings, the mean depth was 3420 metres and the wire sounding was, on the average, 2·2 per cent. greater than the echo sounding. This discrepancy may be due in part to drift and sag of the sounding wire, or, more probably, to the fact that the echo does not in general return from a point directly beneath the sounding vessel. This point is dealt with in the two paragraphs which follow. Since the echo-sounding gear is really a time-measurer we also require to know, for great accuracy, the velocity of sound in the different layers of water, between the surface and the bottom, through which the sound passes. This velocity will not differ markedly from that at the surface, but it will be affected to a calculable extent by changes in salinity, temperature, and the alteration in compressibility at great depths.

[4] Beiheft zu den *Nachrichten für Seefahrer*. Nr. 7, 1926.

The systematic under-estimation of depth by non-directional sonic-sounding gear is considered in another more recent report of the *Meteor* expedition,[5] and the matter is of sufficient interest to be discussed briefly. In an ideal echo-sounding apparatus, the receiving instruments would be arranged so as to detect an infinitesimally small amount of energy, and if such an instrument could be made, the time interval recorded would be the time which elapses between the emission of an infinitely short impulse and the return of the echo from *the nearest point* of the bottom. If the bottom is not horizontal, the echo would in general come from a point not vertically beneath the ship, but from some point on a tangent plane to a sphere the centre of which is at the transmitter, and the true contour of the bottom would be a series of such intersecting tangent planes. The depth recorded would be the distance of the nearest tangent plane and would generally be less than the vertical depth of water beneath a ship.

In actual practice it is not possible to build a receiver which would be sensitive to excessively small quantities of energy, nor would it be possible, on account of parasitic noises which cannot be eliminated, to use it at sea if it could be made. The impulses emitted by practical sonic transmitters are of finite duration and the receivers operate on a finite amount of echo energy. It is therefore obvious that the received echo comes from an area of the bottom and not from a point on it, and that the observed time will in general be less than the time corresponding to the depth of water vertically beneath the vessel, since the area from which the echo is received is not in general directly beneath the ship. In water of gradually decreasing depth the echo comes from an area in advance of the vessel and vice versa, but the error made in estimating the depth will not be great except when the slope of the bottom is large. A warning of an imminent decrease in depth is given to a vessel using sonic gear before the vessel is actually over the obstruction, and this is an advantage in navigation.

A series of echo soundings was made in the autumn of 1925 by four submarines and the depot-ship *Pelikaan* of the Dutch Navy in the Indian Ocean to the south of Java and Bali.[6] The submarines were submerged to a depth of 12-30 metres during the observations and the ordinary sound-signalling gear for inter-ship communication was used with stop-watches, for ascertaining the depths. The results are generally in good agreement with the charts and are of particular interest owing to the peculiar configuration of the bottom, which includes a row of submarine elevations in about 11° south longitude, to the north of which is a long deep depression having a maximum depth of about 7400 metres. These soundings have a particular interest to seismologists, because the deep valley in and near Wijnkoops Bay coincides with the origin of a great many earthquakes. The use of the echo method in Dr. Meinesz's gravity survey in a Dutch submarine has already been reported in NATURE in an article dealing with the new pendulum apparatus for gravity observations.[7]

In the German publication[4] to which reference has been made above, it is stated that 548 soundings were taken in rather less than four days at intervals of about one sea mile. This works out at one sounding every 10½ minutes approximately. While there is nothing remarkable in this, and the number could easily have been increased if desired, the figures given permit a comparison to be made between the rapidity of sonic sounding and wire sounding. Since, when the wire is used, the whole series of operations of slowing down and getting up speed, paying out and winding in the wire, must be repeated for each observation, the time expended in making an equal number of soundings would have been enormous. Even in depths of about 200 fathoms, about a quarter of an hour is lost per sounding, while in about 3000 fathoms, 2½-3 hours is required to do with the wire what is done practically instantaneously with the echo gear. J. B.

[5] *Ibid.*, Nr. 41, 1926.

[6] Koninklijk Mag. en Met. Observatorium te Batavia. *Verhandelingen* No. 17, 1925.

[7] NATURE, April 10, 1926, pp. 531-33.

Tectonic Features of New Guinea.

DUTCH New Guinea is still geologically one of the least known parts of a region which, from Malacca to New Zealand, presents a bewildering tangle of structural problems. A pioneer account of the north coast and its hinterland by J. Zwierzycki, one of the geologists attached to the Dutch East Indies Department of Mines, is therefore unusually welcome.[1]

The Cyclops Mountains along the north coast of the Dutch territory are made up of ancient crystalline rocks, including typical members of the greenschist and amphibolite facies associated with marble and gneisses, and intruded by gabbro and serpentine. Across the Australian boundary to the south-east, the old rocks, though interrupted and hidden by bays and deltas, can be traced through the Bougainville and other coastal mountains to the lofty peaks of the Finisterre group. E. R. Stanley, the Government geologist of Papua, describes the latter as composed of schists, and recognises the terrane as part of a marginal geanticline related to Halmahera and New Britain. West of the Cyclops the crystalline rocks are hidden beneath a low-lying swampy coastal plain. Off the coast, however, there are coral islands with others of serpentine, leading to the mountainous ridge of Jappen Island, which again is built of schists and serpentine. At this point Zwierzycki suggests that the trend line turns north through Geelvinck Strait to the open Pacific, but it seems far more probable that the marginal rocks continue beneath Geelvinck Bay to reappear in the Arfak Mountains. These have been briefly referred to by Suess as an ancient massif flanked by unfolded Mesozoic strata. Moreover, the island of Waigeo, at the north-west corner of New Guinea, carries on the belt of serpentine and peridotite intrusions, and so links up the coastal ranges with Halmahera, where these very significant rocks are widely distributed east of the volcanic line. Actinolite schists are recorded from the south of Halmahera, and gneisses from Bachian.

[1] "Notes on the Morphology and Tectonics of the North Coast of New Guinea," *Philippine Journal of Science*, April 1926, p. 505.

Thus from Halmahera to New Britain there are numerous relics of a crystalline foreland heavily injected with peridotite and serpentine—probably towards the end of the Cretaceous—which served as the buttress against which the Neocene formations to the south were folded and overthrust in the late Tertiary. That this foreland was formerly more extensive is indicated by the presence of pebbles containing Jurassic fossils in the basal Miocene conglomerate, and by the interesting observation that the pebbles diminish in size as they are traced southwards from the coastal region.

A broad belt of Neocene beds has been traversed as far south as the Idenberg River. For the most part this terrane consists of low undulating hills with slow-flowing rivers. There are Miocene andesites and basalts, as in Papua and most of the circum-Pacific lands. But although the landscape is quiet and in a far advanced stage of erosion, the rocks have been strongly compressed and overfolded to the north. Fortunately the low relief is conspicuously interrupted, half-way between the swampy plains of the Idenberg valley and the coast, by a series of ridges having a north-west trend that becomes westerly in the west. These are the Karamoor and Van Rees Mountains, and they constitute a resistant anticlinal core with windows through the Neocene conglomerates revealing the crystalline schists beneath. Folded Miocene beds are known both north and south of McCluer Gulf, while the anticline exposing the older rocks appears to be continued to the west through Misool, Obi, and the Sula and Peling Islands. The observations of Zwierzycki east of Geelvinck Bay thus give a meaning to this east-west line of islands, and make it no longer necessary to assume, as some geologists have done, that the Central Range of New Guinea is continued through the Arfak Mountains or through Misool.

The great Central Range stretches from the south-east of the island through the Owen Stanley Range of Papua to the Charles Louis Mountains of Dutch New Guinea. In the British territory, it has a core of Archæan rocks and is flanked to the north and south by Palæozoic formations.[2] The existence of a similar core in the Dutch part of the Range is known only from pebbles brought down by the rivers, for the mountains themselves have not yet been explored. Nevertheless, it is now clear that the core continues to the west through Ceram and Buru, both of which are Archæan terranes composed mainly of schists.

South of the Owen Stanley Range there is another belt of Tertiary sediments and volcanic rocks. E. R. Stanley states that the trend lines can be traced into Dutch New Guinea, and thence into Ceram, Celebes, and Southern Borneo. Structural and palæontological work in the oil-fields probably justifies this conclusion, but I am aware of no published evidence that helps one to trace any of the trend lines here elucidated into the little-known complex of Celebes. Stanley suggests that the Central Range has an Indo-Malayan structure, and the association of tin with some of the granites, especially in the east, makes this a tempting speculation. Zwierzycki, on the other hand, correlates the Central Range with the Himalayas, and suggests that the depression of South New Guinea is similar to the Indo-Gangetic Plain. It is, however, equally probable that it corresponds to the depression that runs from the Irrawadi valley to the Straits of Malacca. Until the direction of overthrusting or overfolding, if any, is determined in the southern Tertiary belt of New Guinea, and until the puzzling structures of Celebes and Borneo are linked up with those of the neighbouring islands, it will not be possible to deduce the position of New Guinea in the Alpine-Himalayan system.

ARTHUR HOLMES.

[2] E. R. Stanley, "The Geology of Papua," 1924, p. 51.

Obituary.

MANY readers of NATURE will learn with regret of the death of Mr. Joseph Goold, of Nottingham, who passed away in his sleep in the early morning of November 15 at the age of ninety years. He had retained all his faculties until the end. Mr. Goold was well known to many through his invention of a novel method of causing steel bars and plates to vibrate. His method was to fix a short length of cane in a suitable handle, and having arranged the cane to vibrate at a particular frequency, he gently stroked the plate or bar with the end of the cane. The friction set the cane into a state of vibration, and its small motions were imposed upon the plate or bar, which was set into a very active state of similar vibration. Mr. Goold gave many demonstrations of his experiments at conversaziones of the Royal Society, and at meetings of the British Association. He used to relate that this method of vibration suggested itself to him while he was thinking of the difference between the sound of a creaking door and that of a musical instrument. For many years Mr. Goold had worked at new ideas in connexion with the musical scale. A paper on this subject by Mr. Goold was communicated to the Royal Society of Edinburgh and published in the *Proceedings*, vol. 40, part 2, No. 18, June 21, 1920. He says in this paper: "The scale is primarily a system of intervals rather than a series of notes; for though its divisions are marked by notes (just as the divisions of a ruler are marked by lines) the divisions themselves are not notes but intervals." Since then Mr. Goold has extended this investigation, and was working at it practically until the time of his death.

WE regret to announce the following deaths:

Mr. Carl Akeley, author of "In Brightest Africa" (1924), who was collecting for the American Museum of Natural History in Central Africa, on November 29, aged sixty-two years.

Prof. Ettore Molinari, of Milan, one of the best known of Italian technologists, and the author of "Trattato di Chimica generale ed applicata all' Industria" which has been translated into several languages, died on November 9, aged fifty-nine years.

Prof. R. W. Phillips, formerly professor of botany at University College of North Wales, Bangor, on December 2, aged seventy-two years.

News and Views.

FOR the meeting of the British Association which is to be held in Leeds on August 31-September 7 next year, under the presidency of Sir Arthur Keith, the following sectional presidents have been appointed: Section A (Mathematical and Physical Sciences), Prof. E. T. Whittaker; Section B (Chemistry), Dr. N. V. Sidgwick; Section C (Geology), Dr. Herbert H. Thomas; Section D (Zoology), Dr. G. P. Bidder; Section E (Geography), Dr. R. N. Rudmose Brown; Section F (Economics), Prof. D. H. Macgregor; Section G (Engineering), Sir J. B. Henderson; Section H (Anthropology), Prof. F. G. Parsons; Section I (Physiology), Dr. C. G. Douglas; Section J (Psychology), Dr. W. Brown; Section K (Botany), Prof. F. E. Fritsch; Section L (Education), The Duchess of Atholl, M.P.; Section M (Agriculture), Mr. C. G. T. Morison. Notices are being issued for meetings of the organising committees of the sections to take place at King's College, Strand, by kind permission of the Principal, on January 7 at 12 noon, to consider the programme for the Leeds meeting.

NOT so long ago, very considerable claims were made for a new treatment for cancer devised by Prof. W. Blair Bell, of Liverpool. This claim was the outcome of work done by the Liverpool Cancer Research Organisation, of which Prof. Blair Bell is the Director. Recently a good deal more has been added to our knowledge of the new treatment by a discussion on the subject at the British Medical Association held at Nottingham in the summer and published in the *British Medical Journal* of November 20. While it is too early to make categoric statements of the value of the treatment, Blair Bell and his co-workers seem to have emphasised some facts which, if not altogether new, are at any rate confirmatory of the work of others. It is supposed that cancer or other malignant growths really represent a de-differentiation of the cells with a return to an embryonic type. This, of course, is not a new idea, and has indeed been the current teaching for thirty years or more. The embryonic type with which Prof. Blair Bell compares the cancerous tissue is the trophoblastic mass which covers the chorionic villi of the developing embryo. The comparison is valid in that both the syncytium and malignant cells have a destroying effect on the tissues. Prof. Blair Bell suggests a closer analogy, as both have a similar morphological and chemical structure. He conceives malignant new growth to be a state induced by oxygen starvation supervening on injury to the cell itself or the neighbouring blood supply, and that the return to the trophoblastic state is to enable the cell to survive.

As there appears to be an affinity of embryonic cells for certain lead compounds, Prof. Blair Bell was induced to try preparations of the latter in the treatment of cancer. The exact preparation of the lead suspensoid is now published, and it is claimed that the intravenous inoculation of this agent has led to the arrest, disappearance, or cure of some undoubted malignant growths. Many who have seen Prof. Blair Bell's cases agree with him that this is true. The treatment is most drastic and the mortality heavy. Apparently the mode of operation of the lead is to induce necrosis or other regressive changes in the tumour tissue, and while this is going on there may be severe or fatal injury even to normal tissues. Dr. L. Cunningham, the Assistant Director of the Liverpool Cancer Research Organisation, has tabulated the results of 227 cases treated by lead. Of these, 50 died before treatment was completed and 106 died after treatment. In 10 the disease was said to be completely arrested and 31 were "believed cured." He says that "lead is undoubtedly of value in the treatment of malignant disease, either alone or in conjunction with other methods; but we feel not only that something better may be found in the near future but that our preparation is imperfect."

AMONG the names of astronomers famous as the discoverers of comets is that of Giovanni Battista Donati, the centenary of whose birth at Pisa falls on December 16 of this year. Entering Florence Observatory at the age of twenty-six years, Donati became assistant to Amici, and in 1864 was appointed Director, a post he held until his death at the early age of forty-six years. During the years 1854–1864 he discovered six comets, that first seen on June 2, 1858, now bearing his name. The period of this comet is 1950 years, and its next appearance will take place in the year 3808. Donati was also well known for his early studies of the spectra of stars. He observed the total solar eclipse of July 1860 at Torreblanca, Spain, and the same year began his studies in stellar spectroscopy. He indicated the feasibility of a physical classification of the stars, and in 1864 discovered the gaseous composition of comets. In August 1873 he was seized with cholera while attending the International Meteorological Congress at Vienna, and died on September 20 a few hours after his arrival home at Arcetri.

THE latest news to hand of the Dutch-American Expedition to explore Dutch New Guinea under the auspices of the Smithsonian Expedition furnishes some probable indications of the extent and value of the results which are likely to accrue from this penetration of the unexplored belt of forty miles of jungle which separates the Snow Mountains from the sea. Dr. Matthew W. Sterling, the leader of the expedition, expected to reach the mountains in August. The work accomplished by the expedition, which at the time of writing was considerable, especially in mapping much unknown territory and numerous river routes, was to a great extent due to the use of the aeroplane. This machine acted as the scout of the expedition and saved much time and expenditure of labour by its preliminary reconnaisances of the route. It did much survey work as well. Unfortunately it has been put permanently out of action by the effect of climatic conditions, but not before it had practically ensured the success of the expedition. Large collections of plant and animal life, as well as of ethnographical

specimens, have been made. The natives were nervous and not uniformly friendly. Villages were sometimes found to have been deserted on the approach of the expedition. The only implements and weapons in use by the natives are of stone and bone. No metal is known.

IN view of the rising tide of Fundamentalism in the Protestant Churches of America, it is important to note that a certain number of priests in the Roman Catholic Church have conducted important researches in various branches of natural science without interference from the ecclesiastical authorities. In an interesting article in *Truth and Freedom* for October, Dr. J. J. Walsh supplies a number of examples. In the first place, there was the Augustinian monk Mendel, whose researches may be said to have created the new science of genetics. Then there is the German Jesuit, Father Wassmann, one of the most distinguished entomologists of our day. The present head of the Vatican Observatory in Rome, Father Hagen, S.J., is the author of an atlas of variable stars, while the seismographs with which many Jesuit colleges are equipped have contributed much to scientific knowledge. Sir Arthur Keith, in a recent article in an American magazine, has told the story of a young priest, Father MacEnery, who was an important pioneer in the science of anthroplogy a hundred years ago, " working like a navvy to reach the things he prized." How the geological records might tally with Genesis did not trouble the chaplain of Tor Abbey. Since his time many priests have taken a serious interest in palæontological and archæological anthropology, and in a recent number of the *Forum* (June) Prof. H. F. Osborn has named a dozen French, Belgian, German, and Spanish priests who have done valuable work in this department. Prof. Osborn actually dedicated his " Men of the Old Stone Age " to two priests, the Abbé Breuil and Father Obermaier.

THE fact is that between natural science and religion in general there is really no quarrel, in spite of the Fundamentalist panic. Where there does seem to be a certain conflict is between the results of literary and historical criticism and some of the traditional dogmas of Christianity. Here it can scarcely be said that the ecclesiastical authorities allow freedom of research to those under their control. When the Abbé Loisy, professor of Hebrew at the Institut catholique of Paris, dealt on scientific lines with the Canon, the religion of Israel, and the Babylonian myths behind the early chapters of Genesis, it cost him his chair. In 1907 this scholar was excommunicated, and the same fate befel the English Jesuit Tyrrell. Even the great historical scholar Mgr. Duchesne has had to walk warily. His examination of the legends which attached to the great French churches gave offence, while his " Étude sur le Liber Pontificalis " (1877) barely escaped the ' Index.' No doubt an institution has to preserve its integrity, but historical controversies cannot really be settled by disciplinary measures, any more than can controversies in the natural sciences.

THE Rev. J. C. Herrick, College of Mount Saint Vincent, City of New York, in a letter raises the question of the proof of the conservation of mass and energy. He writes: " Lavoisier proved the constancy of mass by the use of the balance " and therefore assumed " the constancy of the mass of his weights," while Joule in his work on the mechanical equivalent of heat also assumed that mass is constant. Mr. Herrick's argument arises from an incomplete statement of the experiments. The only assumption made by Lavoisier and by Joule is that mass does not vary *with time*. Assuming the truth of this fairly obvious proposition, Lavoisier showed that mass is not altered *during chemical combination*; and this result has since been confirmed by Landolt, who showed that the variation of mass as a result of chemical combination cannot exceed some extremely minute fraction of the whole. Joule's experiment merely showed that a given amount of work liberates a given amount of heat. There is no absolute proof that the heat liberated might not be due to the destruction of a minute quantity of matter, but there is no shred of evidence to justify the supposition that by merely stirring water with a paddle the molecules can be destroyed.

THE chief point emphasised in a paper on " Surface Indications of Petroleum," read by Mr. A. Beeby Thompson at the Institution of Petroleum Technologists on October 6, was the invariable necessity of interpreting all surface indications of oil in terms of geological environment. Too often is the oil-show, asphaltic rock or seepage, or mud-volcano made *per se* the sole reason of commerical exploitation, and only too often has such adventure proved disastrous. Petroleum at the surface, in whatever form, obviously implies, and frequently does actually indicate, wastage, especially of valuable light constituents; such wastage may be on quite a large scale and may signify the penultimate, if not the ultimate, phase of widespread inspissation; clearly, from an economic point of view, storage and not escape is the obvious desideratum. The subject of the paper is by no means new, nor was its treatment; there is, perhaps, nothing new which can be said, the substance of the paper being familiar to oil technologists from practically every text-book concerned with the geology of petroleum; but it at least provoked an interesting discussion, if at times slightly critical of the author's text.

BOTH Mr. T. Dewhurst and Prof. V. C. Illing, in the discussion on Mr. Beeby Thompson's paper, voiced the urgency of geological criteria in all investigations of surface indications, and Prof. Illing rightly deplored the author's use of the term ' metamorphosed ' as applied to ozokerite, in view of the more precise geological meaning attaching to that word. In discoursing on the oil indications of the Gulf Coast fields of America, the author omitted any mention of the controversial substance ' paraffin dirt,' which, as Mr. H. B. Milner pointed out, had been the cause of the loss of large sums of money spent on exploiting this type of evidence. Dr. A. Wade was mildly discursive on the mud-volcanoes of Australia, and he also

directed attention to the care needed in diagnosing wax 'indications' of paraffin base oils; unlike mining, the 'salting' of an oil prospect is a rare and difficult practice, and his warnings anent mutton fat and refinery wax were not without interest or humour. Another example of dubious indication was given by Mr. J. Romanes in connexion with bitumen occurring in some of the Quaternary deposits of the Guianas; the possibility of sea-borne material transported from Trinidad cannot be denied, a similar case occurring in the Falkland Islands, implying derivation from the Argentine. The author concluded his paper with a résumé of the coal-oil (carbon ratio) hypothesis, scarcely relevant to the more tangible subjects with which he had previously dealt, but he made no reference to Dr. Murray Stuart's recent contributions to this controversial problem.

PROF. J. L. MYRES, Wykeham professor of ancient history, University of Oxford, has been appointed Sather professor of classical literature for 1926–7 in the University of California. He is to spend the greater part of the semester beginning next month at Berkeley, lecturing in the Department of Classics, and also delivering a public course under the title "Who were the Greeks?" which will be published by the California University Press. On his way to Berkeley he is to attend the Philadelphia meeting of the American Association for the Advancement of Science, as representative of the British Association, and to give a public lecture on the "Geographical Surroundings of Greek Civilisation." He also hopes to attend the meeting of the American Historical Association at Rochester, and has promised to speak to the classical students at Chicago, on his way through.

THE registration of Imperial Chemical Industries, Limited, was formally completed on Saturday, December 4. The company has been registered with an authorised capital of 65,000,000*l*. As has already been announced, if all the shareholders of the merging companies exchange their shares for shares in the new company, the issued capital will be 56,802,996*l*. Amongst the objects of the company are acquiring or holding shares in Brunner Mond and Company, Ltd.; Nobel Industries, Ltd.; the United Alkali, Ltd.; and the British Dyestuffs Corporation, Ltd. The first directors of the company will be: Sir Alfred Mond (chairman), Sir Harry McCowan (president and deputy chairman), Lord Ashfield, Sir John Brunner, Mr. G. C. Clayton, Mr. H. J. Mitchell, Mr. Henry Mond, Sir Max Muspratt, Mr. J. G. Nicholson, Lieut.-Col. G. P. Pollitt, The Marquess of Reading, Sir Josiah Stamp, and Mr. B. E. Todhunter. The company has the biggest initial capital of any company hitherto registered in Great Britain.

NOVEMBER rains were a very special feature of the autumn this year in England and much prominence has been given to it in the *Times*. The Meteorological Office in its summary of the weather for November states that one of the outstanding features was the abnormally heavy rainfall experienced in many districts. At Shanklin it was the wettest November since records began in 1906; at Ross-on-Wye it was the wettest since 1888; and at Kew Observatory it constituted an easy record in November for sixty years. The total for the month was 5·12 in., which is 2·91 in. more than the average; with the exception of October 1923, when 5·32 in. fell, it was the largest total for any calendar month since September 1918. Rains were of frequent occurrence throughout the month, few days having no rain.

THE annual report of the Meteorological Committee to the Air Council for the year ended March last has recently been published (M.O. 288; London: H.M. Stationery Office; 2*s*. net). The report reviews the seventy-first year of the Meteorological Office and the sixth year in which the cost has been borne on Air Ministry votes. Considerable reorganisation of the work amongst the Divisions of the Office has been undertaken. Weather forecasting, weather broadcasting, and climatology have all shared in the changes. The magnetical work formerly carried out at Kew Observatory has been transferred to Eskdalemuir Observatory, and the seismological work from Eskdalemuir to Kew. The changes in the reorganisation will materially affect the efficiency of the work, and so react on the usefulness of the Office to those who need its services. Weather messages are supplied for issue by the British Broadcasting Company. It is shown that in the five years 1921–22 and 1925–26 the inquiries for special forecasts have doubled, increasing from 1914 to 3845 in the year under review. Data for air navigation form an important part of the work of the Office. The Marine Division shows considerable activity; an old difficulty is still experienced, and it is mentioned that renewed efforts are made to obtain an increase of observing ships in Pacific trades. A revision of the Admiralty Wind Charts of the World for the use of H.M. Fleet has been commenced. In the Forecast Division a gazetteer of telegraphic reporting stations has been almost completed. An inquiry is in progress into the relation between upper air temperature and the occurrence of thunderstorms.

REFERRING to the paragraph on the Rev. Edmund Gunter in NATURE of December 4, p. 813, Dr. R. T. Gunther writes from Magdalen College, Oxford: "Any account of Edmund Gunter's inventions should, I think, include the form of slide-rule designed by him which was widely known as a 'Gunter.' To him too are due the words *cotangens* and *co-sinus*, from which we get the familiar abbreviations of *cot* and *cos*. I have lately added models of his improved forms of cross-staff and cross-bow to the Lewis Evans collection, so that his scientific inventions are now for the first time almost completely represented in a modern museum. His work had a great influence on the methods of the next generation."

WE are indebted to Prof. Hugh S. Taylor, of Princeton University, U.S.A., for pointing out an error in the article on "The Reported Conversion of Hydrogen into Helium" (NATURE, October 9) on page 526, col. 2, 8 lines from bottom. The statement that the residual gas, after 12-hours' contact between

palladium and hydrogen, exhibited 4 or 5 lines of the helium spectrum *and only* a single neon-line, should read" . . . *without* a single neon-line." Prof. Taylor suggests that this correction alters quite markedly the conclusion one would reach from the paper, but it may be pointed out that the authors' statement is to the effect that the production of helium from hydrogen can be inferred whether a little neon is present or not.

PROF. JULIAN S. HUXLEY, professor of zoology and animal biology at King's College, University of London, has been appointed Fullerian professor of physiology at the Royal Institution, Albemarle Street, London, W.1.

REFERRING to the letter, "Spectrographic Junction between the X-ray Region and the Extreme Ultra-violet," by M. R. Thoræus in NATURE of November 27, p. 771, Dr. A. Dauvillier writes stating that he did not use "goldbeater's foil" in the experiments described in his letter in the issue of October 16, p. 551, but "gold leaf" (*feuilles d'or battu*). The expression printed in NATURE was incorrect. M. Thoræus' remarks upon the absorption of short wave-lengths by such foils do not apply, therefore, to Dr. Dauvillier's work.

THE Gold Medal of the Royal Society of Medicine was presented to Prof. J. S. Haldane, Director of the Mining Research Laboratory and honorary professor in the University of Birmingham, on the occasion of the annual dinner of the Society held on November 19. This medal, established by the generosity of the late Dr. Robert Murray Leslie, is awarded triennially for original discovery in medicine, surgery, the biological or physical sciences or allied subjects, which has proved of noteworthy importance in the progress of medicine or surgery. It was first awarded in 1920, to Sir Almroth E. Wright, and again in 1923, to Sir Frederick Gowland Hopkins.

THE activities of the Rockefeller Foundation during 1925 are summarised by its president, Mr. George E. Vincent, in a publication entitled "The Rockefeller Foundation," recently issued. The disbursements amounted to 9,113,730 dollars, and were expended in public health work and education, *e.g.* hookworm, malaria, and yellow fever campaigns; medical education, nurse training, and biological studies. Attention is directed to the use of paris green for destroying mosquito larvæ. A mixture of one part of paris green with 99 parts of road dust is sprinkled on the breeding areas, by hand or by aeroplane if necessary. The paris green proved effective, cheap, and safe, being harmless to fish and live stock. Some details are given of the new journal, *Biological Abstracts*, to the issue of which a considerable subsidy is being made by the Foundation.

A CLEARING-HOUSE for sources of information which has recently been brought into existence is likely to prove of great value in the dissemination of knowledge not hitherto generally accessible. Two years ago, on the initiative of some of the industrial research associations, a conference was called to discuss the problem of exhuming the large quantities of scientific, commercial, civic, and other information which is 'buried' in special libraries or for other reasons available only to a knowing few. As a result of this and further conferences, the Association of Special Libraries and Information Bureaux has been formed and is now in process of incorporation. Amongst other activities the Association will aim at assisting members who desire information of any kind to get into touch with the appropriate library or other body specialising on the subject in question. It will not itself attempt to build up any centralised organisation to provide the detailed information direct. The annual membership subscription is 2*l.* 2*s.* and there is no entrance fee. The address of the Association is 38 Bloomsbury Square, London, W.C.1.

THE German Chemical Society has recently published several parts of a new edition of Gmelin's "Handbuch der anorganischen Chemie." In the twenty years which have elapsed since the appearance of the seventh edition of this well-known work of reference, not only has a vast amount of new material been accumulated but also modern methods of research have so transformed the outlook in this branch of chemistry that a drastic reconstruction of the famous handbook has been undertaken. The first part deals with the rare gases of the atmosphere and contains much information that will be valuable not only to chemists but also to physicists, whilst the second part deals with the metals zinc and cadmium. Sections on fluorine and boron have recently been issued, while that on hydrogen, chlorine, and sodium should be ready in 1927. Other sections will follow in rapid succession. The work is being carried out conjointly by a large number of expert collaborators at the Hofmann house in Berlin.

IN order to illustrate the extended capabilities of present-day microscope object-glasses, Messrs. R. & J. Beck, Ltd., propose to give a demonstration of the performance of object-glasses of their manufacture. The demonstration will include a series of apochromatic object-glasses, ranging from 40 mm. 0·15 n.a. to 2 mm. 1·4 n.a., resolving test objects up to the limit of theoretical resolution for their respective apertures. Practical illustrations will be given of general methods of testing object-glasses using the apertometer, the Podura scale, a mercury globule on an ebonite slip, and a silver film with pinholes. In addition, several experiments are being arranged to illustrate the cause of glare and a method of obviating it, the advantage of using polarised light for resolution, and the increase in resolution obtained by using light of short wave-length. Such a demonstration should be interesting and instructive to every one who attends it. It will be given at Messrs. Beck's showrooms, 69 Mortimer Street, London, W.1, on Tuesday, December 14–Friday, December 17, from 2.30 P.M. to 5 P.M., and is open to any one interested in the subject.

THE firm of Max Weg, Königstrasse 3, Leipzig, has sent to us a copy of a large catalogue (No. 190) of works relating to geology and geophysics. More

than 13,000 books are offered for sale in the catalogue, which is classified under 23 headings. The list should be useful to librarians and book-buyers generally.

A VERY interesting catalogue (No. 487) of works relating to the sea, including autograph letters of famous navigators, original ships' log-books, atlases, etc., has reached us from Mr. F. Edwards, 83A High Street, Marylebone, W.1. Upwards of 1000 works are listed. The catalogue is illustrated by reproductions of some of the title-pages.

MESSRS. ERNEST BENN have in preparation a work entitled "Dogs: Their History and Development," by Edward C. Ash. The work will be published in two quarto volumes with nearly 700 illustrations. Mr. Ash tells for the first time all that is known of the history of dogs, of their breeds and development, from the earliest historical time to the present day.

WE have received from the publishers, Messrs. Heffer and Sons, Ltd., Cambridge, a copy of the Decennial Index (vols. 41-50, 1916–1925) of the *Analyst*. This is arranged as an author index and a subject index, and comprises 353 pages. The book will also be found useful to chemists who are not members of the Society of Public Analysts, to the journal of which references are given, since it provides indications of a large number of analytical methods published during the period named.

THE Royal Society for the Protection of Birds has just published another leaflet in its series from the writings of the late Mr. W. H. Hudson. It is entitled "Three Water Birds," and the matter was selected by Mr. Hudson himself from his book "Hampshire Days." The leaflet describes the coot, dabchick, and moorhen, and includes a coloured illustration showing a moorhen and her chicks. The leaflet may be obtained from the Society's offices, 82 Victoria Street, London, S.W.1 (price 3½*d.* by post).

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A pathologist at the laboratory of the City of Nottingham—The Town Clerk, Guildhall, Nottingham (December 14). An assistant lecturer in agriculture under the Cornwall County Council Education Committee—The Education Department, County Hall, Truro (December 20). A professor of organic chemistry in the Egyptian University, Cairo—The Dean of the Faculty of Science, Egyptian University, Cairo (December 30). A senior entomologist and a senior mycologist under the Commonwealth of Australia Council for Scientific and Industrial Research—The Official Secretary, Australia House, Strand, W.C.2 (January 31). A temporary resident lecturer in biology and hygiene at the Hereford Training College for Women—The Principal.

Our Astronomical Column.

COMET COMAS SOLA.—Mr. F. J. Hargreaves obtained a photograph of this comet on November 28. With its aid, Dr. A. C. D. Crommelin has revised the orbit as follows:

T	1927, March 21·314 U.T.	
ω	38° 9′ 25″	1926·0
Ω	65 44 55	
i	13 38 5	
ϕ	34 47 49	
log a	0·614843	
log q	0·247635	
Period	8·36 years.	

The period is so much longer than that (6·4 years) found for 1890 VII. (Spitaler) that identity is possible only if a very close approach to Jupiter took place about 1912. A longer series of observations will be required before a decision can be reached.

EPHEMERIS FOR 0h U.T.

	R.A.	N. Decl.	log r.	log Δ.
Dec. 11	2h 25m 8s	10° 5′	0·304	0·066
15	2 23 27	10 43	0·300	0·070
19	2 22 19	11 23	0·296	0·076
23	2 21 50	12 5	0·293	0·082
27	2 21 57	12 49	0·289	0·089

THE GEMINID METEORIC SHOWER.—Mr. Denning writes: "The return of these meteors is due on December 12 and 13 and the display is likely to be more than usually interesting this year. In 1922 on the early morning of December 13 a very rich exhibition of the Geminids was observed, the number of meteors visible having been estimated at 5 per minute. The astronomical conditions will be somewhat similar on the morning of December 13 next, when a careful watch should be maintained if the sky is clear. The moon will not seriously interfere, as it will be near first quarter and only visible in the evening hours. The radiant point of the shower changes with the time, but on the night of maximum this point is very near, if not coincident with, the position of the bright double star Castor in Gemini."

CONJUNCTION OF MERCURY AND SATURN.—On the early morning of December 15, at 3h 54m G.M.T., the planets Mercury and Saturn will approach each other to within 18′, which is equivalent to little more than half the apparent diameter of the moon. The objects will rise at about 6h G.M.T. and may be observed, should the sky favour observation, about half an hour afterwards near the south-east horizon. A field-glass should enable the two orbs to be picked up readily, and it will then be interesting to compare their relative lustre and colour. Mercury will pass north of Saturn and will be the brighter object of the pair. It may be easily distinguished from Saturn by its fitful, scintillating light, which will contrast strongly with the steady rays of the latter planet. As the morning of December 15 may be cloudy, it will be advisable to obtain a view, if possible, of the planets on the mornings of December 13 or 14 or even after the date of conjunction.

THE TOTAL ECLIPSE OF JUNE 29, 1927.—The B.A.A. Handbook for 1927 reproduces maps of the eclipse track across Wales, England, southern Norway, northern Norway, with notes on the weather prospects. These are rather more favourable in Wales than on the east coast of England. Al, in southern Norway, has a good record of weather, and is on the railway between Bergen and Oslo. The B.A.A. is endeavouring to arrange an expedition to Al. The cost will be 30*l.* inclusive, provided sufficient names are obtained.

The track in northern Norway passes very near Vadso on the Varanger Fjord, which was occupied in 1896, but the weather experienced on that occasion was very unfavourable.

Research Items.

EGYPTIAN ANTIQUITIES FROM SOUTHERN RUSSIA.—Two communications in *Ancient Egypt* for September deal with Egyptian antiquities which have been found at various times in the course of excavations in southern Russia. Militza Matthieu describes scarabs and other objects found on the northern coast of the Black Sea and at Olbia in 1902, 1911, and 1914. These scarabs are of soft paste, coloured light blue or light yellow, usually right through, and of simple form. They have striking analogies with scarabs found at Naucratis. In the same tomb in which five of the scarabs were found at Olbia were three pendants, two representing lions stretched out on a rectangular base, and one a ram's head. Similar pendants are also found at Naucratis, while two of the Black Sea scarabs show a lion with solar disc, exactly similar to a lion and solar disc pendant from Naucratis. In the tomb at Olbia Prof. Pharmakovsky also found black-figure vases, Rhodian, Miletian, and Naucratite ware, pottery, and glass beads. The second communication, by Prof. Zakharoff, describes a fragment of a crown of Osiris found in the Sloboda Nedvigovka (ancient Tanais) near the mouth of the Don—exact place and circumstances unknown. It is a fragment of bronze described erroneously in the Russian Historical Museum Catalogue of 1893 as an ornament of Scythian type. It is flat, broken at the top, and on its right side has a uræus, with solar disc on its head. The front of the uræus is ornamented with enamel in six cavities. The tail is interlaced with the horns of a ram. It may be supposed to be part of a feather crown to be put on a figure of Osiris. It is unique in southern Russia. Similar crowns are shown in the Catalogue of the Cairo Museum, vol. 1.

THE ANTIQUITY OF MAN IN AMERICA.—In the *Scientific American* for November, Mr. Harold J. Cook, who discovered the tooth of Hesperopithecus in the Lower Pliocene deposits of Nebraska, replies to arguments put forward in the July issue by Dr. Aleš Hrdlička against the high antiquity of man in America. Mr. Cook argues that the 'modern' character of the skulls for which antiquity has been claimed may be due to the fact, familiar to palæontologists, that species of vertebrates may remain unchanged over long periods. Man may have remained unchanged physically and structurally in America for thousands and thousands of years. No one can say, except in the most general terms, what were the conditions propitious to migration from Asia during glacial times, but conditions which made it possible for the bison and other animals of Asiatic origin to migrate should also be favourable to man. From known evidence it appears that in recent geological times both animals and man have migrated in successive waves. This long-drawn-out process has produced a degree of hybridisation which makes the anatomical evidence difficult to interpret with certainty. Further, the many Indian stocks exhibit as many great differences as characters in common, so that wide differentiation or homogeneity among them depends upon which characters are stressed. The discovery some months ago of stone arrows and spear points associated with a buffalo skeleton at Colorado, Texas, gives definite positive evidence of the presence of man in America in Pleistocene times. The skeleton was buried under eighteen feet of old Pleistocene gravels; it was undisturbed, and it belonged, not to the living American bison species, but was of an Asiatic or Indian type not known in America, and it was associated with the bones of extinct mammals known from other sources to be of Pleistocene age. Associated with the 'buffalo,' and under the bones, were three stone implements. All the relics were clearly contemporaneous. In the lower Pliocene age, a warm climate which extended to Alaska offered ideal conditions for migration by way of Bering Straits over a temporary elevation, and especially for anthropoid stocks or early man. That such stocks did enter has been shown by the discovery of the tooth of Hesperopithecus, which antedates the classical Anthropopithecus.

CRANIOMETRICAL DATA OF AN IMMATURE SKULL OF A FEMALE CHIMPANZEE.—Dr. E. Warren (*Ann. Natal Mus.*, vol. 5, pt. 3, 1926) has made careful measurements of an immature skull of a chimpanzee with the express purpose of placing on record data which could be used for comparison with the Taungs fossil anthropoid, Australopithecus. From his measurements and observations the author concludes that the young chimpanzee skull is appreciably less human than the Taungs skull, and therefore the peculiarities of the latter cannot be explained by its immaturity. He supports the contention that the Taungs skull exhibits a distinct advance on the living anthropoids in the direction of man, but the relative smallness of the brain would appear to indicate that it is considerably nearer to the living anthropoids than to man himself.

EXPERIMENTS WITH INTESTINAL PROTOZOA.—Prof. R. W. Hegner records (*Amer. Jour. Hygiene*, 6, 1926, pp. 593-601) observations which show that the active stages of *Balantidium coli* from the pig are able to withstand conditions in the stomach and small intestine of the guinea-pig and may reach the cæcum of the latter, apparently unharmed, within one hour after ingestion. The active stages of *Trichomonas caviæ* and *Chilomastix intestinalis* from one guinea-pig may pass through the digestive tract and reach the cæcum of another unharmed. The active stages of *Giardia canis* from the dog are able to live for considerable periods in the stomach and small intestine of the guinea-pig, and were found to be more numerous in that portion of the small intestine (6 in. to 24 in. beyond the stomach) which seems to be their optimum habitat in normally infected animals. Possibly it is the nature of the secretion in this region which causes the giardias to attach themselves to the epithelium by means of their sucking discs. The active stages of *Entamœba histolytica* are not quickly killed in the stomach and small intestine of the guinea-pig, but remain alive and mobile for at least an hour. Infection by these trophic stages is probably not usual in Nature; the cyst stage is more often concerned in transmission, and methods of control should as heretofore be directed against this. *Trichomonas hominis*, which does not form cysts, is, however, present in about 3 per cent. of the population, and infection appears to be by the trophozoite stage, entering by way of the mouth.

THE DIGESTIVE DIVERTICULA IN LAMELLIBRANCHS.—Dr. C. M. Yonge (*Trans. R. Soc. Edin.*, Vol. 54, No. 15, 1926) has investigated the structure of the digestive diverticula—blind tubules which open into the stomach by ciliated ducts—in thirty-four species of marine lamellibranchs. The tubules have been stated to exhibit three kinds of cells, but Dr. Yonge finds only one type. The cells when young stain darkly, but when older are very vacuolated and contain large numbers of coloured granules which disappear after starvation. In fresh material, long, retractile cilia were seen on

the tubule cells in a number of the species and are probably present in all. When lamellibranchs are fed with iron saccharate in suspension, this is found later lying in large vacuoles in the cells of the tubules but is afterwards passed on to the amœbocytes. The manner in which particles are taken in, and the presence of digestive enzymes in extracts of the diverticula, point to the occurrence of intracellular digestion. There is no evidence that the cells of the tubules secrete; the presence of enzymes in the stomach can be accounted for by the dissolution of the crystalline style and the occurrence of great numbers of phagocytes free in the lumen. The diverticula provide the extensive surface characteristic of the alimentary systems of animals which possess intracellular digestion, while as a result of the action of sorting mechanisms only the smallest particles are presented to the ingesting surface. The diverticula possess none of the functions of a liver or of a pancreas, but are organs of absorption and of intracellular digestion.

INBREEDING.—In a discussion of inbreeding from the practical breeders' point of view, Mr. A. D. Buchanan Smith (*Eugenics Review*, vol. 18, No. 3) gives many data from the history of Shorthorn cattle and Clydesdale horses. He concludes that Sewall Wright's method of measuring the coefficient of inbreeding is probably best. There has been considerably more inbreeding in Shorthorns than in Clydesdales, but the latter are equally homozygous, probably owing to careful selection. The level of inbreeding must vary with the breed according to the number of undesirable characters still present or latent in the stock and the nature of the selection practised by earlier breeders. Probably the coefficient of inbreeding in Clydesdales will rise much above its present value.

SAMOAN FORAMINIFERA.—J. A. Cushman describes (*Dept. Marine Biol. Carnegie Inst., Washington*, vol. 21, 1924, but only recently received) collections made by the late Dr. A. G. Mayor in Samoa in 1920. The foraminiferal fauna of Polynesia is interesting because living in this region are many forms known elsewhere only fossil. The author expresses his conviction that the shallow-water foraminiferal faunas are as limited in their geographical distribution as many other groups of organisms, and that there are living about oceanic islands many more species of genera such as Quinqueloculina and Spiroloculina than have been suspected. Closer study will, he believes, lead to the recognition of definite faunal areas for Foraminifera such as are known for other groups. The collection at one station in 50 fm. adds many species of especial interest and of rare occurrence. Altogether about 140 species are recorded, 18 of which are described as new, and two new genera are erected.

LONG-LIVED PLANT CELLS.—Dr. D. T. MacDougal points out in the *American Naturalist*, 60, pp. 393-415, 1926, that the living parenchymatous cells of the medulla of the tree cactus, *Carnegiea gigantea*, may continue to grow for more than a century and may still be active until the death of the plant. These old cells behave differently from young cells in the same plant in their reaction to acid or alkaline solution. When immersed in such solutions the young cells become more permeable and have a diminished water-holding capacity. Old cells, on the other hand, have a zone of maximum swelling at such acid reaction as *p*H 3-3.5 and a secondary maximum between *p*H 9 and *p*H 11.

COLLEMBOLA INJURING MANGOLD SEEDLINGS.—In the *Bulletin of Entomological Research*, vol. 17, October 1926, Mr. W. Maldwyn Davies records a significant attack on mangolds by the springtail, *Bourletiella hortensis*. The infestation occurred on one of the fields attached to the Rothamsted Experimental Station, the insects being extremely abundant during the first week of June 1926. Practically 100 per cent. of the seedling mangolds showed leaf damage due to the gnawing propensities of this insect. The nature of the damage was two-fold, for in addition to the actual biting and enlarging of the injured areas, wounds thus caused were kept open and excessive loss of sap ensued. Methods of control were carried out and a contrivance is described by means of which tarred sacking was hung in such a manner that it trailed just above the ridges. As the apparatus was pushed along the Collembola became disturbed by the shadow of the machine and, exercising their characteristic habit of leaping, became trapped in large numbers on the adhesive surface of the tar. This method of control proved so successful that a simple and more permanent type of apparatus attached to a pair of bicycle wheels, easily pushed by a farm hand, was devised for future use.

PERMO-CARBONIFEROUS FAUNA OF JAPAN.—The fauna of the Permo-Carboniferous limestone of Nagato is described by Y. Ozawa (*Jour. Coll. Sci. Imp. Univ. Tokyo*, 45, 6, 1925). It consists mainly of foraminifera and rugose corals, with a few brachiopods and polyzoa. 67 species or varieties of foraminifera are described, of which 51 belong to the Fusulinidæ. The corals belong to the genera Lonsdaleia, Waagenophyllum, Dibunophyllum and Nagatophyllum; one form of Lonsdaleia is identified with a British species, and the Dibunophyllum is regarded as only a variety of a species found in England. In another memoir (*ibid.* 45, 4, 1925) the same author discusses the classification and evolution of the Fusulinidæ.

WORLD WEATHER.—The Royal Meteorological Society has issued a Memoir (vol. i. No. 5) entitled "The Nile Flood and World Weather," by Mr. E. W. Bliss (price to non-fellows, 2*s.* 6*d.*). To establish the relationship it has first been necessary to find a series for the Nile flood. Aswan discharges provide the truest measure of the flood, values of which have been communicated by the Director-General of the Physical Department, Cairo. The values for the four months July to October together are dealt with for the separate years 1869 to 1925. Correlation coefficients are given with pressure, temperature, rain, ice, and wind. Coefficients with pressure give a high negative figure with Cairo, −0·64 for the June to August quarter. The connexion is closest in June to August, but it begins in March to May and persists throughout the following quarters. Rainfall is usually associated with low pressure, but this is scarcely the whole explanation in the present case. After a high Nile flood the North Atlantic circulation is weak, as seen from the coefficients with pressure in Iceland for December to February. Other associations with a good Nile are low equatorial temperatures as shown by Samoa, Batavia, Senegal, and Port-au-Prince. Pressures in the same season are also low, especially in the South Indian Ocean. Like the monsoon, the Nile has closer relations with succeeding than with preceding weather. There is some evidence of a simultaneous connexion with Antarctic conditions.

ELECTRIFICATION OF BALLOON FABRICS.—During the War the risks to airships due to lightning discharges and to their electrification by atmospheric electricity were frequently discussed, but as accurate data were not available, little progress was made in estimating them. We are glad, therefore, that the Aeronautical Research Committee has published a

report, No. 1017 (M. 37), by Dr. Guy Barr, on experiments relating to the electrification of balloon fabrics. The results prove that spraying the fabric with metal makes the fabric a good conductor but increases its weight by about four ounces per square yard. The surface resistance of the fabric increases if it is crumpled. Fabric 'doped' on the upper surface after having been sprayed on the under surface was satisfactorily conducting after five months' exposure. When the plies of a rubber-proofed two-ply fabric were rapidly separated it was found that the cotton surface left bare became positively charged, and that the rubber attached to the other ply became negatively charged. The experiment was tried of separating the plies of three different rubbered fabrics in a mixture of hydrogen and air, but in no case did any explosion occur. Dr. Barr thinks that this does not prove that ignition cannot take place in any circumstances. So many conditions, however, have to be satisfied that an explosion due to this cause would be a very rare phenomenon, although a considerable electrical effect is produced by separating a heavy rubber proofing from cotton. It is suggested that the graphitisation of the fabric be studied more closely. Further exposure tests should be made and researches carried out to see if the conductivity can be further improved.

THERMAL PROPERTIES OF POTASSIUM AND SOME ALKALI HALIDES.—In order to test the statement of physicists concerning the various electron displacements and dissociations accompanying atomic and molecular energy changes, thermal data calculated from vapour measurements are desirable. On account of the poor agreement between the few existing values, E. F. Fiock and W. H. Rodebush have recently determined the vapour pressures of potassium and some alkali halides in an electrically-heated apparatus of nickel. In discussing the results in the *Journal of the American Chemical Society* for October, the authors point out that the most striking feature is the extremely small value of the heats of solution of the solid salt in spite of the large values of the heats of vaporisation and the lattice energies, a fact which is in agreement with Born's theory of lattice energy.

ELECTRIC DISCHARGE THROUGH HELIUM.—In *Scientific Papers of the Institute of Physical and Chemical Research*, Tokyo, No. 69, Dr. T. Takamine describes the results of some experiments on the discharge through helium by two methods: first, the method of exploding wires at high current densities, introduced by Anderson; and secondly, the ordinary condensed discharge in helium at pressures between ½- and 1-atmosphere. In each case some of the lines showed apparent reversal (though not the same lines in the two sets of experiments). Reasons are given for thinking that the appearance is in reality a Stark effect due to the interatomic electric fields, and it is suggested that 'unsymmetrical reversals,' which are commonly met with in spectroscopic work, may sometimes be due to the same cause, and not, as is usually supposed, to absorption.

AN ANCIENT EGYPTIAN COSMETIC.—One of the many interesting objects found by Dr. H. Carter in the tomb of Tut-ankh-Amen at Luxor was a sealed cosmetic jar of calcite. When opened it was found to contain a considerable quantity of cosmetic, consisting of a rather heterogeneous mixture with a decidedly fatty smell. The substance has been carefully examined by A. C. Chapman and H. J. Plenderleith, but unfortunately the results, which appear in the *Journal of the Chemical Society* for October, do not definitely prove the nature of the fats originally employed in its preparation. It seems probable that the cosmetic consisted of about 90 per cent. of a neutral animal fat with about 10 per cent. of some resin or balsam, the latter in the process of time giving rise to the smell of the material, which is one of its most characteristic features.

THE ATOMIC WEIGHT OF SILVER.—The October issue of the *Journal of the Chemical Society* contains an important paper by H. L. Riley and H. B. Baker on the determination of the atomic weight of silver by finding the direct ratio of silver to oxygen in silver oxide, a method which has hitherto failed owing to loss of oxygen on drying the oxide. The product obtained by drying over pure phosphorus pentoxide at ordinary temperatures or in a vacuum at 100° gave a pink chloride with hydrochloric acid, indicating that some very small amount of oxygen was lost, but it was thought, nevertheless, that this loss might be negligible. Samples of pure silver oxide were prepared in an apparatus of special design, but the analyses proved that appreciable quantities of oxygen had been lost, a result contradictory to the preliminary experiments. It was found that the silver oxide was being reduced by small amounts of organic material which passed through the drying tubes. When precautions were taken to exclude organic matter, a product was obtained which gave a perfectly white chloride on precipitation with hydrochloric acid. Samples of the pure oxide were decomposed in a silica tube in a current of pure air at 350°-400°, and the silver finally melted in an atmosphere of pure hydrogen. From the loss in weight of the silver oxide and the weight of the residual silver the value of the atomic weight of silver was calculated, the mean value being 107·864 ± 0·0013. This includes, however, a correction for a small amount of water from which it was impossible to free the silver oxide.

MOLECULAR STRUCTURE.—In his recent presidential address to the chemical section of the Australian Association for the Advancement of Science, Prof. James Kenner took as his subject "Some Aspects of the Problem of Molecular Structure." In it he gives a full account of the present position of the theory of valency. He does not confine himself to a discussion of the evidence obtained by purely chemical methods, but gives due place to the results of such other methods of attack as the X-ray investigation of crystals. One of the successes of the modern atomic model was that the electron distribution provided a ready explanation of the formation of many of the simpler molecules, but there is still a long way to go before all the facts known to present-day chemistry are satisfactorily explained. The true nature of the so-called homopolar bond is still unknown. The Werner hypothesis of a uniform attraction round an atom has been very useful in stimulating chemical research and in classifying compounds, but it cannot be said to be entirely consistent with modern views of atomic structure. Recent work suggests that not only the very outermost electrons but also those in the outer sub-groups play an important part in chemical combination, and on such a basis it appears probable that a satisfactory interpretation will eventually emerge. Whatever the final explanation, Prof. Kenner's address should serve a useful purpose in that it gives a broad survey of the existing position and indicates the lines along which progress is being made. Too often the workers in one branch are unfamiliar with the results obtained by other methods, and this address should result in a closer co-ordination of their efforts, the more so as, appended to it, there is a very full list of references to modern literature.

Rectal Alimentation.

THE difficulty of securing adequate nourishment in certain conditions in which the taking of food by mouth is impossible or inadvisable, such as coma or following operations on the gastro-intestinal tract, is well known; the attempt is usually made to supply a certain amount of food and drink by means of nutrient enemata, but there are very few substances which are with certainty absorbed through the mucous membrane of the rectum and large intestine. The knowledge that this part of the bowel in man acts mainly as an absorber of water, and contains none of the digestive enzymes which are found in the upper parts of the gastro-intestinal tract, would suggest that only the ultimate products of digestion of the food-stuffs would stand any chance of being absorbed: such, in fact, appears to be the conclusion to be drawn from many researches on this subject. Dextrose, lævulose, amino-acids, saline solutions, and alcohol are absorbed and thus become available for metabolic processes, but the proof of their actual utilisation has not been so easy to obtain. A recent study by T. M. Carpenter brings forward some new evidence on this question (Carnegie Institution of Washington, Publication No. 369, December 1925).

The experiments were conducted on four healthy medical students; the test substances used were alcohol, dextrose, and lævulose, and their utilisation was studied by observing their absorption when introduced rectally, their excretion in the urine, and their influence upon the respiratory exchange, the pulse rate, and the composition of the urine. The amounts absorbed were obtained by analysing a wash-out enema, which followed the introduction of the nutrient solution: the spirometer or respiration chamber was used for the determination of the respiratory exchange and the pulse rate was recorded by means of a pneumograph placed over the thigh. Among the details to which attention must be directed, so as to ensure the comfort of the subject, are the temperature of the solution and the rate of administration and the total volume given: it was found that the most comfortable posture was the supine, and that the enema should enter the rectum at body temperature, and slowly, preferably by drops: 250 to 500 c.c. can be given in the course of two hours.

The experiments were generally carried out in the afternoon and evening, and the subjects had previously fasted for several hours, but not for the twelve hours usual before an estimation of the 'basal' metabolism. In the majority, one or more preliminary periods were run before the injection was made. The general course of events in a normal subject was studied in a series of control experiments, in which a solution of sodium chloride alone was injected. The changes observed were only slight. The respiratory quotient remained steady, the pulse rate and oxygen consumption fell somewhat, the latter after a slight rise, and the urine, although showing a slightly increased output of fluid, yet had less sodium chloride present: presumably the greater salt excretion in the preliminary period should be related to the intake of this substance in the food. When the experiment continued all night, records of sleep and wakefulness were obtained by the response of the subject to an electrical signal: the pulse rate remained steady, except for periods of wakefulness, and the respiratory quotient, oxygen consumption, and carbon dioxide production showed a tendency to increase slightly. The course of events after the injection of a test substance must be interpreted in the light of those occurring under similar conditions in a control subject at a similar period of the day.

The absorption of alcohol, injected in a 5 to 10 per cent. solution in 0·6 per cent. sodium chloride, was almost complete, in most of the experiments a total of 25 gm. being given. Signs of alcoholic intoxication could be produced by administration by this route. Small amounts of alcohol were excreted in the urine, the concentration being of the order of 0·5 per cent. and reaching a maximum in about two hours. The amount excreted and the time of the maximum output depended on the quantity of alcohol injected and also on its concentration. Similar results were obtained following the ingestion of alcohol by mouth: but owing to the quicker absorption, a higher maximum excretion was observed. After five or more hours the excretion ceased. If the subject slept during the experiment, more alcohol appeared in the urine, suggesting a lessened utilisation. It is of interest to note that sometimes the alcohol appeared in the urine in a conjugated condition, distillation following treatment with an inorganic acid yielding slightly higher figures for alcohol than simple distillation alone. The excretion of only small quantities of alcohol after oral ingestion has been confirmed more recently by H. W. Southgate (*Biochem. Jour.*, vol. 19, p. 737, 1925). Apart from its presence in the urine, the rectal administration of alcohol led to a marked diuresis, with a decrease in the nitrogen and sodium chloride eliminated.

The effect of alcohol on the general metabolism was shown by the fall in the respiratory quotient, with a rise in the pulse rate and the oxygen consumption. When adequate amounts were given, the changes began in about an hour and lasted for six or seven hours. With oral ingestion the respiratory quotient fell still more promptly.

The administration of dextrose or lævulose by the rectal route produced similar effects, except that the respiratory quotient rose, instead of falling, as after the alcohol. Only 60 to 90 per cent. of the dextrose and 50 to 100 per cent. of the lævulose was absorbed in the different experiments; absorption was most rapid in the first two hours. The lævulose solution was the most difficult of all to retain. The changes in the urine were slight in the case of dextrose, there occurring a fall in the nitrogen and sodium chloride output: but this fall was very marked following the injection of lævulose. In both cases the respiratory quotient and the pulse rate increased, with little alteration in the oxygen consumption.

Perhaps the most interesting part of the monograph are the deductions made by the author from the experimental data. He considers that there is sufficient evidence to show that alcohol, dextrose, and lævulose, when introduced rectally, are metabolised by the body. Calculations suggest that alcohol replaces in metabolism all the foodstuffs in the proportions in which they are being utilised at the moment; this replacement may take place to the extent of 50 per cent. By the oxidation of the dextrose absorbed enough carbohydrate would be supplied for the metabolic needs of the body for two to three hours. Lævulose, on the other hand, appears to be mostly retained in the body without oxidation, perhaps as glycogen.

Comparison of the effects of rectal administration with those following oral ingestion showed in a few cases certain discrepancies. Thus alcohol *per os* lowered the respiratory quotient more promptly than after administration by the alternative route, but the peak of the alcohol concentration in the urine was reached in about the same time in either case, so that it may be assumed that the difference is not due to the

earlier appearance of an increased concentration in the blood following oral ingestion. Again, lævulose *per os* had a greater effect on the respiratory quotient than when given *per rectum*, whilst with dextrose the reverse appeared to be true, although it was less readily absorbed from the rectum than the former.

The author considers that the differences in the metabolic effects between oral and rectal administration cannot be explained by the absorption of the materials into the systemic venous system alone as distinct from an absorption into the portal system, since the former drains only the extreme lower end of the large bowel. He therefore suggests that the immediate fate of these materials may depend in part upon whether the liver is in an active condition or not. This condition is presupposed following oral ingestion, but if the rectal administration occurs sufficiently long after the previous meal, it may be expected that this organ is in a state of relative quiescence. The idea that the liver may give off to the blood-stream a substance of the nature of an internal secretion has already been envisaged by some experiments of Cannon's on the existence of a substance causing acceleration of the denervated heart, which was only clearly demonstrated in animals digesting meat.

The work suggests lines for future research and at the same time indicates that if resort has to be made to rectal alimentation in a patient, alcohol and dextrose are the substances which should be chosen for this purpose.

The Russian Geographical Society.

WE have received from the Russian State Geographical Society twelve parts of its *Izvestiya*, forming vols. 52-57, for the years 1916–1925. They contain a series of valuable contributions to the geography of the Russian dominions, and British geographers will gladly welcome the renewed activity of that important Society. The word 'Imperial' in the title of the Society was omitted in 1916 and has now been replaced by 'State.' That the conditions of publication in Russia are difficult are indicated by the poverty of the paper, the sparseness and inferior quality of the illustrations and the maps. In these respects the later volumes show a marked improvement, which encourages the hope that the journal will reach its former excellence. The volumes contain many important contributions, but they are rigidly confined to the Russian language, the only exception being that one paper has a title and a short summary in French. If the titles of the papers and the lists of contents were repeated in some western language, the accessibility of its contributions would be much increased. Some of the work has been delayed in publication; thus volume 57, pt. 1 (pp. 3-60), includes papers by Conradi, Kell, and Ghulten on the geological and geographical results of an expedition to Kamchatka in 1908–1910, and a discussion by Prof. Karakash of *Eoanthropus dawsoni* (vol. 52, 1916, pp. 673-714) has been generally overlooked in Great Britain.

Among the papers on physical geography are the discussion by S. C. Bergh (vol. 52, pt. 8, 1916, pp. 579-648) of the origin of loess; many contributions to glacial geography, including a study of the movements of glaciers in the Caucasus by P. Tzirulnikov (vol. 53, 1917, pp. 45-56, 5 pls.), two papers by Belyaev and Besedin (vol. 55, pt. 1, 1919, pp. 1-124) on glaciers in Darvaz from observations during an excursion by the Russian Geographical Society in 1919, and a catalogue by Tronov of the glaciers of the Altai (vol. 57, pt. 2, pp. 107-159). General problems connected with glaciation are discussed by Sobolov (vol. 56, pt. 1, 1924, pp. 101-140, and pt. 2, pp. 5-36) on the glacial formation of northern Europe with reference to the geo-morphology of the Russian plain. The evidence from the Caucasus as to the succession of glacial periods is adduced by Renngarten from the Valley of Assa in the northern Caucasus (vol. 57, pt. 2, 1925, pp. 53-106). I. N. Shamkov describes the climate of Abas-Fuman and its value as a health resort.

The papers on European geography are relatively few, but Alyabev (vol. 56, pt. 1, 1924, pp. 5-54) contributes an account of the Kurghalov Peninsula and the south coast of Finland, and their geographical relationship. Yakovlev (vol. 57, pt. 2, 1925, pp. 3-22) describes the relief of Leningrad and its effect on the inundations.

Shokalskii in a short paper discusses the acceptance of republics by the north-western Russian States (vol. 56, pt. 1, 1924, pp. 154-161), and A. Petrov discusses the physical geography of the Murmansk area (vol. 55, pt. 2, 1924, pp. 3-13).

Studies of the Siberian rivers are given by Sapozhnikov and Nitikin, dealing especially with the plant distribution on the lower valley of the Obi (vol. 55, pt. 1, 1923, pp. 135-180); and by Ghromov, who describes his work at the mouth of the Yenisei (vol. 56, pt. 2, 1925, pp. 107-118).

Contributions on Russian Turkestan include the papers by Spiridonov on the natural history of parts of the Kizil-Kuma (vol. 56, pt. 2, 1924, pp. 145-173), and Smirnova describes the western parts of the Kirghiz Territories (vol. 55, pt. 2, pp. 103-112); Pavlov describes the North Gobi Desert and a traverse of Mongolia (vol. 57, pt. 1, 1925, pp. 111-168).

Mushketov describes the eastern Ferghana and the Alai (vol. 53, 1917, pp. 83-137, 8 pls.), and also a journey in Narjensk and Kashgar (*ibid.*, pp. 138-166). There are some obituaries, including one of P. O. Rovinskii, dealing especially with his work in Serbia (vol. 52, 1916, pp. 515-542), and an appreciation by Sokolovskii of the geographical work of Philip Avril (vol. 57, pt. 1, 1925, pp. 67-98).

Peat Investigation in Canada.

ABOUT eight years ago a Peat Committee was appointed by the Government of Ontario and the Federal Government of Canada, and was directed to find, if possible, a practical commercial method for converting raw peat into fuel. The Committee considered carefully all the more important processes for winning peat fuel which had been previously proposed, and concluded that the only practical commercial method of winning peat fuel is by excavating, mixing, spreading and forming the raw peat by automatic machines. The peat blocks thus formed and spread are then to be dried in the air. Since this process decreases considerably the number of labourers required per ton of fuel, it is well adapted for countries such as Canada, where the cost of labour is high.

The Committee made a careful and exhaustive examination of the efficiencies of two large-scale excavating and spreading plants. One of these had been devised in Sweden by Anrep, and the other in

Canada by Moore. The two machines were provided with mechanical excavators, which, however, differed in detail, and with field-presses. The conveying of the peat pulp from its excavator to the drying ground was by means of tipping cars on a portable railway in the Anrep method, and by means of an automatic belt-conveyer in that of Moore. As a result of the trials, which are fully described in its final report, the Committee found that the best type of process is one which combines the excavating elements of the Anrep system with the conveying and spreading elements of Moore's.

Incidentally it was found that a shredding machine of the Jeffrey swing-hammer type, used for pulping kelp on the Pacific coast of America, is far more efficient as a macerator than those with knives and screws commonly employed in Europe. Two other conclusions of the Committee deserve the serious attentions of peat experts. The operations of excavating, macerating, forming and spreading can be efficiently performed by automatic machines, but there is no cheap automatic method of collecting dry peat sods from the spreading ground. Furthermore, with the introduction of automatic machines for winning the peat, the overhead charges have increased so much that they now amount to nearly half the total cost of the finished peat fuel.

The report of the Committee merits a careful study, not only because it describes the field results of actual large-scale experiments on the winning of peat fuel, but also because it gives in addition a comprehensive and authoritative account of the recent advances in the peat industry. HUGH RYAN.

University and Educational Intelligence.

BIRMINGHAM.—The following appointments have been made :—Dr. Edmund L. Hirst, to be a lecturer in the Department of Chemistry; Mr. Gordon Manley, to be assistant lecturer in geography; Dr. Oscar Brenner, to be part-time assistant in pathology and bacteriology.

The British Thomson-Houston Co. has presented two A. C. motors for use in the Coal Treatment Laboratory.

The Huxley Lecture is to be delivered by Prof. Elliot Smith on February 1, 1927.

CAMBRIDGE.—D. H. R. Rastall has been elected to a supernumerary fellowship at Christ's College. The following have been elected to represent the scientific faculties on the General Board of the Faculties : Mr. R. H. Fowler, Prof. C. E. Inglis, Dr. T. S. Hele, Mr. T. C. Nicholas.

The Governing Body of Emmanuel College offers to a research student commencing residence at the University in October 1927 a studentship of the annual value of 150*l.*, tenable at Emmanuel College for two years. The studentship will be awarded in July, and applications should be sent so as to reach the Master of Emmanuel (The Master's Lodge, Emmanuel College, Cambridge, England) not later than June 30. The award will be made on the evidence submitted by the candidates, which should include a statement of the proposed course of research, a brief account of the candidate's career up to the date of the application, and evidence of general ability and of special fitness for the proposed course of research.

LIVERPOOL.—Dr. W. S. Patton, lecturer on entomology in the University of Edinburgh, has been appointed to the Dutton Memorial chair of entomology at Liverpool as from January 1 next. Dr. Patton graduated in medicine at Edinburgh in 1901 and later studied in the University of Marburg. He joined the Indian Medical Service in 1902, from which he retired with the rank of major in 1921. During the War he was entomologist to the Mesopotamian Expeditionary Force. He has acted as Director to the King Institute of Preventive Medicine in Madras and as Director of the Pasteur Institute of Southern India. He has recently been engaged in investigations in China, and has had charge of the Kala-Azar Commission of the Royal Society.

Prof. H. J. W. Hetherington, professor of moral philosophy in the University of Glasgow, has been appointed Vice-Chancellor of the University of Liverpool in succession to the late Dr. J. G. Adami. Prof. Hetherington was educated at Dollar Academy and the University of Glasgow, in which he distinguished himself in the Departments of Mental Philosophy, Economics, and Classics. From 1910 until 1914 he held a lectureship in moral philosophy in Glasgow and became a member of Merton College, Oxford. In 1914 he was appointed lecturer in philosophy in the University of Sheffield, and a year later became professor of logic and philosophy in University College, Cardiff. In 1920 he became Principal and professor of philosophy of University College, Exeter, in which positions he distinguished himself as an administrator. In 1924 he relinquished his post in Exeter to take the chair of moral philosophy in Glasgow University. He is thirty-eight years of age. Prof. Hetherington is the author of "International Labour Legislation" and has published, in conjunction with Prof. J. H. Muirhead, a study in social philosophy entitled "Social Purpose." He will assume the office of Vice-Chancellor at the beginning of the session 1927–28.

APPLICATIONS are invited by the Royal Society for the appointment of a Foulerton Research Studentship, value 700*l.* per annum. The duties of the student will be to conduct researches in medicine or the contributory sciences under the supervision and control of the management committee. The studentship will be tenable for three years, but may be renewed from year to year up to six years. Members of either sex are equally eligible, but must be of British nationality. Applications must reach the Royal Society, Burlington House, Piccadilly, W. 1, not later than March 1 next.

THE annual meeting of the Geographical Association will be held on January 6-8 at the London School of Economics, Houghton Street, Aldwych, W.C.2, under the presidency of Sir Charles Close, formerly Director-General of the Ordnance Survey. The programme includes a discussion on January 6 for university teachers of geography on research in geography (opened by Sir Henry Lyons), and an address by Mr. J. Fairgrieve to primary school teachers, and a visit on January 7 to the Science Museum, South Kensington, with an address by Prof. H. H. Turner on solar eclipses. There will also be four concurrent discussions on the morning of January 7, on geography in advanced courses, on broadcasting and nature-study respectively in geography, and on school journeys. Sir Charles Close will deliver his presidential address, "Population and Migration," on January 7, and later in the day Col. E. M. Jack, the present Director-General of the Ordnance Survey, will describe the work of his department. The annual dinner of the Association will be held on January 7, and on January 8 a visit to the geography room of the William Ellis School is being arranged. Prof. L. P. Abercombie of Liverpool is organising a visit on January 8-10 to see the changes taking place in east Kent. The honorary secretary of the Association is Prof. H. J. Fleure, Geographical Association, Marine Terrace, Aberystwyth.

Contemporary Birthdays.

December 12, 1838.	Prof. W. C. Unwin, F.R.S.
December 12, 1866.	Prof. E. W. MacBride, F.R.S.
December 12, 1855.	Mr. Arthur William Clayden.
December 13, 1861.	Prof. A. G. Perkin, F.R.S.
December 15, 1869.	Sir John F. C. Snell, G.B.E.
December 16, 1884.	Prof. John W. Bews.
December 16, 1859.	Prof. Douglas H. Campbell.
December 16, 1854.	Prof. John T. Cash, F.R.S.

Prof. UNWIN celebrates his eighty-eighth birthday on Sunday, and very hearty congratulations are accorded to this distinguished veteran of the engineering world. Educated at the City of London School, he began his technical career as a pupil in the firm of William Fairbairn, Manchester. For twenty years he taught the principles of engineering at the Central Technical College, City and Guilds of London Institute. Prof. Unwin is a past president of the Institutions of Civil Engineers and Mechanical Engineers.

Prof. MACBRIDE, the distinguished zoologist, who occupies the chair of zoology in the Imperial College of Science and Technology, South Kensington, was born at Belfast and educated there at Queen's College, and at St. John's College, Cambridge. From 1897 until 1909 he was Strathcona professor of zoology in McGill University, Montreal. A teacher of distinction, Prof. MacBride has made noteworthy contributions to invertebrate embryology. In 1924 he published his "Introduction to the Study of Heredity."

Mr. CLAYDEN was born at Boston, Lincolnshire, and educated at University College School, from whence he graduated at Christ's College, Cambridge. From 1894 until 1920 he was principal of University College, Exeter. Mr. Clayden has contributed much of sterling value to meteorological photography.

Prof. A. G. PERKIN, who, it will be recalled, retired recently from the chair of colour chemistry and dyeing in the University of Leeds, was born at Sudbury. He was educated at the City of London School and Royal College of Science. In 1924 the Royal Society awarded him its Davy medal for researches on the structure of natural colouring matters.

Sir JOHN SNELL was born at Saltash, Cornwall, and educated at Plymouth Grammar School and King's College, London. A past president of the Institution of Electrical Engineers, he is a member of the Advisory Council, Department of Scientific and Industrial Research, and the General Board, National Physical Laboratory. Sir John's advice and guidance are sought frequently in parliamentary projects concerning the technical industries.

Prof. BEWS, born at Kirkwall, Orkney, graduated at the University of Edinburgh. Assistant professor of botany there (1908–10), he left to take up the chair of botany in University College, Natal. In 1924 he published "Plant Forms and their Evolution in South Africa."

Prof. D. H. CAMPBELL, botanist, was born at Detroit, U.S.A. After graduation at the University of Michigan, he studied at Bonn, Tübingen, and Berlin. Professor of botany at Indiana University from 1888 until 1891, he was then elected to a similar chair at Stanford University, California. Prof. Campbell is a foreign member of the Linnean Society of London and a fellow of the Royal Society of Edinburgh. He is the author of "Plant Life and Evolution" (1911) and of many papers on systematic botany.

Prof. CASH, a graduate of the University of Edinburgh, is Emeritus Regius professor of materia medica in the University of Aberdeen.

Societies and Academies.

LONDON.

Royal Society, December 2.—T. M. **Lowry** and W. R. C. **Coode-Adams**: Optical rotatory dispersion (Pt. 3). The rotatory dispersion of quartz in the infra-red, visible, and ultra-violet regions. Measurements of optical rotatory power of quartz were begun in 1908 with the view of testing, in the most drastic way possible, methods that were being developed for studying rotatory dispersion in organic compounds. Data are now given for the rotatory power at 20° C. of a column of quartz, 496·4735 mm. in length, over a range of wave-lengths from 25,170 Å.U. to 2263 Å.U. Observed rotations range from 450° to 101,332°, and rotations per mm. from 0·906° to 202·328°/mm. The latter can be expressed, over the entire range of wave-lengths, by the formula—

$$a = \frac{9{\cdot}5639}{\lambda^2 - 0{\cdot}0127943} - \frac{2{\cdot}3113}{\lambda^2 - 0{\cdot}000974} - 0{\cdot}1905.$$

This formula postulates the existence of bands of selective absorption at 1130 Å.U. and 310 Å.U. The influence of infra-red bands is covered by the small constant −0·1905.

O. W. **Richardson**: Structure in the secondary hydrogen spectrum (v). Fulcher's red bands as extended by various authors form a sequence of bands with the respective vibration transitions $0 \rightarrow 0$, $1 \rightarrow 1$, $2 \rightarrow 2$, $3 \rightarrow 3$, $4 \rightarrow 4$, and $5 \rightarrow 5$. The green bands belong to the same group and have the vibration transitions $1 \rightarrow 0$, $2 \rightarrow 1$, $3 \rightarrow 2$, $4 \rightarrow 3$, and $5 \rightarrow 4$. Associated with these are five bands in the infra-red with transitions $0 \rightarrow 1$, $1 \rightarrow 2$, $2 \rightarrow 3$, $3 \rightarrow 4$, and $4 \rightarrow 5$, and four in the blue-green with transitions $2 \rightarrow 0$, $3 \rightarrow 1$, $4 \rightarrow 2$, and $5 \rightarrow 3$. The blue bands arranged by Dieke form a sequence in another group and have the transitions $0 \rightarrow 0$, $1 \rightarrow 1$, $2 \rightarrow 2$, $3 \rightarrow 3$, and $4 \rightarrow 4$. Belonging to this group are three other sequences with transitions 1 up, 1 down, and 2 down respectively. There are also at least three less well-developed groups in the violet side of these. The Q (1) lines of the bands with $0 \rightarrow 0$ vibration transitions are given by the Rydberg-Ritz formula

$$\nu = A - \frac{R}{(m - 0{\cdot}056704 - 0{\cdot}06080/m^2)^2},$$

where $A = 29330{\cdot}305$, $R = 109678{\cdot}3$, and $m = 3, 4, 5, 6, 7, 8$. The value of A is close to that of the second member when $m = 2$. It follows that the various groups of bands are associated with electron transitions $3 \rightarrow 2$, $4 \rightarrow 2$, $5 \rightarrow 2$, etc. The lines of the Q branches are connected together by a combination rule which extends not only within each group but also from each group to the others.

R. H. **Fowler**: General forms of statistical mechanics, with special reference to the new quantum mechanics. This paper discusses a very general form of statistical mechanics which includes as special cases the classical form, the form of Bose and Einstein, and of Fermi and Dirac. It is shown generally that assemblies of many independent systems are always thermodynamic systems. The correct form for material particles obeying the laws of quantum mechanics is then discussed, and the arguments in favour of the form of Fermi and Dirac summarised. The applications of this form are then greatly extended. Previously it had been applied only to structureless mass-points; it is here shown how to treat assemblies as general as any handled in the classical form. Problems of distribution in space according to the new mechanics are also briefly treated.

R. H. **Fowler** and E. K. **Rideal**: On the rate of maximum activation by collision for the complex

molecules, with applications to velocities of gas particles. New formulæ are used to compute the maximum rate of activation by collision and applied to the dissociation of nitrogen pentoxide. The maximum possible rate of activation by collision is 100 times greater than the observed rate of dissociation at the lowest pressures hitherto investigated. The maximum possible rate of dissociation of bromine molecules by collision and the rate of formation of hydrobromic acid are of the same order. The rate of dissociation need not be 10^5-10^6 times smaller, as claimed by Polanyi.

H. **Dingle**: The spectrum of fluorine (F I). The spectrum of neutral fluorine (F I) has been examined by means of discharges through silicon tetrafluoride, and lists of established and doubtful lines have been tabulated. It contains doublet and quartet systems of terms. The suggested arrangement is consistent with Carragan's observations of the Zeeman effect for fluorine. Relative term values have been deduced for each system, and an ionisation potential of about 17 volts suggested. The discussion suggests that lines of F I should appear with maximum intensity at or near A0 in the Harvard sequence.

Eighteen papers were read in title only.

MANCHESTER.

Literary and Philosophical Society, November 2.—H. B. **Dixon** and W. F. **Higgins**: The burning of gases in nitrous oxide. A small jet of hydrogen burning in air is almost invisible and its light is inappreciable: if nitrous oxide, instead of air, is made to feed the flame, the increase in the size and luminosity of the flames is remarkable. The jet of issuing gas is surrounded by a luminous apricot-coloured zone, and outside this is a thick sheath of greenish-grey colour. The luminous zone appears to give a continuous spectrum, and this is confirmed by a spectrogram taken with a 24 hours' exposure. Hydrocarbon gases burning in nitrous oxide show an intensely bright centre surrounded by a luminous apricot zone, and round all a wide-stretching green-grey envelope. The propylene and acetylene flames deposit a sheath of carbon round their luminous cores. All the gases tested in the 'concentric-tube' apparatus have ignition-points in nitrous oxide lower than those in oxygen or air. They all exhibit a lowering of nitrous-point above and below the *crucial pressure*, just as in oxygen or in air.—R. W. **James**: The intensity of reflexion of X-ray from crystals at low temperatures. The temperature coefficient of X-ray reflection from crystals of rock-salt over a range of temperatures from 290° Abs. to 85° Abs. has been measured. The crystal is suspended just above the surface of liquid air contained in a Dewar flask having specially thin walls made of boro-silicate glass. With molybdenum $K\alpha$ the absorption in the glass is only about 30 per cent. The ratios of the intensities of reflection at 85° Abs. to that at 290° Abs. are 1·22, 1·61, 2·36, 3·39, for the 2nd, 3rd, 4th, and 5th order reflections respectively, from the cube face of the crystal. This is in accord with Debye's theory. At higher temperatures the intensity decreases too rapidly. According to recent work by Waller the value of the exponent should be double that calculated by Debye. At low temperatures the present experiments point to the substantial correctness of Waller's formula.

November 16.—R. **Robinson**: Some recent advances in organic chemistry. In the aliphatic group, special interest attaches to the work of Dudley, Rosenheim, and Starling on the tetra-acid base, spermine, which has been isolated and proved by synthesis to possess the formula—

$$NH_2(CH_2)_3NH(CH_2)_4NH(CH_2)_3NH_2.$$

In the alicyclic group, Ruzicka, after doing much to clear up the chemistry of the sesquiterpenes, has made the astonishing discovery of the stability of large rings of carbon atoms. The clue was furnished by the study of the ketone, civetone, from certain glands of the civet cat. This substance was proved to be cycloheptadecenone. In the aromatic groups Harington has studied the active constituent of the thyroid gland and shown it to be the tetra-iodo derivative of a compound termed deiodothyroxin. The latter contains a diphenyl ether group, is related to tyrosine and has been synthesised. Turning to the heterocyclic groups, H. Fischer's recent announcement of the transformation of cryptopyrrole into aetioporphyrin marks a great advance in our knowledge of chlorophyll and of the blood pigment. For the first time the synthetical method affords evidence of the arrangement of the four pyrrole nuclei in the molecule. The most striking feature of recent organic chemical theory is the increasing use which is made of conceptions based on the electronic theory of valency. Thus, it can be shown theoretically that electrophile groups, those which attract electrons and, for example, actually positively charged centres, have a *m*-directive tendency. On the other hand, groups which are less electrophile than hydrogen is, have an *o-p*-directive tendency.

PARIS.

Academy of Sciences, November 8.—Ch. **Lallemand**: A world-wide scheme for measurements of longitude. The scheme starts with the determination of the differences of longitude between three fundamental points, nearly on the same parallel, and about 120° apart. For these points three permanent observatories were chosen (Algiers, Shanghai, San Diego), and these are to be connected by secondary polygons. Full use is made of radio telegraphy, associated with the most perfect methods of astronomical observation available. Wherever possible, self-recording methods are utilised.—H. **Dauvillé**: Some observations on the Cretaceous strata to the south of Paris.—R. Jarry **Desloges**: The changes observed in the planet Mars during the apposition of 1926. A list of changes from the configurations seen in 1924.—J. **Schokalsky**: The expedition of the Russian Geographical Society in Mongolia (1924–1926).—S. **Drzewiecki**: A new representation of a gas. Application to the barometric pressure. Starting with a simple deduction from the kinetic theory of gases, a new formula for the variation of barometric pressure with altitude is deduced. This formula contains a series in ascending powers of g, and if all terms of this series except the first be neglected, it reduces to the ordinary Laplace formula.—W. **Arkadiew**: The oscillations and resonance of elementary magnets.—H. **Volkringer**: The continuous spectrum of mercury. The continuous spectrum of mercury vapour under oscillating discharge, studied in a tube without electrodes, was of maximum intensity at about 240° C. (vapour pressure 35 mm.). The distribution of energy in the spectrum was determined by comparison with the energy emitted by a black body at 1520° C. The curve given shows a maximum in the neighbourhood of $\lambda = 0{\cdot}512\mu$ and is nearly symmetrical about this point.—René **Dubrisay**: The action of heat on the superficial properties of kaolin. Kaolin was heated to 250° C., 550°-600° C., and 950°-1000° C. The unheated sample and the three heated samples were compared with respect to their adsorption of iodine and of methylene blue, the heat developed on moistening with water and ammonia solution, and apparent volume after shaking up with water and ammonia solution. The comparative results of these experiments are given in tabular form.

—Pierre **Jolibois**, Henri **Lefebvre**, and Pierre **Montagne**: Comparison between the effects of the electric spark and of thermal dissociation.—H. **Forestier** and G. **Chaudron**: The ferromagnetic characters of stable iron sesquioxide.—Jean **Cournot** and Jean **Bary**: Electrolytic plating of aluminium and light alloys, their adherence and resistance to corrosion by sea water. Aluminium and duralumin were used in these experiments. The deposited metals were cadmium, cobalt, and chromium (all on a copper film), also cadmium directly on duralumin. Detailed accounts of cleaning methods and depositing baths are given. As regards resistance to sea water, copper-chromium deposited on aluminium gave the best results.—A. **Sanfourche**: The cementation of iron by silicon chloride.—C. **Marie** and J. **Bertheloot**: Two causes of error in the electrolytic determination of nickel in the presence of iron. The precipitated oxide of iron retains some nickel and the deposited nickel contains some iron. These errors may sometimes compensate each other. The first error may be prevented by the addition of magnesium sulphate, the second by using a diaphragm of filter paper round the cathode.—Georges **Dubois**: Geological study of the Flemish coast in the neighbourhood of Gravelines.—P. **Russo**: The presence of a large volcanic region in the lower plain of Moulouya (Northern Morocco).—Const. A. **Kténas**: The evolution of the volcano of Kamenis (Santorin) in 1926.—Louis **Besson**: Relation between the temperatures of certain months in the year. Taking the mean monthly temperatures at Paris for 123 years, and plotting the figures for July and April against the date, it is seen that there is a remarkable similitude between the two curves; if one curve is displaced seven years the two curves are almost parallel.—J. **Magrou**: *Bacterium tumefaciens* in the tissues of plant cancers. The observations described, which agree with those of Robinson and Walkden and of Pinoy, suggest that the agent of cancer in plants acts at a distance, by a mechanism which remains to be explained, on the cells in which it is causing multiplication.—Stefan **Jellinek**: A biological sign marking the return of spontaneous respiration in cases of apparent death. The first sign of restoration of breathing is a swallowing movement of the larynx and lips.—Alphonse **Labbé**: Herouardia, a new genus of copepod, intermediate between the Harpacticidæ and the Cyclopidæ.—A. **Dorier**: The commensalism of the larva of *Dactylocladius brevipalpis*.—Auguste **Lumière** and Mme. **Montoloy**: The formation of abscesses of fixation.

Official Publications Received.

BRITISH AND COLONIAL.

Ministry of Finance, Egypt: Survey of Egypt, Geological Survey. The Geography and Geology of the District between Gebel 'Atâqa and El-Galâla El-Bahariya (Gulf of Suez). By Dr. H. Sadek. (Survey of Egypt Paper No. 40.) Pp. viii+120+6 plates. (Cairo: Government Publications Office.) 10 P.T.

Proceedings of the Isle of Wight Natural History Society for 1925. Vol. 1, Part 6. Pp. cccxiii-cccxviii+319-403. (Newport, I.W.: The County Press.) 3*s*.

Union of South Africa: Department of Agriculture. Science Bulletin No. 53: Yoking Oxen to the Plough; a new System. By Dr. W. S. H. Cleghorne. Pp. 14. (Pretoria: Government Printing and Stationery Office.) 3*d*.

CATALOGUES.

Catalogue of General and Industrial Laboratory Appliances. Eighth edition. Pp. 1214. (London: A. Gallenkamp and Co., Ltd.)

Medizin und Naturwissenschaften. Mit einem Vorwort von Prof. Dr. Henry E. Sigerist. Pp. xii+103. (Leipzig: Georg Thieme Verlag.)

Books on Art and the Decorative Crafts. Catalogue 488, November. Pp. 56. (London: Francis Edwards.)

A New Catalogue of Publishers' Remainders and other Purchases. No. 131. Pp. 24. (London: Henry W. Glover.)

Firth 'Staybrite': the New Acid-Resisting Steel. Pp. 20. (Sheffield: Thos. Firth and Sons, Ltd.)

Cambridge Unipivot Instruments for D.C. Measurements. List No. 160. Pp. 27. (London: Cambridge Instrument Co., Ltd.)

Diary of Societies.

SATURDAY, DECEMBER 11.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS (South-Western District Meeting) (at Vestry Hall, Dawlish), at 2.15.—S. F. C. Church: Twenty Years in an Urban District.

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS (Associates' and Students' Sections) (jointly with Graduate Sections of North-East Coast Institution of Engineers and Shipbuilders, and Institution of Electrical Engineers) (at Neville Hall, Newcastle-upon-Tyne), at 3.—Joint Discussion on The Production and Transport of Coal by Machinery.

MINING INSTITUTE OF SCOTLAND (at Royal Technical College, Glasgow), at 3.—A. Kyle: Mineral Boring.—Discussions on the following—Coal-Cutting by Machinery and Conveyors in Scottish Mines, G. L. Kerr.—The Problem of In-bye Transport, D. C. Gemmell.—Miner's Nystagmus, Dr. F. Fergus.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Dr. C. Rootham: Henry Purcell and his Contemporaries (1).

PHYSIOLOGICAL SOCIETY (at London Hospital Medical College), at 3.30.—Demonstrations—A Simple Colorimeter Lamp, H. D. Kay.—An Easily-constructed Ultrafilter, R. S. Aitken and H. D. Kay.—A Method of Collecting 'Alveolar Air' during Exercise, A. E. Clark-Kennedy and T. Owen.—The Fractional Analysis of an Expired Breath, R. S. Aitken and A. E. Clark-Kennedy.—Apparatus for Measuring the Osmotic Pressure of Proteins at Constant Hydrogen-Ion Concentration, J. R. Marrach.—Dr. W. A. M. Smart: Some Nomograms of Physiological Interest.—Prof. H. E. Roaf: (*a*) Apparatus for Measuring the Influence of Intensity of Light on Discrimination of Wave-lengths; (*b*) Effect of Exposure of the Eye to a Coloured Light on its Sensitivity to Various Regions of the Spectrum; (*c*) Apparatus for Measuring the After Effects of Exposure of the Eye to any Region of the Spectrum.—S. Wright: A Simple Respiratory Apparatus for Man or Animals.—D. T. Barry: Experimental Lesions of Mitral and Tricuspid Valves.—E. D. Adrian and R. Eckhard: The Time Relations and Frequency of Impulses in the Optic Nerve.—J. T. Cunningham: The Function of the Scrotum.—H. A. Harris: The Growth of the Long Bones in Health and Disease; its Relation to Vitamines and Tissue-Culture.—Dr. F. W. Edridge-Green: The White Equation and its Relation to the Theory of Colour Vision.—F. R. Curtis, A. A. Moncrieff, and S. Wright: On a Supposed Pressor Substance in the Blood of Patients with Hypertension.—I. de Burgh Daly: Effect of a Negative Pressure on the Heart-Lung Preparation.—K. Furusawa: A Muscle Twitch Lasting for Hours.—D. T. Barry and J. Freud: Toxæmia from Liver Grafting.—Prof. H. S. Raper: Indole Derivatives from Tyrosine.—F. Campbell Smith: The Ultra-violet Absorption Spectra of Centrospinal Fluids (Preliminary Communication).

BRITISH PSYCHOLOGICAL SOCIETY (Annual General Meeting) (at University College), at 3.30.—J. C. Flugel: Practice, Fatigue, and Oscillation.

INSTITUTE OF BRITISH FOUNDRYMEN (Newcastle and District Branch) (at Neville Hall, Newcastle-upon-Tyne), at 6.15.—W. J. Molineux: The Manufacture of Iron Castings for Petrol Engines.

INSTITUTE OF BRITISH FOUNDRYMEN (Birmingham, Coventry, and West Midlands Branch) (at Engineers' Club, Birmingham), at 6.30.—W. West: Oil, Sand, and Motor Castings.

HULL ASSOCIATION OF ENGINEERS (at Hull Technical College), at 7.15.—Prof. F. C. Lea: Hydro-Electrical Developments.

OIL AND COLOUR CHEMISTS' ASSOCIATION (Manchester Section) (at Manchester).—R. S. Horsfall: Modern Industrial Chemistry.

MONDAY, DECEMBER 13.

ROYAL GEOGRAPHICAL SOCIETY (at Lowther Lodge), at 5.—Sir Henry Lyons: Ancient Survey Instruments.

SOCIETY OF ENGINEERS (at Geological Society), at 5.45.—Prof. F. H. Hummel: The Economic Proportions, and the Stresses in a Solid Masonry Dam or Buttress, subjected to Water Pressure acting on an Inclined Face.

INSTITUTION OF ELECTRICAL ENGINEERS (London Students' Section) (at Institution of Mechanical Engineers), at 7.—E. H. Lewis: Payment by Results.

INSTITUTION OF ELECTRICAL ENGINEERS (Mersey and North Wales (Liverpool) Section) (at Liverpool University), at 7.—H. W. Edmundson and G. B. Robertson: The Making of a Radio Valve.

INSTITUTION OF ELECTRICAL ENGINEERS (North-Eastern Circle) (at Armstrong College, Newcastle-upon-Tyne), at 7.—J. R. Beard and T. G. N. Haldane: The Design of City Distribution Systems, and the Problem of Standardisation.

INSTITUTION OF MECHANICAL ENGINEERS (Graduates' Section, London) (jointly with Student Sections of the Institutions of Civil and Electrical Engineers), at 7.—E. H. Lewis: Payment by Results.

INSTITUTE OF METALS (Scottish Local Section) (at 39 Elmbank Crescent, Glasgow), at 7.30.—Protection Coating of Metals:—C. H. Faris: Fescolising.—N. C. Marples: Colorising.—E. A. Ollard: Chromium Plating.

RAILWAY CLUB, at 7.30.—W. H. R. Dawson: The Underground Railway.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 8.—G. Drysdale: The Work of Leonard Stokes.

ARISTOTELIAN SOCIETY (at University of London Club), at 8.—J. Anderson: The Knower and the Known.

INSTITUTE OF CHEMISTRY (Leeds Area Section).—F. Scholefield: Registration of Chemists.

TUESDAY, DECEMBER 14.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Sir William Bragg: The Imperfect Crystallisation of Common Things (4).

INSTITUTION OF PETROLEUM TECHNOLOGISTS (at Royal Society of Arts), at 5.30.—Dr. W. R. Ormandy, E. C. Craven, Prof. I. M. Heilbron, and H. J. Channon: A Contribution to the Study of the Origin of Petroleum. The Berginisation of Fish Liver Oils and Other Bodies.

INSTITUTION OF CIVIL ENGINEERS, at 6.—G. Ellson: The Remodelling of Charing Cross and Cannon Street Stations.

INSTITUTE OF MARINE ENGINEERS, at 6.30.—Presidential Address.

INSTITUTION OF ELECTRICAL ENGINEERS (North Midland Centre) (at Hotel Metropole, Leeds), at 7.

INSTITUTION OF ELECTRICAL ENGINEERS (North-Western Centre) (at Engineers' Club, Manchester), at 7.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Scientific and Technical Group), at 7.—W. B. Ferguson: A Modified F.R.B. Photometer Working with Constant Illumination of Field.—F. J. Tritton: The Application of Copper Salts in the Carbro Process.—A. B. Crow: A New Camera for Colour Photography.

INSTITUTE OF BRITISH FOUNDRYMEN (Lancashire Branch, Burnley Section) (at Burnley Municipal College), at 7.15.—Discussion.

SOCIETY OF CHEMICAL INDUSTRY (Newcastle-on-Tyne Section) (at Armstrong College, Newcastle-on-Tyne), at 7.30.—L. H. Sensicle: The Future of High Temperature Carbonisation.

INSTITUTION OF ELECTRICAL ENGINEERS (Scottish Centre) (at Royal Technical College, Glasgow), at 7.30.—J. R. Beard and T. G. N. Haldane: The Design of City Distribution Systems, and the Problem of Standardisation.

INSTITUTION OF AUTOMOBILE ENGINEERS (Coventry Centre) (at Parkside, Coventry), at 7.30.—G. Rushton: The L.G.O.C. Methods of Repairing Motor Buses.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Middlesbrough Branch) (at Middlesbrough), at 7.30.—W. J. Williams: Technical Education.

QUEKETT MICROSCOPICAL CLUB, at 7.30.—Miss A. Lorrain Smith: Some Aspects of Lichens in Nature and in Art.

PHARMACEUTICAL SOCIETY, at 8.—F. H. Carr: The Vitamins in their Relation to Pharmacy.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.30.—Capt. G. Pitt-Rivers: The Effect on Native Races of Contact with European Culture, followed by a discussion by the Hon. W. Ormsby-Gore, Major A. G. Church, Major H. Vischer, and others.

ROYAL SOCIETY OF MEDICINE (Psychiatry Section), at 8.30.—Dr. W. Aldren Turner: Some Observations upon Epilepsy (Presidential Address).

WEDNESDAY, DECEMBER 15.

SOCIETY OF GLASS TECHNOLOGY (at University College), at 2.30.—J. F. Hyslop, R. Gumm, and H. Biggs: Some Corrosion and Erosion Phenomena and their Bearing on the Macrostructure of Refractories.—J. F. Hyslop and H. P. Rooksby: A Note on the X-Ray Patterns of Mullite and Sillimanite.—Prof. W. E. S. Turner: Further Note on Sillimanite as a Glass Works Refractory.—V. H. Stott: The Viscous Properties of Glass.—Prof. W. E. S. Turner: The Effect of Cullet on the Melting of Glass.—Dr. S. English: The Design of Parison Moulds.

ROYAL METEOROLOGICAL SOCIETY, at 5.—N. K. Johnson: Some Meteorological Observations made at Sea.—N. K. Johnson and E. L. Davies: Some Measurements of the Surface Temperatures in Various Kinds of Soil.—Dr. A. N. Puri: Investigation on the Behaviour of Hair Hygrometers.

GEOLOGICAL SOCIETY OF LONDON, at 5.30.—J. H. Davies and Dr. A. E. Trueman: A Revision of the Non-Marine Lamellibranchs of the Coal Measures, and a Discussion of their Zonal Sequences.—Major L. M. Davies: The Ranikot Beds of Thal (North-West Frontier Provinces of India).

NEWCOMEN SOCIETY FOR THE STUDY OF THE HISTORY OF ENGINEERING AND TECHNOLOGY (at 17 Fleet Street), at 5.30.—J. G. A. Rhodin: Christofer Polhem, 'The Archimedes of the North.'—A. Waerland: Mårten Triewald and the First Steam Engine in Sweden.

INSTITUTION OF CIVIL ENGINEERS (Students' Meeting), at 6.30.—J. G. Kimber: Some Applications and Advantages of Town Gas.

INSTITUTION OF AUTOMOBILE ENGINEERS (Manchester Centre) (at Engineers' Club, Manchester), at 7.—F. Randle: Radiator Design.

SOCIETY OF CHEMICAL INDUSTRY (Glasgow Section) (at 39 Elmbank Crescent, Glasgow), at 7.—Dr. E. W. Smith: Some Technical Aspects of the Fuel Problem.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Graduate Section) (at Newcastle-upon-Tyne), at 7.15.—L. P. Tappin: Some Problems of the Locomotive.

INSTITUTION OF ELECTRICAL ENGINEERS (Sheffield Sub-Centre) (at Royal Victoria Hotel, Sheffield), at 7.30.

MERSEYSIDE AQUARIUM SOCIETY (at 1 Falkland Road, Egremont), at 7.30.—R. J. Daniel: Marine Fishes and their Food.

SOCIETY OF TECHNICAL ENGINEERS (London Area) (at 102 Belgrave Road), at 7.30.—The Present Status and Position of Technical Engineers in Russia (Address).

ROYAL SOCIETY OF ARTS, at 8.—W. J. U. Woolcock: Some Aspects of the Chemical Industry.

C.B.C. SOCIETY FOR CONSTRUCTIVE BIRTH CONTROL AND RACIAL PROGRESS (at Essex Hall, Strand), at 8.—Lieut.-Col. Sir John Ramsay: Birth Control as an Official and Administrative Question.

EUGENICS SOCIETY (at London University Union, Malet Street), at 8.—Dr. C. V. Drysdale and others: Discussion on The Common Sense of Heredity: Natural Selection Reversed, Results in Reversal of Evolution.

FOLK-LORE SOCIETY (at University College), at 8.—C. Tabor: The Folklore of Dancing.

ROYAL MICROSCOPICAL SOCIETY, at 8.—C. Beck: A Method of Testing Zonal Aberration.—S. Hirst: Note on the Development of *Allothrombium fuliginosum* Hermann.—Dr. A. Kefalas: A Method of Staining Sections in Acetone.—Capt. J. Ramsbottom and E. H. Ellis: Seedling Structure of Cultivated Orchids.

ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY (at Northampton Polytechnic Institute), at 8.15.—A. W. Hothersall: Acidity of certain Plating Solutions.

BRITISH PSYCHOLOGICAL SOCIETY (Medical Section) (at Royal Society of Medicine), at 8.30.—Dr. B. Hart: The Dissociation of Conception (Chairman's Address).

MERSEYSIDE AQUARIUM SOCIETY (at Egremont, Cheshire).—R. J. Daniel: Marine Fishes and their Food.

THURSDAY, DECEMBER 16.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Sir Squire Spriggs: Medical Literature in relation to Journalism.

CHILD-STUDY SOCIETY (at Royal Sanitary Institute), at 6.—Dr. J. H. Jagger: Criticism of the Infant School.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Col. E. Mercier: Notes on the 60,000-Volt Underground Network of the Union d'Electricité.

INSTITUTE OF METALS (Birmingham Local Section) (at Engineers' Club, Birmingham), at 7.—Dr. W. Rosenhain: Hardening.

CHEMICAL SOCIETY, at 8.—E. J. B. Willey and Dr. E. K. Rideal: On Active Nitrogen. Part I. The Heat of Formation and Nature of Active Nitrogen.—Dr. E. K. Rideal and W. M. Wright: Low Temperature Oxidation at Charcoal Surfaces. Part III. The Behaviour of Blood Charcoal and the Influence of Temperature on the Reaction Rate.—S. G. Clarke, J. Kenyon, and H. Phillips: Investigations on the Dependence of Rotatory Power on Chemical Constitution. Part XXXI. The Resolution of a Sulphilimine into its Optically Active Forms.

ROYAL AERONAUTICAL SOCIETY.—Wing-Comdr. C. D. Breeze: The Training of Aircraft Apprentices.

INSTITUTION OF MECHANICAL ENGINEERS (Birmingham Branch) (at Birmingham).—Prof. E. G. Coker: Elasticity and Plasticity (Thomas Hawksley Lecture).

INSTITUTION OF MECHANICAL ENGINEERS (Manchester Branch) (at Manchester).—T. A. F. Stone: Electric Locomotives: A Method of Classifying, Analysing, and Comparing their Characteristics.

INSTITUTION OF MECHANICAL ENGINEERS (Yorkshire Branch) (at Leeds).—J. H. Barker: Chairman's Address.

INSTITUTION OF MINING AND METALLURGY (at Geological Society).

FRIDAY, DECEMBER 17.

SOCIETY OF CHEMICAL INDUSTRY (Liverpool Section, jointly with Fuel Section) (at Liverpool), at 6.—H. P. Lupton: Gas Undertakings and the Fuel Problem.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Pictorial Group), at 7.—Questions and Problems.

PHOTOMICROGRAPHIC SOCIETY (at 4 Fetter Lane), at 7.—Members' Evening.

SOCIETY OF CHEMICAL INDUSTRY (Chemical Engineering Group, jointly with Birmingham Section) (at Birmingham University), at 7.15.—Prof. J. W. Hinchley: Measurement of Temperature in Technical Practice.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—H. D. Glover: Progress Methods employed in a Large Mass Production Motor Works.

INSTITUTE OF METALS (Sheffield Local Section) (at Sheffield University), at 7.30.—J. S. Hurst: The Influence of Sulphur in Cast Iron.

ROYAL SOCIETY OF MEDICINE (Electro-Therapeutics and Surgery Sections), at 8.30.—Dr. E. P. Cumberbatch (Electro-Therapeutics) and F. J. Steward (Surgery): Discussion on Diathermy.

SOCIETY OF DYERS AND COLOURISTS (Manchester Section) (at Manchester).—H. L. Hockney and C. W. Bancroft: Cloth Dyeing suitable for Rubber Proofing.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY (Chemical Section) (at Manchester).

WEST OF SCOTLAND IRON AND STEEL INSTITUTE (at Royal Technical College, Glasgow).—J. S. G. Primrose: Rod Rolling and Wire Drawing.

SATURDAY, DECEMBER 18.

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

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Dr. C. Rootham: Henry Purcell and his Contemporaries (2).

PUBLIC LECTURES.

SATURDAY, DECEMBER 11.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—M. A. Phillips: The Nursery Life of Animals.

SUNDAY, DECEMBER 12.

GUILDHOUSE (Eccleston Square), at 3.30.—Viscount Grey: The National Genius of England.

MONDAY, DECEMBER 13.

ROYAL SANITARY INSTITUTE, at 8.—Dr. W. A. Robson: Legal Conceptions of Public Health (Chadwick Lecture).

TUESDAY, DECEMBER 14.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 7.30.—W. G. Newton: The Wealth of England.

SWEDENBORG HALL (Hart Street, W.C.1), at 8.—Rev. C. A. Hall: The Philosophy and Theology of Swedenborg.

WEDNESDAY, DECEMBER 15.

UNIVERSITY COLLEGE, at 5.30.—Prof. A. E. Richardson: Public Library Architecture.

SUNDAY, DECEMBER 19.

GUILDHOUSE (Eccleston Square), at 3.30.—Miss Maude Royden: The Debt of Theology to Science.