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The Boxer Indemnity and Chinese Education.

IF it were not for the remarkable powers of recuperation which China has shown on more than one occasion after an apparently crushing disaster, present conditions in that country would appear to afford anything but an opportune moment for discussion of the possibilities of reform and regeneration. An enormous number of her population, estimated at thirty millions, has been rendered destitute by floods, and the country is in the throes of civil war between rival provincial governors. Yet the situation is not entirely without hope. China, for better or for worse, has adopted the form of Western institutions of government. Whatever may be the outcome of the present struggle, which represents on one side an attempt to secure unity with strong central control by force, the future of the country will depend upon how far the Chinese are enabled to assimilate the spirit of Western culture, without which superficial measures of reform may well be a delusion and a disaster. A wise use of the Boxer indemnity, which is to be remitted from the year 1922, would play a paramount part in shaping the course of events. The size, the vastness of the resources, and the immense numbers of the population of China, make the question of her future development of vital and world-wide interest. It is unnecessary to emphasise here the importance of China as a centre of production in relation to world supply, both now and still more in the future. The fact alone that two hundred thousand foreigners are resident in the country, for the most part interested in some form of industry or commerce, makes good government and the stability of the country a matter of immediate concern to the nations to which they belong, while it is no longer possible that a state of unrest in almost any country, however remote, can for any length of time fail to affect other parts of the world.

Without going into detail, it may be useful to recapitulate briefly the present position of the Boxer indemnity so far as Great Britain is concerned. In 1922 it was decided by the Government then in power to remit the balance of the indemnity due from China to Great Britain on account of the Boxer Rising in 1900. The indemnity was payable over a term of years which had been extended to 1945. The payments affected thus cover a period of twenty-three years, the amount payable being 400,000*l.* per annum, representing a capital sum of approximately 11,000,000*l.* The remission, however, was not absolute: the amount due is still to be collected from various sources of Chinese revenue; but instead of being paid into the Sinking Fund, it is to be devoted to objects beneficial to both

countries. A Bill to give effect to this decision was introduced into Parliament in May of this year, but has still to be passed by the legislature.

It is scarcely necessary to enter into the reasons which led to this course of action on the part of the British Government; nor indeed have they ever been fully stated. One consideration which no doubt carried great weight was the fact that of the powers interested, two—the United States and Japan—had already remitted their indemnities on conditions. Great Britain could not have stood aside without damage to her prestige. France also, without remitting her payments, has devoted them to liquidating the affairs of a French bank in China of which the depositors were mainly Chinese. The claims of Germany, the largest participant, were cancelled during the War. Payments to Russia ceased after the collapse of that country, but, by arrangement between China and the Soviet Government, the whole of the Russian indemnity, arrears and future payments alike, is to be devoted to "promotion of education among the Chinese people."

Misappropriation of the funds made available by the cancellation of the obligation to Germany, has served as a warning to those powers which were prepared for remission. They desired to act for the benefit of China; but it was clear that in the disturbed condition of the country which has prevailed since the reform movement of 1911, a strong hand was needed to secure that the people as a whole would profit by the advantages which should accrue from a judicious expenditure of the amount thus made available.

In the Bill introduced into Parliament it was stated, following the announcement on remission made in December 1922, that the amounts receivable from the indemnity fund were to be expended upon objects beneficial to both countries. Various suggestions have been put forward to give precision to this vague phrase. Deputations have urged that the money should be expended on public works under British supervision. Another suggestion was that a Science Museum should be instituted at Peking. In favour of the latter proposal there is little to be said. Even if the country were sufficiently advanced to reap the full benefit of such an institution, difficulties of communication and transport would militate against the free and extended use which alone would justify such a disposal of the funds. The benefit would be confined to Peking. For the former, the proposal to devote the money to public works, there is more to be said, but here again the amount is so small relatively to the size of the country, that in the end it could do little more than benefit one or two more or less restricted areas. Nor is appropriation for this purpose by any means such an urgent need as it has been attempted to make out.

If a broad view of the situation be taken, there can be no two opinions that both the needs of China and the wishes of the Chinese themselves point unmistakably in one direction, and that is education. This view has, at any rate, commended itself to the two powers which have already remitted the indemnity. In each case the funds are to be made available for education. It was at the suggestion of the Chinese themselves that the Russian indemnity has been devoted to this purpose. Among British residents in China, those who are most competent to speak with authority, namely, the representatives of the British Chambers of Commerce, have been most emphatic in urging the claims of education. Further, they have insisted that the situation calls for education on British lines. Thereby they hope that something of the British public school spirit may be introduced into Chinese education.

While the Chinese are endowed with many admirable qualities, in which those who know them best can see much that is closely akin to ourselves, they have many weaknesses which are no doubt due to the isolation in which their civilisation developed. Among them must be reckoned a too restricted view of their obligations and duties as citizens, arising from their intense preoccupation with the claims of the family group. To this must be attributed many of the defects of their government and public life, while, coupled with their distrust of foreigners, it has been responsible for their failure in their international relations both in peace and in war. Without any desire to offend, it may be said that they lack the training in public morality which education on British lines might be expected to develop. By long tradition the Chinese have a devotion to education which amounts almost to veneration; but that they themselves recognise the defects of their system is shown by the efforts at reformation which they have made since 1911. Chinese education is now under the control of a Minister of Education, and with Peking as administrative centre, there is a national system which includes primary and secondary schools, colleges and several universities. China thus possesses the skeleton of a system; but it must be confessed that it is nothing more than a skeleton, and perhaps, to continue the metaphor, not very successfully articulated. In addition, account must be taken of a number of educational institutions of all grades partly or wholly under foreign management, to a great extent the result of missionary enterprise.

The problem how best to utilise the resources which would be made available by using the Boxer Indemnity is in reality twofold. Although it has been possible to touch upon conditions in China only in the most cursory manner, probably enough has been said to show that a prolonged training is necessary before the

country can take the place in the comity of nations to which its importance, particularly in commerce, and its ancient civilisation might lay claim. Nor has anything been said of the danger to the rest of the world which lurks in neglect of this aspect of the question. It follows, however, that on one hand means should be found to give every assistance to the efforts of the Chinese themselves to reform and regenerate their educational system: on the other, it is urgently necessary to secure that such efforts at reform should be inspired by ideals of public and international morality in consonance, but not necessarily identical, with those of Western nations—a not insoluble problem, as is shown by the example of Japan.

It is evident that two considerations must be kept to the fore. In the first place, the sum available is small in proportion to the needs of so vast and so thickly populated a country, and as the funds come to an end in twenty-three years, permanence in result can only be secured by the co-operation of the Chinese themselves. Secondly, however, much as it may be desired to inculcate the spirit of a Western ideal, the education should be thoroughly national in character. The denationalised Chinese student is providing an element of danger in the present political situation which, with extended facilities for education on the lines of which he is the product, might become exceedingly grave. It is therefore necessary that most careful consideration should be given to any scheme which invites or requires Chinese co-operation such as was suggested by the representatives of the British Chambers of Commerce in conference at Shanghai in February 1923, who while urging emphatically that the funds from the Boxer Indemnity should be applied in the direction of education on British lines, regarded it as essential that in distribution there should be "adequate representation of China's opinion," or such a scheme as that outlined recently in these columns (August 30, p. 301), and also by Dr. R. P. Scott in the November issue of the *Empire Review* (see NATURE, November 15, p. 726). These schemes take into account the broad issues we have stated, namely, that, so far as possible, China as a whole should benefit in the exercise of British goodwill, that the fundamental considerations for success are real co-operation and sound finance; also, that higher education is the only field on which effective co-operation is feasible.

In conclusion, there are two points to which it is hoped attention would be given in working out details. One is that, in addition to scholarships for Chinese students tenable in Europe or America, there should be an exchange of lecturers for periods of at least a year; and secondly, that ample provision should be made for research in the geography, social history, and economics of China.

The Glands that regulate Sex.

The Internal Secretions of the Sex Glands: the Problem of the "Puberty Gland." By Prof. Alexander Lipschütz. With a preface by F. H. A. Marshall. Pp. xviii + 513. (Cambridge: W. Heffer and Sons, Ltd.; London: Simpkin, Marshall and Co., Ltd.; Baltimore, Md.: Williams and Wilkins Co., 1924.) 21*s.* net.

THE field of sexual physiology has been so active since "Die Pubertätsdrüse und ihre Wirkungen" was published in 1917, that it has been found necessary to rewrite the book and to give it a new title. Comparison of old and new provides a clear indication of the advances that have been made and of the modifications in opinion—including the author's own—that they have caused. The book is well planned and well written (in English): the illustrations are bountiful and excellent. There are a few of the inevitable typographical errors, and occasionally the author might perhaps have been happier in the choice of his word. But these are merely finicky fault-findings. This book can be strongly recommended to all those for whom the sections in Marshall's "Physiology of Reproduction" dealing with this subject are not sufficiently complete or recent, for in his treatment of the problems of sexual differentiation the author writes as a master.

The general theme of the book is that "in the ontogenetic development of the soma there is in the beginning an asexual stage, the subsequent differentiation of which is caused by the formative action of the sexual glands" (Steinach 1912, Lipschütz 1917). It is submitted that the soma is indifferent in the sense that either male or female sex-characters can develop, according to the kind of the sex-hormone, male or female, produced by the gonads. It can be said that the author has no difficulty in showing that in the mammal the sex-glands elaborate hormones which are able to modify the organism in a sex-specific way.

The book is of particular interest for the reason that it demonstrates in the clearest possible way the interrelationship of genetics and physiology. The problems of sex-determination have been appropriated by the geneticist, those of sex-differentiation by the physiologist, and as yet there is no link between the two. The author falters when brought face to face with the sex-chromosome sex-determining mechanism and finds it difficult to reconcile his theory of sexual differentiation with the established facts of sex-determination. The point of view of the physiologist is expressed in the statement (p. 104) that "*ceteris paribus*, femaleness depends on the ovary, maleness upon the testicle." The geneticist agrees that in the mammal, if an individual is to assume the sexual characterisation appropriate to the male, there must

be present in its body a functioning testicle, that *phenotypic* maleness (*i.e.* maleness as expressed in characterisation) depends on the testis, phenotypic femaleness on the ovary; but from the point of view of the geneticist, an individual develops a testis because it is a *genotypic* male, an ovary because it is a genotypic female.

Maleness and femaleness are characters in the Mendelian sense and are based upon hereditary sex-determining factors brought into the zygote by the conjugating gametes. In the genotype (the factorial constitution) of each zygote there are male-determining and female-determining factors, and these, it must be assumed, elaborate specific sex-differentiating substances. In the genetically determined male it is the rule for the balance between male- and female-determining factors to be such that the male-differentiating substances are efficiently in excess at that time during the development of the individual when the differentiation of the gonads occurs, and under these conditions the gonads become testes. In the determined female, on the other hand, the female-differentiating reactions are in excess at that time, and so the gonads become ovaries.

In order to bring the geneticist and the physiologist into agreement it is only necessary to extend the conception of asexuality, so ably developed in this book, so as to include the gonads. In the development of the gonads there is in the beginning an asexual (indifferent) stage, the subsequent differentiation of which is caused by the formative action of the sex-differentiating substances elaborated by the sex-determining factors. The embryonic gonad, according to the kind of internal environment (established by the sex-determining mechanism) in which it finds itself, can develop into either ovarian or testicular tissue.

The case of the free-martin (p. 389) has not been completely explained by the physiologist. The free-martin is a genotypic female whose sex-differentiation has been directed by the sex-hormone of its male co-twin, and whose sexual organisation is consequently abnormal. Difficulty is made of the fact that whereas the tissues of the genotypic male respond completely to the stimulus of the internal secretion of the testes, those of the genotypic female fail to do so. It is known that genotypic male and female tissues are to be distinguished by differences in their chromosome content and therefore, it may be assumed, in their physiological constitution, and it is reasonable to expect that, though both kinds may be capable of responding to one and the same stimulus, they will respond differentially. In the case of the free-martin, the male co-twin develops testes because he is a genotypic male and the testes elaborate the male sex-hormone. This, passing into the body of the genotypic female before her gonads have differentiated into ovaries, swings her sexual differentiation in the male direction. The swing is not complete because the sex-hormone of the testis is not equivalent physiologically to the sex-differentiating substances elaborated by the male sex-determining factors and because the tissues of the genotypic female are constitutionally different from those of the genotypic male.

In dealing with the question of the physiological action of the gonad in the fowl, the author, naturally enough, draws largely upon the work of Pézard and his collaborators, and with their opinions the geneticist frequently finds himself in disagreement. On p. 462, for example, the fact that Brown Leghorn cock and Silver Dorking hen threw daughters with the plumage characters of the Brown Leghorn, whereas Dorking cock and Leghorn hen gave daughters with the plumage characters of the Dorking, is interpreted as a case of sex-*limited* inheritance and the different plumage characters of the two kinds of daughters as an indication of a racial specificity in sex-hormone activity on the part of two different kinds of ovarian tissue. Prof. Lipschütz suggests that, if this theory is correct, ovariotomy of the two kinds of daughters should give the same result, namely, a plumage presenting a mixture of characters of Leghorn and Dorking, whereas, if such a castration experiment were to result in the plumage of a Leghorn poularde in one case and of a Dorking poularde in the other, it would be necessary to reject the theory. We assure him, however, that this very experiment has been undertaken, with the result that Leghorn and Dorking characterisations were obtained. There is not the slightest reason to call upon any product of the ovary in order to interpret these straightforward results of a mating involving sex-*linked* inheritance. It is enough to postulate that gold and silver are allelomorphic characters, that their factors are resident in the X-chromosomes, and that the female is the heterogametic sex.

Minoura's work on the artificial free-martin in the chick, to which reference is made (p. 311), demands critical repetition before it can be accepted as evidence of sex-hormone action. Any one who is well acquainted with the marked variability in the differentiation of the gonads and associated ducts in the chick must consider that Minoura's results were possibly due to simple interference with the normal process of sexual differentiation leading to irregularity and retardation, being in no way indicative of a specific action on the part of the implanted ovarian and testicular tissues.

In breaking a lance with his authorities, we do not criticise the author of this book; we merely take advantage of the appearance of so good a book to record our regret that it is not always possible for the physiologist to be well versed in genetics, the geneticist in sexual physiology. F. A. E. CREW.

Collective and Individual Effort in Colloid Chemistry.

(1) *The Theory and Application of Colloidal Behavior: Contributed by the foremost Authorities in each division of the Subject.* Edited by Dr. Robert Herman Bogue. (International Chemical Series.) Vol. 1: *The Theory of Colloidal Behavior.* Pp. xi+444+xx. Vol. 2: *The Application of Colloidal Behavior.* Pp. vii+445-829+xx. (New York and London: McGraw-Hill Book Co., Inc., 1924.) 2 vols., 40*s.* net.

(2) *Kolloidchemie und Biologie. Zugleich dritte Auflage von Kapillarchemie und Physiologie.* Von Prof. Dr. Herbert Freundlich. Pp. 47. (Dresden und Leipzig: Theodor Steinkopff, 1924.) 0.50 dollar.

THE editor of a collective work has, no doubt, a difficult and delicate task, and one would scarcely desire him to simplify it by adopting for his own and his collaborators' guidance the cynical maxim: "It does not matter what we say, as long as we all say the same thing." At the same time, while the sentiment expressed in the sentence is reprehensible, the commendation of unanimity or consistency contained in the clause deserves serious consideration.

(1) Such unanimity on fundamentals is quite conspicuously lacking in "Colloidal Behavior," more especially in the first volume, which deals with theory. In the preface, the editor dates the rise of a rational colloid chemistry from the application, by the late Dr. J. Loeb, of physico-chemical principles, *i.e.* Donnan's membrane equilibrium, to the colloidal behaviour of proteins, and confidently suggests that an extension of this method will explain the behaviour of all types of colloids. In the first chapter, Mr. J. A. Wilson attempts to give support to this view, and to apply the theory of heterogeneous equilibria to gold sols, by treating them as systems of three phases: "The solid surface, the film of solution wetting the surface, and the great bulk of solution." Whether it is in accord with classical physical chemistry to treat two regions of a continuous mass of liquid as distinct phases may seem doubtful.

In spite of the fundamental importance thus claimed for Loeb's theories (which, by the way, have not been unreservedly accepted by any one entitled to speak with authority in Europe), the authors of the remaining chapters appear to have little use for them. Prof. E. F. Burton refers to them (adversely) in one sentence in "The Kinetics of Disperse Systems," while Prof. McBain, in the brief but convincing chapter on "The Study of Soap Solutions," succeeds in explaining the behaviour of these typical colloidal electrolytes without ever mentioning membrane equilibria.

Again, in Chap. iii., Dr. J. H. Northrop professes "little doubt" that Perrin's logarithmic formula accurately expresses the vertical distribution of colloid particles. In Chap. v., Prof. Burton suggests that it holds over a range of about 0·1 mm. only, and quotes Porter and Hedges, who gave the complete law in 1922. These are all disagreements on fundamentals—those on minor points are numerous but need not be quoted. The experienced reader who knows the difficulty of keeping abreast of the widely scattered literature, who is aware that even sound theories become periodically unfashionable while unsound ones may stimulate research, will take such discrepancies lightly, but their effect on the student must be unfortunate.

While making every allowance for the difficulties of an editor who can scarcely exercise a censorship of all contributions (some of which, unless American authors differ radically from European, probably arrive in time to be sent to the printers by special messenger), one can reasonably expect him to do two things, if he makes such claims as Dr. Bogue does in his preface. The first is that the contributions should cover the whole subject, and the second that they should be arranged on some definite principle. The work fails in both respects; indeed, the omissions are remarkable. This is the first text-book on colloid chemistry which has no chapters on the ultra-microscope and its use, on the optical properties of sols (not even the Tyndall phenomenon is mentioned), or on viscosity. Nor does the work give any information on experimental methods such as dialysis (apart from a special apparatus briefly described by Prof. Freundlich), ultra-filtration or cataphoresis, though the reader is certainly entitled to look for it in a book claiming to be an advanced work of reference.

As regards arrangement, it is difficult to understand how chapters on the colloidal behaviour of the body fluids, on catalysis and enzymes, have come to be included in the theory of colloidal behaviour. The study of simple protein sols has no doubt helped to elucidate the properties of the highly complex mixtures which occur in organisms, but surely the reverse cannot be postulated. In the same way, while catalytic activity may be a very important property of a few disperse systems, it is not characteristic of the majority, and the study of catalysis can bear but indirectly on the theory of colloidal behaviour. The place for these chapters is obviously the second volume.

Incomplete and unco-ordinated as the material is, the first of the two volumes still contains a great deal that will be of interest to readers sufficiently grounded in the subject to exercise discrimination. The chapter on "Surface Energy" is welcome as a summary of the modern views on this fundamental subject by one of their distinguished originators, Prof. Harkins. Prof. Michaelis's article on "Adsorption" not only shows

how these views may be applied, but also incidentally brings out the highly specific character of adsorption by charcoal, the material used most widely in theoretical investigations. Prof. H. B. Weiser's contribution on "Jellies and Gelatinous Precipitates," and Prof. McBain's on "The Study of Soap Solutions," are valuable summaries, while Prof. E. C. Bingham in "Viscous and Plastic Flow" finds a subject which has not yet received due attention in Great Britain.

The second volume, which deals with the applications of colloidal behaviour to mineral, vegetable, and animal products, contains a vast amount of material impossible to summarise. It has often struck the reviewer as curious that colloid chemists should be so anxious to justify their existence or, perhaps, to magnify their office, by insisting on the applications of the discipline; writers on, say, physical chemistry, do not find it necessary to devote an exact half of their space to "applications." One of the reasons for this attitude may possibly be that the rapid development of colloid chemistry has fallen into a period during which science and an obscure activity called "research" have received much patronising commendation, not as objects in themselves but as possible agencies in the production of wealth. It would be unfair to suggest that the applications described in the work under review, or indeed in others, are all technical and quoted for their material results; in many instances the only claim made is that colloid chemistry has provided a new method of attacking problems of a purely scientific character. But the wish to make such claims has rendered the term "application" very elastic; it may connote a mere restatement in colloidal terminology, or an actual imitation or model of natural processes carried out in colloid material such as used by Nature. Every variety between these extremes is represented in the second volume.

(2) Prof. Freundlich's brief "Kolloidchemie und Biologie," the reprint of an address, also treats of one application of colloid chemistry. That it should here be placed beside the first collective work on the subject is (so far as the reviewer is concerned) an accident which has its piquant side, as the name Freundlich immediately calls up recollections of the greatest individual achievement in the literature of colloids, his "Kapillarchemie." Dr. Bogue must have overlooked it when he wrote in his preface, ". . . no attempt has heretofore been made to gather together material for an advanced text or reference work. . . ."

In the pamphlet under review, the author begins by reminding the reader that all organisms are built up from colloidal material, and then proceeds to show how the increasing knowledge of the colloidal state may be utilised by the biologist and physiologist. The parts played in living tissues by adsorption, electric charges at boundaries, swelling of elastic gels, are not only discussed in general, but each is also illustrated by concrete examples. Many of these are of great interest: thus the elucidation of hydrocyanic acid poisoning by a model in which the active factor—structural elements containing iron—is the same as in tissue. The striking fact that organic structures may, in the course of life, be completely transformed chemically while the appearance revealed by the ultra-microscope or even by X-ray analysis remains unaltered is shown to have its inorganic parallel in bodies capable of reacting rapidly throughout their mass, like the natural and artificial zeoliths, etc.

The brief but highly stimulating survey will be read with profit both by biologists and colloid chemists. It may perhaps induce a few adventurous spirits among the latter to forsake the well-trodden path, to abandon gold sols for a season, and to try their hands at what is surely the most important and most fascinating "application" of colloid chemistry—the elucidation and imitation of the phenomena of life. E. HATSCHEK.

Eddington's Relativity.

The Mathematical Theory of Relativity. By Prof. A. S. Eddington. Second edition. Pp. ix+270. (Cambridge: At the University Press, 1924.) 20*s*. net.

THE second edition of Prof. Eddington's book is a reprint of the first edition with the addition of a number of supplementary notes and one or two corrections. Some of the notes are designed to remove misunderstandings such as are constantly met with in debates on the relativity theory. Others give alternative mathematical treatments of various points, as, for example, the establishment of the four mathematical identities which correspond to the condition of conservation or permanence of the material world.

The main new matter contained in the notes falls under two heads—gravitational waves and affine geometry. Note 7 gives a summary of new results in the study of gravitational waves, and shows that the absolute disturbance is propagated with the velocity of light. At first sight there are other waves of a semi- or completely longitudinal type which may travel with a different velocity, but, in the picturesque language which Prof. Eddington still maintains, "these are merely sinuosities of our co-ordinate system. They exist, not in the world, but in our mental attitude, and the only speed relevant to their propagation is the speed of thought." Note 8 is a very interesting discussion of the gravitation of waves set up by a spinning-rod. This had been previously discussed by Einstein. The author gives a new discussion which confirms

Einstein's calculation save for a factor 2. The effect of the waves is to produce a loss of energy at the rate $32kI^2\omega^6/5$ where $k = 2{\cdot}7 \times 10^{-60}$ in C.G.S. units, I being the moment of inertia, and ω the angular velocity. This is an effect of the third order as compared with that expected by Laplace if gravitation travelled with the velocity of light.

Notes 13 and 14 refer to the recent developments of "affine" geometry, as distinct from metric geometry, and the consequent generalisations of the relativity theory. In the latter note an account is given of Einstein's recent work in this region (Berlin *Sitzungsberichte*, 1923). Einstein supposes that there exists an action which has a stationary value for all variations of the threefold set of coefficients which define the affine connexion, and shows how this may lead by a special choice of the action function to the same results as those obtained by Weyl and set out in § 90 of the text.

There is to be noticed a slight movement in the attitude of Prof. Eddington to the universe as a whole. In the concluding page of the first edition it is remarked that "it is perhaps likely that, after the relativity theory has cleared away to the utmost the superadded laws which arise solely in our mode of apprehension of the world about us, there will be left an external world developing under specialised laws of behaviour." In the concluding note in the present edition, physics is definitely divided into two parts, one of which we are competent to deal with by our methods of continuous analysis, and the other we are not competent to deal with. "We do not pretend to predict *a priori* how nature will behave, but it is not impossible to set limits to the behaviour of that part of nature with which we are competent to deal, if we know the limits of that competence." This careful and conservative statement will remove misunderstandings that hasty readers have formed from passages that might be quoted from the earlier text.

The bibliography has not been revised, but the most important papers that have appeared since the first publication are referred to in the notes. E. C.

British Desmidiaceæ.

A Monograph of the British Desmidiaceæ. By the late W. West and the late Prof. G. S. West. Vol. 5, by Dr. Nellie Carter. Pp. xxi + 300 + 39 plates. (London: Printed for the Ray Society, 1923.) 37*s.* 6*d.*

PROGRESS in the study of a difficult group such as the Desmidiaceæ depends to a very large extent on the publication from time to time of treatises giving an adequate representation of the momentary state of our knowledge. In the past, we have been indebted to de Brébisson, Lundell, Ralfs, and others for works that gave a great impetus to the study of this group. During the latter half of the nineteenth century, Ralf's "British Desmids" indeed formed the standard work of reference, but as the years advanced it became more and more out-of-date, and a new monograph was long overdue when the publication of Messrs. West's "British Desmidiaceæ" commenced in 1904. There can be no doubt that this work, which in thoroughness and general excellence far exceeded anything hitherto produced in this direction, marked a great step forward, epitomising as it did the extensive researches that had been carried out in the last quarter of the last century, and placing at the disposal of the scientific world the prolonged and unrivalled experience of two of the foremost algologists of the time. Its influence was almost immediately manifest and has become increasingly so with the publication of successive volumes.

That neither father nor son should have lived to see the completion of their great work is to be deplored from every point of view, but in the absence of their lifelong experience, the choice of Dr. N. Carter to undertake the compilation of the fifth and last volume was a particularly fortunate one. Trained by the younger West, and having worked on Desmids for several years in his laboratory, probably no better person could have been found. Her task was not an easy one, as, apart from numerous drawings, Prof. West left but very few notes on which the subject matter of the fifth volume could be based. The text is thus entirely Dr. Carter's own work, and she may be congratulated on having produced a volume that in no respect shows any falling off as compared with the earlier ones. In particular, the critical remarks that are appended to the descriptions of many of the species, are often very much to the point. A large number of the figures are reproductions of Prof. G. S. West's own drawings, but Dr. Carter has had to supplement these to a considerable extent. Her own excellent drawings in the majority of cases have been made from material identified by Prof. West, so that, so far as the figures on the plates are concerned, they practically represent the latter's opinion of the characters of the different species and varieties.

The greater part of the volume is taken up with the completion of the genus Staurastrum, the treatment of which was commenced in the fourth volume published eleven years ago. So much confusion reigns with reference to certain species of this genus (*e.g. S. paradoxum, S. gracile, S. simonyi*) that an authoritative account of some of them is particularly valuable. The last sixty pages are devoted to the colonial Desmids, which, in correspondence with the plan adopted in the first volume of the monograph, are treated together,

though probably more closely allied to certain of the non-colonial genera than to one another. The addenda include an amended diagnosis of the genus Roya and a redistribution of some of the species of Penium considered in Vol. 1, necessitated by Lütkemüller's work on the structure of the Desmid-membrane.

Those interested in the study of Desmids will particularly welcome the excellent index to the five volumes with which the present volume concludes, and which, in view of the involved synonymy, will greatly enhance the usefulness of the whole work.

F. E. FRITSCH.

Our Bookshelf.

Die natürlichen Pflanzenfamilien: nebst ihren Gattungen und wichtigeren Arten insbesondere den Nutzpflanzen. Begründet von A. Engler und K. Prantl. Zweite stark vermehrte und verbesserte Auflage herausgegeben von A. Engler. Band 10: Musci (Laubmoose). Hälfte 1. Pp. iv+478. (Leipzig: Wilhelm Engelmann, 1924.) 30 gold marks.

ONLY those bryologists who worked in the 'seventies and 'eighties of the last century can realise the great difficulties which then existed in determining mosses which came from outside Europe. Karl Mueller's "Synopsis Muscorum Frondosorum," published in 1849, had become obsolete so far as its classification was concerned, and Jaeger's "Adumbratio," although putting forward a more natural classification, was entirely destitute of descriptions, which the student had to search for in a widely scattered literature. In 1898 this state of affairs was altered when the Musci were reached in Engler and Prantl's "Die natürlichen Pflanzenfamilien," the bulk of which, after special sections by K. Mueller, W. Ruhland, and C. Warnstorf, was from the pen of Dr. V. F. Brotherus, the publication of whose task was completed in 1909. The appearance of this last-named work rendered the task of bryologists easier, and caused such an accession to their ranks as to necessitate the production of a second edition, the first part of which has just been issued. It consists of a compact volume, which, like its predecessor, is copiously illustrated. A general account of the mosses (including Sphagnales and Andreæales) is given by W. Ruhland, and a special account of the Sphagnales by H. Paul. These occupy 142 pages. The remainder of the groups from Fissidentaceæ to Timmiaceæ has been worked out by the veteran Dr. V. F. Brotherus, who has the opportunity of examining types additional to those used in the preparation of the first edition.

The general plan of the work follows that of the earlier edition, and so renders its use easy to those already accustomed to this plan. Each group contains a key to the genera, and also in very many cases short diagnostic characters of the species, which greatly facilitate the identification of specimens. This is especially noteworthy in the case of the genus Bryum, which occupies 38 pages and contains a large proportion of the 800 species which are widely scattered over the earth and the determination of which has hitherto been a matter of great difficulty. References are made to publications up to 1922 in which new genera have been described. The book should prove a great stimulus to the study of bryology, and we trust that ere long Dr. Brotherus may be able to issue another instalment of this work, which his long experience renders him so competent to perform.

Permeability. By Prof. Walter Stiles. (*New Phytologist* Reprint, No. 13.) Pp. v+296. (London: Wheldon and Wesley, Ltd., 1924.) 12*s.* 6*d.* net.

THERE is no doubt that Prof. Stiles has rendered a very considerable service to physiologists by collecting and arranging the large amount of material dealing with the plasma membrane and permeability. As he remarks, "Any one who takes the trouble to read the literature of the subject can scarcely fail to be impressed by the isolation of thought of the majority of workers in this field." A monograph of this nature removes any excuse for such a state of affairs.

The work is of general interest to physiologists, although it naturally refers chiefly to plant tissues. The various chapters deal thoroughly with the experimental evidence on which our knowledge of cell and protoplasmic structure is based. The physical and chemical behaviour of such systems is considered, and finally the movement of water and other substances into living plant cells. The last chapter is devoted to the statement of the various theories of cell permeability. A bald outline of these subjects cannot do justice to the thoroughness with which they are treated. Two main features mark the treatment. The antithesis between Haberlandt's view that "every protoplast is surrounded by a special dermal layer," and Fischer's statement, "There are no membranes about cells," is considered in a critical presentation of the evidence on which these views must be based. The second feature of Prof. Stiles's treatment may be expressed in his own words, "While the propounding of theories will continue to satisfy the minds of some, yet it cannot be too strongly emphasised that what are wanted to lay the foundations of a proper understanding of the phenomena of permeability in plants are facts, and particularly quantitative data." This point of view has been kept in mind throughout. The result is a work of reference of great value, comprehensive, impartial, and, it may be added, non-committal. We may perhaps hope for a further contribution from Prof. Stiles, in which he puts forward, however briefly, his own views on these vital subjects.

The Leucocyte in Health and Disease: Being an Enquiry into certain Phases of Leucocytic Activity. By C. J. Bond. Pp. viii+84+24 plates. (London: H. K. Lewis and Co., Ltd., 1924.) 12*s.* 6*d.* net.

THE sub-title of the volume under notice gives the more accurate idea of its contents, for it deals almost entirely with the author's own researches during the last seven or eight years. Since Metchnikoff's views on phagocytosis aroused such wide interest, much study has been devoted to the functions of the white blood corpuscles and the part they play in resisting disease. Most of such experiments are naturally done outside the body, and it is difficult to know how far the observed facts are valid under more natural conditions.

The author is well aware of this difficulty and has

made every effort to study the living cell under conditions as natural as possible. He describes certain appearances in the white cells during their activity and certain fine processes called dendrites, which function in much the same way as the blunter pseudopodia. These are illustrated by some excellent plates, but neither these nor his arguments convince one that the appearances are not artefacts, although his reasons are put forward very lucidly and temperately.

The most interesting and original part of the book is the attempt to probe into the chemical processes taking place in the leucocyte. Two substances are described. One of these occurs in the cell and stains readily with iodine, and may be of the nature of glycogen; the other readily diffuses from the cell and can be shown in the surrounding media, and it stains with benzidine and differently with iodine. It is not one of the ordinary oxidases and is probably aldehyde in nature. The author claims that if the leucocytes are incubated with glucose, more of the latter diffusible substance is produced in the presence of insulin.

The book cannot be recommended to the general reader, but will be of interest to the specialist. It seems to the reviewer that the experiments and the theoretical discussion would be better in the pages of a journal devoted to this subject than issued as a separate monograph.

Across the Great Craterland to the Congo: a Sequel to "The Wonderland of the Eastern Congo." Describing a Journey of Exploration and Research to the Land of the Giant Craters in Tanganyika Territory, and to the Forests, Lakes, and Volcanoes of the South-Eastern Congo; with some Account of the African Apes, and the Capture and Training of the African Elephant. By T. Alexander Barns. Pp. 276+64 plates+2 maps. (London: Ernest Benn, Ltd., 1923.) 25*s.* net.

CAPTAIN BARNS'S volume on his expedition in 1921–22 from Mombasa to the Congo at Stanleyville and thence to Capetown is a valuable contribution to the natural history of Central Africa. The author combines the qualities of a daring explorer and hunter, of a keen observer of man and Nature, and of a graphic and interesting narrator. The primary object of the expedition was the discovery of a large butterfly which has been seen on the Upper Congo, but has not yet been captured. On his way to the haunts of this elusive insect he explored a remarkable group of volcanic mountains and basins in northern Tanganyika Territory, and collected skins of some of the third species of gorilla, *G. berengei*, in the forests of Kivu. He also made a large collection of Lepidoptera, including many new and rare forms.

Capt. Barns has written an interesting account of the geography of the region north of Lake Tanganyika. The chapter on the gorillas contains valuable information as to their habits; another is devoted to the adventurous story of the domestication of the African elephant by the Belgians. The volume has an introduction by Prof. J. W. Gregory discussing the nature of the great volcanic basins explored by Capt. Barns. That of Ngorongoro is eleven miles in diameter. He concludes from the geological evidence available that they were not formed as craters, but as calderas or volcanic cauldrons. He defines the distinction between ordinary upbuilt craters, explosion craters and calderas or cauldrons, which have been formed by the collapse of the ground around a volcanic vent. The volume is illustrated by many beautiful photographs, especially of the scenery and big game.

An Introduction to Reflective Thinking. By Columbia Associates in Philosophy: Laurence Buermeyer, William Forbes Cooley, John J. Coss, Horace L. Friess, James Gutmann, Thomas Munro, Houston Peterson, John H. Randall, Jr., Herbert W. Schneider. Pp. vii+351. (London: Constable & Co., Ltd., n.d.) 10*s.* 6*d.* net.

THIS is one of those co-operative books which are becoming a feature of publishing enterprise. It has, however, some quite exceptional marks. The nine authors, members of the staff of the Department of Philosophy in Columbia University, are named on the title-page, but their individual contributions are not specified in the text. We are told in the preface that they sought advice and received aid from their colleagues in other departments. The book therefore has, and is intended to present to the student, a unity due to team work. It is offered as a first course in philosophy or as an introduction to science. Each chapter is divided into sections and followed by a list of questions and exercises and an extensive bibliography. The impression it leaves on us is that the interest of the matter is spoilt by the form, and the matter apart from the form is elementary to the point of insipidity.

Vibration in Engineering. By Julius Frith and Frederick Buckingham. (Reconstructive Technical Series.) Pp. xiv+123. (London: Macdonald and Evans, 1924.) 7*s.* 6*d.* net.

AN increasing degree of attention has been given recently in engineering colleges to the study of vibrations, and students will welcome the appearance of this volume in which has been collected a large amount of information hitherto scattered in various volumes dealing with physics and in technical journals. The matter is arranged in two parts, physical and mathematical, and vibrations commonly occurring in both mechanical and electrical engineering receive attention. For the most part the principles are stated clearly, but there are some loose statements which require amendment, *e.g.* on p. 11 we read, "The restoring force is now a turning moment, the force is measured in pounds weight as before, and its moment in feet."

Spinoza, Descartes and Maimonides. By Dr. Leon Roth. Pp. 148. (Oxford: At the Clarendon Press; London: Oxford University Press, 1924.) 7*s.* 6*d.* net.

DR. ROTH has produced a scholarly book. The author rejects the view that Spinoza is originally a follower of Descartes and that the purpose of his speculation is to develop the logical consistency of the Cartesian principles. He holds that he is mainly concerned to oppose and overthrow the theory of Descartes, and that he does so by recovering and reanimating the four-centuries-old doctrines of Maimonides in the "Guide to the Perplexed." The argument is not lightly to be set aside but it is scarcely likely to be convincing.

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 Rarity of the Inert Gases on the Earth.

IN NATURE of March 15 I published a diagram in which the abundance of the different species of atoms —up to mass number 79—was plotted on a log scale against their mass numbers. I have now extended this, with a small gap, up to mass number 142, and what was fairly obvious before has become, by the inclusion of the region containing xenon, a very striking feature. This is the abnormal scarcity of the inert gases.

I took for purposes of calculation an earth consisting of the atmosphere, the hydrosphere and a lithosphere of the average composition of the igneous rocks of mass equal to that of the whole globe. If we disregard the inert gases altogether, the points lie on at least the semblance of a curve. There are high peaks, O, Fe, Sr, Ba, abnormal depths, Sc, In, and a very marked depression in the region Ga, Ge, but nevertheless a curve is sufficiently well marked for any observer who had been given the mass numbers of the missing inert gases to allot them appropriate positions and so to calculate their most probable abundance. The point I wish to emphasise is that he would in every case state an abundance roughly 10^6 times greater than that obtained from actual atmospheric analysis.

This discrepancy will appear much the same if instead of mass number we plot by atomic number or by atomic weight, and it will not be affected seriously by supposing, as has been suggested, that the innermost quarter of the earth consists mainly of iron and nickel. It cannot very well be ignored, and three possible hypotheses suggest themselves, any or all of which might offer an explanation :—

(1) The fault lies in the method of calculating abundance ; our sample is unfair, and if we could get a fair one, say from the interior of the earth, the discrepancy might vanish. This would require that the earth's atmosphere was entirely derived from a surface shell only a few metres thick—not a very hopeful view.

(2) The abnormal rarity of the inert gases is due to some nuclear property of instability held in common. We have good reason for supposing such a property common to the isotopes of a single element, but none whatever to ascribe it to a set of elements the mass numbers of which range from 4 to 136. It is true that these elements have a very definite property in common, chemical inertness, but this is, so far as we know, an extranuclear one. We are therefore driven to consider as more probable :—

(3) The earth has only one millionth part of its proper quota of inert gases. This very interesting conclusion is founded on very flimsy evidence, but it is not out of keeping with some such origin of the solar system as the planetesimal theory. In the hurly-burly of colliding bodies ranging in mass from atoms upwards, the atoms of the inert gases, unconstrained by irrevocable chemical combination and free to collide and rebound indefinitely, would inevitably gravitate towards the larger masses and forsake the less. On this view the earth's share of inert gases has been lost to the sun, though whether they still remain there unchanged is outside the question. Their abnormal rarity is at least a point of interest and invites comment from those interested in the evolution of our system and of the elements. F. W. ASTON.

Cavendish Laboratory,
Cambridge, November 19.

The Cause of Cyclones.

IN the winter of 1922–23 there appeared in NATURE some correspondence on "The Cause of Anticyclones," and on that occasion I put forward certain views as to the mechanism by which the more rapid increases of barometric pressure are brought about in temperate latitudes (NATURE of March 31, 1923, pp. 429-430). The present communication may be regarded as a sequel in that its object is to describe a mechanism by means of which the more rapid reductions of pressure can conceivably be produced. The idea arises naturally from consideration of a series of papers by Helmholz appearing in the *Sitzungs-berichte* of the Royal Prussian Academy of Sciences in 1888 and 1889, dealing with the equilibrium of rotating rings of air at different temperatures, and with the theory of winds and waves where strata of different density lie contiguous with one another.

The conditions for equilibrium in cases where a surface of discontinuity (of temperature and wind) exists in the atmosphere have since that time been dealt with by V. Bjerknes and others in somewhat more general fashion and need not be set out here.

Designating the warmer (southerly) mass by (1) and the colder (northerly) by (2), Helmholz calculates in terms of their velocities, temperatures and the latitude, the theoretical slope of the bounding surface for a state of stable equilibrium. But, as he points out, first small waves and then mixing of the two media must soon occur over this boundary ; he therefore calculates the slope for stability of the bounding surface between mass (2) and the mixture and between the mixture and mass (1). He shows that these slopes are respectively more acute and less acute (relatively to the horizon) than the original slope between mass (2) and mass (1). Hence, he says, results the important consequence that (in tending towards the new requirements for equilibrium) "all newly formed mixtures of strata that *were* in equilibrium with each other must rise upwards between the two layers originally present, a process that of course goes on more energetically when precipitations are formed in the ascending masses. While the mixed strata are ascending, those parts of the strata on the north and south that have hitherto rested quietly approach each other until they even come in contact, by which motion the difference of their velocities must necessarily increase since the strata lying on the equatorial side acquire greater moment of rotation (about the earth's axis) with smaller radius, while those on the polar side acquire feebler rotation with a larger radius."

Now the importance of this reasoning, applied in the light of modern meteorological knowledge, appears to me enormous. Putting aside for the moment all theories as to the *origin* of cyclones, it appears to be pretty well established by the facts of observation that the normal *structure* of an active and recently formed depression at least approximates to that described by Bjerknes.

Further, observation tends to confirm (1) that the principal reduction of pressure and the principal area of rainfall lie at any moment within the "old" cold air in front of the Bjerknes Steering Line, (2) that where the warm air extends right down to the ground no appreciable pressure-change is taking place, unless quite close to the Steering Line, (3) that where the "new" cold air is undercutting the warm air there is rapidly rising pressure.

I have shown elsewhere that the rise of pressure in the new cold air and the comparative constancy

of pressure in the warm air and also the temperatures of these masses are consistent (dynamically) with their (supposed) northerly and southerly origins and with the processes to which they have been subjected in arriving on the field of operations; and further that the changes in the energy (potential, kinetic and internal) of the "new" cold current are sufficient to account for the work that is being done by it in displacing the warm air and filling up the rear of the depression. But I have never previously been able to see why in front of the depression the warm air should mount upon the old cold air, or why, if it did so, a fall of pressure should at the same time occur in the region below; though I have indeed been able to find evidence that a selected mass within the warm air was continually approaching a selected mass within the old cold air. Now if the Helmholz reasoning is sound we can make an important step forward. The mysterious "eviction of air," as Sir Napier Shaw has called it, is accomplished by the continual procession of the products of mixing of the warm and cold up a kind of giant escalator—with a moving roof as well as steps—hitherto described usually as the Steering Surface; and the process would go on so long as any warm sector remained.

At the moment I can see no fact of observation that is inconsistent with such a theory, and it further appears to lead to feasible energy equations for the front half of a cyclone.

In the problem dealt with by Helmholz the "eviction" and the subsequent "dumping" of the air do not seriously enter, and beyond the remarks quoted above, he devotes no consideration to either. As to the latter, Steering Surfaces appear to extend up to the level of the highest clouds and even into the stratosphere, and their inclination to the horizon appears to be of the order of 1 : 100. Hence the dumping need not take place within 1000 kilometres of the Steering Line and may be spread over an enormous area beyond that. The tracks of the most frequent North Atlantic depressions lie roughly parallel to the line of the (eastern) American and Greenland coasts, and in a belt about 1000 to 2000 kilometres distant from these coasts. The tracks of the North Pacific depressions are somewhat similarly situated with regard to Siberia. Of all places in the Northern Hemisphere the North America-Greenland area and Siberia would most welcome the dumping of surplus air and most of all at those seasons when depressions are most active. For these areas must be receiving air—probably at a high level—to compensate for the constant vertical contraction of the film of atmosphere there by cooling and for the recurrent discharges of cold air into the rear of passing depressions. In this way depressions might perhaps be regarded as the heat-receiving ends of thermo-syphonic arrangements, the corresponding radiating ends being areas like North America, Greenland, Siberia, or the Antarctic continent; both ends being necessary for the maintenance of the circulations. A secondary depression and its "dying" parent would perhaps bear a similar relation one to another. In all cases the principal supply of heat would be borne from equatorial regions by warm currents of high water vapour content. Given sufficiently complete synoptic weather charts of the northern hemisphere, to test the above theory by a combination of the facts of observation, hydrodynamics and thermodynamics would not, I think, be impossible, though the task would be one of some magnitude.

A. H. R. GOLDIE.

Edinburgh,
November 7.

Organ-pipes of Unusual Shapes.

THROUGH the kindness of Prof. W. B. Morton I have been enabled to examine Robert Gerhardt's original inaugural-dissertation on the Rohrflöte, delivered at Halle in 1884. His equation for the case of a pipe with closed chimney is identical with that given by Principal Aldis (NATURE, Aug. 30) for the Bicylindron, and for the Rohrflöte proper with open chimney his equation is the same as mine. Gerhardt discovered a little of the history of this interesting pipe register. The Rohrflöte is apparently of considerable antiquity. Praetorius mentioned it in his "Syntagma Musicum" (1619), and the pipe was probably invented in the middle of the sixteenth century. Praetorius describes the position of the chimney as being wholly outside, half inside, or wholly inside, of which he recommends the last as offering the greatest protection to the chimney.

The theory of such a system was given by Bourget in 1873 in an explanation of the sound given when one cools a narrow glass tube, on one end of which a glass bulb has been blown. Without really extending the theory Gerhardt showed that by graphical means one can always calculate the possible frequencies of any such arrangement. He plots the curves:

$$y_1 = w \tan ml,$$
$$y_2 = -\tan mh$$

(using my nomenclature) and obtains the points of intersection:

$$ml = z\frac{\pi}{2} \pm \alpha,$$

where z is some whole number, α is found from the graphs and differs for every value of z, and the positive sign is taken for the Rohrflöte, the negative sign for the Bicylindron. Gerhardt therefore obtains for the fundamental frequency:

$$N = N_0\left(1 \pm \frac{2\alpha}{\pi}\right),$$

where N_0 is that of the pipe without a chimney when closed. In my previous letter (NATURE, Oct. 18) there is an error; $r/R = \tan \pi/n$ should read $\tan mh = \tan \pi/n$, where π/n is the least angle of which the tangent is $\tan mh$. Gerhardt's expression for the fundamental frequency gives the same values as mine although the form appears different. There is a mistake in my deduction of the overtones, and the given series is only true in some few particular cases. In general the interval between an overtone and its fundamental is $(zn+1)$, where z is an integer, but n is usually multivalued and the overtones quite inharmonic. It is obvious, however, that if the speaking length of the body is some simple multiple of that of the chimney, the points of intersection of the curves must repeat themselves after a definite interval, and hence in this case overtones occur which are simply related to one another. Gerhardt, however, considered the values of α in no way connected. His observations show excellent agreement with the values deduced from his graphs except when the ratio of the diameters approaches unity.

The whole subject of pipes possessing sudden changes of diameter has been attacked recently in a most comprehensive manner by P. Cermak of Giessen (*Ann. d. Phys.* 53, 1917). He first examined a closed pipe formed of two portions of equal lengths and of different diameters, and determined the change of pitch with change of the diameter ratio. The empirical law which satisfies these changes extremely well is

$$N = N_0(1 \pm \rho),$$

where N_0 is the fundamental frequency of a pipe of constant diameter and of the same total length, and

$$\rho = \left(1 - \frac{D_e}{D_w}\right)^{\frac{1}{4}},$$

where D_e and D_w are the diameters of the narrow and wide portions respectively. In the frequency formula the positive sign is taken if the narrow end is closed, the negative sign if one closes the wide end. The latter case is identical with that of the Bicylindron invented by Principal Aldis.

Cermak then proceeded to examine the change of pitch of pipes in which the two portions had a constant difference of diameter, when the junction was gradually moved from the narrow to the broad end, which was closed, and then for the opposite direction of movement with the narrow end closed, the total length being kept constant in both cases. He shows, as also did Principal Aldis, that the pitch in the first case falls to a minimum when the lengths of the two portions are equal, and then rises to its original value when the tube is once more uniform. Combining these results he obtains empirical formulæ giving the fundamental frequency of any closed pipe formed of any number of straight portions of any length and cross-section. His formulæ agree with his observations extremely well, but they are very complicated and most wearisome to handle.

Cermak obtains empirical formulæ for the case of the Rohrflöte, which also fit the results of experiment remarkably well, but he points out that Gerhardt's deductions differ from his observations most where his formulæ show best agreement, and vice versa.

From a brief examination of his curves, I should have expected that a formula built up from transcendental terms would be simpler, easier to handle, and give as good agreement, and, moreover, would give some insight into the physical meaning of the changes. Since Gerhardt's result admits only of graphical solution and conveys little sense of physical reality, one would welcome any equation, even though it were empirical, which might permit of the immediate solution of a problem, and if possible one which would admit of a simple physical interpretation. In the development of the compound resonator such formulæ would be invaluable.

Cermak's work is, moreover, extremely thorough. Of recent years many physicists have produced theories based on observations made with a single pipe, or at most three. Cermak used fifty-eight different pipes, and traced interesting analogies of the phenomena in the creation of longitudinal vibrations in rods of non-uniform section, in the transversal vibrations of strings having sudden changes of diameter, and in the resonance of electromagnetic oscillations in a parallel wire system in which the distance between the wires suddenly changes. To these I should like to add the effect of inserting a short length of wider tubing in a water pipe line in Constantinesco's wave-power transmission.

W. E. BENTON.

Department of Physics,
University of Birmingham,
November 5.

The Word "Scientist" or its Substitute.

THERE is a prejudice against this word. Some profess etymological scruples; they say it is an ugly hybrid with a Latin root and a Greek termination. But surely this is not a serious objection or the one which really prevents its use. For the accusation is not true. The termination *-ist* is French, not Greek; if "scientist" had come from the French it would have been as unexceptionable as "artist," which is an exact parallel; it did not come from French merely because French scientists, having appropriated *savant* (to which we have no close analogy), had no need of it. Even if the accusation were true, those who swallow "voltmeter" and "ionisation" would scarcely strain at such a very mild inelegance.

The real objection, I think, is different. "Scientist" was a doubtful neologism at a time when scientists were in trouble about their style. They were accused, with some truth, of being slovenly; and those who aimed at a higher standard were careful not to offer the slightest cause for offence. The word became a shibboleth. Matters have, however, now changed; we no longer need a shibboleth. Our sentences may not always be polished, but scientific journals contain no higher proportion of gross errors than the Proceedings of the Aristotelian Society or of the Classical Association. Moreover, the word has arrived; there is no chance of suppressing it entirely. Even if so far it were confined wholly to the illiterate—which it most certainly is not—we ought (as the authors of "The King's English" say) to "begin seriously to consider whether it has not been resisted as long as honour demands." Cumbrous circumlocutions, such as "man of science"—offensive to feminists and with an artificial air no artifice can conceal—are wretched substitutes. The idea is definite and important; the discovery that there is something common in the intellectual attitude of all the sciences and foreign to other branches of learning is one of the greatest advances made by the thought of the last century. For a new thing (to quote the same authors) we must have a new name.

Let me therefore plead with you, Sir, who have done so much to raise the standard of scientific literature, and with all others who have striven to show that scientific and linguistic precision are not incompatible, to give us a lead in this matter. If you will not have "scientist," at least provide us with some other single word. NORMAN R. CAMPBELL.

[Hitherto the word "scientist" has not been used in the columns of NATURE to designate a man of science or scientific worker, and Dr. Campbell now suggests that the time has come to reconsider the exclusion of the word. Our language has grown into what it is through process of change and development, and there is no permanent standard of purity for it; so that new words and phrases are continually being incorporated while others are becoming archaic. The only criterion as to what is permissible is that afforded by refined feeling or usage in the best literature of a particular epoch. We have, therefore, invited a number of authorities on good English, including distinguished men of science, to favour us with their opinions on the desirability, or otherwise, of adopting the word "scientist" to signify generically one who has at different periods been described as a natural philosopher, naturalist, or man of science, and we propose to publish any replies received of a critical or constructive kind. EDITOR, NATURE.]

Cell-wall Formation.

A CHARACTERISTIC difference between the processes of cell-wall formation in plants and animals has long been recognised. In the tissues of higher plants a new cell-wall is generally laid down on the nuclear spindle and then spreads peripherally until it cuts the cell into two. The cell-wall may thus be said to be endogenous in its origin. It is also generally believed that this plate on the spindle is first formed by the coalescence of a row of granules, afterwards

splitting into two layers which secrete the primary wall between them. In animal cells, on the other hand, the characteristic method of division is by constrictions or furrows beginning at the periphery and proceeding inwards. The same is true of many Thallophytes.

In recent years the observations of Farr on Nicotiana, Magnolia, Sisyrinchium and other forms, of Tahara on Chrysanthemum, and of the writer on Lactuca (Proc. Roy. Soc. B., vol. 91, p. 222, 1920), have shown that in pollen mother-cells, quadripartition usually occurs by furrowing. Recent critical observations of this process in the pollen mother-cells of Lathræa (in a paper now in the press in *La Cellule*) show that there are, however, essential differences between the process of furrowing as it occurs in pollen mother-cells and generally in Thallophytes, and the manner of furrowing in animal cells.

In Lathræa, a new wall is first formed inside the pollen mother-cell wall. At four equidistant points on this wall tetrahedral thickenings or deposits then appear, and from the apices of these thickenings four furrows grow in until they meet in the centre of the cell. But as the furrows advance, a delicate cell-wall, which is a continuation of the peripheral thickening and which has usually been missed, is deposited in each furrow.

In animal cells, Spek and others have shown that cleavage is accompanied by peripheral currents in the cytoplasm moving in the direction of the furrows. Early observations of J. Loeb and others, recently confirmed by Chambers (in "General Cytology," Ed. Cowdry, p. 296, 1924), show that in various animal eggs as the cleavage furrow is formed pigment granules accumulate in the wall. This process is to be contrasted with the secretion of a wall in the furrows of a dividing pollen mother-cell. Observations of Chambers on cleaving animal eggs also show that an appreciable time is necessary for the walls of the furrow to become non-coalescent when they come into contact. This hardening effect may perhaps be due to the accumulation of these granules in the walls.

It thus appears that there is an essential difference between the process of wall formation in pollen mother-cells and the cleavage of animal cells. In both cases a furrow is formed, but in the former a delicate cell-wall is secreted as the furrow advances, while in the latter there is no such secretion. We may thus say that quadripartition in pollen mother-cells combines the essential features of both methods of wall formation.

R. RUGGLES GATES.

King's College, London,
November 10.

Nitrogen and Uranium.

YEARS ago, before the discovery of terrestrial helium, W. F. Hillebrand isolated this gas with nitrogen, in his work on rock analyses. Because a large amount of nitrogen was obtained he attributed all of the gaseous constituent to this source. Some of his analyses are described in the *American Journal of Science*, vol. 140, pp. 384-94, 1890, under the title, "On the Occurrence of Nitrogen in Uraninite and on the Composition of Uraninite in General," and more fully in Bulletin U.S. Geological Survey, No. 78, pp. 43-79, 1890. He concluded that "nitrogen exists in uraninite in quantities up to over 2·5 per cent., and seems generally to bear a relation to the amount of UO_2 present. This is the first discovery of nitrogen in the primitive crust of the earth." "The nitrogen is liberated from the mineral as nitrogen gas by the action of a non-oxidising inorganic acid and by fusion with an alkaline carbonate and probably also caustic alkalies in a current of CO_2." "In a Geissler tube under a pressure of 10 mm. and less, the gas afforded the fluted spectrum of nitrogen with great brilliancy." That uraninite is actually the source of the nitrogen is not open to doubt. Ramsay later confirmed Hillebrand's discovery. The chemical evidence suggests that the nitrogen was present in the mineral in the free state, as occluded gas. The question therefore arises as to how such a quantity of gas could accumulate. The unknown nature of its origin has been frequently mentioned by Dr. Hillebrand during the past thirty years.

Very likely the nitrogen is merely occluded in the uraninite in a manner similar to the occlusion of gases in charcoal. If so, this fact may prove important in problems of laboratory technique. From a more speculative point of view, however, in view of the fact that the atomic weight of uranium is almost exactly an integral multiple (17) of nitrogen, one is attracted to the possibility that the uranium nucleus may contain nitrogen nuclei. Further, the ejection of nitrogen of atomic number 7 from uranium should give the missing, and possibly unstable, element 85, with an atomic weight somewhat higher, to be sure, than should be expected. These latter questionable suggestions, wholly unsubstantiated by radioactive evidence, are offered merely to direct attention to the fact that the presence of nitrogen in uraninite is a problem of interest and importance.

PAUL D. FOOTE.

Bureau of Standards, Washington, D.C.

Edible Earth from Travancore.

IN the Travancore Court of the British Empire Exhibition at Wembley several interesting products of this enterprising State were displayed. Among the medicinal products there were two substances named "Kalpal" and "Kalmadom." From a description drawn up by Dr. Kunjan Pillai, these are said to be deposits found in the clefts and hollows of high rocks "in the form of a brownish-white foam which on exposure becomes harder with time and has the consistence of lime-plaster." The decomposed rock is washed with water to remove foreign matter, as lichens, leaves, etc., and the sediment is made up into balls and dried in the sun. The lumps reduced to powder are said to be a valuable medicine for kidney complaints.

Dr. Pillai has kindly supplied me with samples of these materials, and they were at once recognised as forms of prepared edible earth used throughout India —"Kalpal" was in the form of white balls consisting of sand and clay, while "Kalmadom" was in rounded lumps with the colour and appearance of ochre. In a paper on "Earth-eating and the Earth-eating Habit in India," published in the Memoirs of the Asiatic Society of Bengal, vol. 1, No. 12, 1906, and noticed in NATURE of September 27, 1906, Dr. Mann and I have described about forty different kinds of edible earths, with the results of their chemical analyses, and a history of the habit. They were all siliceous earths, containing in a few cases a fair quantity of iron or lime. In tea estates the coolie women use the unctuous clay taken fresh from exposed deposits, but in the cities the clay is baked and sold in thin plates of various sizes. The earths we examined in connexion with this remarkable habit included the following varieties: Hydrated silica, cream-coloured clay, finely divided felspar, marl, yellow clay, brown clay, greyish calcareous clay, reddish micaceous loam, talc-schist, laterite, halloysite, blackish grey clay, brown earth from ant-hills, and infusorial earth.

DAVID HOOPER.

The University, Bristol,
October 31.

Colour Nomenclature.

By Dr. L. C. MARTIN.

THE content and meaning associated with any word is always liable to vary with the mental outlook of an individual. Thus the word "distance" may convey to a psychologist the idea of a psychological experience developed by various means through the senses; to a physicist the same term conveys the idea of a magnitude to be expressed in centimetres or other arbitrary units. In practice, however, this causes very little inconvenience. The fundamental concepts are identical; it is the principle of measurement which varies.

Up to comparatively recent times the discussion of colour had connexion almost exclusively with the use of pigments, precious stones, and the like, in the decorative arts. Individual pigment names were satisfactory and not too numerous to remember, while the vast range of aniline dyes was unknown, but at the present time the use of colour names is in confusion. We recall the words of Locke: "Men take the words they find in use amongst their neighbours, and that they may not seem ignorant what they stand for, use them confidently without troubling their heads about a certain fixed meaning." We all suffer to some extent from this over-confidence. There is now a great need for some manner of measuring and specifying colour, which avoids the employment of these individual names.

The early work of thinkers and experimenters such as Newton, Young, Tobias Mayer, Johann Lambert, Runge, Grassman and Goethe cannot be reviewed here. We must begin with Helmholtz, who, inheriting the result of their labours, started with the basic idea of a three-dimensional continuum of colour sensations, the sensation being clearly differentiated from the stimulus. He was solely concerned with sensations when he described them ("Physiological Optics," 1856–66) as variable in terms of hue (Farbenton), saturation (Farben Sättigung), and brightness (Helligkeit). The subject of colour vision attracted great attention about this time, the work of Chevreul being translated (1854) into English by Charles Martel, who made in the introduction a plea for the more accurate standardisation of colour names by reference to the spectrum. Chevreul did not, however, trouble to distinguish between the sensation and the object seen; he describes colour variations by reference to the effects obtained by mixing white and black with various colours, but he uses the terms "tint" and "tone," which have not found acceptance for scientific work. Helmholtz had this in common in Chevreul, that he carefully described the physical conditions which would cause illustrative variations in the three sensation variables mentioned above.

Several other books, dealing with the subject mainly from the physical point of view, followed in the latter half of the nineteenth century. Benson (1871), having the benefit of Helmholtz's work, starts his account with the three fundamental sensations of the Young-Helmholtz theory of colour vision; this affords a radically different machinery with which to discuss colour sensation phenomena. It is still three-dimensional, but not so directly related to ordinary experience as the hue, saturation, and brightness. Rood ("Modern Chromatics" 1883) discusses "hue, luminosity, and purity," and describes experimental means of varying them in physical stimuli. His "luminosity" corresponds to the "Helligkeit" of Helmholtz, and his "purity" to "Sättigung." He takes even less care than other authors to distinguish between sensation and the stimulus, as the following quotation shows: "the hue of the colour or, as the physicist would say . . . the wave length." Abney ("Colour Measurement and Mixture," 1891) speaks of the "luminosity" of a coloured object, and the "purity" of coloured light, but when giving the results of some of the first actual colour measurements in such units he is sufficiently cautious to give: "Wave length of dominant ray," "percentage of white light," and "percentage of luminosity as compared with white." While he was very sparing in the use of terms which might have a psychological meaning, such as "purity" and the like, he thought it quite legitimate to connect sensation and stimulation in quite an arbitrary way, as Helmholtz did, by the postulate that equal stimulation of all three primary sensations of the trichromatic theory shall produce white. Moreover, the white was perfectly arbitrary; in Abney's case it was the white sensation evoked by the light from the crater of his carbon arc.

In passing, the distinction between various meanings of "white" may be made clear. A surface which reflects diffusively and non-selectively, and has a high albedo or reflection coefficient, is usually described colloquially as white. To the psychologist, however, white is sometimes a hueless sensation of light which happens to be brighter than any other sensation present in consciousness. Frequently, the distinction is not pointed out, and misunderstanding results. To the present writer the simplest conception to appeal to a physicist seemed to be that of the "whiteness" of sunlight (probably a psychologist would prefer to speak of "greyness"), which we learn to recognise in the whiteness of clouds and mist, and in the appearance of all diffusely reflecting and non-selective surfaces. The sensation due to the *light* is the first thing to grasp.

The importance of the "hue, saturation, and brightness" classification of colour is revealed in the colour charts which have been prepared on this basis, and the corresponding commercial colour notations. One of the most notable is that of Munsell, who employs the terms "hue," "chroma," and "value," where the latter two terms correspond to our previously used "saturation" and "brightness." This colour chart, which I have described elsewhere,[1] is in use for commercial purposes. Others on similar lines are also extant.

It will be realised from the foregoing notes that some co-ordination in the use of terms is extremely desirable, and to this end a committee of the Optical Society of America, under the chairmanship of Prof. L. T. Troland, published a report[2] in August 1922 which suggests

[1] "Colour and Methods of Colour Reproduction." Blackie, 1923.
[2] Journal Opt. Soc. Amer., Vol. 6, No. 6, 1922.

definitions for the three variables of colour *sensation*. They are as follows :

1. Brilliance is that attribute of any colour in respect of which it may be classed as equivalent to some member of a series of greys ranging between black and white.

2. Hue is that attribute of certain colours in respect of which they differ characteristically from the grey of the same brilliance and which permits them to be classed as reddish, yellowish, greenish, or bluish.

3. Saturation is that attribute of all colours possessing a hue, which determines their degree of difference from a grey of the same brilliance.

The reason for discarding the terms brightness and luminosity is that both these terms have received technical definitions [3] in connexion with photometric measurements. The Committee would retain the term saturation for the subjective attribute of colour sensation, while allocating the word purity to the "ratio of homogeneous to total radiation in the stimulus." According to the report, any definite physical application of these terms (brilliance, etc.) will "corrupt" them. Many other colorimetric matters and experimental methods are also dealt with in the report.

For practical colour measurement it is necessary to distinguish between the measurement of a colour stimulus such as obtained from the field in a spectroscope, and the measurement of reflected body colour. For the latter case the report describes the specification of colour in terms of (1) luminosity, (2) dominant wave length, (3) per cent. hue. Presumably the former case would best be met by using the term "brightness," but the use of the physical terms is still very variable. The colloquial use of the word "luminosity" is a little against its use as a contraction for "relative luminosity as compared with white."

We have not up to this point discussed the scales of measurement. Just as temperature may be measured in the mercury scale, the hydrogen scale, the platinum scale, and so on, it is possible to measure quantities like brightness on various scales.

The physicist will undoubtedly adopt the ordinary photometric luminosity scale for all colorimetric purposes in which instrumental measurement is required. On the other hand, other scales more nearly related to psychological experience, but still essentially arbitrary, will be far more valuable in the preparation of colour charts, as Ostwald points out.

The nomenclature of Ostwald [4] seems at first somewhat different. He is concerned only with body colours having reflection coefficients between 0 and 1. A grey reflects a fraction w of the incident white light as compared with a quantity 1 reflected by a perfectly reflecting and diffusing surface. The other portion s is absorbed ; then $w+s=1$, where w can be called the white content and s the black content of the grey. Ostwald adopts a scale of greys in which the white contents vary geometrically ; these are called a, b, c, d, etc.

In the case of a colour showing hue, the reflected portion is divisible into two parts, v due to the pure hue and w to more or less white. Hence the equation above becomes $v+w+s=1$. w and s are the white and black contents as before. Colour is specified by its dominant hue and its contents of "full colour" (Vollfarbe), and white. Ostwald criticises Helmholtz for not realising that the "black content" is an essential factor in the appearance of a surface in an ordinary case where colour contrasts are manifest in the field of vision, but Helmholtz was concerned only with the variation of the elements of sensation, and his employment of the term "Helligkeit," signifying absolute light strength, was therefore quite correct while a single sensation was discussed apart from contrast effects. Ostwald's system has been employed in his "Farbenatlas," which gives 2500 indexed colours. A system of colour measurement has also been developed.

While the report of the Colorimetry Committee has put psychological nomenclature in order, the physicist will feel that the use of terms such as white, grey, and the like in fundamental definitions is highly unsatisfactory. For purposes of colorimetry psycho-physical measurements are necessary, and it seems necessary to choose units and formulate definitions which, although possibly arbitrary, are founded securely in physical facts wherever this is possible. In thinking over the matter for the purposes of the book to which reference was made, it appeared to the present writer that the only way to discuss a sensation for purposes of measurement is by reference to an arbitrary physical stimulus which evokes this sensation (or something near it) in the normal subject. Hence white was defined by reference to the colour of sunlight, an arbitrary but definite step. The alternative is the adoption of the results of such lengthy statistical work as that of Priest on "the spectral distribution of energy required to evoke the grey sensation" (Bureau of Standards, Scientific Papers, No. 417). The term "brightness" can be given its usual photometric significance, but there is still the difficulty of finding a suitable term for the relative brightness of a diffusely reflecting surface. It seemed that the term brilliance suggested by the American report gave the term required.

Since the issue of the book, this step has been criticised on the ground that the intent of the American definition of the term brilliance is to exclude the idea of a quantity specified or measurable by any reference to stimuli. Certainly if this appropriation of the term is of importance to psychology, physicists must agree upon some other word such as luminosity or value when dealing with body-colour measurement ; but unfortunately the multiplication of terms for identical mental concepts is quite likely to lead to the confusion which the report seeks to avoid. The present writer prefers the careful use of *one* word provided that the manner of its use is indicated, just as is necessary in the case of terms like "temperature" and "distance," which themselves carry no implied reference to any special mode of physical measurement, but are in perfectly arbitrary use in physics. The question needs more discussion before it is finally settled, but the whole matter is of great importance for purposes of colour standardisation and measurement. Until matters are definitely settled we might do far worse than follow Abney in the non-committal terminology mentioned above.

[3] The *Illuminating Engineer*, Vol. xv. No. 8, p. 227. The definition of "brightness" is given there, but "luminosity" is not defined in British practice. Colloquially, it refers to self-luminous surfaces. The American report says: "*Relative* light quantities are called *luminosities*."

[4] For a concise statement of Ostwald's theory see "Die Grundlage der messenden Farbenlehre." (Barth, Leipzig, 1921.)

The Trend of Development of Marine-Propelling Machinery.

THE eleventh Thomas Hawksley lecture was read before the Institution of Mechanical Engineers on Friday, November 7, by Engineer Vice-Admiral Sir George G. Goodwin, and dealt with the development of marine-propelling machinery. Whilst naval conditions impose restrictions on the design of machinery, both warships and vessels of the mercantile marine must possess the qualities in their machinery of reliability, endurance, durability, and economy, each in high degree. The best economical performances are generally obtained in the merchant service, where machinery is designed for economical running at steady speed. In warships, economy at full power is necessary in order to keep down the weight of the boiler installation; most of the steaming is done at powers so low as one-tenth, or less of full power, and economy at these low powers is also of great importance. Both desires cannot be met completely, and a compromise is arranged.

Marine-propelling machinery develops in warships by the striving for high power on low weight per horse-power, involving the development of high class and special materials, and by the concurrent aiming at the most economical running under very varying conditions. In merchant ships, where weight is allowed on a more generous scale, and steady running is the rule, the development is by the efforts to reduce fuel consumption and, so far as other conditions will allow, by arranging the design so as to enable the machinery to be manufactured, but manufactured properly, at low cost, and to be kept running efficiently with a low repair bill and other running costs.

At present none of the British surface fighting ships is propelled by reciprocating steam engines; these have disappeared entirely except in a few auxiliary vessels and non-fighting craft. All are now fitted with turbines, the later vessels being all-geared, that is, all the turbines in the ship are geared down to drive the propeller; there are now no partially geared turbines in the Navy.

Lloyd's Register Book for 1924–5 shows that the tonnage afloat is divided between the different types of propelling machinery as follows: steam reciprocating engines, 50,742,758 tons; steam turbines, 8,795,584 tons; motors, 1,975,798 tons. The percentage tonnages for five years is divided as follows:

Year.	Steam reciprocating, per cent.	Steam Turbines, per cent.	Motors, per cent.
1918–19	70	28	2
1919–20	57·4	30·7	1·9
1920–21	73·6	23·3	3·1
1921–22	56·4	34·6	9·0
1922–23	52·3	37·4	10·3

These figures show the preponderance of reciprocating engines in the mercantile marine, and that this type is still being built to a larger extent than all other types. But very little development is taking place in reciprocating machinery, and the ratio of tonnage fitted is a falling one. The engine has great advantages but also grave disadvantages. The anticipated better economical performances of the fast-running geared turbine and slow-running propeller have been realised and the direct driving turbine may be regarded as quite obsolescent for marine purposes, and indeed obsolete so far as manufacture is concerned, especially as the geared type lends itself to further improvement, which cannot be developed in the older type.

In a paper read before the Institution of Naval Architects in 1920, Engineer-Commander Tostevin states that there were then 600 sets of mechanical reduction gearing in service in the Navy. There had been trouble in a few cases only; six instances had occurred of fractured pinion teeth, and two of these had taken place during service and the others during trials before the receipt of the machinery by the Admiralty. Some of the later merchant ships have not been so fortunate, and several cases of cracked and fractured teeth have been reported. Facilities have been freely given all round to assist in the investigation of the behaviour of the gears in the merchant service as compared with those in the Navy, and although general agreement as to the cause has not been reached, the discussions have brought to light much valuable information. It may be noted that double-reduction gears were fitted in the merchant vessels where the mishaps occurred, whilst the Navy has generally single-reduction gears. Failure almost always occurred by fracture of the pinion teeth and rarely, if ever, by fracture or permanent deformation of the wheel teeth. No case of faulty or fractured gearing has been reported since April last, and confidence is being rapidly restored.

The inherent disadvantages of electric and hydraulic transmission have outweighed their known advantages, and these alternatives to mechanical gearing have not been adopted in this country.

There is a field for development in point of economy by increasing the temperature range by the adoption of higher boiler pressures, or higher superheat, or both. The steam turbine is specially suitable for both, or either. Whether we are yet ready for the adoption of materially higher boiler pressures afloat is a little problematic; past experience calls for caution, but the matter is receiving consideration. In the merchant service the benefit of superheating has been realised to a greater extent than in the Navy. A recent trial under normal sea-going conditions of a single screw ship with all-geared turbines of 3000 shaft-horse-power, with steam at the high-pressure first expansion of 165 lb. per sq. in. and 200° F. superheat, with exhaust pressure of 28¼ inches, gave a steam consumption for the turbines only of just over 9 lb. per shaft-horse-power per hour. Sir Charles Parsons states that the consumption should be about 8 lb. in the case quoted, hence there is still scope for improvement.

Sir George Goodwin also reminds us that development in one respect must be accompanied by developments in other respects, and cites the development of the single-collar thrust block in time to take the thrust from a geared turbine installation of 38,000 shaft-horse-power passing through a single shaft.

Auxiliary machinery and motor propulsion machinery were also dealt with in the lecture. There are two recent ventures of interest: (1) A combination of

heavy oil engines with electric transmission. (2) The transmission of the power of a fast-running heavy oil engine through mechanical gearing.

Sir George Goodwin has come to some conclusions regarding the future. These are as follows:

(1) The reciprocating steam engine will be the most common type in the mercantile marine for some years yet. It is not likely to be developed in power, and not in economy of fuel consumption to any marked degree.

(2) Geared steam turbines must continue to be the engine for all ships of high power, as in the Navy. Its development will be in the direction of improving its fuel consumption by use of superheated steam and by attention to its details and auxiliary machinery.

(3) The heavy oil engine, having established its reputation for reliability, will, having regard to its low fuel consumption per horse-power, be the propelling engine of an increasing number of cargo ships and ships of low and moderate power, but its rate of increase of use will be retarded while its cost remains high, and efforts will be made to reduce the cost by increasing the power per cylinder by the several stages leading to the double-acting two stroke cycle engine.

Development will require a great deal of engineering research and experimental work, and also probably fundamental research in certain branches of pure science. Co-ordination in the different fields of research and with the engineer has been accomplished in some branches of engineering in the United States, and Sir George Goodwin invites attention to the system adopted of having an intermediate laboratory separate from the fundamental research station and separate from the factory. Here the results of fundamental research are collected and sifted, and the parts promising to be of service to the engineer are co-ordinated and developed with the help of engineers who know the needs of the factory, and also with the help of others who are expert in the economical side. The results are said to be satisfactory and to justify the cost.

Dielectric Mineral Separation.

By Prof. S. J. TRUSCOTT.

IN the preparation of clean mineral from crude ore, the processes of water concentration and flotation concentration, in combination or separately, achieve all that is required with sulphide ores, the former process being particularly successful in the recovery of coarse and granular mineral, while flotation is equally successful with fine and with the finest mineral. But, with oxide or oxidised ores, though water concentration will generally suffice where the mineral grain is large and remains so during crushing, there is no equivalent of flotation to recover fine mineral or that so fine as to go into suspension. Yet in the dressing of tin and other oxide ores requiring fine crushing, a substantial proportion of the ore passes into the fine condition described as slime, from which it is at present impossible to make a satisfactory mineral recovery. Again, the recovery of the vanadium mica, roscoelite, from the sandstone in which it occurs typically in the United States is not at present possible by any dressing process, because the roscoelite is friable and light; such vanadium deposits, large as they are, at present lie idle. Even where the mineral grain is sufficiently large it sometimes happens, and particularly with minerals of the rare metals, that water concentration will yield a complex concentrate of two or more minerals with properties of density, magnetic permeability, electric conductivity, etc., so similar that no one of the presently applied methods of dressing is effective in separation. Thus, some vanadium, uranium, and molybdenum minerals occurring together largely remain inseparable; and some alluvial tin concentrates contain rare minerals from which it is difficult to free the tin.

Given this position, any new process based upon physical differences between minerals not yet used in dressing, and disclosing possibilities of useful application in the field as yet unoccupied, is welcome. Dr. H. S. Hatfield, in a paper read before the Institution of Mining and Metallurgy in February last, brought forward such a process, one based on the differences in inductive capacity between minerals and one which he termed "dielectric mineral separation," substances being dielectrics by virtue of their property to propagate electric forces through themselves by induction. The "specific inductive capacity" may be considered to be a particular range of the more general "dielectric constant." Conductors may be considered to have an infinitely high dielectric constant; but insulators are the characteristic dielectrics.

As groups, the sulphide ore-minerals are conductors, the oxide ore-minerals poor conductors, and the gangue minerals are non-conductors. Actually, the oxide ore-minerals have dielectric constants of the order of 20-30, while the constants of the gangue minerals are of the order of 5, that of air being unity. Situated in an electric field in air, the forces acting on particles of ore are such that all would be attracted to the electrode with forces so much of the same order that gangue and mineral could not be differentiated. The position is different in a magnetic field, in that gangue minerals have a magnetic permeability practically the same as that of air and accordingly behave as non-magnetics. In dielectric separation there are no non-electrics comparable to the non-magnetics of magnetic separation.

Dielectric separation therefore employs a liquid dielectric having a constant intermediate between that of the gangue and that of the mineral, in which medium the gangue is repelled and the mineral attracted to the electrodes. Water is useless, because when pure its dielectric constant is too high, and when impure it becomes a conductor. Dr. Hatfield has chosen to mix kerosene and nitrobenzene in proportions such as in each case give the desired constant, that of kerosene being about 2 and that of nitrobenzene about 36.

The necessary electric field is obtained by a single-phase alternating current of about 200 volts and 150 frequency, brought to electrodes about a couple of millimetres apart. These electrodes may be parallel wires, or one wire coiled around a straight wire, or

points on parallel plates. With the field in being and the crushed ore passing, the mineral is held while the gangue falls through. When loaded the circuit is broken and the mineral drops. Conducting minerals are rendered innocuous by covering one electrode with paper.

There is difficulty in this process in that the dielectric constant of a mineral is liable to vary according to its previous treatment in crushing and in exposure; it varies also with the frequency: these are points upon which careful work is necessary. There is also economic difficulty in recovering the expensive medium which passes out both with the mineral and with the gangue, these two products having to be filter-pressed and then subjected to heat to distil the remaining liquid. It is claimed that a similar difficulty has been successfully met in removing sulphur from kerosene with added colloidal silica, the silica being recovered dry and in a condition to be used again.

The process differs, on one hand, from ordinary electrostatic mineral separation in that it is not operative by reason of charges acquired by contact, and, on the other hand, from cataphoresis in that this latter is a migration of particles towards an electrode by reason of charges they possess of themselves. In dielectric separation there is no question of electric charges; the particle in the electric field is in an analogous position to ore in a magnetic field, only that there is both attraction and repulsion in dielectric separation, whereas with magnetic separation there is rather differential attraction, magnetic repulsion being a rare phenomenon.

Obituary.

SIR MAURICE FITZMAURICE, C.M.G., F.R.S.

BY the death of Sir Maurice Fitzmaurice on November 17, the engineering world has lost a leader of outstanding ability who served the country in many capacities and whose name will always be associated with two great undertakings, the construction of the Assouan Dam on the Nile and the extension of the main drainage of London. He was also associated with railway development and harbour and dock work in various parts of the world. In 1916 he was chosen to succeed Mr. Alexander Ross as president of the Institution of Civil Engineers, from which he received the Telford and Watt Gold Medals, and three years later he was admitted a fellow of the Royal Society, a distinction also conferred upon many of his predecessors such as Telford, Walker, Sir Benjamin Baker, Rennie, Hawkshaw, Robert Stephenson, and Sir William Preece.

The son of Dr. Robert Fitzmaurice of Cloghers, Tralee, Sir Maurice Fitzmaurice was born in Co. Kerry on May 11, 1861. At Trinity College, Dublin, which has possessed a school of engineering since 1847 and where for thirty years Samuel Downing occupied the chair of engineering, he took the degrees of M.A. and Master of Engineering, and then became articled to Sir Benjamin Baker, who at that time was engaged with Sir John Fowler on the Forth Bridge. This was the first great work with which Sir Maurice was associated. During the 'nineties he was in charge of construction work in Canada and elsewhere, and then in 1898, at the age of thirty-eight, he received the important appointment of Chief Engineer to the Egyptian Government for the construction of the great Assouan Dam, with which Sir William Willcocks, Sir Benjamin Baker, and Sir John Aird were associated. This Dam, once described as "one of the grandest engineering undertakings of our time," is 6400 feet long, has 180 sluices, and contains more than 1,000,000 tons of granite. Begun in 1898, it was completed in 1902, Sir Maurice's work being recognised by the award of the C.M.G.

Returning home, Sir Maurice was appointed successor to Sir Alexander Binnie as Chief Engineer of the London County Council. In this capacity, he was responsible for the construction of the Rotherhithe Tunnel, the Embankment in front of the new County Hall, the new Vauxhall Bridge, and the subway for trams under Aldwych and Kingsway to the Embankment. During his period of office, 1902–1912, he also carried through the duplication and extension of the whole drainage system of London at a cost of about 4,000,000*l*. Until 1847 the sewage of London was discharged direct into the Thames, and it was under one of Sir Maurice's predecessors, Sir John Bazalgette, that the great sewers were carried down to Barking and Cross Ness, and in Sir Maurice's report to the Council in 1912 will be found many details of the growth of the wonderful network of sewers which carry off the drainage of London and the methods used for its disposal.

During the latter part of his career, Sir Maurice was a partner in the firm of Coode, Fitzmaurice, Wilson and Mitchell, consulting engineers to the Crown Colonies and to the Sudan Government for the Blue Nile Irrigation Works, and chief engineers of the national harbours at Dover and Peterhead. He also acted as chairman for important committees appointed by the Admiralty, War Office, Foreign Office, and Board of Trade; on two occasions he visited the British front in Flanders to advise on questions of drainage, and served on the International Technical Commission of the Suez Canal. Knighted in 1912, Sir Maurice received many honours, among which was the honorary membership of the American Society of Civil Engineers. He was the author of works on bridges and drainage, while his presidential address to the Institution of Civil Engineers contains much valuable advice to young engineers, the results of his own experience. "In looking back," he said, "over the great number of engineers whom I have come across in works and in office, I cannot bring to mind any case of a hard worker who has really failed."

WE regret to announce the following deaths:

Mr. Romeyn B. Hough, author of the "Handbook of Trees of the Northern United States and Canada," who was known also for his remarkable fascicles of sections of North American woods, aged sixty-seven.

Dr. E. König, of the photographic department of the dye-works of Meister, Lucius and Bruning, Höchst-am-Main, whose name is known in connexion with the pinatype process, and with sensitisers and desensitisers, on October 29, aged fifty-four.

Current Topics and Events.

IT is of interest to recall that the date November 23 marks the 260th anniversary of the publication in 1664 of that rare and notable folio by Robert Hooke, entitled "Micrographia: or some Physiological Descriptions of Minute Bodies made by Magnifying Glasses, with Observations and Inquiries thereupon." The issue was licensed by Viscount Brouncker, P.R.S. Hooke, who was born in 1635, at Freshwater, Isle of Wight, died in 1703. He was associated in intimate fashion with the early founders of the Royal Society—Moray, Wren, Boyle, Evelyn, and others—and worked with amazing industry to promote its aims. The lineaments of this remarkable man have not been bequeathed to posterity, since no authentic portrait of him exists. Sir Robert Moray had originally suggested Hooke, in 1662, as a curator of experiments to the Royal Society, putting it that "Mr. Hooke should come and sit amongst them," but it was not until November 23, 1664, that the president was desired to declare to the whole Society that the council thought good to have a curator by office, and Dr. Wilkins was deputed to submit that "Mr. Hooke standing for a curator's place be this afternoon nominated." Robert Boyle was thanked for dispensing with his services, in favour of the Society.

THE "Micrographia" contains a dedication to the King, this subscribing to the current flamboyant style. "There are, Sir" (Hooke says) "several other of your Subjects, of your Royal Society, now busie about Nobler Matters: The Improvement of Manufactures and Agriculture, the Increase of Commerce, the Advantages of Navigation: In all which they are assisted by your Majestie's Incouragement and Example. Amidst all those greater Designs, I have presumed to bring in that which is more proportionable to the smalness of my Abilities, and to offer some of the least of all visible things, to that Mighty King that has established an Empire over the best of all Invisible things of the World, the Minds of Men." The Royal Society is given a special dedication, Hooke informing them that "the Rules you have prescrib'd yourselves in your Philosophical Progress do seem the best that have ever yet been practis'd. And particularly that of avoiding Dogmatizing." A long and somewhat drawn-out preface to the reader follows. Of Wren and Wilkins, Hooke has much to say in eulogy and evident friendship. There scarce ever met, he affirms, in one man (Wren) so great a perfection, such a mechanical hand, and so philosophical a mind.

BORROWING the title of a world-known story, "A Tale of Two Cities," Mr. H. S. Pritchett discusses in the November issue of *Scribner's Magazine* the application and function of Benjamin Franklin's trust for the cities of Boston and Philadelphia, the provisions of which were set forth in a codicil to his will made some eight months prior to his death. The recent celebration of the centenary of the Franklin Institute of Philadelphia gives the article special point. The detailed information respecting Franklin's philanthropic foundation is, indeed, welcome and timely. Needless to say, two other cities hold Franklin in honoured remembrance. He lived in London eleven years, was elected a fellow of the Royal Society, and served on its council. The Society would take no fees from him. The Paris National Assembly wore a badge of mourning for three days after his death; Condorcet pronounced a eulogy before the Academy of Sciences. Franklin's design was to benefit Boston and Philadelphia through the creation of a money trust for each, which, however, contained at the same time a hard and fast plan, operative for one hundred years, with a contingent second centennial period. He wished to form the mind of youth and conduce to the material prosperity of youth; also to encourage the projection of works of public utility of such nature as might lead to the comfort and convenience of the inhabitants of the cities named. Without stretch of imagination he would seem to have preceded Mr. Carnegie and Mr. Rockefeller. The story of these bequests, their limitations, the difficulties encountered in their administration, and, not least, the economic and social changes which have affected them, form, in the hands of Mr. Pritchett, an interesting record, throwing as they do much light upon the question of the institution, management, and obligations which arise therefrom.

ELECTRIC supply authorities are sometimes required to give a supply of electricity to districts at a great distance from the generating station, although the probable demand is small. In these cases it does not pay them to erect a manually operated substation, and a completely automatic substation is too expensive. Mr. Chattock, the electrical engineer to Birmingham, deserves great credit for doing valuable pioneering work with small automatic substations equipped with mercury vapour rectifiers of the glass-bulb type. This apparatus statically transforms alternating current into direct current. When a mercury arc exists in a vacuum under certain temperature conditions, it acts like a valve, allowing current to flow through it in one direction and not in the other. The cathode bath of mercury is the positive pole of the direct-current circuit. If the vacuum fail for any reason, then a violent short circuit occurs, but luckily this rarely happens. In a paper read to the Institution of Electrical Engineers on November 20, Mr. Rogers stated that in the case of glass bulbs for 230 volts, no single instance in his experience of a short circuit has occurred. This paper will be of immediate value to engineers, as not only are the arrangements for the automatic control of these rectifiers given in full, but also schedules of the complete costs of rectifier substations. A method is given in the appendix of supplying direct current at 550 volts to a six-mile length of double tramway track by means of semi-automatic rectifier substations. The method is both simple and cheap, and probably will have applications in the immediate future.

THE decision of the editors of the *Irish Naturalist* to cease publication of this journal with the December number will be learned with deep regret by the many readers in Great Britain and elsewhere who have followed the admirable work done by the magazine in promoting the study of the fauna of Ireland for a period of thirty-three years. It has been unable to recover from the vicissitudes due to the War, and increased costs of production, with the loss by death or otherwise of a large body of its former supporters, have combined to render continued publication impossible. An author index to the last eight volumes, on the same lines as that for the first twenty-five, will be issued with the concluding number of the current volume. A subject index and title index to the whole series is contemplated if sufficient financial support is forthcoming.

THE remarkable and well-known collection of stone implements and other Irish antiquities formed by Mr. W. J. Knowles of Flixton Place, Ballymena, Ireland, was sold by auction at Sotheby's on November 17 and three following days, the total amount realised being 4005*l*. The more important stone implements were purchased for the Belfast Museum, including a fine kite-shaped lance-head of flint found between Bellaghy and Castle Dawson (25*l*.), one of gray flint polished on both sides, 6 inches long, from Tyhorney (25*l*.), a spear-head of elongated kite-form, 7½ inches, from Carndon (10*l*.), chipped axe of basalt, 13 inches long, found at Armoy (10*l*.). Several of these implements were figured in the Journal of the Royal Anthropological Institute, vol. xxxiii. The Ashmolean Museum obtained two rare pieces—a cauldron of thin sheet bronze formed of four riveted plates found near Portglenoue (50*l*.), and a heart-shaped bronze fibula with triangular plate of the second century A.D. (17*l*. 10*s*.). A Celtic quadrangular iron bell with clapper fell to Belfast Museum (25*l*.).

FEW educational organisations have done more valuable work than has the School Nature Study Union, which celebrated its coming of age in September last. Founded in 1903 by a small band of enthusiasts, of whom the leaders were Miss Kate Hall and the Rev. Claude Hinscliff, with the primary object of bringing a breath of the country into the drear and drab lives of the children of the London slums, it has grown into a large and vigorous organisation permeating the educational system of the whole of England, endeavouring to foster in children a real love of the natural world around them, an appreciation of its beauty, and an interest in its manifold workings. The special anniversary number of its official organ, *School Nature Study*, issued to commemorate its coming of age, contains much interesting matter on various aspects of nature study, and a review of the growth of the Union and of the work that has been accomplished. Three articles deserve special notice. Prof. J. Arthur Thomson has rewritten his pamphlet on "The True Inwardness of Nature Study," and, in its revised form, it is worthy of the close attention of all who desire to see an extended system of biological teaching put into practice. It is a clear and reasoned statement of the objects, methods, difficulties, and potentialities of nature study, and embodies the ideals of the Union for which it was written.

THE other two articles in this anniversary issue of *School Nature Study*, by the president of the Union, Dr. Chalmers Mitchell, on "Observation and Theory," and Prof. J. B. Farmer on "Teleology in Nature," bear on the same problem and also contain timely warning against one of the greatest dangers of nature study in inexperienced hands, namely, the attempt to interpret the facts observed, the tendency to warp the powers of observation through the influence of preconceived theories, and the interpretation of animal and plant behaviour on anthropomorphic lines. Dr. Chalmers Mitchell deals with the general problem; Prof. Farmer is concerned mainly with the dangers of teleology, the appeal to design or purpose as an explanation of structure or behaviour. For these friendly warnings, so timely given, the Union and its supporters should be grateful. We join in the many congratulations which the Union has received on this special anniversary of its foundation. With the ideals before it so high, with the enthusiasm of its executive so keen and whole-hearted, and with a growing volume of support from biologists on one hand and educationists on the other, the Union in its maturity should bring to fruition the seeds so diligently sown in its infancy and adolescence.

A CHADWICK public lecture on "Smoke: its Cause, Nature, Effects and Methods of Prevention" was delivered by Prof. J. B. Cohen on Wednesday, November 19. Prof. Cohen stated that soot from factory chimneys is very different in character from that from domestic fireplaces where raw coal is burnt. In the former case, owing to the high temperature and strong draught, the volatile portions of the coal are mainly consumed, whilst the draught carries off mechanically fine mineral dust and grit mixed with carbon containing little tar. Domestic soot, on the other hand, may contain as much as a quarter of its weight of tar. It is this tar which causes the soot to cling, accumulating with time and blackening surfaces with a varnish which is not removed by rain. Vegetation suffers in several ways from the presence of smoke. If the light is partially cut off by the pall of smoke, or if the leaf (more especially of evergreens) is blackened by a coating of soot, or again if the stomata are blocked with tar, the plant must suffer. Again, the plant is affected by the acid soot, and also by the sulphur acids which pass into the air from burning coal and are washed down by rain. The effect of this acid is to corrode the leaf, which withers and falls much earlier in and near a town than in the country. Moreover, the acid percolating through the soil destroys certain organisms and enzymes concerned in the assimilation of the soil constituents, and many grasses, vegetables and flowering plants succumb. Even the colour of flowers is affected. The observations of Sir Frank Baines have also made it evident that the sulphur acids from coal attack masonry, while fabrics,

leather bindings and metal work are being similarly attacked. Passing to remedial measures, Prof. Cohen stated that in his opinion the situation could be much improved by the production of cheaper gas, coke, and electricity, while local authorities should encourage their sale and exercise to the full their powers under the Public Health Act of 1875 to stop unnecessary smoke from boiler chimneys.

THE opening meeting of the Illuminating Engineering Society on November 18 was, by custom, devoted to reports of progress and the exhibition of novelties. Mr. Leon Gaster in his opening address remarked that the vacation had been a period of exceptional activity. Illumination had been dealt with at the World Power Conference, the meetings of the International Illumination Commission and the International Conference on Industrial Hygiene in Geneva, and at the Conference afterwards arranged by the Society at the British Empire Exhibition. At Geneva an excellent opportunity of interesting hygienists in lighting problems had been presented, and good lighting is now definitely accepted as an element indispensable for health, safety, and efficiency. Developments abroad had been rapid, and in the present year an Illuminating Engineering Society had been formed in Austria. A report presented by the Committee on Progress in Electric Lamps and Lighting Appliances directed attention to the steady advance towards higher values of illumination, and quoted examples of the general tendency to utilise light in a more scientific manner. The exhibits after the meeting as usual covered a wide range, including new reflectors and luminous signs, and a motor-car headlight specially designed to overcome the dazzle difficulty. Mr. W. G. Raffe dealt with the psychology of illumination, and Miss Mary Wurm gave an address on stage lighting in connexion with music, illustrating her remarks by experiences in various Continental theatres.

IN the unavoidable absence of Lord Weir, Mr. H. B. Weeks presided at the third annual meeting of the Cast Iron Research Association in London on November 19. The chairman laid stress on the great progress made during the year, and summarised the main developments, referring particularly to the extended research programme and the establishment of a laboratory. Sir John Dewrance was elected president of the Association for the period 1924–26, and the following were elected vice-presidents: Mr. Geo. Pate (Falkirk), Mr. Summers Hunter (Wallsend-on-Tyne), Mr. F. W. Firth (Sheffield), Mr. C. E. Lloyd (Dudley), and Mr. W. B. M. Jackson (Chesterfield). Commander C. W. Craven and Prof. T. Turner were re-elected vice-presidents. A great tribute was paid to the services rendered to the Association by the retiring president, the Rt. Hon. Lord Weir of Eastwood, who was elected an honorary member. Mr. A. J. Burn, Mr. F. J. Cook, Mr. T. Donaldson, Mr. N. B. Ellington, Mr. J. Haigh, Major C. Howl, and Mr. M. Riddell were re-elected to the council. Dr. W. Rosenhain and Prof. T. Turner were elected honorary members, and Dr. Rosenhain spoke, expressing the hope that there would be even greater co-operation in future between the Association and the Ferrous Alloys Research Committee. Delegates nominated by the leading technical institutions were also elected at the meeting.

THE next Congress of the Royal Sanitary Institute and Health Exhibition will be held at Edinburgh on July 20-25, 1925, by invitation of the Magistrates and City Council.

THE following have been elected officers of the Cambridge Philosophical Society for the session 1924–1925: *President*, Prof. J. T. Wilson; *Vice-Presidents*, Prof. J. Barcroft, Mr. C. T. Heycock, Dr. G. T. Bennett; *Treasurer*, Mr. F. A. Potts; *Secretaries*, Dr. F. W. Aston, Mr. J. Gray, Mr. F. P. White; *New Members of the Council*, Dr. A. B. Appleton, Dr. C. D. Ellis, Mr. F. F. Blackman, Mr. C. T. R. Wilson, Mr. J. E. Littlewood, Mr. G. Udny Yule, Prof. E. A. Milne.

THE *Chemiker Zeitung* reports that Prof. F. Paschen, formerly director of the Physical Institute of the University of Tübingen, was installed on November 1 as president of the Physikalisch-Technische Anstalt, Berlin. The same issue also records the appointment of Herr Geheimrat Wiedfeldt, German Ambassador to Washington, to the head of the directorate of the firm of Krupp in Essen-Ruhr. Dr. Bruhn retires from the board of directors, in order to become the representative of Krupps in Berlin, in succession to Dr. Kurt Sorge, who has resigned.

A NEW expedition to the Arctic is being planned by Mr. Lauge Koch, the Danish explorer. According to the *Geographical Journal* for November, the objects will be mainly geographical and cartographical, and the field of work will be Grant Land and other islands of Arctic Canada, where Mr. Koch proposes to investigate and map the mountain range which he believes to be a continuation of those he explored in Northern Greenland and a section of a great arc that continues through Spitsbergen, the Shetlands, Scotland, and Wales. No date for the departure of the expedition has yet been fixed.

THE Royal Geographical Society, in conjunction with the University of London, has arranged a meeting of a special character to be held at the Central Hall, Westminster, on December 1. M. Albert Kahn, who is already well known for the establishment of the Albert Kahn Travelling Fellowships and similar works for the promotion of international comity, is sending to the meeting a number of photographs taken in natural colours by his direction in various parts of the world. These will be projected on a screen in four groups illustrating European scenery, the relation of environment to man, modern architecture, and China, and will be described by Mr. A. Ogilvie, Mr. L. H. Dudley-Buxton, Mr. E. A. Benians, and Prof. P. M. Roxby, all of whom have held Albert Kahn Travelling Fellowships.

WE learn from *Science* that an Institute of Research has been established by Lehigh University, Bethlehem, Pennsylvania, "to encourage and promote scientific

research and scholarly achievement in every division of learning represented in the organisation of the university; and in recognition of the need for further and more exact knowledge in science and in the applications of science to the affairs of modern life." The Institute will be controlled by an executive board including heads of the faculties of Lehigh University, and it is hoped to afford training in research methods to the staff of the University and the Institute, to graduate students of the former, and to special investigators. The New Jersey Zinc Company has already founded a research fellowship in science and technology in the new Institute. Bulletins or reports on the progress made in problems attacked will be issued from time to time.

MESSRS. Dulau and Co., Ltd., 34 Margaret Street, W.1, have just circulated their Catalogue No. 119, giving the titles of some 1400 second-hand books and serials relating to astronomy, dialling, meteorology, aviation, physics and chemistry, mathematics and mechanics, and fen drainage, which they have for sale.

THE Cambridge University Press announce for early publication "A History of British Earthquakes," by Dr. C. Davison, the aim of which is to record all known British earthquakes, to trace the zones in which crust-changes have recently occurred and in which the faults are yet alive, and to discover some of the laws that rule the growth of faults.

THE Cantor Lectures on "Colloid Chemistry," which were given by Dr. E. K. Rideal at the beginning of the year, have been published in three recent numbers of the Journal of the Royal Society of Arts (Oct. 17, 24, and 31). Dr. Rideal's review included such topics as adsorption, methods of preparation, stability of sols, emulsions, soaps, etc., practical applications of the features discussed being frequently given.

THE Oxford University Press will publish at the beginning of December a limited edition of "The History of Aeronautics in Great Britain from the earliest period to the latter half of the Nineteenth Century," by J. E. Hodgson. The work will include chapters on the development of international aeronautics, an annotated list of papers read before the Aeronautical (now the Royal Aeronautical) Society between 1866–93, and a selected bibliography.

Our Astronomical Column.

A STUDY OF STELLAR MOTIONS.—The *Scientific Monthly* for November contains an interesting analysis of stellar velocities by Dr. Gustaf Strömberg. He forms *velocity surfaces* for different groups of stars by imagining the bodies forming a group to start from a common point at the same instant; then after moving each with their proper speed for the selected unit of time, the curve or surface drawn through them gives a graphic representation of the velocity distribution.

These surfaces in most cases are considerably elongated not only in sections perpendicular to the galactic plane (which we might foresee *a priori*) but in the galactic plane itself. This is so far in accord with Schwarzschild's ellipsoidal hypothesis, but a considerable deviation from such a symmetrical form is found, which is especially notable when stars of high velocity, more than 100 km./sec., are examined. They are found to be practically all moving towards one hemisphere. A similar want of symmetry is found in many other distant objects.

The author gives a tentative explanation, supposing that some fundamental system of reference exists in space, and that high velocities relatively to it are far more rare than small velocities. He gives an illustration; supposing a ship moving rapidly through the air, then various classes of objects on deck are variously affected by the strong draught produced, some moving with the ship, others keeping their position in the air, while others have intermediate motions. If several ships are postulated, a close resemblance to the observed stellar motions would arise. The paper closes with some discussion on the bearings of these results on Einstein's general theory of relativity.

MARTIAN PHOTOGRAPHY.—Two very interesting series of Martian photographs are reproduced and discussed in the October number of Publications of the Astronomical Society of the Pacific. The first, by W. H. Wright, deals with photographs taken with the Crossley reflector at the Lick Observatory in light of three different wave-lengths, (1) ultra-violet, (2) yellow, and (3) infra-red. (1) shows no detail on the disc except the polar cap, and gives a distinctly larger image than the others; (2) agrees with the visual aspect of the planet; (3) shows the dusky regions in an accentuated manner, the polar cap being small and faint. (1) is thought to give a picture of the Martian atmosphere, extending 120 miles above the limb (this is supported by some recent observations of the occultation of Mars, a glow being seen for a few seconds after the disappearance of the disc). It is concluded that the polar cap is mainly an atmospheric phenomenon, but that there is probably a less conspicuous surface cap below it. The darkness of the dusky areas in (3) indicates that their radiations are mainly in the blue and green, agreeing with their visual aspect. Terrestrial landscapes taken from Mt. Hamilton with (1) and (3) show that the distant landscape is wholly blotted out in (1) by the atmospheric veil, while it is clearly visible in (3).

The second series was made by Prof. E. C. Slipher at Flagstaff, with the 24-inch refractor and the 40-inch reflector. The tests with light of different wave-lengths are in full accord with those of Mr. Wright. The pictures are grouped in a manner to bring out the seasonal changes, the dusky areas darkening in the late spring and fading in the autumn; this is in full accord with the vegetation hypothesis. On the whole, these markings and the polar cap have repeated the cycle of change recorded in 1909, the region Deucalion being, however, fainter this year.

Search was made, without success, for the chlorophyl bands in the spectrum of the dusky areas. It is noted that it is much more difficult to detect these in reflected light than in transmitted light.

Prof. R. Trumpler also publishes some simultaneous drawings and photographs made with the 36-inch Lick refractor. The drawings show numerous canals, including some in the dusky areas; traces of several of these can be seen in the photographic reproductions, and the original negatives are stated to show many more. The polar cap had some dark bands across it, and detached white patches at its edges. A small white spot is shown in the middle of Auroræ Sinus, not very far from "Dawes Ice Island."

Research Items.

HOLY WAYS AND HOLY PLACES.—Prof. H. J. Fleure has published in the *Sociological Review* a communication to the Conference on Living Religions, recently held at Wembley, on the origin of sites which are or have been held in special veneration as centres of religious cults. Such centres have to a great extent grown up along routes of trade and intercourse such as can be traced so far back, at least, as the late neolithic and early metal ages. There is evidence for the spread of cultural influences between the Iberian Peninsula, France, western Britain and Ireland, southern Sweden, Denmark, and north-west Germany. The megalithic monuments which mark this spread of culture may well have been stations of men of superior culture to which natives would come to trade, their sanctity continuing down to historic times, as is shown by the records of the early Christian Church. The stations along the route followed by Abram from Haran through Palestine—Shechem, Bethel, Hebron, and Beersheba—gathered traditions of sanctity in course of time. Mecca, a station of sanctity far older than Islam, as is shown by the cult of the Black Stone, is a place of contact on the trade way from Arabia Felix northward. Santiago de Compostella is a focus behind alternative ports going back directly and indirectly to the earlier stone monuments. Similarly St. Davids in South Wales, Canterbury, and possibly St. Andrews, each acted as a focus for sea routes; while Kief analogously is the culture entry for the land and rivers both from the south, by which Byzantine influence reached Muscovy, and from the west. Jerusalem originally was the fortress controlling the trade routes, whether from Hebron to Bethel and Shechem, to Jericho and across the Jordan, or along the western side of the Dead Sea.

GROWTH OF CHINESE.—Dr. S. M. Shirokogoroff and Dr. V. B. Appleton have published in the *Chinese Medical Journal* for May last an analysis of measurements of Chinese children and adolescents ranging in age from three years to twenty in the case of males and eighteen for females. The data investigated cover stature, weight, and growth, and are derived from 873 males and 266 females. It was at once apparent that the growth of females is not the same as males. There is, in the case of males, a regularity in increase of stature, weight, and relative weight. In females this regularity is disturbed at the age of 4 and 17 years in relative weight and at 18 in stature. There seem to be two critical periods in the development of males, at the age of 6 years and 15 years, when the absolute growth is evidently accelerated. The average stature of the Chinese is about 64·5 inches for males. Hence it appears that male stature growth stops at about 21 years. The curve of weight mounts smoothly up to about 17 years, when it nearly stops. For females the growth of stature stops almost completely at 15 and completely at 18. Though no data of adult females are available, the average stature is probably about 60 inches. In weight, the starting weight is as much as 2·5 pounds less than the males, and the growth almost ceases at 15 years.

KEMP FIBRES IN THE MERINO SHEEP.—Prof. Duerden and Miss Ritchie (Union of South Africa, Department of Agriculture, Science Bulletin No. 34) have made investigations into the nature of kemp fibres in the wool of sheep. These are straight, coarse, dull, opaque-white fibres, very brittle and inelastic, and not dyeing like wool fibres in the process of manufacture. Their presence in wool depreciates its value considerably, since it leads to lack of uniformity in texture and colour. The authors find that kemp fibres have a thick central medulla, with hollow interspaces containing inclusions of air, whereas wool fibres are solid, with no medulla and no air inclusions. Their experiments prove that kemp fibres dye just as readily as wool fibres, but that the air inclusions interfere with the effectiveness of the dye, and that the want of uniformity in colour is therefore purely an optical effect. They conclude that kemp fibres represent all that remains of the outer of the two coats of hair which the ancestor of the merino sheep, in common with most mammals, possessed. Under domestication this outer coat has largely disappeared as a result of long selective breeding and the inner coat, wool, alone remains. It is suggested that kemp fibres may be completely eliminated from the fleece of the merino sheep by an intensification of selective breeding and, alternatively, that it may be found possible by experiment to introduce some method for removing all the air from kemp fibres at one stage or other of the dyeing process and thereby secure uniformity of colour.

A GIANT INFLORESCENCE.—The *Gardener's Chronicle* for November 1 contains some very good photographs showing the development of the inflorescence of *Amorphophallus Titanum*, Beccari, in the Botanic Gardens at Buitenzorg, Java, Mr. P. Dakkus, the curator, having recorded in this manner the development of spathe and spadix from bud to maturity between June 5 and 27, 1924. The total height of the expanded inflorescence is recorded as 2·01 metres, the circumference of the spathe 1·30 metres. From temperature readings Mr. Dakkus concludes that but little heat is developed in the tissues during growth, though the data given seem to be obtained simply from readings of the air temperature within the unexpanded spathe. This giant inflorescence has frequently been seen at Kew, and the editor of the *Gardener's Chronicle* reports that a new and large tuber has recently reached Kew. The plant is a native of Sumatra.

THE POISONOUS ACTION OF COPPER AND MERCURY SALTS IN PLANTS.—In view of the growing practice of trying to sterilise seeds before germination, considerable interest attaches to the attempts of H. Lundegårdh to establish some general fundamental points as to the toxic action of the ions of copper and mercury upon the plant (*Biologisches Centralblatt*, 44, pp. 465–487, September 1924). These ions are absorbed very strongly in the fruit coat of wheat grains by a process which is apparently strongly periodic, like the Liesegang ring phenomenon, and the author thinks it is in this case based upon the interference between primary copper absorption and secondary alterations of the degree of swelling of the material of the fruit coat. Germination and germination energy are as a consequence differently affected by different concentration, so that, whilst a very low concentration may be harmful, a slightly higher may be beneficial if anything, whilst a higher concentration again inhibits or depresses germination. Obviously these results may have great bearing upon practice, and show that great caution will be necessary in establishing the concentration of such toxic substances when used in seed sterilisation.

EXPLORATIONS IN THE LIBYAN DESERT.—Mr. Hassenein Bey's account of his journey across the Libyan desert through Kufra to Darfur appears in the *Geographical Journal* for October and November. It is followed in the November number by a long article

by Dr. J. Ball discussing the cartographical results of the journey. Dr. Ball briefly summarises the additions to our knowledge of north-eastern Africa as follows: The true positions of Zieghen and Kufra have been shown to be 100 and 40 kilometres respectively from the hitherto assigned positions. Oases discovered at Arkenu and Owenat open up possibilities of new routes into the unexplored regions of the Libyan desert. A new route with water courses along it has been mapped across the Erdi and Ennedi plateau, and valuable information, including barometric levels, has been collected over a vast region, confirming Col. Tilho's conclusion that there is no possible drainage outlet from Lake Chad in an easterly direction. Two papers follow on the geological data by Dr. W. F. Hume and Mr. F. W. Moon.

PROBLEMS OF ANTARCTIC SEA-ICE.—In "Manchester Memoirs," vol. lxviii., No. 7, Mr. R. W. James discusses some problems of pack-ice, especially in regard to the Weddell Sea. The most interesting part of the paper deals with the salinity of sea-ice. It is well known that pack-ice, particularly in old pressure hummocks, on melting yields water fresh enough to drink. Freshly formed ice yielded on melting a solution with 1·2 to 0·7 per cent. of sodium chloride. Older pack-ice which has been exposed to weathering for at least one summer has a salinity of 0·2 per cent. This old hummock ice has a vitreous appearance and has lost the original fibrous appearance that is characteristic of new ice. One condition of loss of salinity in old ice seems to be elevation consequent on pressure, which enables the included saline liquid to drain by the action of gravity. Mr. James made the interesting observation that even at very low temperatures (*e.g.* – 30° C.) certain of the salts contained in the ice are in solution and may be lost by draining. But he believes that for sea-ice to lose its salinity, exposure to high summer temperatures is also necessary. Tentatively he advances a theory to account for alternate rise and fall of temperature leading to drops of saline liquid descending through the ice without it being actually porous.

THE OILFIELDS OF ARGENTINA.—The time was ripe for an up-to-date and authoritative summary of petroleum developments in the Argentine, and Mr. Campbell Hunter's paper, read at the Institution of Petroleum Technologists on November 4, attracted attention because of this, quite apart from the technical interest of the communication. It has been difficult both for science and the oil industry to gauge with any assurance the commercial possibilities of the Argentine as an oil producer, largely because only the broadest facts of essential geology are known, and also because the vicissitudes of past operations there have proved somewhat bewildering. Success in one part of the country has often been counteracted by failure in another, at all events from a commercial point of view. In spite of widely separated operations spread over a number of years, the chance find of petroleum in a water well at Comodoro Rivadavia in 1907, the impetus this gave to the industry, and the position of that field to-day as the most important in the country—the output averages some 750,000 tons annually—are still the outstanding features of oil exploration in this part of the world. At Comodoro Rivadavia the oil is apparently obtained from Cretaceous beds (Danian and Senonian), in which lenticularity is the dominant factor, though owing to a thick covering of Quaternary deposits and the presence of two unconformities within the Tertiary sequence, the geological structure of the oil-bearing rocks remains doubtful. The oil has a gravity of 0·912, a viscosity (at 15° C.) of 21·15, flash point 22° C., with 77 per cent. distilling over above 300° C. It is thus essentially a fuel oil, and is used as such at Buenos Aires and Bahia Blanca, where most of it is shipped. Other actual and potential oilfields include those of the Province of Neuquen, the Cerro Alquitran and Cacheuta fields of the Province of Mendoza, and the Salta-Jujuy territory bordering Bolivia. Two economically important veins of high grade asphalt occur near the ancient volcano Auca Mahuida; from the analytical details given, this bitumen is remarkably pure, and recalls some of the grahamite successfully mined in the United States. Future prospects of the Argentine as an oil-producing country lie in extending the Comodoro Rivadavia field, and in the more intensive development of fields such as those of Neuquen, where higher grade oils are obtainable and from which South American markets must eventually be fed.

SELENIUM CELLS AND X-RAYS OF VARIOUS WAVE-LENGTHS.—Dr. H. Küstner describes experiments in which he has compared the action of X-rays on selenium cells, and on ionisation chambers of greatly differing dimensions, in the *Zeitschrift für Physik* of September 2. It is not possible to use fully monochromatic X-rays, as the selenium cell is not sufficiently sensitive; but copper filters of varying thickness were employed with different voltages on the X-ray tube, so that different degrees of hardness were obtained. The average wave-length varied from 0·119 Å to 0·473 Å. The larger of the two carbon ionisation chambers employed was 25·5 cm. high and 6·4 cm. in diameter, while the smaller "thimble" chamber was 21 mm. high and 14 mm. diameter. The ratio of the reading with the selenium cell, and that with the large chamber, showed a maximum at about 0·22 Å, and only half this maximum value was observed at about 0·12 Å and 0·4 Å. This behaviour cannot be related to an absorption spring in selenium, since the shortest wave-length of an absorption band head, that of the K series, is near 0·979 Å. The fact that the ratio between the values obtained with the two ionisation chambers varies with the hardness excludes a suggestion that the X-rays do not produce the full amount of ionisation, being absorbed by the walls of the chamber. An attempt is made to explain the phenomenon as being due to the difference between the scattering and pure absorption effects in air and in selenium. Although a quantitative treatment is not at present possible, a qualitative explanation is obtained.

ATOMIC RAYS FROM HEATED SALTS.—In the *Annalen der Physik* for October, Dr. G. C. Schmidt describes experiments in which a platinum wire is coated with various salts, and heated electrically *in vacuo*. The wire is surrounded by a wire gauze cylinder which is connected to an electrometer, and the sides of the containing glass cylinder are lined with earthed wire gauze. Simple solid or fluid substances, which at a given temperature give out positive or negative ions, or both, conduct electrolytically at that temperature; if they give out electrons they conduct metallically. Salts in which the positive ions are alone mobile send out positive ions only, and similarly for negative ions; while, if the mobility of one kind of ion is greater than that of the other, the first is given out faster than the second at the temperature in question. Complexes such as Cd_nI_{2n} are formed in the solid salt, which disintegrate into $Cd_{n-1}I_{2n}$ and Cd^+. When iodine and bromine, which form complex salts, are present, they break up the large aggregates such as Cd_nI_{2n}, and so the number of ions increases and more are given off. At the same time a badly conducting layer forms on the wire and in the end the current falls. Measurements of the ratio e/m show that the salts of various metals send out positively charged metal atoms; the values of m thus

obtained are as follows—Cd 54-58·4, Cu 31·1-32·7, Zn 32·4, Pb 108·4, Ca 20·5; these are approximately half the atomic weights, since each atom carries the charge $2e$ of two electrons.

ELECTRICITY FOR AUXILIARY POWER ON SHIPS.—In a paper read to the Institution of Engineers and Shipbuilders in Scotland on November 18, by Mr. Gilbert Austin, a new system of electric driving which will be specially useful for driving the capstans, steering gear, pumps, fans, etc., used on board ship is described. The drawback to the ordinary shunt motor used on a constant voltage system is that it is practically a constant speed machine, and if it is pulled up there is a risk of the armature being burned out. The author has devised an ingenious system in which the current through the armature is independent of the speed, and the voltage of the constant current generator varies with the load. He shows how readily it can be applied to various kinds of ships. In a passenger liner, for example, there are three entirely independent circuits each actuated by its own constant current generator, which is driven by a steam turbine. At times of light load any one of the units may be used to supply the whole ship. Some startling statements were made about the cost of running steam auxiliaries. A 15-knot turbine vessel was found to be burning too much coal. It was found by tests that the main turbines took 75 tons of coal per day, whilst the various auxiliaries were responsible for 30 tons. The steam steering gear alone took 7 tons of coal per day. Assuming 250 days per annum at sea, and that coal costs 30*s.* per ton, the fuel cost alone for that particular steering gear amounts to 2625*l.* per annum. The author says that this steam steering gear could have been worked by a 40 horse-power electric motor at an annual cost of about 40*l.* Thus electric driving would effect a saving of 2585*l.* per annum for the steering gear alone. In another case, the loss of steam from 20 leaky joints in long lengths of steam piping was estimated to waste coal at the rate of 440*l.* per annum.

OLIVE OIL.—The *Chemical Trade Journal* for Oct. 24 prints a review of the olive-oil industry. Two varieties of olive tree are known, but only the cultivated thornless type, which exists in forty-five sub-varieties, is used for oil-production; it is cultivated chiefly in Asia, Australia, South Africa, the Western States of America below latitude 35°, and, from the very earliest times, in Mediterranean countries. Spain and Italy are the two largest olive oil producing countries. The ripe fruit yields a sweet pale yellow oil if pressed immediately after gathering; stored ripe fruit gives an inferior colourless oil and unripe fruit a green, bitter oil. The extraction process is described in some detail; the physical and chemical properties are tabulated. The oil appears to consist of 70 per cent. tri-olein and 28 per cent. of tri-palmitin and tri-stearin, together with a small quantity of linolein and arachin. The applications of the oil and of the by-products of manufacture are discussed in detail, as also is adulteration. Its chief uses are for human consumption and in the manufacture of artificial leather and of soap.

THE ELECTRIC MOMENTS OF MOLECULES.—In the October number of the Journal of the American Chemical Society, C. P. Smyth shows how the electric moment of a molecule can be calculated from measurements of indices of refraction, dielectric constants, etc. These calculated moments are much smaller than those deduced from the hypothetical molecular structure based on G. N. Lewis's theory, and the conclusion is drawn that the charges shift under the forces of attraction and repulsion within the molecule, the discrepancy depending on the ease of displacement of the electrons. The electric moments of a series of alcohols, ethers, and analogous sulphur compounds vary from 1 to 2 times 10^{-18}; the value for water is $1{\cdot}98 \times 10^{-18}$, whereas the value deduced from the atomic structure model is $5{\cdot}51 \times 10^{-18}$. The forces required to displace an electron through unit distance are calculated in dynes $\times 10^{-6}$; water, 1·24; ammonia, 0·84; methane, 0·71; hydrogen sulphide, 0·51; and these are regarded as indicating the order of magnitude of the mobilities of the electrons in the molecules.

FLUORINE AND HYDROGEN FLUORIDE.—The preparation of fluorine by the electrolysis of fused acid potassium fluoride in a copper apparatus with a copper diaphragm and graphite anode is described by J. Simons in the October issue of the Journal of the American Chemical Society. Fluorine was obtained at the rate of 4 litres per hour, and the apparatus could be run for 20 to 30 hours. The same author also describes the preparation of anhydrous hydrofluoric acid, and measurements of its freezing-point (−83° C.) and vapour pressure. Anhydrous potassium hydrogen fluoride was heated in a heavy copper retort; the vapour was passed through a tube packed with copper wire to remove salt spray, and condensed in a gold-plated copper cylinder. The relationship between pressure and temperature was found to be reproduced by the equation

$$\log P(\text{mm.}) = -1315/T + 7{\cdot}37.$$

Measurements of the vapour density of hydrofluoric acid, made by Simons and Hildebrand, are described in the same journal. Nitrogen was bubbled through the liquid acid, and the hydrofluoric acid vapour carried off was absorbed in weighed copper tubes containing sodium fluoride. From the known vapour density and the weight carried off, the density of the gas could be calculated. At the low temperatures used (15-19° C.) the molecular complexity exceeded H_4F_4. The results could be correlated with the vapour density measurements of Thorpe and Hambly at higher temperatures, by assuming that the vapour contains an equilibrium mixture of HF and H_6F_6 and a heat of association of 6670 cal. per mole of HF.

STAINLESS STEEL.—At an informal meeting of the Junior Institution of Engineers on November 21, Mr. J. G. Hopcraft discussed this material. The special properties of stainless steel are inherent and not merely superficial. The properties of withstanding heat and corrosion and remaining bright are produced immediately after tempering and removal of the scale, with polishing if necessary. The fact that the steel has to be heat-treated after being worked imposes a limitation on the size of job which can be undertaken, so that the production of large girders, for example, is not a commercial proposition at the present time. Stainless steel has good heat-resisting qualities and will not scale up to about 800° C., the effect on the surface being confined to colour effect only. The removal of scale from the inside of long tubes and similar inaccessible positions is difficult. Stainless steel cannot be expected to machine like mild steel, but with the right degree of hardness and a little experience in the use of the tools for the particular job, the turning and screwing, etc., of the metal can be carried out without much difficulty. A new stainless steel combining a high degree of resistance to corrosion with extreme malleability has recently been brought out under the name of "Stabrite." This metal can be produced in sheets for cold-pressed articles which require no further heat treatment. It cannot be hardened, but can be welded, soldered, and brazed fairly easily.

Science in South Africa.

THE twenty-second annual meeting of the South African Association for the Advancement of Science was held at Cape Town on July 7-12, under the presidency of Prof. J. A. Wilkinson, professor of chemistry in the University of the Witwatersrand, Johannesburg. The meeting was well attended, and more than 80 papers were read. Joint meetings of sections were held for a symposium on veld-burning and for the paper by Prof. H. B. Fantham on "Heredity in Man: its importance both biologically and educationally." There were various visits to places of scientific and historic interest in the neighbourhood, and a popular lecture was delivered by H.M. Astronomer at the Cape, Mr. H. Spencer Jones, on "Wireless Messages from the Stars." A scientific conversazione was arranged by the Royal Society of South Africa, and there was a reception by the Consul-General for Belgium.

The president of the Association, Prof. J. A. Wilkinson, gave as his presidential address, "A Review of some Developments in Chemistry during this Century." Commencing with a historical résumé, a synopsis was then given of progress in knowledge of the zero valency elements, radium developments, cathode rays, positive rays, atomic structure, X-ray spectra, newer work on isotopes, the configuration of the atom, X-ray crystal analysis, colloid chemistry and its developments, Werner's co-ordination theory, hydrogen-ion concentrations, and the theory of solutions. Progress in organic and inorganic analysis was noted, and the methods of soil analysis were outlined. The address concluded with a statement of the needs of research and an appeal for such research.

The presidential address to Section A was delivered by Dr. J. K. E. Halm, on "The Luminosities of the Stars." The history of progress in the several branches of astronomy was traced. The visual and photographic methods of obtaining photometrically correct magnitudes were discussed, and the practical applications of Planck's formula to the distribution of energy in stellar spectra were outlined. Methods of determining distances of stars were noted, and some new results recently obtained at the Cape Observatory in connexion with masses of the stars were outlined. The need of adequate equipment of observatories was urged.

Dr. A. L. du Toit, president of Section B, took as his subject, "The Contribution of South Africa to the Principles of Geology," in which he described the advances made, indicated the bearing of such discoveries in advancing geological theory, and suggested lines for future research. In mineralogy, reference was made to crocodilite and African "jade." The different origins of several kinds of asbestos in the Union, stanniferous ores in the Bushveld tin fields, gold-bearing conglomerates and kimberlite were discussed, and the Bushveld igneous complex of the Transvaal indicated as a field for research. The history of past glaciations in South Africa, and evidence of at least four past glaciations, were presented. The evidence for the existence of Gondwanaland and the hypothesis of continental disruption were discussed. The palæontological vertebrate assemblage of South Africa and its development were noted, as was the well-known Glossopteris flora. The address concluded with an appeal for more attention to field geology.

"Kirstenbosch, South African Botany and Nature Reserves," was the subject of the presidential address to Section C, given by Prof. R. H. Compton, who directed attention to the need for greater output of research, and for developing on national rather than on local lines. The creation of the National Botanic Gardens at Kirstenbosch, their history, manifold botanical possibilities due to situation, rainfall, variety of soil and many types of vegetation were described. Substations are projected, one of which, the Karroo garden, has materialised. The wide scope of the intended activities of the National Gardens was outlined and the need of pure research, in contrast to applied work, was emphasised. Kirstenbosch is also a sanctuary for the native flora and fauna of South Africa. The importance of the preservation of mountain catchment areas by an adequate covering of natural vegetation, the prevention of unnecessary veld-burning, the protection of the natural flora, and its preservation under natural conditions were urged.

Prof. E. H. Cluver dealt with "Some Applications of Physiology to Industrial Hygiene" in his presidential address to Section D. It was pointed out that all improvements directed towards improving health also increase efficiency. Developments in work on industrial fatigue, tests for the assessment of fatigue, arrangement of work periods, rhythmic movements, work postures, etc., were discussed. The importance of atmospheric conditions, such as heat and moisture, particularly in South Africa, in the mines and in factories, was emphasised. Dusty conditions, particularly silicosis, were considered. Dietetics were discussed from the point of view of under-development, correct feeding, and adequate supply of vitamins. It was pointed out that stunted growth and low resistance to pathogenic organisms are accompanied by industrial discontent, and physical inefficiency by inadequate output.

The presidential address to Section E, "The Education of the Native," was delivered by Mr. W. G. Bennie, who has had thirty years' experience of native education in the Cape Province. The historical landmarks in native education were first outlined, and the nature or scope of native education discussed. In primary schools a fairly liberal course with a strong industrial bias was recommended, the native language being the medium of instruction in early life and one of the official languages later. Instruction in physiology and hygiene and some form of handwork is essential. Secondary school work should resemble that for Europeans, suitable options being provided. Agricultural training is of great importance. A sympathetic attitude towards native education was urged, since the raising of the native is necessary for economic development, for the maintenance of our own civilisation, and from motives of justice.

The Chief Archivist of the Union, Mr. Graham Botha, delivered his presidential address to Section F on "The Public Archives—their Value to Scientific Research." After dealing with the widespread interest of the Archives, archive administration and availability, the Archives as a great storehouse of materials for research was dealt with at some length. The historian can find documents for reconstructing the history of the race and for studies in political and social evolution; the political economist can obtain materials relating to wages, land tenure, currency, commerce, development of resources; agricultural progress can be traced; sociologists can study to advantage the organisation and development of society in all its grades in South Africa. Documents on agrarian practices, plant life and forest reports are not only of intrinsic interest but also of economic importance. The Archives thus can provide abundance of material of great diversity for investigators in numerous fields of knowledge.

It is only possible to notice briefly some of the interesting papers read before the various sections.

In Section A, Dr. J. D. Schonken gave a paper on desiccation and how to measure it, defining desiccation, exsiccation, and siccation. He considers that a growing irregularity of rainfall provides a more trustworthy index of desiccation than the measurement of rainfall in inches. Dr. J. S. van der Lingen contributed a paper on the planetesimal hypothesis and dealt with uniform belts of planetesimals and equatorial accelerations. Dr. B. F. J. Schonland gave a paper on the scattering of the cathode rays, considering that the law of force in an encounter between an electron and an atomic nucleus appears to be that of the inverse square.

In Section B, Dr. B. de C. Marchand read a paper on the origin of black turf soils in the Transvaal. These are really clays, derivatives of plagioclase, and not particularly rich in organic matter. Mr. C. W. van der Merwe dealt with the formation of soil from diabase in the central Transvaal, the weathering being mainly due to chemical decomposition. Prof. G. H. Stanley reviewed metallurgical progress in the Transvaal during the decade 1914–1924. Mr. T. Leslie discussed the huge Transvaal formation of dolomite, which is very suitable for fluxes. Dr. J. J. Theron and Mr. J. V. Cutler gave a paper on the function of nicotine in tobacco, which their investigations show to be a storage product and not waste. Mr. Cutler also gave an account of the growth, ash content and constituents, and nicotine content of tobacco grown on experimental fertiliser plots at the Rustenburg Cotton and Tobacco Station. Mr. Steenkamp described the chemical composition of the latex of a Euphorbia. Dr. Theron wrote on the reaction of some Transvaal soils. Messrs. A. J. Pelling and J. B. Robertson further discussed the reciprocal salt-pair formed by sodium chloride and calcium nitrate. Studies on the thiazoles were contributed by Dr. J. L. B. Smith with Messrs. E. H. Flack and A. R. Inggs. Mr. O. G. Backeberg gave a paper on the theory of indicators. Mr. W. Torrance described his studies on metamorphic mudstones, and Dr. F. Nopcsa made a palæontological contribution on the systematic position of Saurosternon and Tangasaurus.

In Section C, Dr. R. Marloth gave a paper on the determination of acidity of soils. He considers Truog's test convenient and sufficiently accurate for the farmer. Prof. C. E. Bremekamp made a contribution on hydrotropism and thigmotropism of roots, and Prof. R. S. Adamson described some new cases of secondary growth in monocotyledons. The seaweeds of the Cape Peninsula and their distribution were discussed by Mrs. M. R. Levyns, the Atlantic and Indian Ocean seaweeds being contrasted. Notes on the aquatic flora of South Africa were presented by Miss E. Stephens. Mr. A. Stead contributed a paper on Saaidam terraces in the Karroo, a method valuable for securing an underground water-supply. Dr. J. S. van der Lingen gave three papers on plant pigments, including those of *Bacillus pyocyaneus*, which he has examined spectroscopically. Dr. W. F. Barker summarised his results on the function of the chloroplasts in carbon dioxide assimilation. Dr. T. Sim gave further notes on mosses from the south-west part of South Africa, and Prof. P. A. van der Bijl continued his descriptions of South African Polyporeæ. Mr. Pont contributed a paper on osmotic pressure in correlation with growth form and habitat. Mr. J. Phillips gave an interesting paper on the biology, ecology, and sylviculture of a valuable indigenous timber tree, *Ocotea bullata*, known as "stinkwood."

The symposium on veld-burning was opened by Dr. R. Marloth, who dealt in general with the problem, illustrating from occurrences in the South-west Cape, where thick evergreen scrub has been replaced by fire-resisting bulbs as a result of veld-burning, the run-off being greatly increased. Capture of water from the south-east cloud by mountain vegetation was urged. Mrs. M. R. Levyns spoke of the effect of veld fires on two contrasted areas in the Cape Peninsula. Mr. Pillans described the destruction of indigenous vegetation in the Cape and condemned veld-burning. Mr. Graham Botha contributed an historical account of the practice, originally derived from the Hottentots.

In Section D, Mr. A. D. Stammers dealt with the effect of altitude on health and longevity; from physiological experiments and statistical data he concludes that if certain minor precautions are observed, detrimental effects will not accrue from long residence at altitudes of 4000 to 6000 feet. Dr. Annie Porter gave an account of five kinds of insect larvæ observed by her in man in South Africa. Prof. R. W. M. Mettam described an ox liver possessing accessory lobes and so being more equine than bovine in character, and also described the greatly enlarged condition of the petrous temporal bone of a calf. Prof. H. B. Fantham gave an account of his further researches on parasitic Protozoa, and described *inter alia* a new Entamœba from a duck, a new Herpetomonas from the larva of Eristalis, and several new Trichodinas. Prof. Fantham also summarised the observations on various protozoal and helminthic parasites from South African Amphibia that have been investigated by Miss C. Weinbrenn and himself, and presented a further report, in collaboration with Miss N. F. Paterson, of their researches on the protozoal fauna of certain South African soils. The distribution of the soil Protozoa differs in the coastal belt, the Karroo belt, and the High Veld. It also varies in soils from False and Table Bays, which are adjacent. More work on seasonal variation in soil Protozoa and a preliminary account of the effect on them of veld-burning were also recorded. Mr. H. H. Curson presented a paper on the causal agents of nagana, showing that *Trypanosoma brucei*, *T. vivax*, and *T. congolense* are all associated with this condition in Zululand. Mr. H. H. Curson and Mr. J. M. Hugo discussed the preservation of game in South Africa, giving details of the various game reserves and measures for game preservation. Dr. C. S. Grobbelaar gave an account of his interpretation of the blood vascular system of *Xenopus lævis*. Dr. M. M. Prates sent a note on the fusiform bacillus-spirochæte association found among natives in Portuguese East Africa. Mr. J. Hewitt discussed the irreversibility of evolution, giving examples, particularly among spiders, tending to show that reversible evolution is possible by loss of mutations. Prof. J. E. Duerden and Miss M. Ritchie traced the development of the merino wool fibres from their first appearance to the birth of the lamb. Prof. Duerden and Miss G. Brock described the structure of the lining of the gizzard of the ostrich. A joint meeting was held with Sections E and F for a paper by Prof. H. B. Fantham on heredity in man, its importance both biologically and educationally. In this an account was given of various heritable traits, physical, mental, and moral, shown in man, both normal and abnormal characteristics being considered. The interaction of eugenics and euthenics was noted. Sociological applications were made, and suggestions put forward for educational betterment.

In Section E, Miss D. Earthy described various body markings employed more particularly by the VaChopi and VaLenge of Portuguese East Africa. Mr. A. J. H. Goodwin dealt with AmaPondo sibs. Col. W. E. Hardy exhibited stone implements col-

lected in the Cape and demonstrated methods of preparing them. Mr. G. D. Laing gave an account of Strandlooper skulls from Zitzikama, showing transition from a short face with light zygomatics to a long face with prominent zygomatics. Prof. R. A. Dart gave a paper on the Rooiberg cranium, which is probably not that of an ancient miner, but of a man who used the old mine as a dwelling. Prof. A. Radcliffe Brown gave details of the position of the mother's brother among the Bantu, a proper understanding of which is very necessary in dealing with native peoples. Prof. W. A. Norton and Mr. H. Velaphe presented sixty-eight Sesuto riddles with translations of the same. The science of tonetics and its application to Bantu languages was discussed by Dr. D. M. Beach.

In Section F, Advocate G. T. Morice discussed psycho-analysis and criminals, criticising various methods and certain new books. He considers Freudian psycho-analysis of little use, as it concentrates on the sexual and ignores other instincts. Prof. S. F. Gie gave an account of the economic development of South Africa from 1652 to 1795. Prof. R. D. Nauta gave a reasoned résumé of the moral value of Molière's works. The conception of intelligence was dealt with by Prof. R. W. Wilcocks. Much interest attached to a paper by Mr. C. S. Richards on the monetary history of South Africa since union, in which the currency problem and inflation of currency were dealt with, and a return to the gold standard advocated. Of much historic interest also was Miss M. L. Hodgson's paper on the Hottentot question in South Africa down to 1828. Prof. E. H. Brookes discussed the changes in native economic life in South Africa due to European influence and changes in Europeans due to native influences. He advocates economic differentiation and native development in agriculture and native industries, with no detachment of their natural leaders from the bulk of the Bantu. Mrs. Mabel Palmer gave an account of a South African Whitley Council as shown in the organisation of the printing industry. Rev. R. Balmforth pleaded for a more fully representative international authority than the present League of Nations.

As a result of Dr. Fantham's paper, the Eugenics and Genetics Committee of the Association has renewed its activities.

The next anual meeting of the Association will be held at Oudtshorn, under the presidency of General J. C. Smuts, in July 1925.

H. B. FANTHAM.

Sex Determination.

MANKIND has always been intrigued by the problem of what are the factors that determine sex, but it is only comparatively recently that a real light has been thrown upon this subject. The influence of the sex glands upon certain characteristics of the body has, it is true, been known for many centuries, as witnessed by the effects of castration, but the mechanism by which these changes are produced was obscure. With the discovery by Oliver and Schäfer in 1894 of the effects of suprarenal extracts upon blood pressure, a mechanism by which one part of the body may influence another (other than that involved in the intervention of the nervous system) was suggested, and experiments have shown that the action which the sex glands exert upon the body generally must be due to a substance or substances—"hormones" in fact, or chemical messengers—circulating in the blood stream. Thus removal of the testes or ovaries from their normal position to another part of the body produces no alteration of bodily appearance, although all nervous connexions must necessarily have been severed. Complete extirpation of both glands, however, leads to disappearance of those characters which are correlated with sex and are known as the secondary sex characteristics.

It is interesting to note that these characters vary considerably according to the species: thus the antlers in certain species of deer are present in the male sex only; the combs and spurs of cocks are peculiar to the male; in male frogs in the breeding season a clasping pad is developed on the thumbs. The external differences, however, between the sexes are especially well marked in birds, where the two sexes usually possess a very different plumage. For this reason, perhaps, those rare cases in which the creature during its lifetime changes its sex have been more frequently described in birds: these "freaks" have always excited much curiosity. In a recent paper in *Science Progress* (October 1924) F. W. Rogers Brambell describes some examples of this transformation. The change is always of a female into a male, and *post mortem* examination discloses the presence of testicular tissue as well as or without ovarian tissue: at times the latter is mostly degenerated. The change is therefore due to the development of a sex gland of the opposite sex; but the transformation is usually incomplete, some of the female characteristics remaining unchanged.

Now after simple removal of the sex glands from an animal the characteristics of the opposite sex do *not* usually develop; the change in appearance is towards a neutral type which, according to the species, may be either nearer to the male as in birds or to the female as in mammals. It is, however, certain that the actual appearance of the opposite sex depends on the development of the appropriate sex gland. Does this imply that every organism in species with separate sexes contains within itself the factors upon which the sexes ultimately depend? Probably this does not occur normally, the sex of the individual being determined at conception, possibly by the particular arrangement of the chromosomes in the ovum and spermatozoon which unite in fertilisation. The sex-determining chromosomes pass into the sex glands and thus influence the development of the somatic cells along the lines of the particular sex involved. In certain rare cases, however, of hermaphroditism or sex reversal the sex chromosomes of *both* sexes must be present, and the result is either a mixture of the two, or one predominates either completely or for a time.

This view is borne out also by the fact mentioned above that simple removal of the sex glands does not produce the characters of the opposite sex: on the other hand, the somatic cells are capable of being influenced by the secretions of *either* gland, and after removal of the normal glands, grafting of the glands of the opposite sex from an animal of the same species leads to the development of the characteristics of the grafted sex. The factors which produce any particular arrangement of the chromosomes in the ovum or spermatozoon and so lead to the appearance of the corresponding sex are not yet completely elucidated: it is, however, suggestive that in pigeons and doves, Riddle found a predominance of males amongst the offspring when the parents were the most vigorous, early in the breeding season. One factor which influences the constitution of the spermatozoon or ovum is therefore the general metabolic condition of the parent. Research along these lines may lead in the future to knowledge which will enable mankind so to arrange the conditions as to produce, with a fair amount of certainty, an offspring of the sex desired.

The Ramsay Memorial Laboratory, University College, London.

THE new Chemical Engineering Laboratory at University College, London, founded as a memorial to the late Sir William Ramsay, was opened on November 12 by H.R.H. Prince Arthur of Connaught, accompanied by Princess Arthur. There was a large gathering, including Lady Ramsay and representatives of university, professional, and industrial circles.

Sir Robert Robertson from the chair emphasised the need, felt especially during the War, for men trained in the development of chemical operations to the industrial scale. He laid stress on the necessity of thorough preliminary training in chemistry, physics, and mathematics, and also on the need for whole-hearted co-operation between the industries themselves and the new department, in providing facilities for students to extend their training to include actual works practice and the investigation of problems on a manufacturing scale. He stated that he noticed recently in America that it is possible for the universities to maintain a small colony of post-graduate students at the factories, working on fundamental plant problems, and that this arrangement seems to work to the utmost advantage of both students and manufacturers. He urged chemical manufacturers in Great Britain to consider the possibility of similar co-operation.

Prince Arthur of Connaught, in declaring the Laboratory open, sketched the history of the Ramsay Memorial Scheme, which has now been carried to completion. The new Laboratories—which are temporary—have been reconstructed and equipped under the guidance of Prof. E. C. Williams. In addition to the funds handed over by the Ramsay Memorial Trustees, the Laboratory has received generous support from many of the great British chemical firms, which, by subscriptions for a period of five years, have ensured a minimum income of 1400*l*. Further support is still needed to enable the Laboratory to rise to its full powers of usefulness to industry.

Mr. W. J. U. Woolcock, president of the Society of Chemical Industry, said that although there has, in the past, been some doubt as to the value of the chemical engineer, he looked forward to this pioneer laboratory, as a result of the course of studies which has been framed, sending out men who will play a great part in British chemical industry. He noticed with great satisfaction that Prof. Williams had laid stress on the planning of the large scale operations with special regard to the underlying chemical and physical phenomena involved, as well as on the actual design and operation of the plant. He foresaw the Laboratory becoming a centre to which chemical manufacturers would send their fundamental problems for solution, and although Great Britain is an old and conservative country, in which tradition dies hard, he appealed to manufacturers to bear in mind the possibility of still further co-operation along the lines indicated by Sir Robert Robertson.

Prof. E. C. Williams, in describing the scope and facilities of the Laboratory, said that the chemical industries require men of the same high scientific imagination and experimental skill as have done such great work in the pure sciences, but they must be trained to apply these gifts to the problems and plant operations of chemical industry. In the Ramsay Laboratory, men would be encouraged to develop processes from the test-tube scale to the industrial scale, and themselves to work out the whole of the data necessary for efficient operation on a commercial scale. Chemical engineering is essentially a quantitative science. Provision is made in the Laboratory for carrying forward investigations to the semi-industrial scale; a special laboratory has been built for this purpose, in which students can erect any plant they desire to their own designs and to meet their own special requirements.

A vote of thanks to His Royal Highness was moved by Sir John Rose Bradford and seconded by Mr. Roscoe Brunner.

After the ceremony, the Laboratory was thrown open for inspection. In addition to chemical and physical laboratories, there are provided a drawing office, mechanics shop, which is available for the use of students, and an industrial laboratory. The guiding principle in the design of the Laboratory has been flexibility. This is particularly apparent in the industrial or semi-large scale laboratory, where structures, services (including steam, gas, water, power, electricity, vacuum, and compressed air), and equipment are designed to give the greatest facility in the erection and operation of any desired experimental plant. The Laboratory is already well equipped with plant planned for quantitative investigation rather than for the illustration of industrial practice, it being felt that the latter can only be satisfactorily obtained at an actual factory.

Innermost Asia: its Geography as a Factor in History.

SIR AUREL STEIN delivered the first "Asia Lecture" before the Royal Geographical Society on November 3. He chose for his subject an account of his three expeditions to the Tarim Basin in Chinese Turkestan, which he undertook in the years 1900–1, 1906–8, and 1913–15. Sir Aurel has long held a foremost position as an archæologist and explorer. We well remember, many years ago, his interesting investigations into the identity of the site of Mount Aornus, described by the Greek historians, somewhere to the north of Attock, which Alexander the Great besieged on his way to India. Since then he has gone much farther afield, and his chief work has been in Central Asia.

The scene of these explorations lies in the great drainageless basins situated between the Tien-Shan, or "Celestial Mountains," on the north, and the Kun-lun ranges to the south which separate them from Tibet. To the west it abuts on the great mountain masses of the Pamirs, and on the east is bounded by the Nan-Shan forming the watershed towards the Pacific Ocean. This vast area is some 1500 miles long from east to west, and up to 600 miles wide from north to south. But "ground capable of settled life is strictly limited to strings of oases and only a few of them in the extreme east and west offer enough arable soil to support a population of some size. The rest of the area is occupied by huge stretches of desert . . . almost everywhere devoid of water."

This desert differs from the deserts of Arabia and South Africa, where whole tribes move about, sure to find grazing for their flocks, at least at certain seasons of the year. Such is not the case in the deserts of the Tarim Basin, where "the absence of moisture bans not only human existence, but practically also all animal and plant life," and what life there is, round the scattered oases, is entirely de-

pendent on irrigation derived from the water of glacier-fed rivers, which, if not artificially caught, rapidly disappears in the sand. This absence of atmospheric moisture is due to the immense distance which separates this region from the sea, and the high mountains which intervene on all sides.

The importance of the Tarim Basin lies in the fact that it was in the direct line of communication which once formed the great trade route between China and the West. Two thousand years ago it seems to have been the only means of interchange of commerce between the Far East and the West. Not only does the shortest route lie along it, but also the way to the north was barred by the presence of the fierce and warlike Huns and the Tien Shan Range, while to the south the snow-clad mountains of Tibet and the Himalayas formed an impenetrable barrier. Formidable as the passage of such a desert must have been, it appears to have presented less difficulties to the Chinese than were likely to be encountered on any alternative route. These circumstances accounted for the control China found it necessary to assume over this far-extended line, which eventually reached to the Pamirs. This was at first of a political nature, but ended in complete military occupation lasting for a thousand years. Sir Aurel Stein has been able to trace over a long distance the remains of the old *Limes*, or defensive wall, erected at the end of the second century B.C., no doubt the ancient representative of our modern line of block-houses.

The reasons for the abandonment of such a route as this, and the evacuation of the former inhabitants, give rise to interesting speculation. Was it due to an alteration of climate bringing about excessive desiccation, or to some other cause? From the high state of preservation of records, and other materials, discovered by Sir Aurel, it would appear that the climate has not altered and is much the same now as it was 2000 years ago, for such friable objects as were found could only stand the test of time in an extremely arid climate. If, then, the occupation of this area was independent of climate, it must have been dependent on irrigation, which in its turn was dependent on water derived from glacier-fed rivers.

The lecturer discovered several abandoned sites of human habitation which had been maintained by irrigation, but are now far distant from the terminal point of the river which formerly supplied them with water. This seems to show, as originally suggested by Sir Sidney Burrard, that the evacuation of this area was due to the diminution of water in the rivers and not to an alteration of climate, of which there is no evidence. The glaciers, probably the remains of a former ice-age, are known to be shrinking, with the consequent decrease of the water supply, which probably accounted for the abandonment of this important commercial highway. But while this seems to afford an explanation, it is not safe to rely entirely on it, as there is always the human element to be taken into account, and that is not so easy to gauge. The way in which the Chinese have held this region, throughout the long years of varied history, is a remarkable testimony to their tenacity of purpose. On more than one occasion it has been lost, generally on account of internal dissensions, only to be regained in more settled times, and is held down to the present day.

It is to be hoped that at some future time Sir Aurel Stein will give us some details of the contents of the documents he has found, and of other objects of interest. We may add that he was accompanied on his expeditions by surveyors of the Indian Survey, and that a series of maps on a scale of 1/500,000, and 1 inch to 4 miles, have been produced by that department as the result of his surveys. H. L. C.

Tropical Medicine in the Southern United States.

THE recent Conference on Tropical Problems at Kingston, Jamaica, has served to direct attention to the enormous interest which is taken at the present time in tropical medicine and allied sciences in the United States. This movement may be said to have started some thirty years ago when the States had to take control of the Philippine and Cuba Islands after the Spanish War; it became greater when it was decided to open the Panama Canal. The building of the canal was rendered possible by the genius of Gorgas, who applied in a practical way the discoveries of Ross and Manson. The scourges of yellow fever and malaria which had caused the complete failure of the French effort were successfully combated, and the canal was built.

A very important feature of the moment is that private concerns and corporations with estates and financial interests in the tropical zone are taking great interest in tropical medical problems. Some of these concerns have complete medical services of their own. The United States Fruit Company, for example, has a tropical medical service admirably organised, with branches in several Central American countries, Guatemala, Costa Rica, Honduras, etc. At the head of each branch or division there is a principal medical officer with an adequate medical and nursing staff in each division. The Company has built one of several up-to-date hospitals with splendid laboratories, X-ray departments, etc. Some of these hospitals are magnificent, and would adorn any big European or American city.

Several United States universities, as, for example, Harvard, established departments of tropical medicine some years ago. Funds have been collected now to found a large and up-to-date tropical school at New Orleans, and to institute a professorship of tropical medicine at the University of that city.

New Orleans certainly seems to be from every point of view the ideal place for such a school; it is in one of the most southern parts of the States (Louisiana), and tropical diseases are far from scarce there; yellow fever used to be a scourge in Louisiana and other southern United States, and malaria is still common. It has intimate trade relations with Cuba, Mexico, and Central and Southern America. It has the most famous university (Tulane) in the south, and modern progressive scientific institutes.

The authorities of Tulane University have offered the university professorship and the directorship of the new school to Dr. Aldo Castellani, lecturer at the London School of Tropical Medicine and Director of Tropical Medicine at the Ross Institute. Dr. Castellani is known by his discoveries in connexion with sleeping sickness, yaws, and several other tropical diseases. It may also be remembered that it was Dr. Castellani who, some years before the War, devised and prepared the combined typhoid + paratyphoid, and the typhoid + paratyphoid + cholera vaccines which, after much discussion, were generally adopted by all the allied armies, instead of the simple typhoid vaccination. He has written jointly with Dr. Albert J. Chalmers a standard text-book on tropical medicine, which has run already into three editions.

The Cinematograph in Anthropology.

AT the Royal Anthropological Institute, on November 18, Capt. M. W. Hilton-Simpson showed a cinematograph film of native life in the Algerian Hills. Last winter, when they commenced their sixth season of ethnological research among the Shawiya tribes of the Aures Hills in S.E. Algeria, Capt. and Mrs. M. W. Hilton-Simpson were accompanied by Mr. J. A. Haessler, who is beginning to compile a "library" of cinema films destined to illustrate the ethnography of primitive peoples. He secured a series of pictures among the Shawiya, from which Capt. Hilton-Simpson and he have prepared a film which shows how arts, crafts, and customs, when once they have penetrated to the remote valleys of the Libyan hills, have persisted there unchanged until this day.

The film begins by illustrating the inaccessibility of the inner valleys of the Aures Massif. It shows cave dwellings, palæolithic in their simplicity, still inhabited by the Shawiya (Berber) tribes; and it traces the growth of the cave dwelling to the stone-built Shawiya hut. Views of hamlets of the Aures demonstrate how the villages can have altered scarcely at all since the time of Jugurtha as described by Sallust. The film also shows the occupations of the modern male population; their primitive basketry; the fashioning of wooden door-locks (probably of Roman origin); the chipping out of quern stones; and their methods of husbandry. This last included a complete series of pictures illustrating the use of a "water clock" in connexion with irrigation.

Owing to Mrs. Hilton-Simpson's long acquaintance with the Shawiya women, a full series of photos of the activities of these Mohammedan women has been obtained. The two most complete series of pictures are those representing their weaving and the making of pottery. The former, which appears to date back to early Egyptian times, is shown in all its processes from the shearing of the beast to the finished fabric. The pottery-making, which is done by hand, without the aid of a wheel, appears to be more ancient in its origin even than the weaving.

The final reel of film deals briefly with folk-lore, and illustrates some customs which, it seems certain, constitute a survival of the cult of the great goddess of fertility and the crops, who was worshipped in Libya in early times. The conclusion to be drawn from the film is that, contrary to the belief of the natives themselves and of many European visitors to Algeria, the Shawiya owe but little to the influence of the Roman occupation of the country round; but still keep alive arts, crafts, and customs with which they were probably acquainted long before the fall of Phœnician power in Africa.

University and Educational Intelligence.

CAMBRIDGE.—The Adam Smith Prize has been awarded to G. T. Griffith, Trinity College, for an essay entitled "A discussion of the causes contributing to the increase of the population in England and Wales during the Industrial Revolution, with some inferences drawn from Ireland."

LEEDS.—On grounds of intellectual distinction and of long and meritorious service to the University, the Council has decided to confer the title of emeritus professor upon Dr. J. B. Cohen, who recently retired from the chair of organic chemistry.

Mr. J. W. Baker, senior chemistry master at Barnard Castle Secondary School, has been appointed to a new demonstratorship in organic chemistry.

LONDON.—Dr. F. L. Hopwood has been appointed, as from October 1, 1924, to the University chair of physics tenable at St. Bartholomew's Hospital Medical College. Dr. Hopwood has had considerable experience as a lecturer in physics. During the War he was for three years a research physicist to the Admiralty, and received an award of 1000*l.* for his inventions used by the Service. He is the author of a number of papers in the *Phil. Mag.* (1915–16) and Proc. Phys. Soc. (1921–23).

The title of professor of botany in the University has been conferred on Dr. F. E. Fritsch in respect of the post held by him at East London College. Since 1907 Prof. Fritsch has been head of the Department of Botany at East London College; he has published a number of papers on freshwater Algæ. The title of reader in human embryology in the University has been conferred on Dr. R. J. Gladstone, lecturer and senior demonstrator in anatomy at King's College. The title of emeritus professor of mathematics in the University has been conferred on Dr. M. J. M. Hill, who held the chair of pure mathematics at University College from 1884 to 1923.

Miss Mary Brodrick, a former student of University College, has made a donation for the foundation of an annual prize in geography at that College.

Two University Travelling Scholarships (open to internal and external graduates in all faculties), each of the value of 275*l.* per annum, and three University Post-graduate Studentships (open to internal and external graduates in the faculties of theology, arts, laws, music, and engineering), of the value of 150*l.* per annum, are to be instituted.

The following doctorates have been conferred: D.Sc. (*Zoology*): Mr. H. G. Cannon (Imperial College—Royal College of Science), for a thesis entitled "On the Development of an Estherid Crustacean"; D.Sc. (*Chemistry*): Mr. L. E. Hinkel (King's College), for a thesis on "Reactions in the Hydroaromatic Series resulting in the Formation of Aromatic Compounds."

Dr. G. V. Anrep has been awarded the William Julius Mickle Fellowship for 1925, of the value of 200*l.*, in respect of the work which he has carried out during the past five years in experimental physiology.

Fifteen entrance scholarships and exhibitions are available for award to students entering University College in October 1925. Three of them are tenable in any of the five College faculties: arts, laws, science, engineering, medical sciences, or in the School of Architecture. One is tenable in each of the faculties of science, engineering, three in the faculty of medical sciences, two in the School of Architecture, and one in the School of Librarianship.

A course of five public lectures on "Modern Bacteriological Technique" is to be begun at the Royal College of Surgeons of England on December 11, at 4 o'clock, by Mr. F. W. Twort, Superintendent of the Brown Institution. The succeeding lectures will be given on December 12, 15, 16, and 17. No tickets will be required.

OXFORD.—The Edward Chapman Research Prize, value 20*l.*, will be offered for competition at the commencement of summer term, 1925, to members of Magdalen College who shall have been in residence for a period of two years, for a published piece of original research in natural science. Competing papers or memoirs must reach Mr. R. T. Gunther, Magdalen College, by, at latest, May 1.

THE Scholarship of the Institution of Petroleum Technologists, granted to a student member of the Institution who is completing the petroleum

technology course at the University of Birmingham, has been awarded to Mr. Geoffrey Cotton.

IT is recorded by the *Times* correspondent at Brussels that the foundation-stone of the new buildings of the University of Brussels was laid on November 20 by Prince Leopold. The erection of the new premises has been made possible by financial assistance, amounting to nearly 20,000,000 francs (about 208,300*l.*), given by the Commission for Relief in Belgium and the Educational Foundation, as a result of the good offices of Mr. Hoover. The ceremony coincided with the fiftieth anniversary of the Polytechnic School, and was attended by a number of delegates from British and American universities and technical institutions.

THE Board of Education has issued the following list of successful candidates (in order of merit in each group) to whom awards have been made in the competition for Royal Scholarships and Free Studentships (Science), 1924. GROUP A. ENGINEERING. Number of competitors, 102. *Royal Scholarships*, W. G. Crocker, A. A. Butler, A. W. Morley, J. Donegan, E. W. Packenham, R. A. Yeo, G. W. Mills, W. J. Offord; *Free Studentships*, R. S. Bone, A. S. Crouch. GROUP B. PHYSICS. Number of competitors, 42. *Royal Scholarships*, F. Gill, E. T. D. Offer, D. T. Jones, W. H. Aldous, A. H. Nagle; *Free Studentships*, L. F. Stanley, W. D. Wright, W. Singleton. GROUP C. CHEMISTRY. Number of competitors, 29. *Royal Scholarships*, J. Cantor, A. O. Ball, J. D. Johnson, F. Witt, M. Kamenetsky, P. L. Jones; *Free Studentships*, E. Tanner, J. Anderson, T. Mitchell. GROUP D. BIOLOGY. One candidate. No award. GROUP E. GEOLOGY. Number of competitors, 4. *Royal Scholarship*, F. E. Eames.

THE Rensselaer Polytechnic Institute of Troy, in the state of New York, celebrated last month the hundredth anniversary of its foundation, and Prof. Ray Palmer Baker has contributed to *The Scientific Monthly* an account of some of its services to the cause of science. The first head of this "the oldest institution devoted to science in any English-speaking country" was Amos Eaton, an original genius whose eminence as a naturalist—he has been called the "father of American geology"—was surpassed by his even greater renown as an educator. "He ranged over many subjects—botany, zoology, physics, chemistry, geology, and mineralogy; and in every field he fired the imagination of students who outreached him in knowledge and attainment." He was the first to introduce field work and laboratory practice into the American college, and was the founder of the first popular museum of natural history. His were the first attempts to adapt the results of research to the needs of agriculture. Among other distinguished Rensselaer men were: Ebenezer Emmons, from whose monographs originated the bulletins of the Department of Agriculture; Asa Fitch, the first official entomologist in America, known as the "father of economic entomology"; De Volson Wood, who inaugurated the system of independent colleges for the pure and applied sciences; Henry Augustus Rowland, first professor of physics in Johns Hopkins University, than whom there is no more significant figure in the history of physics in the United States; James Curtis Booth, the most distinguished chemist of his day, who organised at Philadelphia a laboratory on the lines of a miniature factory, the first of its kind; and James Hall, "the founder of American stratigraphy and invertebrate palæontology."

Early Science at the Royal Society.

November 30, 1663. This being the anniversary election-day of a new Council for the year ensuing, the Society met in a solemn manner. The Society proceeded, according to their charter, to the election of the Council and Officers for the year ensuing, observing the orders prescribed for that purpose in their statutes, there being present fifty-seven or fifty-eight fellows.

December 2, 1663. Mr. Boyle moved, that Mr. Povey, Mr. Hoskyns, and others, who could, might bring in their collections of observations concerning springs.

1669. Mr. Hooke produced a picture printed after the expeditious manner of Dr. Wren, who having covered a very thin brass-plate with etching varnish, caused it to be etched upon by a hand careful not to close any letter, in which work the aqua fortis must be so strong, as to corrode the plate quite through: which done, the plate is to be turned and laid upon another thick plate covered all over with printer's ink, to be passed, after the usual manner, through the rolling press.

December 3, 1662. Dr. Power's paper of subterraneous experiments, and observations made of the damps of coal-mines, was read, and registered.

1674. It was resolved, that every member of the present council shall provide an experimental discourse for the Society to be made at some one public meeting within the year, either by himself or some other member of the Society; or to pay forty shillings.

December 4, 1666. Sir Robert Moray proposed, that the council would take into consideration, how the experiments at the public meeting of the society might be best carried on; whether by a continued series of experiments, taking in collateral ones, as they were offered, or by going on in that promiscuous way, which had hitherto obtained.—The earl of Northampton and the lord bishop of Exeter were desired to speak to the duke of Buckingham, that he would accommodate the society with some rooms in York-house for their meetings.

1672. Mr. Oldenburg produced and read a letter from Mr. Lister concerning veins and other curious observables in plants, and particularly of the liableness of all vegetable juices to be frozen, except the milky one. It was ordered to be entered in the Letter-book.

1673. There was present at this meeting the abbé D'Angeau, brother to the marquis of that name, who had attended her royal highness the duchess of York from Paris to London.

December 5, 1667. Mr. Oldenburg produced a great packet of letters and other papers sent to him by Mr. Hevelius. To which were added several relations of other particulars communicated by some learned men at Dantzick, of their own accord, concerning trials made of injecting liquors into human veins, an odd birth of twins, and a suggestion of new materials for telescopical glasses, etc. Of these only that on the trials of injection was read at this meeting. [Oldenburg records that upon hearing the account, a certain physician then present, to Oldenburg's "great grief," was so precipitate as to denounce it. I could not (he says) but take him afterwards aside, and represent to him how he would resent it, if he should communicate upon his own knowledge an unusual experiment to the curious at Dantzick, and they in public brand it with the mark of falsehood: that such expressions in so public a place and in so mixed an assembly would certainly prove very destructive to all philosophical commerce, if the curious abroad should be once informed, how their symbolas were received at the Royal Society.]

Societies and Academies.

LONDON.

Royal Society, November 20.—J. **Barcroft**, M. L. **Anson**, A. E. **Mirsky**, and S. **Oinuma**: The correlation between the spectra of various hæmoglobins and their relative affinities for oxygen and carbon monoxide. Hartridge's reversion spectroscope was used, and it was found that if A be the position of maximum intensity of the α-oxy-hæmoglobin spectral band and B that of CO-hæmoglobin in mammalian blood, and K the equilibrium constant of the equation $CO + HbO_2 \rightleftarrows COHb + O_2$,

$$\text{Log } K = 0{\cdot}05\ (A—B),$$

A and B being in angstrom units. The relation is also true of the recrystallised hæmoglobins. Log K is a measure of the change in free energy involved in the reaction. The value of (A—B), called in the paper "the span," varies from 43 to 56 angstrom units in the mammals observed. The variation in individuals in the same species is very marked, and seems to be due to specificity of the globin portion of the molecule. Brown and Hill's observations on effect of temperature on blood have been treated along similar lines.—H. R. **Hewer**: On certain abnormalities occurring in the pituitary of the frog. Three types of abnormalities are described in the pituitary of the frog: (*a*) Proliferation of cells in the *pars nervosa*; (*b*) formation of non-ciliated cysts in the hypophysial region; (*c*) formation of ciliated cysts in the same region as in (*b*). Probably the non-ciliated and ciliated cysts are similar if not identical in origin. The cilia are therefore incidental, and possibly derived from the epithelium enveloping the anterior lobe.—A. **Howard**: The effect of grass on trees.—J. W. **Pickering** and F. E. **Taylor**: Blood coagulation, anti-coagulants, and hæmolysis. Most substances which inhibit the clotting of blood also inhibit hæmolysis. The anti-coagulants employed were potassium oxalate, sodium citrate, "peptone," leech extract, neutralised thymus, and yeast nucleic acids, novarsenobillon, cobra venom, egg-white, and sugars. A general correspondence between anti-coagulants and substances antilytic to platelets does not exist. The phenomena in protection against hæmolysis and clotting are parallel up to the stage of thrombin formation in the latter process, and experimental evidence shows that the inception of the clotting of blood, like hæmolysis, is essentially the lysis of a colloidal complex, and that both these phenomena are inhibited in a similar manner by certain protective substances. These results support the view that the inauguration of the clotting of blood arises from the disassociation of a protective colloid with the clotting complex of the plasma.—R. J. **Ludford**: The distribution of the cytoplasmic organs in transplantable tumour cells: with special reference to dictyokinesis.—E. **Ponder**: On the balloon-like structure of the mammalian erythrocyte. In the case of the human erythrocyte, the experimentally obtained figures agree in a striking manner with the figures deduced by considering the cell as a balloon-like body with a membrane for which Poisson's ratio is about the same as for most known substances. From this result it may be deduced that Rollett's view of the structure of the erythrocyte is at variance with the facts, and therefore untenable.—V. B. **Wigglesworth**: Uric acid in the Pieridæ: a quantitative study. The wings of the male contain 0·5 mg. and of the female 0·3 mg. of uric acid. This sexual difference is due to the greater size of the wing scales. The pupa of *Pieris brassicæ* contains about 2 mg. of uric acid. This total amount is not changed during development. In the resting pupa most, if not all, of the uric acid is contained in the fat body. Shortly before emergence, some is deposited in the wings and more is transferred to the gut. There is no evidence for a new formation of uric acid during pupal life. The Pieridæ appear to differ from other families in the use to which uric acid is put, and not in the amount of this substance produced.—G. Lindsay **Johnson**: Contributions to the comparative anatomy of the reptilian and the amphibian eye, chiefly based on ophthalmological examination.

Linnean Society, November 6.—E. B. **Poulton**: Mimicry among Fijian butterflies. Of the four species of Euplœa, three had, in the western islands, gained pronounced white marginal patterns in mimicry of the fourth (*helcita*), this last being probably kept constant by fresh invasions from the islands farther west. The ancestral forms of the three species, with reduced patterns, still persisted in east Fiji, and occasional intermediates were found in Taveuni, near to the eastern group, and in the isolated Kandavu. *Helcita*, the model of the other three species in the west, became itself a mimic with reduced pattern in the east, although some reciprocal approach appeared to have taken place in the others, especially the females. *Hypolimnas bolina*, an abundant Nymphaline butterfly with a constant male, had produced, among a wonderful series of female forms, one which was a mimic of the dark eastern Euplœas, and another mimicking the more strongly patterned species of the west. In some islands, especially Viti Levu, many all-female families had been bred; males occur in the island, although far more rarely than females. There was no reason for supposing that these female families were produced parthenogenetically.—Mrs. W. H. **Pearsall** and W. H. **Pearsall**: Phytoplankton of the English lakes. These lakes fall into three groups according to their plankton types: (1) those with green Algæ dominant; (2) those with Dinobryon dominant; (3) those with diatoms and Myxophyceæ dominant. This classification agrees very exactly with their classification according to physical characters, water analyses, and rooted vegetation.—B. M. **Griffiths**: Studies in the phytoplankton of the Lowland Waters of Great Britain: the phytoplankton of Shropshire, Cheshire, and Staffordshire. The natural waters of Shropshire and Cheshire frequently show "water-bloom," due to a prodigious development of blue-green algæ. The algal flora of the district is poor in desmids. One new desmid, a remarkable twisted form, was found in Marbury Mere, and named *Closterium tortum*. In general, these Lowland waters resemble those of the European plain, and differ from the lakes of the British mountain areas.

Aristotelian Society, November 10.—Judge **Dowdall**: What is a society? A society is an interrelation of human action which is complementary, or a number of men regarded as standing to one another in that relation. It is based upon a community, community being defined as an abiding system of mental dispositions such that each member of the society is disposed to perform his appropriate part of the interrelated action as occasion requires. The occasion and the action which it requires are determined partly by institution, an institution being defined as a mental structure determining persons to certain types of conduct in certain types of contingency.

Royal Meteorological Society, November 19.—Sir Gilbert **Walker**: Note on Bjerknes's contribution of 1921 to the mechanics of the general circulation. The object of the note is to elucidate several important

theorems due to Bjerknes; these deal with the slope of surfaces of discontinuity between portions of the atmosphere under various conditions; and so throw light on the general circulation.—W. H. **Dines**: The correlation between pressure and temperature in the upper air, with a suggested explanation. It has been considered that this correlation is due to the fixed relationship between the pressure at the surface, the pressure at any height, and the temperature of the intervening air column. This relationship partly accounts for the high correlation in the troposphere, but fails entirely to account for that in the stratosphere; similarly with regard to the equation for adiabatic change of temperature with change of pressure. If air is forced outwards from the cyclone towards the anticyclone in the upper half of the troposphere, the observed changes of temperature indicated by the correlation coefficient will be produced. This explanation is also valid for the fall of the tropopause in cyclonic regions.

CAMBRIDGE.

Philosophical Society, October 27.—J. T. **Saunders**: The hydrogen ion concentration of the waters of Lake Lucerne. Observations of the P_H of Lake Lucerne during July and August 1923 showed that considerable variation occurred at different depths. The P_H of the surface (0 metres) increased from 8·4 at the beginning of July to 8·7 at the beginning of September, and a similar relative increase was found in all layers down to the bottom. The P_H of the water below 30 metres is about 0·45 less than that of the surface, and from this depth to the bottom (100-200 metres) it is the same, except that just over the bottom a slight decrease (0·02-0·05) was observed. The maximum during calm conditions is found in the layer at 5-6 metres, and this is due to the photosynthetic activity of the phytoplankton.—J. **Gray**: The process of cell division in the eggs of echinoderms. The form of the cleaving egg is due to the growth of the asters and the force exerted by the surface layer of the cell.—V. **Nath**: Oogenesis of Lithobius. The formation of vitelline yolk in the oocytes is preceded by nucleolar extrusions, and the two processes are associated with each other. The fatty yolk is formed from the Golgi rods. Mitachondria are also present.—H. Singh **Pruthi**: Studies on insect metamorphosis—1. Prothetely in mealworms (*Tenebrio molitor*) and other insects. Effects of different temperatures.—H. Munro **Fox**: Chlorocruorin.—C. G. F. **James**: Characteristics of complexes of conics in space of four dimensions.—T. M. **Cherry**: On integrals developable about a singular point of a Hamiltonian system of differential equations.—R. A. R. **Tricker**: A helical method of focussing β-rays.—D. R. **Hartree**: Some methods of estimating the successive ionisation potentials of any element.—Sir Joseph **Larmor**: Why wireless electric waves can bend round the earth (*v.* NATURE, November 1, p. 650).

MANCHESTER.

Literary and Philosophical Society, November 18.—G. **Andrew**: Note on the occurrence of Pachytheca in the Buildwas Beds. A single specimen of Pachytheca extracted from the Buildwas Beds is, so far as is known, the first specimen from this horizon. The specimen is a black carbonised sphere, diameter about 3 mm., and the surface originally was unbroken, but with a few irregular cracks. Subsequently the outer layer became fractured, displaying the characteristic structure of the organism: a central region, or medulla, surrounded by a cortex about 0·3 mm. thick. The cortex is composed of radiating tubes of about 8 μ diameter. Since the algal filaments are not shown, and since the specimen is single, it is referred to as Pachytheca sp. The Buildwas specimen, associated as it is with a shelly fauna which has not yet been studied in detail from the zonal point of view, cannot be dated accurately. The associated fossils indicate a wholly and definitely marine sediment.—C. L. **Barnes**: The Ben Nevis Observatory. The proposal to erect an observatory on Ben Nevis was first made in 1877 by Mr. Milne Holme, president of the Scottish Meteorological Society, and plans were drawn up, but no progress was made until 1881. In June of that year the late Mr. Clement Wragge began a series of daily ascents, which were continued by himself or an assistant until October. An observatory was opened in 1883, and put in charge of two salaried observers, whose duties were to read all the instruments, with certain exceptions, every hour of the day and night, and to make notes of phenomena such as fogs, haloes, rainbows, coronas, etc. A companion observatory was established at Fort William in 1890, as it was thought that simultaneous observations at the two stations would yield valuable results. In 1896 a smaller station was added, half-way up the mountain. The cost of maintaining the three was about 1000*l.* a year, towards which the Meteorological Office contributed 350*l.*, the remainder being subscribed by various societies and by private individuals. Eventually it was decided that the results were not commensurate with the cost, and on October 1, 1904, the observatory was closed down after twenty-one years of continuous work. The records and the log are accessible in the Transactions of the Royal Society of Edinburgh, vols. 36 and 42-44.

PARIS.

Academy of Sciences, November 3.—M. Guillaume Bigourdan in the chair.—L. **Lecornu**: The deformation of a spherical envelope.—E. L. **Bouvier**: The nidification and the metamorphoses of some saturnian hemileucids.—S. **Winogradsky**: The study of anaerobiosis in arable soil. An account of results of experiments with natural soil to which one per cent. of mannite or glucose was added. As test organisms, Azobacter was chosen as typically aerobic and Amylobacter as anaerobic. The moisture content was allowed to vary, loss of moisture giving increased access of air, and the proportions of the test organisms at various levels determined.—Maurice **Lugeon** and Nicolas **Oulianoff**: The geology of the neighbourhood of Camarasa (Catalonia).—Arnaud **Denjoy**: Series of rational fractions.—A. **Jygmund**: A generalisation of the method of Cesàro.—R. de **Montessus de Ballore**: The evaluation of $\log \underline{n}$.—Alexandre **Kovanko**: Series of functions with one complex variable.—E. **Merlin**: A geometrical property of curved surfaces.—Bertrand **Gambier**: The polygons of Poncelet generalised.—D. **Riabouchinsky**: Some general properties of plane movements of a liquid.—F. **Baldet** and E. M. **Antoniadi**: Observations of cloud-capped protuberances which recently appeared on Mars. The positions and movements of these protuberances, observed between October 10 and 13, are shown in seven drawings.—A. **Brun**: The discovery of a new variable star, with a period probably very short. This star, +80°·5030 in the Greenwich catalogue, varies in magnitude between 12·6 and 13·3 in a period of less than two hours.—T. **Peczalski** and A. **Launert**: The velocity of cementation of copper as a function of the temperature.—Mlles. Marya **Kahanowicz** and Ada **Estrafalaces**: The selective absorption of coloured glasses and the radiometric method for the determination of their reflective

power.—J. **Cojan**: Modification of the method of zones (Ritchey) for the determination of the aberration of optical systems. Its extension to aberrations outside the axis. A series of photographs at different determined positions is taken, and the densities measured by the microphotometer. The accuracy (0·01 mm.) is greater than that obtainable by eye observations.—F. **Guéry**: The magnetic field of the electron in movement. The conclusion is drawn that the magnetic field of the electron is only a mathematical expression without physical reality.—H. **Pied**: The precipitation of tantalum and niobium by cupferron and their separation from iron. After removal of iron as the sulphide in a solution containing oxalic and tartaric acids, tantalum and niobium can be completely separated by cupferron. Titanium, if present, is also precipitated.—Mme. P. **Ramart** and Mlle. **Amagat**: Molecular transpositions. The preparation and dehydration of some α-α-diarylethanols and alkyldiarylethanols.—Léon **Piaux**: The action of catalysts on the oxidation of uric acid: copper and cuprous urate. Both copper powder and cuprous urate serve as active catalysts in the oxidation of uric acid in alkaline solution by oxygen. Potassium oxonate and allantoin are produced.—E. **Kohn-Abrest**: The examination of blood for gaseous poisons. An apparatus is described and illustrated capable of detecting and estimating alcohol, sulphuretted hydrogen, hydrocyanic acid, carbon dioxide and carbon monoxide in 50 c.c. of blood.—Marcel **Solignac**: The eruptive rocks of the archipelago of Galite.—E. **Henrijean** and W. **Kopaczewski**: Colloids and mineral waters. A study of a ferruginous mineral water has proved the presence of a colloid in this water. From its chemical composition, this colloid can be only an electropositive hydrosol of iron.—— **d'Arsonval** and — **Bordas**: Remarks on the preceding note.—E. **Rothé** and Mme. A. **Hée**: The earthquakes observed in France during the year 1923. Fifteen earthquakes were felt in France during the year, the most important being in the Pyrenees region.—Ch. **Brioux**: The influence of urea, used as manure, on the reaction of the soil. Experiments with soil showed that urea, utilised as manure, behaves at first as an alkali on account of its rapid conversion into ammonium carbonate. As the latter is nitrified, it acts as an acid like other ammoniacal manures.—Jules **Amar**: Course of the vital coagulation.—Gabriel **Bidou**: An artificial hand or apparatus for replacing a hand after amputation.—E. **Lagrange**: A reaction of the testicular hormone.—L. M. **Betances**: New details on cytohaematogenesis.—Alphonse **Labbé**: An experimental phylogenetic race. An account of variations in some copepods produced by varying the P_H of sea water.—E. **Gley** and J. **Cheymol**: The presence of iodine in venous blood from the thyroid. It was found that the thyroid gland of the goat yielded sufficient venous blood to permit of the determination of the iodine. The blood in the general circulation also contained iodine. Whilst the proportion of iodine in the blood issuing from each lobe of the gland generally increases with the proportion of iodine in the gland itself, the two are not proportional, and there are probably other controlling factors.—H. **Lagatu** and L. **Maume**: The study, by the periodical analysis of the leaves, of the influence of manures containing lime, magnesia, and potash on the vine.—Louis **Lapicque**: The formula of electrical stimulation as a function of the time.—G. **Sanarelli**: The so-called "intestinal" anthrax. The enteric secretions of the dog, rabbit, and guinea-pig, although without action on the development of several species of organisms (Proteus, Staphylococcus, *B. mesentericus*), completely prevent the development of anthrax spores. These results throw some doubt on the views commonly held on "intestinal anthrax."—C. **Levaditi**, S. **Nicolau**, Mlles. J. **Salgue** and R. **Schoen**: The mechanism of the action of bismuth in syphilis. The destruction of the treponema *in situ* is the effect of quantities of bismuth too small to detect by chemical methods.

Official Publications Received.

United States Department of Agriculture. Department Bulletin No. 1238: The Canker-worms. By B. A. Porter and C. H. Alden. Pp. 38+3 plates. 10 cents. Department Bulletin No. 1243: Studies of the Mexican Bean Beetle in the Southeast. By Neale F. Howard and L. L. English. Pp. 51+12 plates. 20 cents. (Washington: Government Printing Office.)

University of Illinois Engineering Experiment Station. Bulletin No. 143: Tests on the Hydraulics and Pneumatics of House Plumbing. By Prof. Harold E. Babbitt. Pp. 80. (Urbana, Ill.) 40 cents.

The National Institute of Agricultural Botany. Fifth Report and Accounts, 1923–1924. Pp. 19. (Cambridge.)

Meddelelser fra Kommissionen for Havundersøgelser. Serie Fiskeri, Bind 7, Nr. 5: On the Summer- and Autumn-Spawning Herrings of the North Sea. By Dr. A. C. Johansen. Pp. 119. 8 kr. Serie Fiskeri, Bind 7, Nr. 6: Fish Eggs and Larvæ collected in the Belt Sea in March 1922. By P. L. Kramp. Pp. 19. n.p. (København: C. A. Reitzel.)

County Borough of Huddersfield. The Tolson Memorial Museum Publications. Handbook 3: Early Man in the District of Huddersfield. By James A. Petch. With an Appendix on the Nature and Making of Graving Tools, by Francis Buckley. Pp. 95. (Huddersfield.) 1s.

Commonwealth of Australia. Institute of Science and Industry. Bulletin No. 27: Australian Clays in the Manufacture of White Pottery Wares. By R. C. Callister. Pp. 87. (Melbourne: H. J. Green.) Gratis.

Meddelanden från Statens Meteorologisch-Hydrografiska Anstalt. Band 1, No. 5: Översikt över Sveriges vattenkraft. Av Sven Norlindh. Pp. viii+40+3 maps. (Stockholm.) 8.50 kr.

State of Connecticut. Public Document No. 34: Biennial Reports of the Storrs Agricultural Experiment Station, Storrs, Connecticut; including the 32nd Annual Report for the Nine Months ending June 20, 1920, 33rd Annual Report for the Year ending June 30, 1921, 34th Annual Report for the Year ending June 30, 1922, 35th Annual Report for the Year ending June 30, 1923. Pp. xiii+323. (Storrs, Conn.)

Smithsonian Institution: United States National Museum. Contributions from the United States National Herbarium. Vol. 20, Part 13: Revision of the American Species of Rinorea; New Plants from Venezuela; Hemibaccharis, a new Genus of Baccharidinæ. By S. F. Blake. Pp. x+491-554+plates 31-51. (Washington: Government Printing Office.) 20 cents.

Field Museum of Natural History. Zoological Series, Vol. 10, No. 16: Contents and Index to Volume 10, Numbers 1 to 15. (Publication 214.) Pp. ix+375-385. Zoological Series, Vol. 15: The Marine Fishes of Panama. Part 1. By Seth E. Meek and Samuel F. Hildebrand. (Publication 215.) Pp. xi+330+24 plates. Anthropological Series, Vol. 16: Japanese Sword-Mounts in the Collections of the Field Museum. By Helen C. Gunsaulus. (Publication 216.) Pp. 195+61 plates. Report Series, Vol. 6, No. 3: Annual Report of the Director to the Board of Trustees for the Year 1923. (Publication 217.) Pp. 167-264+plates 30-46. Zoological Series, Vol. 12, No. 4: New Birds from Central Peru. By John T. Zimmer. (Publication 218.) Pp. 49-67. Zoological Series, Vol. 12, No. 5; New Birds from Chile. By C. E. Hellmayr. (Publication 219.) Pp. 69-75. Zoological Series, Vol. 12, No. 6: Notes on Central American Crocodiles. By Karl P. Schmidt. (Publication 220.) Pp. 77-92+plates 5-9. Zoological Series, Vol. 12, No. 7: New Salamanders of the Genus Oedipus, with a Synoptical Key. By E. R. Dunn. (Publication 221.) Pp. 93-100. (Chicago.)

Department of the Interior: United States Geological Survey. Bulletin 758: Bibliography of North American Geology for 1921–1922. By John M. Nickles. Pp. ii+273. 25 cents. Water-Supply Paper 516: Surface Water Supply of Hawaii, July 1, 1919, to June 30, 1920. Pp. v+159. 20 cents. Water-Supply Paper 518: Ground Water in Musselshell and Golden Valley Counties, Montana. By A. J. Ellis and O. E. Meinzer. Pp. vi+92+5 plates. 20 cents. Water-Supply Paper 520-C: Power Resources of Snake River Basin between Huntington, Oregon, and Lewiston, Idaho. By William Glenn Hoyt. Pp. ii+27-51. n.p. Water-Supply Paper 535: Surface Water Supply of Hawaii, July 1, 1920, to June 30, 1921. Pp. iv+151. 15 cents. Professional Paper 127: The Composition of the Earth's Crust. By Frank Wigglesworth Clarke and Henry Stephens Washington. Pp. v+117. 20 cents. (Washington: Government Printing Office.)

Department of the Interior: United States Geological Survey. Mineral Resources of the United States in 1923 (Preliminary Summary). Introduction by Frank J. Katz; Statistics assembled by Martha B. Clark. Pp. iv+130A. (Washington: Government Printing Office.) n.p.

Diary of Societies.

SATURDAY, NOVEMBER 29.

ROYAL IRISH ACADEMY, at 4.15.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Graduate Section, jointly with the Mining Institute) (at Bolbec Hall, Newcastle-on-Tyne), at 7.

HULL ASSOCIATION OF ENGINEERS (at Hull Municipal Technical College), at 7.15.—W. J. Bowtell: Lifting Machinery for Docks.

SOCIETY OF DYERS AND COLOURISTS (West Riding Section).—Dr. F. M. Rowe and V. Tarbett: The Dyeing Properties of some Azo Derivatives of Tetra Hydro Naphthalene.

MONDAY, DECEMBER 1.

ROYAL SOCIETY, at 4.—Anniversary Meeting.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.—General Monthly Meeting.

SOCIETY OF ENGINEERS (at Geological Society), at 5.30.—H. A. Rickwood: Recent Developments in Ferro-Concrete Cooling Towers.

INSTITUTION OF ELECTRICAL ENGINEERS (jointly with the South Wales Institute of Engineers) (at Cardiff), at 6.—W. E. Bush: Demonstration on Modern Illumination.

JUNIOR INSTITUTION OF ENGINEERS (North-Western Section) (at 16 St. Mary's Parsonage, Manchester), at 7.15.—B. Spencer: Modern Locomotive Lubrication Practice.

ARISTOTELIAN SOCIETY (at University of London Club, 21 Gower Street, W.C.), at 8.—Prof. J. A. Smith: Prof. Alexander's Space-Time.

ROYAL SOCIETY OF ARTS, at 8.—Dr. L. C. Martin: Modern Colour Problems (II.) (Cantor Lectures).

SOCIETY OF CHEMICAL INDUSTRY (London Section, jointly with Oil and Colour Chemists' Association) (at Chemical Society), at 8.—Discussion on Protective Paint Coatings.

ROYAL GEOGRAPHICAL SOCIETY (at Central Hall, Westminster), at 8.30.—A selection from M. Albert Kahn's collection of Photographs in Natural Colours, described by A. G. Ogilvie: Physical Geography and Landscapes.—E. A. Benians: Moslem Architecture.—L. H. Dudley Buxton: Man in Relation to his Environment.—Prof. P. M. Roxby: China.

INSTITUTION OF THE RUBBER INDUSTRY (London Section) (at Engineers' Club, Coventry Street, W.).—Major B. J. Eaton: Research Work on the Plantation.

TUESDAY, DECEMBER 2.

ROYAL HORTICULTURAL SOCIETY, at 4.—Lecture.

INSTITUTION OF PETROLEUM TECHNOLOGISTS (at Royal Society of Arts), at 5.30.—A. W. Nash and H. G. Shatwell: Fuel Oil Resources of the Future.—H. G. Shatwell, A. W. Nash, and J. I. Graham: The Somerset Oil Shales.

INSTITUTION OF CIVIL ENGINEERS, at 6.—R. H. L. Pennell and H. Addison: Water-Supplies to the Smaller Provincial Towns of Egypt.

INSTITUTE OF MARINE ENGINEERS, at 6.30.—R. B. Stewart: Fire and Fire Protection.

INSTITUTION OF ELECTRICAL ENGINEERS (North-Western Centre) (at 17 Albert Square, Manchester), at 7.

INSTITUTE OF METALS (Birmingham Section) (at Chamber of Commerce, Birmingham), at 7.—W. E. Ballard: Metal Spraying.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Kinematograph Group), at 7.—M. Ruot, K. C. D. Hickman, and others: Colour Stencilling and Tinting.—Messrs. Pathé: Demonstration of their Process of Colour Kinematography, in which the Film is Coloured by a Mechanical Process.

INSTITUTION OF AUTOMOBILE ENGINEERS (Coventry Centre) (at Coventry), at 7.15.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND (at 39 Elmbank Crescent, Glasgow), at 7.30.—W. D. McLaren: The Further Development of Large Power Diesel Engines.

INSTITUTE OF METALS (North-East Coast Section) (at Armstrong College, Newcastle-on-Tyne), at 7.30.—G. B. Brook: Aluminium, its Production and Uses.

RÖNTGEN SOCIETY (at British Institute of Radiology, 32 Welbeck Street, W.), at 8.15.—Prof. J. A. Crowther: Some Experiments with Induction Coils.—Prof. J. A. Crowther and R. J. Stephenson: Effect of Capacity on the Induction Coil.

WEDNESDAY, DECEMBER 3.

GEOLOGICAL SOCIETY OF LONDON, at 5.

INSTITUTION OF ELECTRICAL ENGINEERS (Wireless Section), at 6.—G. Shearing: Wireless Telegraph Valve Transmitters employing Rectified Alternating Current.

INSTITUTION OF ELECTRICAL ENGINEERS (South Midland Centre) (at Birmingham University), at 7.—G. Rogers: Automatic and Semi-Automatic Mercury-Vapour Rectifier Substations.

INSTITUTION OF HEATING AND VENTILATING ENGINEERS (at Engineers' Club, Coventry Street, W.), at 7.—H. W. S. Martin: Air Washers and Air Filters.

SOCIETY OF CHEMICAL INDUSTRY (Nottingham Section) (at University College, Nottingham), at 7.30.—Prof. W. E. S. Turner: Glass.

ROYAL MICROSCOPICAL SOCIETY (Biological Section), at 7.30.

INSTITUTION OF SANITARY ENGINEERS (at Caxton Hall), at 7.30.—H. A. Roechling: House Drainage, with special reference to the Intercepting Trap.

SOCIETY OF PUBLIC ANALYSTS AND OTHER ANALYTICAL CHEMISTS (at Chemical Society), at 8.—G. Van B. Gilmour: The Analytical Value of the Melting Point of the Insoluble Volatile Acids from Fats.—A. H. Ware: The Use of Mitchell's Ferrous Tartrate Reagent in Qualitative Analysis.—Dr. S. Glasstone: The Influence of Hydrogen Ion Concentration on the Colorimetric Estimation of Pyrogallol and Catechol Derivatives.—B. S. Evans: The Futility of Sealing: A Suggestion for its Safeguarding.

ROYAL SOCIETY OF ARTS, at 8.—Prof. C. A. Carus-Wilson: The Teaching of Science in Secondary Schools.

ENTOMOLOGICAL SOCIETY OF LONDON, at 8.

THURSDAY, DECEMBER 4.

ROYAL SOCIETY, at 4.30.—Prof. A. Fowler: The Structure of the Spectrum of Ionised Nitrogen.—Dr. H. Jeffreys: The Formation of Water Waves by Wind.—J. E. Jones: (1) The Determination of Molecular Fields. III. From Crystal Measurements and Kinetic Theory Data. (2) On the Atomic Fields of Helium and Neon.—F. S. Tritton: A Centrifugal Method of making Small Pots of Electrically Fused Refractory Materials.—*To be read in title only*:—Prof. J. W. Nicholson: Spheroidal Wave Functions.—J. V. Howard and S. L. Smith: Recent Developments in Tensile Testing.—F. C. Harris: The Photo-Elastic Constants of Glass as affected by High Temperatures and by Lapse of Time.—Prof. A. L. Narayan and D. Gunnaiya: Absorption and Dispersion of Thallium Vapour.—R. d'E. Atkinson: Note on Vegard's Theory of the Aurora.—Mollie Weinberg: The Spark Spectra of Indium and Gallium in the Extreme Ultraviolet Region.—S. W. Richardson: The General Law of Electrical Conduction in Dielectrics.—T. Lewis: The Interpretation of the Results of Bucherer's Experiments on e/m.—A. M. Mosharrafa: The Quantum Dynamics of Degenerate Systems.—E. G. Dymond: The Precise Measurement of the Critical Potentials of Gases.—I. Langmuir and K. H. Kingdon: Thermionic Effects caused by Vapours of Alkali Metals.

LINNEAN SOCIETY OF LONDON, at 5.—Dr. G. C. Druce: Exhibition of *Epipogum aphyllum*, and other British Plants.—Miss V. Hay: The Adult and Juvenile Forms of *Sophora tetrap'era* vars. *microphylla* and *prostrata*.—Miss V. M. Grubb: The Development and Liberation of Spermatia in some previously undescribed cases.—Prof. E. S. Goodrich: The Cranial Roofing-bones in Dipnoi Fishes.

ROYAL AERONAUTICAL SOCIETY (at 7 Albemarle Street, W.), at 5.30.—Col. F. Searle: The Maintenance of Commercial Aircraft.

CHILD-STUDY SOCIETY (at Royal Sanitary Institute), at 6.—Dr. Octavia Lewin: Some Physical Causes of Mental Deficiency.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Prof. J. G. Gray and J. Gray: Gyroscopic Pendulums.

SOCIETY OF CHEMICAL INDUSTRY (Bristol Section) (at Bristol University), at 7.30.—W. E. Fearnsides: Some International Aspects of the Dye Industry.

INSTITUTE OF METALS (Sheffield Section, jointly with the Silver Trades Society) (at Sheffield University), at 7.30.—A. Jefferson and others: Discussion on Electro-Plating.

CHEMICAL SOCIETY, at 8.—H. Burgess and Prof. T. M. Lowry: (*a*) New Halogen Derivatives of Camphor. Part VI. β-Bromocamphor-α-Sulphonic Acid; (*b*) New Halogen Derivatives of Camphor. Part VII. The Constitution of the R-ychler Series of Camphorsulphonic Acids. Experiments on Chlorosulphoxides.

ROYAL SOCIETY OF MEDICINE (Dermatology, Laryngology, and Odontology Sections), at 8.—J. F. O'Malley, Dr. H. W. Barber, and others: Discussion on Focal Sepsis in relation to Diseases of the Skin.

INSTITUTION OF MECHANICAL ENGINEERS (Glasgow Section).—Report of the Marine Oil-Engine Trials Committee.

INSTITUTION OF MECHANICAL ENGINEERS (Manchester Section).—Report of the Marine Oil-Engine Trials Committee.

FRIDAY, DECEMBER 5.

ROYAL SOCIETY OF ARTS (Indian Section), at 4.30.—Lt.-Col. R. McCarrison: Problems of Food, with special reference to India.

ROYAL ASTRONOMICAL SOCIETY (Geophysical Discussion), at 5.—Col. H. G. Lyons and Sir G. P. Lenox-Conyngham: The Use of Submarines in the Determination of Gravity at Sea. Chairman: Prof. G. I. Taylor.

SOCIETY OF CHEMICAL INDUSTRY (Liverpool Section) (at Liverpool University), at 6.—Dr. P. Lewis-Dale: Liquid Hydrocarbons obtained in the Compression of Oil Gas.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Prof. F. C. Lea: The Effect of Low and High Temperatures on Materials.—J. M. Lessells: The Elastic Limit in Tension, its Influence on the Breakdown by Fatigue.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Pictorial Group), at 7.—L. Wood: Matters Pictorial.

SOCIETY OF CHEMICAL INDUSTRY (Manchester Section) (at 16 St. Mary's Parsonage, Manchester), at 7.—A. V. Slater: Peptisation.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—J. B. Pollard: Metal Cutting under Water by the Oxy-acetylene Blow Pipe.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Graduate Section) (at Cleveland Institution, Middlesbrough), at 7.30.—L. W. E. Rowbotham: Constructing a Ship.

PHILOLOGICAL SOCIETY (at University College), at 8.—R. J. Whitwell: Future of N.E.D.

INSTITUTION OF MECHANICAL ENGINEERS (Liverpool Section).—Report of the Marine Oil-Engine Trials Committee.

SATURDAY, DECEMBER 6.

GILBERT WHITE FELLOWSHIP (at 6 Queen Square, W.C.), at 3.—E. W. H. Piper: Durham Cathedral (Lecture).

INSTITUTE OF BRITISH FOUNDRYMEN (at Chamber of Commerce, Birmingham), at 4.—D. Wilkinson: Malleable Iron.

PUBLIC LECTURES.

SATURDAY, NOVEMBER 29.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—S. H. Warren: Prehistoric Man and the "Land of Lyonesse."

TUESDAY, DECEMBER 2.

KING'S COLLEGE, at 5.30.—Miss Hilda D. Oakeley: The Philosophy of the Absolute in English Thought: The Eternal and the Temporal.

WEDNESDAY, DECEMBER 3.

MEDICAL SOCIETY OF LONDON, at 5.15.—Dr. W. M. Feldman: Post-Natal Child Physiology and Hygiene (Chadwick Lecture).

UNIVERSITY COLLEGE, at 5.30.—I. Björkhagen: Sweden: Its Land and People.

THURSDAY, DECEMBER 4.

BEDFORD COLLEGE FOR WOMEN, at 5.15.—Dr. J. F. Spencer: The Historical Development of Conception of the Atom.

KING'S COLLEGE, at 5.30.—M. Beza: Pagan Remnants in Roumanian Folklore. (Succeeding Lecture on December 11.)

FRIDAY, DECEMBER 5.

KING'S COLLEGE, at 5.30.—Dr. E. S. Russell: Scientific Method.

SATURDAY, DECEMBER 6.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—H. N. Milligan: The Eggs of Animals.