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Research in Mental Disorder.

WE welcome the address of the Earl of Birkenhead at the Royal Society of Medicine lately as evidence that it is at last appreciated by others, besides a very few specialists, that far graver and more urgent criticisms may be launched against the present lunacy administration than have yet reached public notice. So long as fault-finding was based solely on allegations of abuse of official power, entailing injustice or ill-treatment of individuals, it was clear to most people who had any understanding of the facts that agitation might be futile or mischievous, but it could do nothing to advance our methods of dealing with the vast problem of mental unfitness, either medically or socially.

Lord Birkenhead displayed a caution and moderation proper to a lay approach to a highly specialist problem when he "doubted whether medical science, medical care and nursing efficiency had made the advance in dealing, from the preventive point of view, with mental cases, that, even in his lifetime, they had made in almost every branch of medical and nursing science." So far as medical science is concerned, a unique combination of disastrous circumstances has conspired to restrain advance. More than 7,000,000<sup>1</sup> is expended annually upon the upkeep of mental hospitals in England and Wales alone, and this sum, large as it is, gives but a partial and uncertain indication of the economic importance of mental disorder, taking no account of the cost to society, from inefficiency, mistakes and crimes, of a multitude of sufferers, uncertified or uncertifiable, the existence of which has only recently been revealed through the establishment of a very few widely scattered out-patient clinics. Nor does it count the cost of congenital mental deficiency in most of its forms and degrees. It is merely one item in an account the true magnitude of which cannot be gauged. From the humane point of view, also, mental disorder deserves at least as much consideration as other disorders. Lunacy as a disease is not painless in any but the narrowest sense.

Lord Birkenhead spoke only a day or two after the publication of specialist opinions which deserve as wide attention as his. They were Dr. Bernard Hart's, that the actual state of affairs with regard to research and the early treatment of mental disorder were in Great Britain "little short of a scandal," and Dr. Mapother's, that "whether strictly between ourselves we may not admit that we have no definite information on the prevention of mental disorder."<sup>2</sup>

The phraseology of these criticisms would be mild if mental disorder were something new which had come

<sup>1</sup> 7,658,823*l.* in 1922. The figure, 6,953,804*l.*, given in the Report of the Board of Control for 1924 is for County and Borough Mental Hospitals only.

<sup>2</sup> *Brit. Med. Jour.*, Oct. 31, 1925.

upon our community suddenly. Its main features have been well known throughout historic times, and it is well over a hundred years since Gall laid the foundations of an extensive science of cerebral structure and function. Physiology has attained dimensions which would appear vast even to Huxley. Medicine, preventive and curative, has its victories. But of psychology and mental disease, nothing: even to say that they had baffled us would be dishonest, for that would imply a vigour of attack which is wholly lacking.

The responsibility for this remarkable situation may lie with the medical men who undertake the study of mental disease and the care of the insane; with the authorities, for the most part public, which employ them; or with the Board of Control which at present supervises the administration of the Lunacy Act. A discerning reading of the Board's recent reports, and particularly that just published,<sup>3</sup> throws some light on this point, surely a vital one for future development. They certainly betray a confusion of mind which cannot fail to be reflected in asylum committees and through them in the administration of mental hospitals. It was not until 1922 that the Board's attention was diverted, probably with relief from pressing domestic matters, to the problem of research. It then found that "it has long been realised that there is an urgent necessity for co-ordinated research into the basal causes of mental disorder."

Trite remarks of this kind are inevitable from a body the natural course of which, if not a "neat rivulet of text in a meadow of margin," is a broader and correspondingly a shallower flood, for, so far as public asylums are concerned, the Board has no executive authority worth mentioning. In private institutions it can, and frequently does, indulge any fancy of the reforming zeal on pain of immediate closure; but elsewhere it can only hope without expectation and desire without hope. In consequence, the Reports of the Board are politely benevolent in tone, with a strong flavour of reminiscence and remoteness. These tendencies are clearly evident in the matter of research. What attracted the sudden interest of the Board was the inception of a scheme at Birmingham for research under the City and University jointly. The means were provided by private generosity. This appeared to be fortunate to the Board, which recalled the fact that in the absence of legislative permission local authorities "are precluded from collaborating with this object."<sup>4</sup> No wonder that "it is our hope, and we shall do all in our power towards its fulfilment, that

similar or corresponding Research Centres will be instituted in connexion with each University." Three years later this hope has expanded slightly and we find (p. 106)—"We wish, too, to repeat our desire (see 9th Report, p. 55, and our last Report, p. 70) to see research centres (Schools of Psychiatry) established—one in connexion with each of the Universities—with each of which all the institutions at which mental cases are received in the neighbouring counties would be grouped and affiliated."

It may be argued that, while a Royal Commission is inquiring into the present administration, the Board of Control does wisely to mark time. But this phrase is not one which properly describes the Board's activities. They are directed towards a definite policy—the grouping of mental hospitals about central laboratories with a more or less ill-defined university association. This plan, at present in operation, is inadequate to the real need. But "it is with no small satisfaction" that the Board observes a tendency to develop along these lines. Then it plunges into an argument which reveals at once the hopeless confusion into which a problem may be thrown by special pleading in conjunction with irresponsibility. "Not less than 60 per cent of the [mental] hospitals possess a laboratory *in more or less active operation*, in 21 of which the work is *to some extent* linked with a teaching centre." (Eight universities and the Maudsley Hospital are named.) The position "though there is room for a good deal of improvement, . . . compares favourably with that which obtains outside mental hospitals, where, we gather from information kindly supplied from 85 general hospitals *exclusive of those which subserve a Medical School*, the proportion at which laboratory work is prosecuted is 46 per cent." Without information concerning the size and character of these hospitals, comparison is impossible. Ninety-six mental hospitals average 1082 patients each. How many points of view are the following passages, found cheek by jowl in the same paragraph (p. 181), designed to meet?—

I. Sound training and skill in ordinary bedside examination are essential, and it would be a great mistake were it to be neglected or undue reliance placed upon laboratory reports. Nevertheless, a growing recognition of the important part played by certain bodily conditions—*e.g.* morbid states of the nose, throat, teeth, intestines, blood and other fluids, endocrine disturbance, the presence of the syphilitic virus, etc. . . . makes it imperative that every mental hospital should possess at least a small clinical laboratory, instead of relying on the present inadequate method of posting a selection of specimens for examination elsewhere. . . . *It is a waste of time for much of this work to be actually performed by a doctor, and the medical staff should not be expected or encouraged to undertake it; the employment of a trained Labora-*

<sup>3</sup> The 11th Annual Report of the Board of Control, 1924. (London: H.M. Stationery Office, 1925.) 12s. 6d. net.

<sup>4</sup> In the case of London with its many hospitals this difficulty has not arisen. So long ago as 1895, Sir Frederick Mott was appointed by the L.C.C. to control a joint pathological laboratory at Claybury.

tory Assistant, who will work under their instructions, is therefore not only desirable but essential.

II. As to the medical staff, while it is an advantage if all can find time for at least some work or attendance in the laboratory, *the routine application of laboratory investigation in aid of bedside methods is likely to be more reliable and systematic if entrusted either to a resident or to a visiting pathologist*, the latter alternative being the manner in which the smaller hospitals probably can best meet these requirements. Even where there is a resident pathologist, however, unless he is allowed to undertake duties at a general hospital . . . it seems to us desirable that a pathologist should be appointed on the staff of Visiting Specialists. When the mental hospital is in the vicinity of a University, it would be an additional advantage were he a member of the University staff.

Surely the Board is aware of the difference between a laboratory assistant and a pathologist of university rank.

It has been the custom of the Board recently to publish an account of asylum laboratory work compiled from statements made to the Board by medical officers. This is headed in the present report "Scientific Research Work in Mental Hospitals in 1924." The returns are seventeen in all. They are not constructed upon any general plan, and to the uninitiated the information they contain is not presented in an easily assimilable form. Throughout, there is no effort to distinguish between the barest necessities of clinical investigation and research; between research into what may be termed "administrative" diseases—physical disorders affecting the administration of asylums, like dysentery—and research into mental disease; between research into treatment and research into "the basal causes of mental disorder." The reports which mean most are generally the shortest and convey least information; those which mean nothing are most painfully detailed—urines tested and throat swabs taken, with actual figures but no percentages of hospital population. All this is collected together, with serious work at Cardiff, in the north of England and at the Maudsley Hospital, to fill forty-one closely printed pages of "scientific research."

On other vital points, the Board is an adroit but scarcely a trustworthy guide.

"In our view, doctors who take up permanent resident posts in mental hospitals can fairly be expected to acquire a specialist's competency in psychological medicine; but it is unfair to them and to their patients to expect them, for instance, to undertake surgical operations or to possess a corresponding competency in other branches, which is nevertheless wanted for a proper elucidation of many cases." At some hospitals "it happens that one or more of the resident medical staff has special competency in some of these branches, and reliance is placed on his services; however great his competency, we think this policy is a mistake, as it

. . . must . . . cause the sacrifice of time which can ill be spared from his recognised duties."

His recognised duties are partly administrative—and without actual experience few can realise how heavy this may be—and partly the care of a number of patients varying from 300 to 600. It is scarcely surprising that research reports are under suspicion.

What interest does it serve to disguise the facts of mental research or to present them in a garbled and unintelligible form? If there is no time for serious research, no facility, no guidance, why should not public authorities be told that they have made no provision for more than the detention and care of their insane patients? London, with 182,068 certified insane, has one qualified pathologist to whom are referred most of the more refined diagnostic questions of many hospitals and the intensive physiological investigation of the Maudsley patients. If all that is contemplated in that extraordinary paragraph quoted above about laboratory tests were referred to him, he would be utterly unable to deal with it. Similarly with the Birmingham laboratory. Last year this laboratory summarised its work as follows:

#### TOTAL SPECIMENS.

Total Bacteriological . . . . .	1306
Total Wass, Sig., Colloidal gold . . . . .	459
Total Serolog. Agglutinations . . . . .	375
Total Chemical Sundry . . . . .	175
Total Basal Metab. Determinations . . . . .	60
Total Iodine in Thyroid Glands . . . . .	60

Most of this is not research work but routine work, undertaken to persuade a parsimonious and pound-foolish public to allow the research worker to approach his subject in his spare moments.

It is by disguises and evasions of this kind that a situation has grown up which richly deserves the strictures of Dr. Bernard Hart and Dr. Mapother. The men upon whom falls the direct responsibility are the worst paid in the medical profession. They are in most cases on duty for ninety-five hours a week in circumstances which rigidly restrain enterprise and enthusiasm; and in addition they must struggle to adjust themselves to the atmosphere created by official short-sightedness. The prevailing affective tone is one of cynicism and discontent. Would it not be a simple expedient for the Government to appoint a single Commissioner to report upon the scientific aspects of mental disorder? It is one which, directly or indirectly, has been richly productive in other scientific questions of great public importance, and it need not conflict with the work of the present Royal Commission. But preferably he should be a man of science independent of the conflicting interests of the asylum world.

### Recent German Work on Heredity and Evolution.

*Die Abstammungslehre: Tatsachen, Theorien, Einwände und Folgerungen im kurzer Darstellung.* Von Prof. Dr. Ludwig Plate. Zweite Auflage des "Leitfadens der Deszendenztheorie." Pp. vii+172. (Jena: Gustav Fischer, 1925.) 6 gold marks.

*Pluripotenzerscheinungen: Synthetische Beiträge zur Vererbungs- und Abstammungslehre.* Von Valentin Haecker. Pp. viii+213. (Jena: Gustav Fischer, 1925.) 9 gold marks.

THESE two books contain some of the most recent German ideas on the subject of heredity and its bearing on theories of evolution.

(1) Prof. Plate's work is an ordinary treatise on evolution, embodying all the well-known arguments from embryology, morphology, and palæontology, and evidently intended more for the benefit of the intelligent outsider than for the special student of biology. It is beautifully illustrated, and on this account possesses a value of its own, whether we do or do not agree with Prof. Plate's conclusions; we may mention two views of an almost perfect Mousterian skull from the Berlin Museum on page 137; views of the male and female Bird of Paradise on page 31; views of the male of *Papilio memnon* of the three types of females belonging to this species on page 32.

When we come to the theoretical part of the treatise, we find that Prof. Plate, like St. Paul, endeavours to be all things to all men. He accepts "mutations" as the causes of evolution, and also reactions to changes of condition—which is essentially Lamarckism. He admits that the attempt to produce changes in animals which shall be inheritable has met with a considerable measure of success: he accepts as valid the results of experiments of exposing the pupæ of Lepidoptera to changes of temperature: these experiments produce changes of coloration not only in the imagines which emerge from the pupæ but also in the following generation. It seems to us, however, that Prof. Plate, like so many modern zoologists, thoroughly misunderstands Lamarck when he opposes natural selection and the inheritance of acquired qualities, and when he rejects what he calls Lamarck's assumption of "psychic roots" for variation in Lamarck's phrase "the inner needs." Whether we accept Lamarckian ideas or not, there is no escape from natural selection. The logic that since the female cod produces nine million eggs a year, and that since on the average only two of her progeny reach maturity, all the rest must prematurely perish, is unanswerable. But the slaughter of the majority of the family does not in itself explain the qualities of those that survive.

In order that any change may be produced at all, there must be constant variation, and to find the causes of this is the real problem of the evolutionist. The great attractiveness of the Lamarckian doctrine is that it proposes an explanation of these variations; and therein it gets nearer to the root of the matter than Darwinism. Lamarck's assumption of "inner needs," by which he means the appetite or urge that spurs an animal to activity, is a piece of the most far-sighted philosophy. Modern research on animal behaviour—such as that of Jennings on the most primitive animal of all, *Amœba*—has shown that it is utterly impossible to explain the activities of even the lowest form as a mechanically connected chain of automatic reflexes. All animal life is a striving to attain ends, and this striving is expressed in the activities of the animal, in a word, in its habits, and changes in habits lead to the use and disuse of organs.

Prof. Plate states that neither the Lamarckist nor the selectionist has been able to produce a crucial experiment in support of his views. We may predict that no Lamarckist will ever be able to adduce a proof which will satisfy his opponents so long as their minds are obsessed by the Weismannian complex. For of any account of experiments, however conclusive, they may say that they will not accept them but will wait until these have been repeated, and as such experiments require periods of from five to fifteen years for their accomplishment, and the objectors make no effort to repeat them, their entrenchments will be impregnable. Only as younger and more plastic minds succeed to those trained in the older philosophy will Lamarckism come to have justice done to it.

Prof. Plate concludes with a chapter on the relation of the doctrine of evolution to religion and education which throws an interesting light on post-War German psychology. He attacks in the most vigorous language "Haeckelismus," which we may translate as the "mechanist" view of life: he asserts that a monistic view of Nature with our present knowledge is impossible, and that matter, force, and spirit are incommensurables, which the theory of evolution does not aid us in connecting with one another. The efforts of Haeckel to alienate the people from the Church is deplored; since only on the central doctrines of the Church can a practical system of ethics be founded.

Prof. Plate then goes on to make an equally violent attack on what he terms the "Jewish" doctrines of democracy, universal peace, and the equality of the races of men. The fact that all life is the history of a struggle is emphasised, and the German youth is warned to beware of being deprived of the powers of self-defence through being misled by these ideas.

(2) The treatise on "Pluripotenz" by Dr. Haecker

is a book of quite a different character. It is an attempt to penetrate further into the causes of variation, by bringing together a large number of obscure phenomena. It is in our opinion a rather confused book, but it is a valuable testimony to the fact that thoughtful German opinion is beginning to be discontented with the fashionable theory of variation embodied in the terms "factors" and "genes." By "Pluripotenz" is meant the fact that the form which an animal or vegetable germ develops does not fully express its latent powers, that in other circumstances it can produce something quite different; so, for example, the skin in the shoulder-region of the tadpole normally produces only skin, but if the embryonic eye-vesicle be cut off from the brain and pushed along under this region, then the skin of the shoulder will develop into a lens. But in later chapters the conception of "Pluripotenz" is enlarged to include the fact that quite similar variations turn up independently in different strains of the same larger group; so, for example, the transformation of the molluscan mantle-chamber into a lung has occurred at least six times. "Petaloidy," or the transformation of stamens and carpels into petals, occurs independently in quite unrelated flowers. A blue colour crops up in the plumage of birds belonging to quite different families. A further application of the idea of "Pluripotenz" is to the effect of the sex-hormones on the growing bodies of many forms of animals, so that, as Zawadovsky has shown, it is possible to convert a hen into a cock with comb, spurs, hackles, tail feathers, and voice complete by first extirpating the ovary and then grafting on a testis. Then "Pluripotenz" is also stretched to cover cases where several so-called "mutations" occur, in some cases associated with one another and in other cases separately. So in human families "polydactyly," or supernumerary fingers, and "syndactyly," or a web of skin between the fingers, and "brachydactyly," or the fusion of two of the phalangeal bones in each finger, associated with a short thick shape, often occur together, but one of these characters may appear and be inherited specially.

Having thus stretched "Pluripotenz" like an overcoat which covers many defects, over a whole range of vaguely defined phenomena, Dr. Haecker endeavours to extract from these phenomena certain general ideas. He points out that if a large group of divergent genera, or even families, are descended from a single ancestor, they will have inherited from this ancestor a particular type of germinal substance, which in consequence will be specially liable to the same type of change in all the descendants of that ancestor. This is, in fact, "orthogenesis" in the sense in which Eimer used the word, though so-called orthogeneticists nowadays employ it in a very different sense. Dr. Haecker gives

a beautiful analysis of the causes of the blue colour in birds' feathers. The formation of yellow and brown pigment in the cortical cells is inhibited and the superficial cells of the medulla become hollow boxes the walls of which are pierced by pores. These pores exist in this situation in all feathers, but in these blue feathers they are enlarged. The deeper cells of the medulla develop dense black pigment, so that no light is reflected from them, and the light reflected or rather scattered from the "cloudy medium" constituted by the horn + air of the superficial cells of the medulla is blue.

When dealing with the various associated mutations in man and other mammals, Dr. Haecker puts forward the valuable idea of a definite "habitus" which manifests itself in more or fewer symptoms according to its intensity. We may translate "habitus" by "diathesis," and Dr. Haecker directs attention to the fact that all these symptoms are indications of "Entwicklungs-hemmung," which we may translate as "germ-weakness." Thus, polydactyly is often associated with hare-lip and mental defect. Even brachydactyly, which superficially regarded appears to be an insignificant aberration, is fatal when inherited from both sides of the house, for brachydactylous people when they marry with each other are childless.

Lastly, Dr. Haecker attacks the crude conception of the linear arrangement of the genes in the chromosome, and the idea of crossing over. He points out that Chambers has shown by micro-dissection of living cells that the chromosome in life is an elastic gelatinous rod, and the absurdity of supposing that such a rod would break in the complicated manner which Morgan assumes is obvious. He discounts all deductions from stained figures of chromosomes in which a pair appear to be spirally twisted around one another, stating that exactly the same figures can be seen in the vegetative division of nuclei in Radiolaria. Finally, he makes the significant remark that only in *Drosophila* has a correspondence between chromosomes and linkage-groups of genes been observed: the significance of this would have been still more evident had he been aware that in the pea, nine linkage groups have been demonstrated, and there only exist seven chromosomes.

It appears to us that in recent times nothing more disastrous to the real progress of biology has occurred than the spread of the idea of "genes" and crossing over; for it has induced many biologists to be content with pseudo-explanations, which consist in inventing new imaginary entities to fit all irregularities which turn up, and it has diverted research from seeking the real physiological bases of these mutations. Each particular group of animals, of course, requires special investigation, but Jansen in Holland, Tornier in Germany, and Sir Robert Jones in Great Britain have

shown that a whole host of mutations (many of which are "linked") which occur in man can be regarded as results of one cause, namely, amniotic pressure. Their linkage is not due to the ranging of genes in a chromosome, but they are manifold results of the same weakness. The embryo of the higher vertebrates is early covered by the amniotic fold: this at first clings closely to the embryo, but as growth proceeds it is forced away from it by the secretion of the amniotic fluid, and into this fluid the various members grow out. The secretion of this fluid is correlated with rocking movements of the embryo, as Foster and Balfour showed forty years ago. If then, owing to germ weakness, these movements are weakened, too little fluid is secreted and the amnion for a longer or shorter period clings too tightly and presses on growing members and inhibits their growth. "Polydactyly" and "brachydactyly" are both due to the pressure of the amnion on the growing rudiments of the fingers. In the first case the rudiment is split into two, and in the second case it is shortened. When the amniotic pressure sets in early it may interfere with the growth of the brain and produce mental defect, and in extreme cases it may inhibit the growth of the brain altogether and so prove to be what Morgan calls a "lethal factor." The childlessness of brachydactylous couples seems to be due to the lethal effect of a double dose of germ weakness.

We do not for a moment suggest that all manifestations of "Pluripotenz" are associations of symptoms due to a given grade of germ-weakness. The fact is that Dr. Haecker has grouped together things of totally different nature. The development of a lens, for example, from the skin of the shoulder in a tadpole means that all the nuclei of the embryo are potentially alike as their chromosome content shows, and in all the complete hereditary powers of the organism are latent; and it depends on the stimulus applied which of these powers are manifested. So in fowls, the male and female sex hormones are capable of producing on indifferent material (the ordinary cells of the body) quite different results.

Similar organs turning up independently as specific characters in quite different stocks of the same class are the reactions of similar constitutions to similar changes in the environment; so the independent production of a lung in different groups of the Gastropoda may be explained. Sometimes the similarity may be due to the atavistic reproduction of a long-lost organ which may be compared to the revival of an almost forgotten memory. Of this a marvellous example was recently given to the Zoological Society by Mr. Tate Regan, and with this we shall close. It is as certain as anything of the kind can be that the original dermal skeleton of fish consisted of scales like those now found in our

sharks and rays. Remnants of this "shagreen" exist in all the higher vertebrates in the form of teeth; for the scale of the elasmobranch fish is merely a dermal tooth. As time went on the bases of these dermal teeth became bound together by calcifications of the dermis beneath them; and thus bony scales came into existence which soon rendered the teeth superfluous, although in the bony gar-pike of N. America (*Lepidosteus*) microscopic representatives of these teeth can be found scattered around the periphery of the scales. When the first Teleostei appeared, which may be termed Jurassic herring, even these remnants had disappeared and the scales alone were left. Later, probably in Eocene times, the first invasion of the rivers by Teleostei took place, and thus were evolved the oldest teleostean fresh-water fish, the Characini of Africa and South America. These Characini are covered with smooth well-developed scales. In turn these gave rise to the cat-fish, most of which have naked skins, but some of their South American representatives have bony scutes, in the intervals between which typical dermal teeth are found exactly like those of an elasmobranch. No more wonderful recovery of long-lost organs is to be found in the animal kingdom.

E. W. MACBRIDE.

### The Theory of Limits.

*Elements of the Mathematical Theory of Limits.* By Dr. J. G. Leathem. Pp. viii + 288. (London: G. Bell and Sons, Ltd., 1925.) 14s. net.

PARTLY due to the fact that their knowledge of the subject is acquired piecemeal, most mathematical students show confusion of thought on questions relating to the theory of limits. On it rests the theory of the calculus, the subject above all others where accuracy of thought is needed in the training of a present-day mathematical specialist. For many years Dr. Leathem was known in Cambridge as one of the most genial exponents of the theory of limits: he introduced the arrow symbol for tendency to a limit in 1905. The MS. of the book before us was substantially complete before his death in March 1923. Profs. H. F. Baker and E. T. Whittaker have seen to its publication.

The volume develops the theory of limits in elementary mathematical analysis with lucidity and accuracy. Infinitesimals and infinities, and their orders, are adequately discussed, also elementary asymptotic expansions and the meaning of continuous functions and differentiation. The last section deals with infinite series and products, including the simpler tests for their convergence.

Dr. Leathem only assumes elementary mathematical knowledge on the part of his readers, but, as an intro-

duction to elementary calculus, the book is much too long and elaborate. Some readers (with analytical minds) will revel in the wealth of meaning assigned to the conceptions of infinity and continuity: others will think that all the salient features could have been presented more briefly. It is disappointing to find that so large a volume contains no reference to uniform convergence or to Riemann integration, which are now considered to be essential to the training of a young mathematical analyst. Only three pages are given to the integral calculus, but seven to the less-studied convergence of continued fractions.

The author's proof of the existence of a limit of a sequence of real numbers (when convergent) is made to depend on the one-one representation of real numbers by points on a straight line. Here he protects himself by a footnote saying that the existence of the limit is really postulated by the existence of the arithmetical continuum. It is practically impossible to say what is actually proved in the existence-theorems of Chap. xxii. The defence of Dr. Leathem's book is that it is for beginners, who must have the subject presented much as it would be in the seventeenth century.

Many able teachers of mathematics agree with the late Prof. F. Klein in advocating the use of intuitive methods before strictly logical ones, but it should never be suggested that the latter are unnecessary. From the strictly arithmetical point of view, a logical discussion of irrational numbers, such as Dedekind's or Cantor's, must necessarily precede any criterion for the convergence of a sequence of real numbers. Dr. Leathem's attitude on the matter is contained in his closing words.

"While we have dealt with the conceptions of limits and irrational numbers from the geometrical point of view, regarding it as incomparably the more useful way of presenting the subject to beginners, there is nevertheless the alternative arithmetical aspect, to be studied perhaps at a later stage. As regards these alternatives, the most ardent partisan of either can scarcely claim that a choice between them is a choice between right and wrong; one may doubt if it is a choice between better and worse. As there are mathematicians who find the keenest intellectual pleasure in geometry, so there are others who would approach all subjects, geometry included, by arithmetical methods. The difference is one of temperament and taste, such as cannot be finally disposed of by argument."

This, however, is not the only possible view on the question at stake. Another quite defensible attitude is to say that a choice between the arithmetical and geometrical arguments is not a matter of disposition at all. Every one uses geometry as far as it will go, but geometry is bound to break down due to passing beyond the threshold (*Schwelle*) of intuition; and then the geometry itself must be buttressed by Dedekind's axiom.

W. E. H. B.

## The Destructive Distillation of Wood.

*The Technology of Wood Distillation: with Special Reference to the Methods of obtaining the Intermediate and Finished Products from the Primary Distillate.*

By M. Klar. Translated by Dr. Alexander Rule. With an additional Chapter by the Translator. Pp. xv + 496. (London: Chapman and Hall, Ltd., 1925.) 25s. net.

THE destructive distillation of wood is one of the earliest industries known to man. The need of charcoal for fuel and for the smelting of iron was the primary aim of the undertaking. Up to the beginning of the nineteenth century, the carbonisation of wood was carried on mainly with the object of furnishing sources of heat and light. At a somewhat later period the industry was in a precarious condition, for coke and tar from coal distillation successfully competed with the related products from wood.

With the rise of the organic chemical industry in the nineteenth century and the great demand for such products as acetic acid, methyl alcohol and acetone, the wood distillation process survived, but only, as M. Klar remarks, as a result of never-ceasing progress made by chemical research. With the gradually increasing difficulty in obtaining wood supplies, and with competition on every side, the struggle for its existence as an industry was a keen one. It was only by the fullest application of scientific methods, especially in the direction of improving the process of carbonisation and in the manner of working up the volatile products, that success was obtained. The striking features of a wood-distillation plant at the beginning of the twentieth century have been briefly described by M. Klar to include among other operations and processes the following: The use of large carbonising plant with mechanical charging and discharging apparatus; the use of producer gas for heating and the utilisation of waste heat for initial drying of the wood; preheating of the non-condensable gas on the regenerative principle before combustion; scrubbing the gas produced and using it for generating power; economic recovery of calcium acetate and its drying by a continuous process; preparation of pyroligneous acid free from tar, and the rectification of crude wood naphtha and production of pure methyl alcohol in one operation. M. Klar has dealt with all these subjects, and has done his work so well that the original has long been regarded as the German standard in this subject. There is no doubt that this translation will secure a similar position in English-speaking countries.

During the War period, according to M. Klar, the method of operation as carried out in Germany did not undergo such changes as to render a revision of

the book essential, and the third German edition (1920) is a simple reprint of the second (1909) edition with cost data and values of products at the 1909 period left unchanged. Dr. Rule has in the main translated without alteration, but some additional matter and new references have been added. The extra material deals especially with investigations which aim at increasing the yields of acetic acid and methyl alcohol. In many ways the translation has produced a book which excels the original, and Dr. Rule has made every effort to bring the material at his disposal up-to-date. He has certainly achieved his object in filling a gap in the literature of the subject available to English readers. Except for the excellent book by Bunbury, this branch of technology has not received close attention from English writers.

While the state of the industry was insecure twenty-five years ago, the present position is considerably more serious, especially in Europe. Much more valuable uses are now being found for surplus wood than mere destructive distillation. The securing of wood for the production of cellulose for paper and artificial silk, to mention but two requirements, makes an enormous demand on the gradually decreasing forest supplies. But the troubles of the wood carboniser do not end here. Recent progress in applied chemistry has shown that with the aid of electrical power, synthetic acetic acid can be produced in enormous quantities at a comparatively cheap rate. Again, the economic production of methyl alcohol from water gas is now claimed as a commercial proposition in Germany. The wasteful destruction of wood to give small yields of methyl alcohol or acetic acid may therefore before long be unnecessary. Modern practice inclines rather towards the utilisation of the cellulose molecule in the form in which Nature has carefully built it up rather than the wasteful breaking down of this complex to simpler substances. On the other hand, the chemist aims at the direct syntheses of substances such as acetic acid, methyl alcohol, acetone and formaldehyde, and in recent years much success has followed from such efforts. The main hope of the wood distiller in the future possibly lies in the direction of gas production from wood waste unsuitable for other purposes.

Apart from the actual distillation process, there is a considerable amount of very valuable information in this book which will be of great value to the technologist and analytical chemist. Such subjects as charcoal and its composition, wood naphtha, acetate of lime, acetone, acetic acid, formaldehyde, etc., receive detailed treatment. In addition, there is a first-rate analytical section comprising nearly one-fifth of the book, which will be of general use to the chemist in the works laboratory.

J. REILLY.

### Our Bookshelf.

*Memoirs of the Geological Survey of Great Britain. Palæontology. Vol. 2, Part V.: Fossil Plants of the Carboniferous Rocks of Great Britain.* By Dr. Robert Kidston. Pp. 377-522 + plates 92-122. (Southampton: Ordnance Survey Office; London: Edward Stanford, Ltd., 1924.) 20s. net.

THE work on which the late Dr. Kidston was engaged at the time of his death is probably the most important contribution to our knowledge of the plants of the British Carboniferous rocks which has yet been printed. Whether regarded as a study of the distribution of species in our British coal seams, or as a critical systematic account of a fossil flora of scientific interest and economic importance, it ranks as a unique work. Unfortunately Kidston's sudden death occurred when only four parts had been published, and the present part is the first to appear since; but it is hoped that several more parts are in a condition sufficiently advanced to admit of their publication. It will be a catastrophe if the material collected for so many years by such an indefatigable worker is not made available by publication.

The present part, like those which have preceded it, deals with those varied and often perplexing fern-like plants which form such an important element in the Carboniferous flora. Some of the genera described and figured are rare and little-known forms, such as species of *Cyclothea*, *Unatheca*, *Anemites*, and *Alcicornopteris*, while others are common but polymorphic forms such as *Dactylothea*. The treatment of the fronds of the fern genus *Pecopteris* is commenced. The old group was a very large and artificial one, and a system of nomenclature is now proposed which will limit the artificial genus *Pecopteris* to a much smaller number of forms. The species which have been found in a fertile condition are removed to their appropriate natural genera, and we have seven of the more familiar species now described as species of the genus *Asterotheca*. Some of the genera described, such as *Zeilleria*, *Telanguium*, and *Seftenbergia*, are of considerable botanical interest on account of the form of their reproductive structures. The records of the exact horizons and localities of each species in Britain are given, and this should prove of great value not only in the recognition of the horizons of coal seams, but also for the study of the evolution and distribution of the Carboniferous flora.

H. H. T.

*The Pliocene Mollusca of Great Britain: being Supplementary to S. V. Wood's Monograph of the Crag Mollusca.* By F. W. Harmer. Vol. 2, Part 4. (The Palæontographical Society: Volume for 1922.) Pp. xiv + 857-900 + 1 plate. (London: Printed for the Palæontographical Society, 1925.)

ALTHOUGH the preparation of this monograph was begun very late in life, the author lived to complete his work, but not to see the publication of the concluding portion. The first part was issued in 1914, and the author died in April 1923. Since the appearance of Searles V. Wood's great monograph on the "Crag Mollusca" (1848-57), with its Supplements (1872-82), there has been much progress in conchology and considerable additions have been made to the



already known rich fauna of the English Pliocene deposits, especially to that of the Waltonian Crag. Consequently, during his stratigraphical investigations F. W. Harmer found that a supplementary monograph was needed. The present memoir deals mainly with the gasteropods and is illustrated by 65 excellent plates. The author's work on the stratigraphy of the Pliocene deposits of East Anglia and Western Europe, and his interesting conclusions concerning the physical conditions of the period, have been published in the *Quarterly Journal of the Geological Society* and elsewhere, but a few further points of general interest are given in this monograph, such as his discussion of the supposed Miocene age of the Lenham Beds.

[Sir Sidney Harmer informs us that he has a few copies of Vol. 2 of the above monograph, and he would be glad to hear from workers on Pliocene Mollusca who received copies of Vol. 1 but have not yet had Vol. 2.—ED.]

*Evolution, Heredity, and Variation.* By D. Ward Cutler. Pp. 147. (London: Christophers, 1925.) 3s.

THE purpose of this book is, in the words of the preface, "to present, in as simple a manner as possible, some of the results of modern research on the great questions of evolution, variation, and heredity." The book is designed mainly for the use of schools in which biology receives a place in the curriculum, and for the general non-scientific reader who is interested in the bearings of these problems on questions of human sociology. It naturally contains nothing that is new, nor even a new viewpoint, and the author has had to make rigorous selection of available material in order to present the various aspects of the questions in as complete and impartial a manner as the exigences of space would allow.

On the whole, Mr. Cutler has done his work well. It is almost inevitable in a book of this kind that the author should tend to be dogmatic, and this attitude is rather emphasised by the author's somewhat stilted and peremptory style. We should, for example, have preferred a less summary statement on the question of the inheritance of acquired characters, and a little fuller presentation of the more recent work on this baffling problem, especially in view of the reaction towards Lamarckianism, of which signs are not wanting, and of the grave importance of the matter in its bearings on human sociology. But this is, perhaps, a small point in an otherwise well-balanced book, which should be found very useful for the higher forms of schools where biology is taught for one or other of the school leaving certificates.

*The Negro and his Songs: a Study of Typical Negro Songs in the South.* By Prof. Howard W. Odum and Guy B. Johnson. Pp. ix+306. (Chapel Hill: University of North Carolina Press; London: Oxford University Press, 1925.) 13s. 6d. net.

THIS is the first volume of a series in which the story of the United States negro is to be presented. It comprises songs from Northern Mississippi, Northern Georgia, and a few others, chiefly from North Carolina and Tennessee. The types included are religious songs, social songs, and work songs, the last named being, perhaps, the most attractive from their purely rhyth-

mical effect. The two earlier classes are, however, the more instructive in the light they throw upon the mentality of the negro; and no one who reads through the whole of the social songs, with their peculiarly frank exhibition of the negro's attitude towards sexual feelings and relations, can fail to appreciate one side of the race problem in the United States. This, however, is not the whole story, and the religious songs show another side. Throughout there is ample evidence of the negro's gift of imagery, of graphic description, and above all of appreciation of dramatic effect. Amusing examples are given which illustrate the fact that the negro has not lost the gift of improvisation which other primitive singers have, or their impish delight in bringing into their songs any white man who may be present. The authors make an eloquent plea for the systematic study of negro culture, which readers of this volume will heartily support.

*Le calcul des probabilités à la portée de tous.* Par Prof. Fréchet et Prof. Halbwachs. Pp. xi+297. (Paris: Libr. Dunod, 1924.) 18 francs.

TO mathematicians of the seventeenth and eighteenth centuries, the main interest of the theory of probability, then a new object of curiosity, lay in its application to games of chance. In more recent times this theory has developed in such a way as to occupy a central place in many theoretical and applied sciences, from astronomy and physical chemistry on one hand to biology and sociological science on the other. Probability is also the foundation of statistical work, which forms the basis of economics and of actuarial science.

Most treatises on probability, like Laplace's classical "Probabilités," involve some acquaintance with mathematics, and a reader without a working knowledge of the calculus usually finds them too formidable. In the volume before us, Profs. Fréchet and Halbwachs lucidly expound a variety of investigations in the subject which require no wider mathematical knowledge than that of elementary algebra. The questions discussed belong to a wide range of sciences, and the book will be a useful one to readers who are interested in the applications of probability but have only scanty mathematical attainments. W. E. H. B.

*A Treatise on Light.* By Dr. R. A. Houstoun. Fourth edition. Pp. xi+486+2 plates. (London: Longmans, Green and Co., 1925.) 12s. 6d. net.

DR. HOUSTOUN has now remedied one rather serious defect in his well-known "Treatise on Light," namely, the out-of-date character of the section dealing with spectral series. That some modification was desirable will be apparent from the remark still to be found in the third edition (1923) that "all attempts to explain the origin of spectral series are regarded as unsuccessful." In the present edition a brief non-mathematical account of Bohr's theory is introduced, and some of its simpler applications, as to the spectra of hydrogen and ionised helium, are considered. Only a very few pages are devoted to this, for in the author's view the quantum theory of spectra belongs rather to mathematics and the theory of atomic structure than to light. It is perhaps debatable ground, like so much else in modern physics, but those who do not share his opinion will doubtless temper their criticism with appreciation of the many merits of the book in other respects.

## 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 Occurrence of Dwi-Manganese (At. No. 75) in Manganese Salts.

IN investigations of the electrolytic deposition potentials of manganese solutions by the use of the dropping mercury cathode and the automatically registering "polarograph," comparatively large impurities (1:20,000) were detected even in the purest samples, e.g. Kahlbaum's or Merck's "pro analysi." (Cf. *Rec. Trav. Chim. Pays-Bas*, 44, 1925, 488-600.) From the position of the hump on the current-voltage curve (Fig. 1), the impurity was at first thought to be zinc (*l.c.* p. 520). However, on closer examination, the "saw-like" character of the undulations showed that this increase of current must be due to the deposition of a

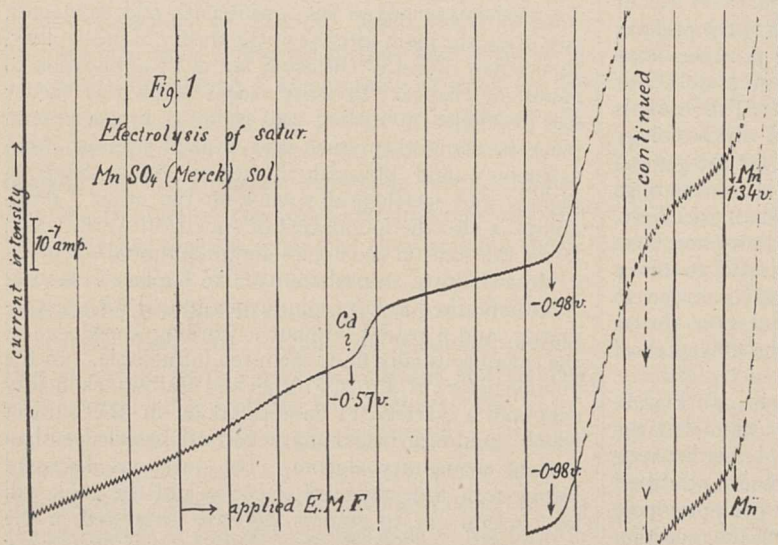
described in his monograph. The  $L\beta_1$ -line (Siegbahn's notation) of the element 75 was at once observed, the  $L\alpha_1$ -line being masked by the  $K\alpha_1$ -line of zinc. Owing to this superposition the wave-length of the zinc  $K\alpha_1$ -line could not be accurately determined. Although this evidence did not seem sufficient to establish the new element, the authors have used it, in conjunction with the electrolytic method, to deduce some chemical properties of dwi-manganese. The impurity (1:100,000) causing the first hump was easily shown to contain no element 75, since it disappeared entirely from the graph when hydrogen sulphide was passed through the acidified manganous solution and the trace of precipitate thus formed gave on X-ray analysis no line of the element 75. The second "hump" was not affected by passing hydrogen sulphide through the acidic; or the sodium acetate solution, and when the solution was treated with sodium hydroxide, only the precipitated hydroxides showed the 75 line. Owing to the considerable amount of zinc which was introduced into the solution by the scraping, further polarographic investigation was inapplicable, and no progress was made until a few weeks ago, when the procedure was so modified that it yielded, in one operation, a pure X-ray spectrum of three lines of the 75 L series.

The method is as follows: Into a nearly saturated solution of pure manganous sulphate a small crucible containing manganese amalgam, prepared electrolytically, is introduced together with a large platinum foil which is connected to the manganese amalgam. After several days the platinum foil is removed, rinsed with water, and the deposit washed off with concentrated hydrochloric acid. The solution thus obtained is diluted with water, neutralised with sodium carbonate, and slightly acidified with acetic acid. Hydrogen sulphide is then passed to remove zinc, nickel, cobalt, and the metals of the first two analytical groups. The solution then remaining contains manganese with ca. 2 per cent. dwi-manganese, as shown from the spectrometric evidence

given by the hydroxides precipitated from this solution by sodium hydroxide.

The simultaneous polarographic examination of the manganous solutions always reveals two impurity humps which constitute 2-3 per cent of the manganous content (Fig. 2). One, as shown previously, is due to the element 75; whether the other hump is caused by the element 43 could not be determined, as the coil used would not withstand the powerful exposure for the K-series of element 43.

Concentrated acidic chloride solutions containing element 75 are greenish although nickel has been carefully removed; the dry green chloride darkens rapidly to black on standing. Neutral chloride solutions containing element 75 deposit a yellowish-brown precipitate on standing in air, probably due to oxidation; this precipitation is avoided in the electrolytic method where the solutions are kept in an atmosphere of hydrogen. This seems to indicate that higher valency compounds of element 75 are more stable than those of manganese. In agreement with this is the fact that the manganous chloride prepared from potassium permanganate (Merck's "pro analysi") gives a polarographic hump six times as high as an equi-concentrated solution of manganous sulphate. This chemical behaviour



metal or metals not alloying with mercury (*l.c.*). At the potential at which the manganese impurity is distinctly shown, *i.e.* at  $-1.0$  volt (from the calomel zero), zinc, nickel, cobalt, and iron may be deposited from their  $10^{-5}$  molar solutions (cathodic potentials 1.00, 1.06, 1.20, and 1.27 volts respectively). From the different heights of the humps on the polarographic curves, the impurity in the manganous solutions can be estimated as  $0.54 \cdot 0 \times 10^{-4}$  equiv. per litre, varying in different specimens within these limits. As analytical tests for zinc, nickel, cobalt, and iron in these solutions give negative results, these metals cannot be present in concentrations greater than  $10^{-5}$  equiv. per litre. Hence the persistent impurity was suspected to be analogues of manganese—eka-manganese (43) and dwi-manganese (75).

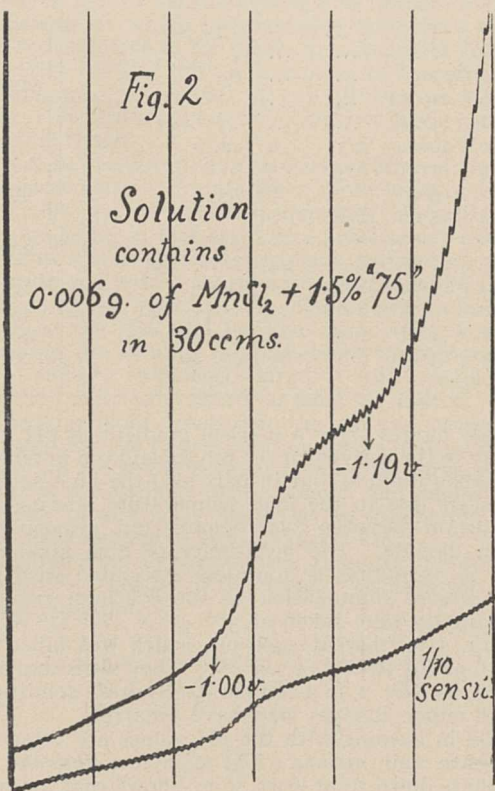
The method of separation, first attempted in May 1925, consisted of dipping strips of zinc or platinum foils connected to zinc rods into concentrated manganous solutions; this would cause all metals having potentials less negative than zinc to be deposited. The deposit was scraped off, dissolved in a few drops of hydrochloric acid, evaporated to dryness or precipitated by sodium hydroxide and its X-ray spectrum examined.

Prof. M. Siegbahn's apparatus was used, as

coincides with that mentioned by Dr. G. Druce (*Chem. News*, 131, p. 273, 1925), whose results indicate the presence of element 75 in crude manganese compounds.

The provisional spectroscopic results are:  $L\alpha_1 = 1430$  X.U.,  $L\beta_1 = 1235.3$  X.U.,  $L\beta_2 = 1204.3$  X.U.,  $L\gamma_1 = 1059$  X.U. The copper  $K\beta$ -line was used as reference (M. Siegbahn and V. Dolejšek, *Zeitschr. f. Phys.* 10, 1922, 159). No lines of other elements appeared in the spectra of the final specimens except the copper  $K$ -lines. The  $L\alpha_1$ -line could not be measured with the same exactness as the others since only the most recent specimens were entirely free from zinc.

W. Noddack, I. Tacke, and O. Berg claim (*Naturwiss.*, 1925, 26, 567) to have discovered the element 75 in columbite. As there published, their spectroscopic evidence is not conclusive, since two of their  $\beta$ -lines of the  $L$  series of element 75, according to their own data, coincide with those of tungsten;



moreover, their observed  $L\beta_2 = 1204.8$  X.U. and their  $L\beta_3 = 1216$  X.U. for element 75 happen to coincide exactly with  $L\alpha_1 = 1204.7$  X.U.,  $L\alpha_2 = 1216.0$  X.U. for thallium. In view of the accuracy of their measurements, their observed lines agree with those of thallium better than with those calculated for element 75, namely, 1204.1 and 1216.9. They do not state whether the specimen was freed from thallium, a common impurity in such minerals, which in the presence of arsenic would accumulate with the insoluble sulphides; their "eka-manganese" should not be precipitated by hydrogen sulphide (cf. Dr. Druce's results). The only free  $L\alpha_1$ -line they recorded, which by the ordinary Siegbahn dispersion is indistinguishable from the  $K\alpha_1$ -line for zinc (difference ca. 1 X.U.), might be, at the abnormal dispersion they used, a new, hitherto unobserved, line split off from the zinc doublet.

From the scientific point of view the chemical character of the element 75 seems to the present

authors more suitably expressed by the old Mendeléeff designation of "dwi-manganese" than by "rhenium," as proposed by the German authors.

V. DOLEJŠEK.  
J. HEYROVSKÝ.

Institute for Experimental Physics and  
Institute for Physical Chemistry,  
The Charles University, Prague,  
November 4.

### The Law of Force and the Size of Diatomic Molecules, as determined by their Band Spectra.

IT is well known that from an evaluation of the vibrational energy of a diatomic molecule, as a function of the vibrational quantum number  $n$ , it is possible to deduce quantitatively the law of force of the molecule, in the vicinity of the equilibrium position of the two nuclei. Now when the dipole rotates, the nuclear separation  $r$  increases, and the amount of this increase depends upon the forces called into play when the nuclei are displaced from the equilibrium distance  $r_0$ . But these are the same forces which determine the frequency of vibration  $\nu_0$  and the vibrational energy. Hence, if neither the vibration nor the rotation is sufficiently violent to distort the electron orbits appreciably, there should be a direct connexion between the constants which enter into the vibrational energy function, and those which characterise the rotational energy.

Kratzer has obtained such a relation, in its first approximate form ( $\nu_0^2 = -4B^2/D$ ), but in the few cases where this matter has been considered, the relation in question has been assumed rather than carefully tested. I have now, however, derived the following direct relations. If one assumes for the law of force the function  $F = k_1(r - r_0) + k_2(r - r_0)^2 + k_3(r - r_0)^3$ , etc., and for the rotational energy of a non-vibrating molecule the usual function  $E_m = Bm^2 + Dm^4 + Fm^6$ , etc. (where  $m$  is generally, but not always, an exact half-integer), then the  $k$ 's, I find, may be expressed as explicit functions of  $B$ ,  $D$ ,  $F$ , etc. Explicit expressions for the  $k$ 's in terms of the constants of the vibrational energy function may be obtained from the work of Born and Hückel (*Phys. Zeitschr.* 24, 1, 1923). From vibrational energy data it is possible to evaluate  $k_1$  with great accuracy,  $k_2$  and  $k_3$  with fair accuracy, and in the case of HCl, even  $k_4$  at least roughly (paper by Prof. E. C. Kemble, now in press). From rotational energy data it is possible to determine  $k_1$  with fair accuracy, and in the case of CN, even  $k_2$  at least roughly. The great difference in accuracy is due to the fact that the available data on rotation, in the case, for example, of CN, apply to a maximum value of  $(r - r_0)/r_0$  of only three per cent., while the maximum observed amplitude of vibration is about fifteen per cent.

Using new measurements and calculations for the  $\lambda 3883$  CN band, I have evaluated the rotational energy function, for the final (emission) state, up to  $m = 91.5$ , and from these data have obtained  $k_1 = 16.12 \times 10^5$  dyne  $\cdot$  cm $^{-1}$ ,  $k_2 = -6.18 \times 10^{14}$  dyne  $\cdot$  cm $^{-2}$ . From the vibrational energy data, by the customary process I obtain  $k_1 = 16.00 \times 10^5$  and  $k_2 = -5.44 \times 10^{14}$ . Considering the accuracy with which the rotational energy data must be known, to obtain a value even of  $k_1$ , this agreement is quite remarkable, but can scarcely be accidental. It is to be emphasised in this connexion that the first set of values is obtained from an analysis of the energy of the molecule in a series of states in which it is *rotating*, but *not vibrating*, while the second set of values is deduced from the energy in a series of *vibrating*, but *non-rotating*, states.

Hence the two sets of data are entirely independent, and the agreement of the results is a real confirmation of the theory underlying this work.

In a similar manner I have obtained values of  $k_1$  from the rotational and from the vibrational energy data, for the initial and for the final state of the CN, CuH, N<sub>2</sub>, and N<sub>2</sub><sup>+</sup> molecules, using for the rotational energy data the (O, O) bands  $\lambda_{3883}$  CN,  $\lambda_{4280}$  CuH,  $\lambda_{3914}$  N<sub>2</sub><sup>+</sup>, and  $\lambda_{3371}$  N<sub>2</sub>. The mean position of the doublets was used for the first three bands, and the middle component of the triplet for the last. The difference between the rotational and vibrational energy values of  $k_1$ , for the initial and final states respectively, for the four molecules in the order named, is -1.0 and +0.75, -1.7 and +3.5, +0.4 and +2.2, +4.8 and +3.2 per cent. In all cases the discrepancy is well within limits of error.

This quantitative agreement in the case of the two non-polar molecules N<sub>2</sub> and N<sub>2</sub><sup>+</sup> has an interesting consequence. As we now know, the successive lines forming the band series of such molecules usually alternate in intensity, and the explanation of this phenomenon has become a matter of considerable difficulty. The only promising explanation thus far is due to Dieke (*Zeit. f. Phys.* 31, 326, 1925), but it carries as a necessary consequence a reduction of the value of the moment of inertia to one quarter of the previously accepted value. A serious objection to such a reduction is the close correlation between the magnitude of the frequency of vibration and of the moment of inertia (using the older values), noted independently by several investigators (see, for example, Mecke, *Zeit. f. Phys.* 32, 823, 1925). This, however, is not necessarily a vital objection to Dieke's theory, since it may well be that there is such a correlation for both polar and non-polar molecules, but that the "correlation factor" is quite different in the two cases.

I now find that Dieke's interpretation of the band series of non-polar molecules, which involves halving the customary values of  $m$  in the expression for  $E_m$ , leads directly to a value of  $k_1$  just four times as large as that obtained from the same rotational energy data, using the older theory. Hence the above quantitative agreements, which are based on the older interpretation, seem to offer conclusive evidence in favour of the usually accepted values of the moments of inertia of non-polar molecules, as against the new smaller values. This assumes of course that the value of  $k_1$  as obtained from vibration is correct, and it may be noted that permitting the vibrational phase integral ( $\int pdq$ ) to vary by only  $h/2$  between adjacent possible values, would in turn lead to a value of  $k_1$  four times as large. Since, however, Dieke's interpretation leads to no change in the assumed minimum possible variation ( $h$ ) of the rotational phase integral, there seems to be no reason for modifying this fundamental postulate of the quantum theory, in the case of the vibrational phase integral.

RAYMOND T. BIRGE.

University of California, October 17.

#### The Variation with Depth of Certain Salts utilised in Plant Growth in the Sea.

DR. STANLEY KEMP and the scientific staff of the R.R.S. *Discovery* have been good enough to provide us with water samples which have rendered it possible to obtain information, long considered desirable, as to how far the depths of the oceans act as reservoirs of salts necessary for plant growth. The samples also enable a comparison to be made between the concen-

tration gradient found in these and in more southerly latitudes, between Lisbon and the Canary Isles.

The following determinations were made, and are shown in the table, along with the temperature records received from Dr. Kemp: alkalinity of the water, expressed as  $pH$ , namely,  $\log 1/H$ , where  $H$  is the hydrogen ion concentration in grams per litre; phosphate, expressed as phosphorus pentoxide, nitrate as nitrogen, and silicate as silicon dioxide, all three in milligrams per cubic metre, namely, parts per thousand million of sea water. The methods of analysis have already been described in the *Journal of the Marine Biological Association*, save that for nitrate, which forms the subject of a forthcoming paper by one of us.

Depth in Metres.	T. °C.	pH.	In mgm. per m <sup>3</sup> .		
			P <sub>2</sub> O <sub>5</sub> .	Nitrate-N <sub>2</sub> .	SiO <sub>2</sub> .
0	21.10	8.35	0	15; 11	220
10	21.10	...	...	7	
20	21.00	...	...	6	
30	21.00	...	...	...	
40	21.00	...	...	16	
50	20.01	8.35	0	ca. 6	220
75	17.31	8.31	5	6	
100	15.10	8.18	8	55	
150	15.06	8.16	10	65	250
200	13.86	8.11	22	100	
300	12.25	8.12	44	178; 158	
500	10.94	8.00	50	200	280
1000	9.55	8.03	74	264; 262; 274	450
2000	4.81	7.94	78	ca. 265	480
3000	3.10	7.87	88	ca. 265	1200

These figures show a marked gradient in  $pH$ , due mainly to the activity of the phytoplankton in removing carbon dioxide, but in part also the high surface values are due to the high temperature altering the equilibrium between bicarbonate and atmospheric carbon dioxide. The persistence of high alkalinity down to 75 metres is doubtless associated with the more intense illumination of the southern regions. The samples were taken at 37° 44' N., 13° 21' W. on Oct. 12, save that at 3000 m., which was taken on Oct. 16 at 29° 59' N., 15° 03' W. They were analysed on Oct. 30-Nov. 2, in a comparatively fresh condition, though minor changes may have occurred.

Quite in keeping with the  $pH$  values are those for phosphate and nitrate. The complete removal of phosphate down to at least 50 m. shows that, as previously reported, lack of phosphate sets a limit to the multiplication of the phytoplankton. The corresponding low values for nitrate indicate that this constituent runs phosphate close as a limiting factor; indeed it is possible that it does limit growth under certain conditions, for in early August in the English Channel this year some regeneration of phosphate had occurred, but down to the bottom, 70 m., only traces of nitrate were found.

Once the illumination becomes inadequate, both phosphate and nitrate increase, so that in the deeper waters they accumulate; not until upwelling occurs, when the deep water is moved to good illumination, are these supplies again available for plant growth; from this it follows naturally, as suggested by Nathanson, that oceanic banks are noted fishing grounds, for the phytoplankton constitutes the ultimate food source of oceanic animals.

The silica analyses show that while much silica is removed—by the diatoms—from the upper water, lack of silica is not under these conditions a factor

limiting diatom growth. The values given may be somewhat high owing to the solution of silica from the glass during storage. Tests with similar bottles leave, however, little doubt as to the substantial accuracy of the conclusions reached from the figures given here.

W. R. G. ATKINS.  
H. W. HARVEY.

Marine Biological Laboratory,  
Plymouth, November 6.

**The Stokes-Planck Theory and the Michelson-Morley Experiment.**

It seems to have been implied, in recent discussions, that the Stokes-Planck ether theory, while correlating the facts of astronomical aberration and other first order phenomena having to do with the earth's motion, is also in harmony with Prof. Miller's recent experiments in which he concludes that there is an ether drift relative to the earth, amounting to zero at the earth's surface and to something of the order of 10 kilometres per second at the altitude of Mount Wilson. It would appear that this conclusion cannot be substantiated.

It will be recalled that the original Stokes' theory was unsatisfactory because, when the velocity normal and relative to the spherical boundary was assigned (its value being in fact zero), the problem for irrotational flow was uniquely determined, and the solution gave finite and indeed considerable tangential relative velocities at the surface. The Planck generalisation introduced the idea of a variable ether density, and, by making the ratio of the density at the surface to that at infinity sufficiently large, it was possible to make the tangential velocity as small as desired.

On looking more closely into the analysis, however, it appears that the Planck solution serves to determine the way in which the tangential velocity varies with altitude in the vicinity of the sphere, and denies the possibility of any such change as 10 kilometres per second for a change of altitude of 1.7 km.

Thus, referring to the solution as given in Note 67 of Lorentz's "Theory of Electrons," we have for the velocity potential

$$\phi = z \left[ a \left( \frac{\mu\omega}{2r} - 1 \right) + b \left( \frac{\mu\omega}{2r} + 1 \right) e^{-\frac{\mu\omega}{r}} \right], \quad (1)$$

where  $b - a = w_0$

and  $a = \left( \frac{\mu^2\omega^2}{2R^2} + \frac{\mu\omega}{R} + 1 \right) e^{-\frac{\mu\omega}{R}b}$ ,

and where  $\mu$  and  $\omega$  are constants,  $R$  is the radius of the earth,  $w_0$  the relative velocity parallel to the axis of  $z$  at infinity. The origin is at the centre of the sphere,  $r$  is the radius vector, and  $z$  the distance from the origin parallel to  $w_0$ .

From the above it is easy to show that, if  $V_R$  and  $V_{R+h}$  are the horizontal relative ether drifts for  $z=0$  at  $r=R$  and  $r=R+h$  respectively, where  $h$  is a relatively small increment in  $r$ ,

$$\frac{V_{R+h} - V_R}{V_R} = \frac{h}{R}$$

Hence, if  $h=1.7$  km., and  $R$  is the radius of the earth (6400 km.), it is obviously impossible to have the change of velocity  $V_{R+h} - V_R$ , which Miller concludes to be 10 kilometres per second, comparable even with the quantity  $V_R$  which the object of the large density ratio is to render negligible.

W. F. G. SWANN.

Sloane Laboratory,  
Yale University.

**The Chromosome Complex of *Gammarus chevreuxi* Sexton.**

THE spermatogenesis of *Gammarus chevreuxi* having been investigated by me at the Plymouth Laboratory of the Marine Biological Association, it was considered desirable, in view of the genetic interest of this form, and of the fact that detailed results will not be published for some months, to summarise briefly the essential conclusions. These are:

(1) The chromosomes of *Gammarus chevreuxi* are small, ovoid and minutely heteromorphic, and have a diploid number in the male of twenty-six, this number being arrived at by the study of a large number of spermatogonia, and also of spermatocytes and synapsis stages.

(2) This chromosome number includes in the male an X and a Y chromosome, the former being larger, and the latter smaller than any of the autosomes.

(3) The spermatogonial metaphase plates fall into two distinct classes as regards chromosome size. There is considerable evidence that the large plates are merely the later stages of the spermatogonial series.

(4) While *Gammarus* does not provide favourable material for the detailed study of synapsis, the chromosomes appear to spin out in the typical way in the early synaptic stages.

(5) Preliminary studies of the embryonic chromosomes indicate that the somatic chromosome number is about twenty-six, but sufficiently favourable material has not yet been obtained to warrant any more definite statement.

RICHARD PALMER.

Royal Grammar School,  
Worcester, November 5.

**The Solar Constant and Terrestrial Magnetism.**

DR. CHREE has obligingly sent me a copy of his paper entitled "The Relationship between the 'Solar Constant' and Terrestrial Magnetism" (*Proc. Roy. Soc. A* 109, 1925). He finds no indication in the solar constant data of 1918-1924 of a repetition of departures after a solar rotation period. This finding is quite in accord with ours. We have, indeed, noted the solar rotation period very plainly in some of the data, but only for a few months at a time, as in the year 1915. (See C. G. Abbot, "On Periodicity in Solar Variation," *Smithsonian Miscellaneous Collections*, vol. 69, No. 6, 1918.)

In the second place, Dr. Chree does find indications of magnetic disturbance associated with low values of the solar constant. Inasmuch as higher solar constant values are generally associated with numerous sun-spots, and abundant magnetic disturbances, he thinks this paradoxical finding of low solar constants associated with magnetic disturbances is non-significant. On the contrary, it is exactly what we should expect.

Referring to a recent paper (C. G. Abbot, "Solar Variation and Forecasting," *Smithsonian Miscellaneous Collections*, vol. 77, No. 5, page 23, Figs. 15 and 16), the passage of an individual sun-spot group over the central meridian of the solar disc is almost always associated with decreased values of the solar constant, and doubtless frequently with terrestrial magnetic disturbances. Hence, it is prevailing with low rather than high solar constant values that individual magnetic disturbances will be found associated.

C. G. ABBOT,

Smithsonian Institution,  
Washington, U.S.A.,  
October 26.

### Examination of Bronze Implements.

By Prof. C. O. BANNISTER and J. A. NEWCOMBE.

THE results of modern methods of research on the constitution of metallic alloys and on the effects of varying mechanical and thermal treatment on their structure and mechanical properties have increased our knowledge of these subjects enormously. Of these methods, the use of the microscope for the examination of the micro-constitution and crystalline condition of suitably polished and etched specimens is one of the most important. This method of examination is capable of indicating not only how the component metals exist in the alloy, but also what mechanical or heat treatment the alloy has undergone. As regards constitution, the microscopical examination is used in order to ascertain whether the component metals are present in the free state, in chemical combination, or mutually dissolved and retained in solution in the solid state. As regards treatment, the structure observed is used to decide whether the metal object was obtained by a casting process or was shaped by mechanical work, and is also capable of indicating whether any work has been applied to the object and also whether this work has been followed by an annealing process. Below are given some results of an examination of a chisel and a palstave of the Bronze Age found about 1898 in a brickfield near the Hanwood-Shrewsbury road and supplied by Mr. F. Drinkwater of West Kirby through Miss L. F. Chitty of Yockleton, near Shrewsbury.

With regard to the constitution of bronzes, these consist of alloys of copper and tin in varying proportions, and if the molten metals be allowed to solidify and cool very slowly, or if cooled normally and then reheated for the necessary length of time, the tin is soluble in the copper in the solid state up to 13 per cent. of tin. After such treatment, the bronze would show one constituent only under the microscope.

On cooling a liquid alloy containing 8-13 per cent. tin, the first portions to solidify are richer in copper than the portions solidifying last. On polishing and etching such an alloy, these copper-rich portions are found to have a fern-like structure, and the presence of these dendrites, as they are called, is indicative of cast metal. The alloy not being homogeneous throughout its mass has areas with a greater tin percentage than 13, and in these areas a pale blue constituent, which is a very intimate mixture of two solid solutions, makes its appearance. The more of this second constituent that is present the harder and more brittle does the metal become, and with any definite percentage of tin the more quickly the metal is cooled, within limits, the more of this constituent is present in the casting. If the cast bronze be now heated for some hours at a temperature below its melting point, diffusion takes place, the metal becomes more or less homogeneous in composition, and the dendrites and the second constituent more or less disappear, the metal becoming more homogeneous the longer the annealing or the higher the temperature. With cast bronze of less than 8 per cent. tin, the dendrites would appear as above, but little or no blue constituent would be present because the tin rich areas would contain less than 13 per cent. of tin.

If the cast metal were cooled in the mould very slowly, this would have, as regards the homogeneity of the metal, a similar effect to annealing. The rate of cooling of a casting will depend on three factors: first, the temperature of the metal when it is cast, it being obvious that the higher this temperature the longer will the solidifying and cooling take. Secondly, the material of which the mould is made. If the material conducts heat rapidly from the metal, the rate of cooling will be greater than in the case of a mould from which the heat was less rapidly removed. The stone mould commonly used for casting antique bronzes would be a bad conductor of heat, and the cooling would take place very slowly. A bronze mould would chill the casting, and cooling would be very rapid. A sand mould would have an effect intermediate between these two. The third factor would be the size of the casting, one of large bulk cooling more slowly than a smaller casting, as there would be more heat to disperse.

Another important characteristic in the structure of bronze is the outline of the crystals revealed by the etching. In the cast metal the crystals are very irregular, some crystals being of large size compared with others, and having interlocked boundaries. If the metal be now worked in some way by hammering or rolling, an examination will show the results of this work in the distortion of the original crystals, which are often elongated to a considerable extent at right angles to the direction of the work when this has been excessive. The effects of less drastic amounts of work are seen in the appearance of parallel lines on the crystals, these lines being known as slip bands. If the metal be annealed after working, new crystals will make their appearance, appearing quite different from the casting crystals and characteristic of the annealed metal. These crystals are much more uniform in size, and have sharp lines as their boundaries. They invariably show a great deal of twinning, which is recognised by the crystals having two or more parallel lines traversing them. As a result of this working the dendritic structure will be somewhat destroyed. Instead of being fern-like, it generally appears as thick, dark, irregular parallel bands over the specimen in a direction at right angles to the force applied. A long annealing entirely eliminates this structure, but the new crystals grow before this is effected, so that in annealed metal, traces of the dendrites may still be seen.

It will be gathered from these notes that much can be deduced from the micro-examination of antique bronzes. From the fern-like, dendritic, or core structure, as it is variously called, and the type of crystal boundaries, the cast structure is at once recognised, and with an 8-13 per cent. bronze some sort of deduction can be made as to the mould used, because with very little of the blue constituent present the metal would have cooled slowly, and it is probable that a stone mould would have been used. The twinned equiaxed crystals and the partial or total absence of dendrites indicate that the metal had been hammered and annealed.

*Examination of Chisel.*

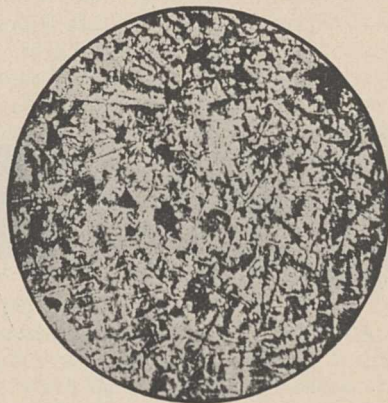
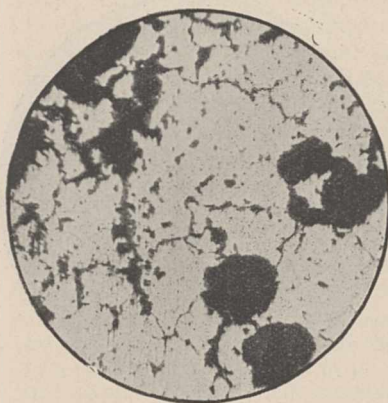
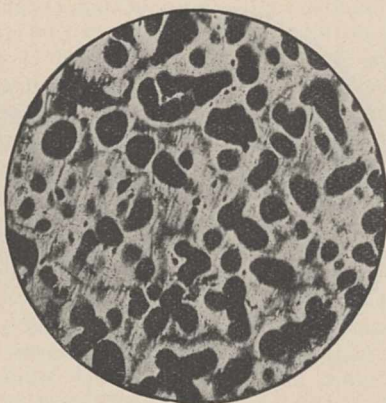
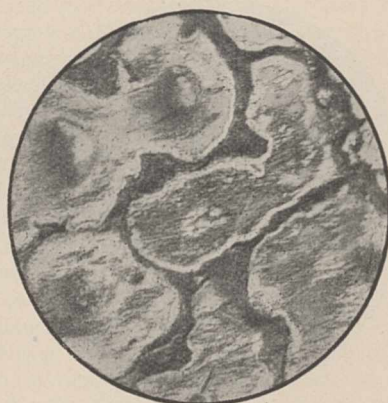
The chisel was 15.5 cm. in length and, as is shown in Fig. 1, was fractured when received. The fracture showed a considerable amount of porosity. An analysis shows copper 85.5 per cent., tin 14.2 per cent. A section taken of a part near the fracture was polished and etched in a solution of ammonia containing a few drops of hydrogen peroxide. Fig. 2 shows the dendritic structure at a magnification of 15 diameters. The section was again polished and photographed unetched. Fig. 3, at a magnification of 25 diameters, shows how very porous the metal is; the holes were formed at the

amount of blue constituent and the number of blow-holes would indicate the metal to be very brittle, and on examination the metal was found to be so brittle that it could be crushed by gentle tapping with a small agate pestle.

A very important matter brought out by the examination of this ancient chisel is the persistence of the dendritic or core structure, because it has been suggested that, during the course of a long time, even at ordinary atmospheric temperatures, diffusion would proceed in solid alloys, with the result that equilibrium would eventually be obtained exactly as it may be



FIG. 1.

FIG. 2.  $\times 15$ .FIG. 3.  $\times 25$ .FIG. 4.  $\times 60$ .FIG. 5.  $\times 270$ .

time of casting, and were due to the fact that the metal was cast at too high a temperature and insufficient provision was made for the escape of gases from the metal. Fig. 4 was taken to show the dendritic structure at the higher magnification of 60 diameters and is typical of cast bronze. Fig. 5, taken at a still higher magnification of 270 diameters, shows the blue constituent situated along the boundaries of the crystals. The percentage of tin present in the alloy would account for this apart from the heterogeneity of the metal.

From the well-defined dendritic structure and the large proportion of blue constituent, it may be assumed that the metal cooled quickly in the mould, the small bulk of metal being sufficient to account for this, apart from the nature of the material of the mould. The

obtained at higher temperatures in a few hours. The dendritic structure of this chisel, however, is so typical of a recently cast bronze that it appears safe to say that no diffusion has taken place during the ages.

*Examination of Palstave.*

The palstave examined is shown in Fig. 6, and is 15 cm. long. An analysis shows copper 86.9 per cent., tin 12.7 per cent. A portion of the socket was polished and a photomicrograph was made of a portion adjacent to the corrosion product at a magnification of 75 diameters; this is shown in Fig. 7. The corroding agent operates in the first place along the crystal boundaries, this being the portion of the metal in which any traces of impurities present become concentrated,

corrosion taking place more readily with impure than with pure material. The presence of corrosion of this type in bronze is a sure proof of its antiquity, and a check against the fraudulent "antiques" which are made with so much perfection at the present day. With recently cast bronze, although it is easy to imitate the effect of age on the outside by chemical means, age alone will allow the slow penetration of the corrosion around the crystal boundaries without too rapid attack on the crystals themselves.

Fig. 8 was very deeply etched by means of a solution of ammonia containing hydrogen peroxide to show the

A section of the cutting edge was polished and etched, and the photomicrograph is shown in Fig. 10, at a magnification of 75 diameters. The crystals shown here are much smaller in size and of a totally different shape from those of Fig. 9. They are more uniform in size, they are sharp, and a large number of them are twinned. It will be observed that indications of dendrites are almost entirely absent. This structure shows that this end of the palstave has been hammered and afterwards heated. There is little doubt that the hammering was performed with the object of sharpening or resharpening the palstave, and the reheating operation

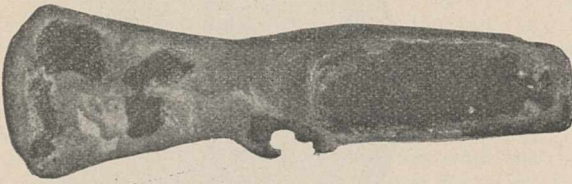
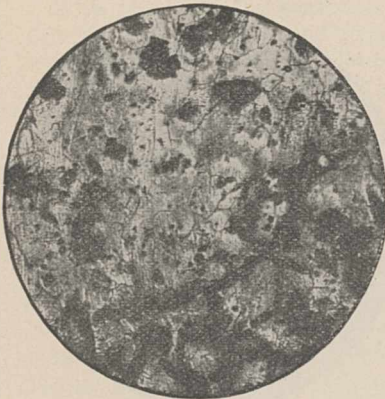
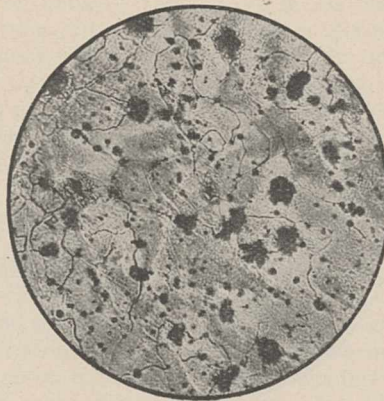
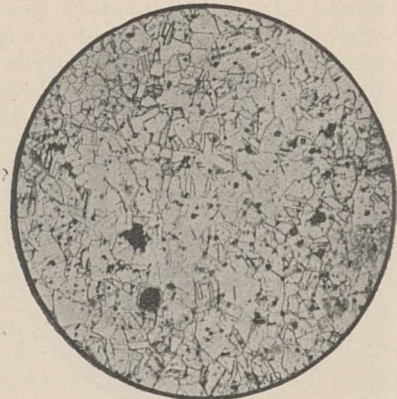


FIG. 6.

FIG. 7.  $\times 75$ .FIG. 8.  $\times 70$ .FIG. 9.  $\times 75$ FIG. 10.  $\times 75$ .

type of crystals present. The very irregular crystals can be seen, and it will be noticed that the corrosion follows the crystal boundaries. Some of the crystals show striations across their surfaces and these are slip bands. These slip bands are formed when a metal is subjected to an amount of work just sufficient to cause a permanent deformation in them. This would naturally be towards the end of the socket where the metal is thinnest, and would be caused by the force exerted on this part by the wooden handle fitted on to the socket when the palstave was in use. The smaller dark patches in Fig. 9 consist of the blue constituent, but the larger are the result of corrosion.

Fig. 9 shows more clearly the shape of the casting crystals and illustrates variation of size and interpenetration.

was used to remove the brittleness induced by the work, as it would soon become apparent to the ancient metallurgist that these operations would give a stronger and tougher metal. The metal could not have been hammered hot, because bronze of this composition is not malleable when hot. The palstave was finally annealed, as otherwise the effect of the work would have been apparent on the crystals in the photograph.

From Figs. 8 and 9 it is evident that the dendrites are not well defined, and very little blue constituent is present although the composition is near the maximum at which tin is soluble in copper. This is due to the comparatively long time the metal took to solidify and cool, thus allowing some diffusion to take place in the solid metal, and the composition to become approximately uniform.



It has been suggested that if an antique metal had been worked or strained, crystals may form at ordinary

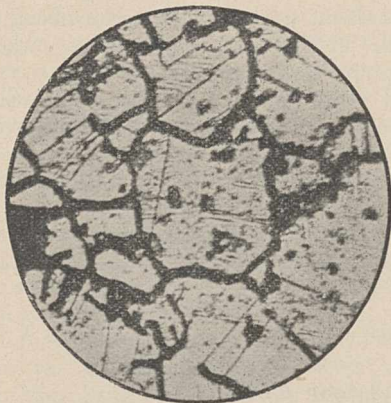


FIG. 11.  $\times 300$ .

temperatures during the ages similar to those that would be formed in a short time if the metal were

heated. The evidence obtained from the examination of this palstave appears to prove that this is not so in the case of bronze. Fig. 11 is a photomicrograph of a portion near the cutting edge of the palstave and is similar in appearance to the structure shown in Fig. 10, but at a higher magnification of 300 diameters. This photograph was taken in order to illustrate the fact that corrosion on this part of the palstave follows the crystal boundaries, which are not of the casting crystal type but have been formed subsequent to mechanical work. The presence of the corrosion product in these boundaries indicates that these crystals must have been in existence before corrosion commenced and therefore had not been slowly formed during the ages. This photograph also shows that the crystals are still of the same size as they were when corrosion commenced and that no growth has taken place. This suggestion of the germination of crystals during the enormous time that has elapsed since the castings were made is further disproved by Fig. 8, as the slip bands shown in this photograph indicate strained metal and no new crystals are seen to have formed.

### The Darling and Lothian Foundations for Research in Malaria.

SOME months ago we had to record (NATURE, May 30, p. 845), with much regret, the deaths in a motor-car accident, near Beirut in Syria, of Dr. S. T. Darling (United States of America), Dr. N. V. C. Lothian (England), and Mlle. Besson (France), members of the Malaria Commission of the League of Nations who, with Prof. Nocht (Hamburg), Swellengrebel (Amsterdam), Ottolenghi (Italy), Anigstein (Poland), and Colonel James (England), were undertaking a tour of investigation in Palestine, Syria, and part of Turkish Asia Minor. In the recently published report on the work of the fifth session of the League's Health Committee, held at Geneva on October 8-14, it is announced that the Committee, wishing to honour and perpetuate the memory of Dr. Darling and Dr. Lothian, has decided:

(1) To collect by private subscription a capital fund, the interest on which will be expended on a prize to be awarded periodically. This will be known as "The Darling Prize."

The prize (a medal or other reward) will be awarded by the Malaria Commission of the League of Nations to a scientific worker who, in its opinion, has carried out recent distinguished research on a subject connected with malaria which comes within the general scope of the Commission's investigations.

(2) To devote a portion of the credits provided for in the budget of the Health Organisation for the encouragement of malariological study to the establishment of a periodical scholarship to be known as "The Lothian Scholarship." This scholarship will be awarded by the Malaria Commission to a selected candidate whose course of study should be in conformity with the general programme of the Malaria Commission.

In our issue of August 8, p. 216, we printed the substance of an appreciation, from the pen of Prof. R. W. Hegner, of the life and work of Dr. Darling. In the Malaria Commission's report of the Palestine tour, which preceded the journey to Syria on which the tragic accident occurred, it is said that the Commission had frequent occasion for congratulation that Dr. Darling had found it possible to be one of the party. "His

previous experience of malarial epidemiology and anti-malarial operations in many countries was unrivalled. He appreciated very clearly the particular aspect of the subject with which the Commission's mandate is chiefly concerned, and his observations during the tour constantly proved that he was at the zenith of his powers as an expert adviser on antimalarial work."

Dr. Lothian joined the Secretariat of the Health Section of the League in May 1923, after a career of considerable achievement in the Royal Army Medical Corps. He had specialised in hygiene, and some of the scientific papers which he published during his army service were of outstanding merit and practical usefulness, notably his "historical inquiry into the load carried by the soldier of various periods," in which he showed that a soldier should not be required to carry more than 33 per cent. of his own weight; the load of a mule is 32 per cent. and of a horse 28 per cent., and to require a soldier to carry more than 33 per cent is to destroy his marching power and capacity for battle.

Dr. Lothian, during his two years' service with the League, travelled in many countries and came into close contact with administrators and public health officers of many nationalities. He accompanied and guided the "interchange courses" of foreign public health and medical officers which, in collaboration with the Rockefeller Foundation, now form a regular item in the programme of the Health Organisation at Geneva. He was secretary to the League's Malaria Commission, and in the report of the Commission's tour of investigation through eastern Europe and Russia, which was published last year, the chapter entitled "Summarised Impressions of the Tour" was wholly drafted by him. It is a sufficient illustration of his expert knowledge of the subject and of the industry which characterised all his work. His high sense of duty and his attractive personality gained him the highest regard and respect wherever he went, and the shock of his death was the greater because he was in the exuberant vigour of youthful manhood, looking forward with enthusiasm to the highest and best that life holds in store.

### The Total Solar Eclipse of January 14, 1926.

NUMEROUS parties have been organised to observe the solar eclipse on January 14 next, which is total in central and eastern Africa, Amirante Islands, Sumatra, Borneo, etc. (Fig. 1). The duration of totality is  $2^m 12^s$ , and the sun's altitude about  $26^\circ$  on the African coast, which is to be occupied by Signor Horn d'Arturo. The Amirante Islands will not, apparently, be occupied, the meteorological conditions being unpromising.

Most of the parties will be stationed in Sumatra,

stood that this shift will be investigated by a party from Potsdam, stationed near Palembang, and by Prof. Miller of Swarthmore Observatory, who will use a coronagraph of 60-feet focus.

Several other parties from the United States will also go to Sumatra, representing the Observatories of Harvard, Mount Wilson, and Washington (Naval); the names of Messrs. Anderson, Littell, and Stetson have reached us as belonging to these parties.

Messrs. Vanderbilt and Voute are going from Java

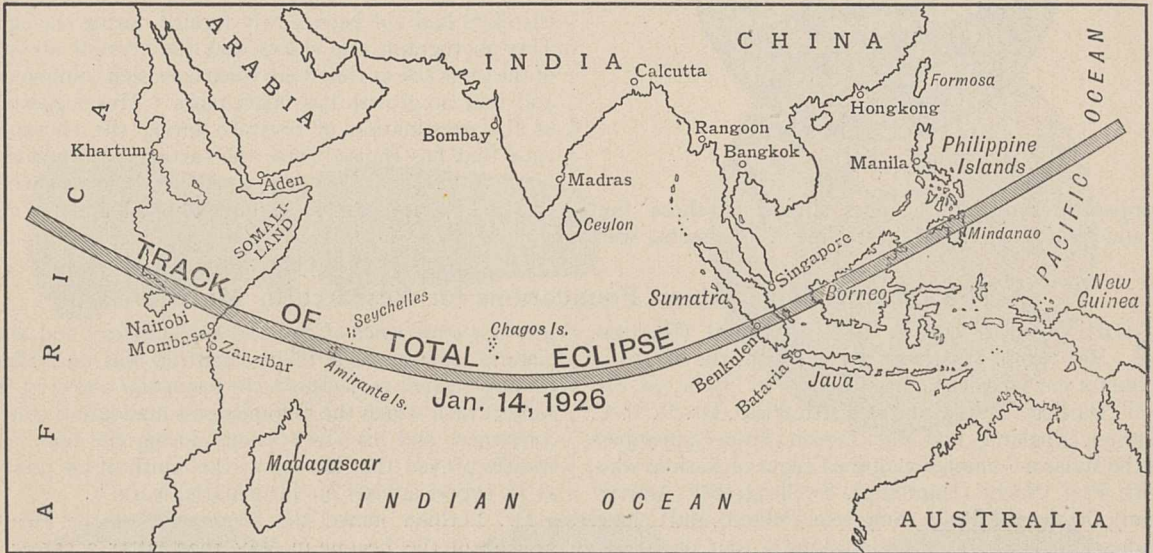


FIG. 1.—Map showing the track of the solar eclipse of January 14, 1926.

Emery Walker Ltd. sc.

where the duration of totality will be about  $3^m 13^s$ , and the sun's altitude  $54^\circ$ . Benkulen, on the west coast, is near the central line; the British party, consisting of Col. Stratton, Mr. C. R. Davidson, and others, will be stationed here. They will reach Benkulen via Palembang on the river Musi, the landing of heavy packages at Benkulen being difficult. They are taking two cœlostats and the Copeland coronagraph lens of 40-feet focus, which has seen service at several eclipses. Their work will be wholly on problems of solar physics, the "Einstein" shift being considered as sufficiently established in 1919 and 1922. It is, however, under-

to Palembang. There is no news to hand of any parties occupying the islands east of Sumatra. This is the second time that Sumatra has been visited by eclipse expeditions in the present century; there was a very long totality there in May 1901, when Sir Frank Dyson, among many others, made successful observations, though the weather conditions were not wholly propitious. There will be another totality in Sumatra (northern part) on May 9, 1929, with high sun and more than 5 minutes' totality. The island will then have a rest until March 18, 1988, which is a return of the Indian eclipse of 1898 after five saroses.

### Obituary.

PROF. JEAN MASSART.

BRITISH botanists will have learnt with regret of the death of Prof. Jean Massart, of the University of Brussels, which occurred somewhat suddenly at Houx, a little village on the Meuse, in August last. Prof. Massart had retired thither to recuperate, his health being possibly impaired by a long journey in Brazil with some of his students, followed by a strenuous lecture tour in America.

Born in 1865 at Etterbeek, a suburb of Brussels, Prof. Massart obtained his doctorate in science at the University of Brussels and became professor there in 1895. His early researches turned upon general biological problems, such as chemotaxy, pathologic

infection by micro-organisms, immunity, etc. From a study of the lower organisms, especially flagellates and fungi, he passed gradually to still more botanical fields of work. After the death of his former teacher, Prof. Léo Errera, he was nominated director of the Institut Léo Errera, and a great deal of his botanical work is published in the memoirs of the Institute. His early work upon the lower forms of plant and animal life has imparted a distinctive character to his recent text-book, the "Éléments de biologie générale et de botanique." Prof. Massart, however, is probably most widely known outside Belgium for his beautifully illustrated vegetation studies, especially of the polder country. His account of the recovery

of the vegetation in the devastated region of the Belgian battle front was referred to in *NATURE* (vol. 111, p. 97, Jan. 20, 1923).

During the War, Prof. Massart's outspoken comments upon the actions of his country's invaders led to his enforced departure, and he found refuge first in Holland and then in France. During this period he continued botanical work so far as possible, and also tried by various means to raise funds for the aid of necessitous fellow-countrymen, Red Cross work, etc. Prof. Massart was back in Brussels in January 1919, where the present writer found him busily engaged in re-establishing order in Institute and Botanic Garden. Students were gathering around him and further investigations were already projected or in progress.

A quiet, forceful personality, immersed in his scientific work and the interests of the students under his guidance, Prof. Massart's departure makes a gap in the ranks of Belgian botany that will not easily be filled.

J. H. P.

THE funeral took place in Paris on November 3 of M. Eugene Tisserand, for many years a most prominent figure in French agriculture. Born at Flavigny-sur-Moselle, he lived to the great age of ninety-five years. In 1850 he entered the recently founded Institut Agronomique at Versailles. After a distinguished student career he spent five years in visits to other countries, studying their methods of agriculture. On his return he set about the task of enriching large areas of poor agricultural land. After the war of 1870 he was appointed Inspector-General of Agriculture, and he commenced his great campaign in favour of the furtherance of scientific agriculture in France. In 1879 he was appointed director of the newly reconstructed Institut Agronomique. At the same time he

was Director-General of Agriculture. Under his directorship the study of agriculture spread rapidly, and he was instrumental in establishing new laboratories and institutes. In the little time he had to spare from administrative duties he was engaged in research, and among his chief publications are "Economic Studies of Denmark and Schleswig-Holstein," "Vegetation of High Altitudes," and "The Low Temperature Treatment of Milk." He was a member of the Paris Academy of Sciences and also of the Academy of Agriculture, of which he was president in 1911. For many years he was chairman of the editorial board of the *Journal of the Institut Agronomique*. For his services to agriculture he was awarded the Grand-Croix de la Légion d'Honneur. The passing of so notable a figure is a great loss to French agriculture.

WE regret to announce the following deaths:

Prof. J. Guiteras y Gener, professor of general pathology and tropical diseases in the University of Havana, president of the Cuban National Board of Health and a founder of the *Revista de Medicina Tropical*, whose name is associated chiefly with the campaign against yellow fever, aged seventy-three years.

Dr. George Reid, formerly medical officer of health to the Staffordshire County Council, who was known as an authority on sewage disposal with reference to bacterial filtration and as the author of "Practical Sanitation," on November 6, aged seventy-one years.

Canon C. H. Robinson, editorial secretary to the Society for the Propagation of the Gospel, formerly lecturer in Hausa in the University of Cambridge and the pioneer white man in Hausaland, on November 23, aged sixty-four years.

Prof. H. J. Waters, president of the Kansas State Agricultural College from 1909 until 1917, who was known for his work on the nutrition of farm animals, on October 26, aged fifty-nine years.

### Current Topics and Events.

THE death of Queen Alexandra on November 20, when within a few days of the end of her eighty-first year of age, has aroused world-wide expressions of regret and brought Great Britain and Denmark close together in sorrow at the loss of one whose memory will long be cherished with affection in both countries. From the moment when, as Princess Alexandra, she arrived in England in 1863 for her wedding with the Prince of Wales, to the day of her death, the Queen-Mother occupied a place in the hearts of British people which can never be filled again. She was loved by all, and her sympathy and active interest were always forthcoming for any institutions or organisations which worked to promote human well-being. It was through her that the Finsen light treatment was first introduced into the London Hospital, of which she was president. While on a visit to her native city of Copenhagen, she was so much impressed with the good results obtained there by the treatment of lupus by light that she presented a set of the apparatus to the hospital and thus initiated here the treatment of disease by light, which has now a recognised place in the domain of therapeutics. While Princess of Wales, and as Queen

Consort when the Prince of Wales ascended the throne under the title of King Edward VII. in 1901, her royal and beautiful attributes did much to mould the character of our national life. She identified herself with many progressive movements, and with King Edward in 1909 opened the Victoria and Albert Museum and the new buildings of the University of Birmingham. Though Queen Alexandra has now passed into silence, her life and influence will be remembered with pride for many generations.

BIRTHDAY congratulations are due to Prof. J. Ambrose Fleming, who will be seventy-six years of age on November 29. Son of that well-known divine, the Rev. Dr. James Fleming, he was born at Lancaster, November 29, 1849. He was educated in the first instance at University College, London, and at St. John's College, Cambridge, and early enjoying the advantage of study under Sir Edward Frankland at the old Royal College of Chemistry, almost the whole of Prof. Fleming's long working life has been devoted to teaching, in University College, the theory of electricity and magnetism, together with its manifold developments and, in addition, the industrial

applications arising therefrom. In 1879 he was scientific adviser to the Edison Telephone Company; later, he was associated with the Edison-Swan Company, actively engaged on the arc lamp, its accessories, and incandescent lighting in general. In 1899, when wireless telegraphy was forsaking the abstract, Prof. Fleming was helping the Marconi Company. The electrical resistance of metals and alloys constituted the basis of researches with the late Sir James Dewar. Prof. Fleming received the Albert medal of the Royal Society of Arts at the hands of the Duke of Connaught, in 1921, in recognition of valuable contributions to electrical science and its applications and specially of his invention of the thermionic valve, so widely employed in wireless telegraphy and telephony and for other purposes.

THE year's work of the Imperial Cancer Research Fund was reviewed at the annual general meeting held on November 19. It is as usual a record of solid unhurried progress towards elucidating the nature and modes of origin of cancer. A few years ago it was discovered by Japanese workers that malignant tumours of the skin could be produced with ease and certainty by the application of tar or some of its components; this made available a weapon of further inquiry of the greatest value which has been vigorously exploited in many directions. Thus in the present report we find that Dr. Cramer has shown that denervated skin responds less readily than normal, and Dr. Findlay demonstrates that a single application of hot tar may be followed months later by the development of cancer, reproducing in this way experimentally what had been suspected from human experience and observed in the branding of sheep. Other researches on the influence of one tar cancer in inhibiting the development of another are in progress: they indicate clearly that changes in the skin in one part of the body may alter the skin everywhere. The other main line of investigation arises through Gye's recent clarification of Rous's old observation that certain fowl tumours could be transmitted by extracts which contained no cells. The fundamental experiments are being repeated by Dr. Begg with chicken sarcoma and the venereal sarcoma of dogs at the Fund's new laboratories at Mill Hill, where the work is carried on in close association with that of Gye at the establishment of the Medical Research Council next door. It is too early to discuss such results as have been obtained, but it is clear that the new methods provide possibilities of analytical experiment which enable many old problems to be attacked in a fresh way. The progress of cancer research at the moment is satisfactory. The new knowledge is nowhere discrepant with the old but is enabling us to add together a number of apparently disconnected facts into a coherent tale. Not the least of the services rendered by the Imperial Cancer Research Fund is its maintenance by continuous propagation through animals of a number of animal cancers which are always available for use in its own laboratories and in any other responsible hands when a new idea crops up which needs experimental testing.

IN the *Lancet* of November 14 there is a paper "On the Specific Character of Malignant Neoplasia," by Dr. W. Blair Bell, professor of obstetrics in the University of Liverpool. This paper was the subject of an address given at the Toronto Academy of Medicine, and press reports announced the view that the author had made an important addition to the knowledge and cure of malignant growths. Dr. Blair Bell holds that malignant tumour formation is a specific growth process and is a reversion, on the part of a cell that is starving, to the nutriment-seeking proclivities of its ancestral type, the chorionic epithelium. With the co-operation of other workers Dr. Blair Bell has confirmed the observation of Gye and Cramer (1913) that in certain rapidly growing malignant growths there is a high phosphatide content, approximating to that found in the chorionic villi. Experimentally it was found that certain compounds of lead have a specific action on the chorionic epithelium leading to its death. From the chemical analogy between chorionic epithelium and cancer tissue, it was argued that lead might be expected to have a destructive action on the latter and such indeed it is claimed to have. A considerable number of cases of malignant growths have been treated and two of the successful cases are published by Dr. Blair Bell in some slight detail. Dr. Blair Bell hopes, however, that less toxic and more potent chemicals than lead will be discovered in further study.

THE controversy on the alleged transmutation of mercury into gold by Prof. Miethe still continues. It will be remembered that Prof. H. Nagaoka communicated to our columns (*NATURE*, July 18, p. 95) his production of ruby glass by means of a discharge between tungsten and mercury electrodes in paraffin oil, and also that E. Tiede, A. Schleede, and F. Goldschmidt (*Die Naturwissenschaften*, August 28, p. 745) failed to detect any trace of gold in mercury that had been treated by Miethe's method after it had been twice distilled in a high vacuum. The *Scientific American* (November 1925) now reports a similar failure from the experiments performed by Prof. H. H. Sheldon and R. S. Estey, of Washington Square College, University of New York. Initially, these workers used a specially constructed quartz-lamp provided with electrodes made of pure tungsten, and redistilled gold-free mercury obtained from a natural source. They operated the lamp for three separate runs, ranging from 30 to 50 hours, with voltage 170 and current strength 13 amp., and if Prof. Miethe's contentions are correct, they should have obtained at least ten times the amount of gold that could be detected by the analytical tests employed. The experiments were repeated, using an exact replica of Prof. Miethe's lamp, and following his *modus operandi* in every detail, but purified natural gold-free mercury was again employed. As no trace of gold was found in any of the tests, the authors suggest that the mercury used by Prof. Miethe was not sufficiently purified. In Germany, Prof. E. H. Riesenfeld and W. Haase have recently found that

ordinary mercury can only be freed from gold by repeated slow distillation *in vacuo*; according to them, all mercury on the market contains gold, and all the metal that has hitherto been used in transmutation experiments contained that element.

DR. F. GOLLA writes to say that he finds it difficult to understand how our correspondent, in remarking (*NATURE*, October 31, p. 660) upon the recent Harveian Oration by Sir Frederick Mott, has failed to appreciate the answer which "the lecturer himself gave and on which he laid great stress," to the question: What ontogenetic event coincides with the maturity at birth of the cells of Leydig? Dr. Golla then proceeds to quote at some length from the address: "Seeing that the male sexual hormones are active for probably more than six months in pre-natal and post-natal periods, it follows that this influence has been operating on all the somatic cells, including the nervous system, during this time. And, if there be an elective storage of the sexual hormone in the nervous system, as Steinach's experiments indicate, then a masculine behaviouristic tendency may thus early be engraven upon the nervous system. Moreover, by the sensitising influence of the testicular hormone, the primary male characters are thus early made dominant in all the bi-sexual somatic cells." A reference to Lillie's experiments and the pathology of sexual hypoplasia follows. What our correspondent commented upon was the ambiguity of Sir Frederick Mott's terminology and the looseness of his argument. To the term "ontogeny," morphologists attach a precise meaning which can scarcely be identified with a "behaviouristic tendency," masculine or feminine. A few showy experiments do not set aside the fact which a rapidly increasing morphological literature is forcing upon our notice, that knowledge of the interstitial cells of the ovary and testis is fragmentary and conflicting. "Great stress" is a poor substitute for amply substantiated fact.

THE situation in China continues to attract a considerable amount of attention and a number of articles in the November reviews deal with various aspects of the subject. Among them Mr. George W. Keeton's study of the psychology of the Chinese student in the *Nineteenth Century and After* may serve to dispel a number of popular delusions on the characteristics of the race. At the same time, the author places his finger on perhaps the most important differences between the student of the west and of the east when he emphasises the Chinese student's lack of intellectual initiative and his proneness to memorise rather than reason—a characteristic in which the Chinese does not stand alone among eastern peoples. Another article in the same review, on the anti-Christian movement, by the Rev. A. Chirgwin, is also necessarily much concerned with the student as being practically the only articulate class in present-day China. Mr. Chirgwin shows that although much of the anti-Christian propagandist output is crude and, in so far as it is inspired by Soviet Russia, anti-religious, it is not so much the product of intolerance

as of an attitude based on a patriotic belief in Chinese culture with its long and creditable history of achievement. Against this is opposed a Christianity which, to the Chinese mind, represents in its past history and present performance an agency bringing interference with Chinese culture and ideals, western imperialism, and exploitation. This opinion is strengthened when the Chinese review the history of Christianity in the west, their judgment in this matter being strongly coloured by the critical point of view adopted by Mr. Bertrand Russell in his lectures delivered in 1922.

INTERESTING sidelights are thrown on the influences at work in present-day India by an article on "Orthodox Hindu Women," by Cornelia Sorabji, which appears in the *Empire Review* for November. The author gives a sympathetic account of the training of the Hindu girl with its insistence on the importance of caste and of marriage in the life of a woman. The resulting orientation of the female mind is entirely in the direction of the absolute acceptance of the complete subordination of the purpose of womanhood to the well-being of the soul of her husband after death and of the souls of his male forebears. This leads on one hand to the status of the wife being made dependent on the birth of sons who may inherit and thus carry on the cult, on the other hand, to the devotion of the widow, since the suppression of *suttee*, to ceremonial observances for the benefit of her late husband. The broader significance of this mental attitude is its indication of the almost complete preoccupation of the orthodox who form the majority of the Hindu population with religious rather than political matters. The position of "progressives" in these matters is delusive. The door has closed behind them; for the bulk of the population religion is still the dominant factor, and not negligible, as might be thought from a superficial view based upon the departure of the Progressives from certain observances, such as that by which the age of marriage has been raised. The successful suppression of a custom so fundamental psychologically as *suttee* is an indication of what has been possible in the past by the exercise of tact and informed judgment rather than force. Sympathetic knowledge of Hindu orthodox psychology is no less essential in dealing with the situation to-day, though this seems in danger of being overlooked.

THE November issue of *Scribner's Magazine* opens with a well-reasoned and temperate statement of the position of the American man of science in the evolutionist controversy by Prof. E. G. Conklin, who holds the chair of biology in Princeton University. His conclusions that the universality of natural law has not destroyed faith in God, that science leaves us faith in the worth and dignity of man, and that science gives us hope for the future, together with the arguments which lead up to these conclusions, are, in the main, such as will be familiar to those who have traced the development of thought on this subject in Great Britain. To English readers, however, the chief interest of Prof. Conklin's article lies in the exposition, thoroughly fair-minded, of the Fundamental point of view and the causes which have

strengthened this obscurantist movement in the United States. Among these causes, one of the most potent is undoubtedly the fact that the name of science has been taken in vain in recent years to justify license masquerading as freedom of development, moral laxity, and other social changes of an undesirable character, in a way that has brought the true spirit of scientific inquiry into disrepute with the uninstructed and narrower section of the population.

THE Cast Iron Research Association has now entered on the fifth year of its existence, and the report on its fourth year's working has just been published. The Association has a small central laboratory in Birmingham, but most of its investigators work in university or other public laboratories, or in the foundries of some of the component firms, often dividing their time between the foundry and the laboratory as the nature of the experiments demands. The programme of researches in hand is an interesting one, and although the record of definite scientific results is small in comparison with that of some other associations, this is largely to be accounted for by the fact that the industry formerly gave little attention to research, whilst problems of immediate practical importance were pressing for solution, and engaged the first efforts of the new body. Useful help has been given to the industry, and the investigators are now in a position to undertake more definitely scientific work. The determination of the ternary equilibrium diagrams which cover the range of composition of the cast irons has been begun at the National Physical Laboratory, and the results should assist materially in the control of the structure of cast iron. Reports on the progress of foundry methods in Germany have been issued to members, and the Association's Bulletins, containing full abstracts of technical literature and occasional longer articles on the theory and practice of foundry work, furnish another reason why it should receive the support of the industry.

AT the International Conference on Sleeping Sickness held in London during May last, it was unanimously resolved by the delegates to recommend to the Council of the League of Nations and to their respective governments to form a small international commission for the investigation of sleeping sickness in Africa (NATURE, June 27, p. 985). It was estimated that the expenses of such a commission would be about 10,000*l.*, and contributions were to be invited from the respective governments, the Health Organisation of the League of Nations, and scientific research institutions of certain countries. It was proposed to pursue investigations in Uganda and the regions adjacent to Lake Victoria, and the laboratories at Entebbe have been placed at the disposal of the commission. We now learn from the Geneva correspondent of the *Times* that the British Government has informed the Secretary-General of the League of Nations that it is ready to contribute a sum not exceeding 3050*l.* to the general expenses of the commission. The Belgian Government has already put at the disposal of the commission a sum of 100,000 francs, the Spanish Government 5000 pesetas,

and France the sum of 50,000 francs in the name of the administration of French Equatorial Africa and the French Cameroons.

CONSIDERABLE interest has been aroused by the announcement in the *Observer* of Sunday, November 22, of the discovery by Dr. Robert A. Millikan, director of the Norman Bridge Laboratory of Physics of the California Institute of Technology, Pasadena, of "ultra" X-rays of great penetrating power. It will be remembered that Dr. Millikan gave a series of three lectures at University College, London, in June 1924, and an abstract of the lectures, prepared by Dr. Millikan himself, was printed in our issue of July 26, 1924, p. 141, under the title of "Atoms and Ethereal Radiations." The last of the lectures dealt with "The Penetrating Radiations of the Upper Air" and it would seem that the recent announcement refers to a continuation of the work described in this lecture. In conjunction with Mr. I. S. Bowen and Dr. Russel Otis, measurements were made of the ionisation of the upper air by means of sounding balloons, during aeroplane flights and finally on top of Pike's Peak (14,100 ft.) in Colorado. The conclusion reached from the latter experiments was that the whole of the radiation measured in the closed vessel used was of local origin and that "there can exist no such penetrating radiation" of cosmic origin as had been suggested by Kolhörster's work on the ionisation of the atmosphere. Dr. Millikan's new results are referred to as showing the existence of radiation of wave-lengths shorter than the  $\gamma$ -rays and capable of penetrating 6 ft. of lead. The publication of his results will be awaited with great interest.

IN consequence of the death of H. M. Queen Alexandra, the anniversary dinner of the Royal Society on November 30 has been cancelled.

THE eighth annual Streatfeild memorial lecture will be delivered at the Finsbury Technical College, Leonard Street, E.C.2, at 4 o'clock on Thursday, December 3, by Mr. F. H. Carr. The subject will be "The Scientific Basis of Industry."

THE second Röntgen Award of the Röntgen Society has been made to Dr. Robert Knox for his paper entitled "The investigation of the movements of the heart by the use of the slit diaphragm and the moving film," which he read before the Society during the course of the past session.

THE Council of the Royal Meteorological Society has awarded the Symons Gold Medal for 1926 to Lieut.-Col. Ernest Gold, assistant director of the Meteorological Office. The medal is awarded for distinguished work in connexion with meteorological science, and will be presented at the annual general meeting on January 20.

MR. L. C. M. S. AMERY, Secretary for Dominion Affairs and the Colonies, stated in the House of Commons on November 23 that the Governments of the East African Territories are prepared to grant sufficient funds to enable the Amani Research Institute in Tanganyika Territory to be reopened. The

necessary capital expenditure in this connexion can be found from the proposed guaranteed loan, for which a Bill will in due course be laid before Parliament. His Majesty's Government is, he said, fully alive to the importance of Amani for the future development of East Africa.

THE July number of the *Australian Museum Magazine* urges the need for additional building. The exhibition galleries are congested, the lecture-room should be doubled in size to accommodate all who desire to attend, and there is an entire lack of space for research students. It is sixteen years since additions were made to the building, and during that time the population of Sydney has increased from 600,000 to more than a million. To judge from this most attractive magazine, the Australian Museum is appealing on the best lines to the intelligent lay public of the Commonwealth, and it thoroughly deserves public support.

MESSRS. W. Heffer and Sons, Ltd. (Cambridge), have in the press "The Nature of Tumour Formation," by Dr. G. W. Nicholson. The work embodies the Erasmus Wilson lectures of 1925, and seeks to

correlate the knowledge of the cellular changes which result in tumour formation with the established facts of biology and physiology, and to show that, although the etiology of tumours is still obscure, there is evidence that it is to be sought for in extrinsic causes.

MESSRS. George Allen and Unwin, Ltd., have in the press "University Reform in London," by T. Lloyd Humberstone, giving an account of the establishment of the university and of the controversies which preceded its reconstruction as a teaching university in 1900. It will deal with current questions of university politics, including the reconstitution of the Senate, the policy of incorporating colleges in the University, and the site question. The work has an introduction by Mr. H. G. Wells.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A principal for Rutherford Technical College—Director of Education, Education Office, Newcastle-upon-Tyne (December 12). Junior scientific assistants in the Engine Research Section, Royal Aircraft Establishment—Superintendent, Royal Aircraft Establishment, South Farnborough (December 19).

### Our Astronomical Column.

THE DETONATING FIREBALL OF SUNDAY, NOVEMBER 15.—A splendid fireball which gave a vivid illumination and, a few minutes later, a thunder-like detonation, was seen on the early morning of November 15 at 2<sup>h</sup> 40<sup>m</sup>. It was observed from many places in the eastern counties, and several descriptions came from London and its suburbs. At Caterham, Surrey, it left a brilliant train of sparks, and a loud report as of an explosion was heard shortly afterwards. At Bletchingley the object threw a strong light through a green curtain, and the moving shadows of the window frame showed the direction of the flight to be from S.W. to N.E. At London, E.C., the duration of the object was estimated as 3 seconds, and the interval between the outburst of light and the thunder-like sounds was the same (3 minutes) as at several other places. A resident near Uxbridge, Bucks., noticed the brilliant light through his window-blind and the noise, as of a distant explosion, 2½ minutes later. At some places houses were shaken and birds and animals much startled by the vibration and suddenness of the visitation, which might have been mistaken for an earthquake had not the light of the blazing meteorite proved its real character.

It was thought that the object was one of the Leonids, as the date conforms with that of this shower's return, but the direction of its motion from the S.W. proves that it belonged to some other stream than that of Leo, the latter constellation being in the east by south at the time of the meteor's appearance. It was a fine Taurid and a member of a system which annually supplies us with some brilliant detonating meteors between about November 15 and 25. The observations already to hand are not sufficiently precise to enable the real path of the fireball to be accurately determined, but its height was approximately from 62 to 30 miles over Hampshire and across the northern limits of Surrey and southern boundaries of Middlesex. The velocity was about 17 miles per second, and the detonations seem to have occurred over the neighbourhood of Hounslow.

TWO NEW COMETS.—Comet 1925 *j* was discovered by Prof. Van Biesbroeck at the Yerkes Observatory on November 17, at 11<sup>h</sup> 31·9<sup>m</sup> Univ. T., in R.A.

11<sup>h</sup> 56<sup>m</sup> 32·6<sup>s</sup>, N. Decl. 34° 55' 8"; magnitude 8. The news was circulated in London by the British Broadcasting Company the following evening, and Dr. W. H. Steavenson found the comet the same night as a result of sweeping in Canes Venatici, which was the only clue to the position given by the B.B.C. His position was Nov. 18<sup>d</sup> 2<sup>h</sup> 46·6<sup>m</sup> Univ. T., R.A. 11<sup>h</sup> 57<sup>m</sup> 2·70<sup>s</sup>, N. Decl. 34° 41' 51·2". Both positions are for the equinox of 1925·0. The deduced daily motion is +47·4<sup>s</sup> in R.A., -20·91' in Decl.

Dr. Steavenson stated that there was a nucleus of magnitude 11, and that the coma had a parabolic outline, being extended in position angle 310°. Clouds have prevented further observations in England, and none has been received from abroad, so material for the orbit is still lacking. Assuming uniform motion, the position on the morning of November 28 will be R.A. 12<sup>h</sup> 5<sup>m</sup>, N. Decl. 31° 13'.

Comet 1925 *k* is of magnitude 7 or 8, and was first found by Mr. Peltier, of Delphos, Ohio; Nov. 14<sup>d</sup> 0<sup>h</sup> 12<sup>m</sup> Univ. T., in R.A. 15<sup>h</sup> 25<sup>m</sup> 0<sup>s</sup>, N. Decl. 44° 0'.

Mr. Wilk found it independently in Poland; Nov. 19<sup>d</sup> 17<sup>h</sup> 10·0<sup>m</sup> U.T., in R.A. 17<sup>h</sup> 18<sup>m</sup> 28<sup>s</sup>, N. Decl. 33° 4'. It was apparently observed the following night at Cracow, as Prof. Banachiewicz telegraphed that the daily motion was +14<sup>m</sup> 24<sup>s</sup>, South 2° 27'. A further observation by Herren Guthnick and Prager has since been received: Nov. 18<sup>d</sup> 17<sup>h</sup> 42·6<sup>m</sup> Univ. T., R.A. 17<sup>h</sup> 1<sup>m</sup> 37<sup>s</sup>, N. Decl. 35° 28' 20"; daily motion +17<sup>m</sup> 20<sup>s</sup>, South 2° 30'. From these data the following very rough orbit has been deduced, the elements being referred to the equator, not the ecliptic.

$$\begin{array}{r} T \text{ 1925 Dec. 4.29 U.T.} \\ \omega' \quad 124^\circ \quad 49' \\ \Omega' \quad 132 \quad 25 \\ i' \quad 128 \quad 56 \\ \log q \quad 9.8960. \end{array} \left. \vphantom{\begin{array}{r} T \\ \omega' \\ \Omega' \\ i' \\ \log q \end{array}} \right\} 1925.0$$

There are now ten comets observed, the perihelion passage of which lies in 1925, thus equalling the record of 1898. If the perihelion passage of 1925 *j* lies in 1925, the present year beats all previous records.

### Research Items.

THE ANCIENT INHABITANTS OF CALIFORNIA.—Mr. A. L. Kroeber's long-expected study of the Indians of California is now published as Bull. 78 of the Bureau of American Ethnology. It contains a detailed study of some fifty tribes. In the concluding chapters Mr. Kroeber gives some attention to ethnological questions of a broader character. Of these the one of most general interest deals with the archaeology of California. The most important sources of information bearing upon the early inhabitants are the shell mounds found in several parts of the State, but investigated with most profit in the Santa Barbara area and San Francisco Bay. The antiquity of the mounds has been calculated in various ways, such as the extent to which they have been submerged by subsidence of the shore, the rate of deposit on the basis of an assumed population, the cubic contents of the mound, and the quantity of shell or wood ash mixed with the other material. These concur in pointing to an antiquity of about 3000 years for the first settlers. In cultural areas the subdivisions are constant. It is evident that the culture of the general Californian area was formed a long time ago and has remained constant ever since. During the whole shell mound period the culture remained identical in implements and utensils, in food, and in religion, the last being indicated by the charms found throughout the strata of the mounds. This permanence of Californian culture is of more than local interest. It contrasts with almost every other area in the world, while even in North America, in the Atlantic, and Mississippi regions, decisive evidence has been found of two, or several, distinct cultures in each area.

IMPLEMENTS OF THE EXTINCT ADELAIDE TRIBE.—In *Man* for November, Dr. H. Basedow discusses the purpose of certain unrecorded stone implements from South Australia to which both he and Dr. T. D. Campbell, independently, have directed attention recently. Specimens have been found at Port Noarlunga, Normanville, and Woodville, west of Adelaide. They are of blue, brown, or banded clay-slate, in general form a flat segment approximately equal to or greater than a half circle. The edge representing the chord is either straight or notched, and sharpened. Dr. Campbell suggests that they may be sacred objects akin to the stone "churinga" of Central Australia, partly on the ground of form, partly because they show certain incised markings and traces of red ochre. Dr. Basedow, however, considers that the markings are due to scratching in the making, and thinks the implements are scrapers. He relies upon information obtained from an old native of the Murray River. The tribes in the area in which these implements are principally found, the southern coast and Rapid Bay, served as a connecting link between the natives of Adelaide and the Murray River. The implement must therefore have been known to all the tribes between those two areas. According to his informant, the implements were used exclusively for scraping fat and fleshy tissue from the opossum skin used for rugs. The skin was laid over a cylindrical rod held vertically and drawn tight, the convex edge of the scraper being laid on the skin and used in a downward direction. The advantage of the concave notch for this purpose is obvious.

ETHNOLOGY OF NORTHERN AFRICA.—Some interesting and suggestive conclusions relating to the ethnology of North Africa were put forward by Mr. Francis Rodd in a paper on "The Origin of the Tuareg" read at the Royal Geographical Society on November 16. There are among the indigenous peoples of North

Africa—for whom the name Libyan, first used by Herodotus, is preferable to that of Berber—certain nomads inhabiting the Sahara, some of whom are known by the Arab name of Tuareg. Of this race there is little known that is authoritative. They live principally by means of and on camels. Of their numerous peculiarities the best known are their intractable character, the veiled faces of the men, and the freedom of their women. Although Moslems, they retain matriarchal customs from which good Moslems would be averse. The usual statement that racially they are Berbers or Libyans conveys little. Three physical types can be distinguished among the Libyans: (i.) a tall dolichocephalic type with narrow face; (ii.) a short dolichocephalic type with broad face, obviously related to Cro-Magnon man; and (iii.) a short brachycephalic type with short, broad face. The Tuareg belong to the first of these. No nomads occur in the second and third groups, this mode of life apparently being a racial characteristic. The second type is probably that which is the prototype of the race responsible for the agricultural people who predominantly populate North Africa. Egyptian records of the invasion of the Nile Valley by the Libyans in the eighteenth and nineteenth Dynasties suggest that the Tuareg are to be identified with the Temahu and Tehenu of those invasions. The Tuareg type displays certain Nordic characters which may therefore be tentatively explained by attributing to them a northern origin due to the racial movements which took place at the beginning either of the Bronze Age or of the Iron Age, and of which the invasions of the Nile Valley from the west at various periods were a result.

THE STRUCTURE OF PROTOPLASM.—Prof. Josef Spek of Heidelberg summarises briefly in *Die Naturwissenschaften* for October 30 the change in the attitude of the investigator towards this problem. No longer is there an attempt to find, with improved microscopic methods, an ultimate unit of living matter, or to resolve all protoplasmic structure upon a "foam" structure, such as advocated by Bütschli. Microdissection experiments, experiments with centrifugal force, etc., have led to the recognition that the plasma may vary in consistency from fluid to solid gel, and that both types may coexist in different parts of the same cell. Spek reviews the results obtained by studies of transparent infusoria in the dark field illumination, when these organisms are subjected to various external solutions, and shows that for many protoplasmic masses, but not all examined, the evidence supports the presence of an emulsion of very fine dispersed watery droplets in another continuous phase. He illustrates the manner in which these droplets can be brought readily within the limits of vision by treatment with salts near that end of the "lyophile" series which indicates great activity in producing precipitation. Spek shows that in emulsions of various immiscible liquids a similar microscopic dispersion of one phase within the other takes place, e.g. of glycerin in olive oil, water in aniline, etc. The physical chemistry of such a distribution is not clear; either one substance disperses through the other by methods that are non-molecular but in the form of particles that are colloidal and even of microscopic visibility, or it dissolves in the dispersing medium and afterwards comes again out of solution.

THE SARGASSO SEA.—In the *Geographical Journal* for November, Capt. C. C. Dixon gives the results of many observations on the amount, extent, and condition of weed in the Sargasso Sea at various seasons.



He shows on a map that the extent of the Sea is approximately between lat.  $15^{\circ}$  and  $40^{\circ}$  N., and between the West Indies and long.  $35^{\circ}$  W. Within this area weed occurs. By adopting a scale from 1 to 10 he has been able to map the distribution of weed, while on several occasions he conducted experiments to determine the amount of weed per square nautical mile. From this he estimates that in the whole area of the Sargasso Sea there are about twenty million tons of weed. If the supply comes from the Caribbean Sea, as seems probable, it must come mainly through the Straits of Florida, where estimates show that about five million tons pass in a year. These estimates would suggest that the weed in the Sargasso Sea cannot all die and be replaced in less than four years. The state of the weed appears to be a question of locality rather than season or sea temperature, for most of the dead weed is found in the warmer waters, while the freshest weed is on the north-western side of the Sea nearest to the source of supply. Capt. Dixon contends that from past records there is evidence that the weed-strewn area is decreasing in extent or changing its position, but the evidence for this conclusion is somewhat slender.

ARGON IN LIVING CELLS.—The presence of argon in living cells has been shown by the experiments of Amé Pictet, W. Scherrer, and L. Helfer, described in the *Compte rendu des Séances de la Société de Physique et d'Histoire Naturelle de Genève*, vol. 42, No. 2, 1925. The authors proved that the small quantity of argon they found in the fermentation of glucose came from the yeast. It was roughly estimated by distillation in a vacuum and by passing the gases over heated copper oxide. The nitrogen evolved contained about 3 c.c. of argon for 10 grams of yeast. Bullock's blood and sheep's brains on similar treatment yielded slightly higher proportions of argon. The exact origin of this argon has yet to be found.

VEGETATIVE PROPAGATION OF RUBBER.—The *Malayan Agricultural Journal*, September 1925, reproduces fully Dr. Heusser's important report upon the experimental tapping of Hevea budded trees. Dr. Heusser's work has now progressed so far as to lead him to recommend firmly the budding from selected stock instead of the planting of seedlings. If budding methods prove successful, this advice almost inevitably follows, as it permits of a plantation in which a few "clones," that is, trees all propagated vegetatively from one common stock, give a uniform grade of produce, instead of the variable yield and quality obtained from a plantation consisting of seedlings. Thus gradually tropical agriculture may be expected to follow along the lines which cultivation has followed in the Old World and in North America.

ENTOMOLOGICAL ANALYSES OF TREES.—In the *Bulletin of Entomological Research* for October 1925, Dr. Ivar Trägårdh, of the Swedish Forest Experiment Station, has an interesting paper on this subject. The forest entomologist, examining dead or dying trees, is confronted with the problem of the species responsible for the attack, and why particular trees should suffer while their neighbours of the same species are left untouched. These points are vital in that if we know exactly what type of tree is liable to be attacked by a certain insect, it opens up the possibility of prevention by the aid of improved forest management. In order to obtain the requisite information, Dr. Trägårdh is of opinion that two things at least are necessary: first, an extensive series of analyses of felled dead or dying trees, recording the ways in which different species of insects succeed one another, the nature and extent of the injuries they occasion,

and the position of such species in the tree; secondly, experimental plots for the purpose of watching the attacks from their initiation. By combining the results obtained by these two methods, with a thorough analyses of ecological factors, it is hoped that we shall eventually be in a position to formulate better-founded opinions respecting the activities of injurious forest insects.

FIBRE FROM PINEAPPLE LEAVES.—Messrs. R. O. Bishop and E. A. Curtler have some interesting notes upon the experience of the Department of Agriculture, Malay States, in preparing fibre from the leaves of *Ananas sativus*, of which some 20 tons were shipped from an  $8\frac{1}{2}$ -acre plantation in which pineapples were grown for the canneries (*Malayan Journal of Agriculture*, September 1925). So far as could be judged, this amount of leaf stripping had no appreciable effect upon the plantation. The 20 tons of fresh leaves only gave some 4 cwt. of fibre, but the fibre appears to be of high grade, fine in staple and lustrous, and with a fine silky texture. The leaf was stripped in a raspador machine designed to treat sisal, and the fibre required further washing and scraping with a blunt knife. Its commercial utilisation would depend upon a more suitably designed machine, but in view of the comparatively small leaves with low yield of fibre, the authors conclude that whilst fibre can be obtained from the leaves as a by-product in canning the fruits, it is extremely doubtful whether the process would be profitable commercially.

PERMIAN INSECTS.—Dr. R. J. Tillyard continues his work on the Permian insects of Kansas (*Amer. Journ. Sci.*, 9, 1925, p. 328, and 10, 1925, p. 41) and Australia (*Proc. Linn. Soc. N.S. Wales*, 49, 1924, p. 429). The earliest remains of beetles hitherto known are of Triassic age. In the Upper Permian of Belmont, New South Wales, numerous elytra of beetles have now been discovered, and include a form (*Protocoleus*) which differs in important respects from all known Coleoptera; for this genus a new order (*Protocoleoptera*) is proposed and is regarded as the forerunner of the Coleoptera, and as intermediate between the Carboniferous *Protoblattoidea* and the true Coleoptera.

SWEDISH TRILOBITES.—A monographic account of the trilobites of the Leptæna limestone of Dalarne is given by Miss Elsa Warburg (*Bull. Geol. Instit. Upsala*, 17, 1925). The fauna is a rich one, and includes about 120 species or varieties of trilobites. It is of interest to British geologists from its resemblance to the Upper Ordovician faunas of Keisley and Kildare. The Leptæna Limestone is a reef rock found in the neighbourhood of Lake Siljan. The author concludes that it was formed during two periods separated by a time during which no reef building took place; so that there is a Lower and an Upper Leptæna Limestone, and it is the latter which seems to represent the limestones of Keisley and Kildare. The systematic part of this memoir is preceded by a discussion of the morphology, classification, and affinities of trilobites.

TILTING OF THE GROUND AT THE HAWAIIAN VOLCANO OBSERVATORY (KILAUEA).—Mr. R. H. Finch has contributed a preliminary note on this subject to the *Volcano Letter* (October 8, No. 41) of the Hawaiian Volcano Research Association. In addition to the diurnal and seasonal tilts which follow closely the diurnal and seasonal temperature changes, there is a much more distinctly marked tilt in connexion with volcanic activity. From 1913 to 1919–20, there was a gradual rise of 600 feet in the mean lava level. This was accompanied by a gradual swelling of the mountain-top as shown by the north-east tilt of

the observatory seismographs. The re-levelling of the ground from the sea-level showed that the height of the observatory had increased by more than a foot between 1912 and 1921. From 1919-20 to 1924, the lava column gradually sank, and, with this sinking, there was a rapid south-west tilt of as much as  $1' 32''$  during the three years 1922-24. Re-levelling from the observatory to two points near Halemaumau showed that one point had sunk five feet and the other nine with respect to the observatory, which itself had undoubtedly sunk several inches.

**ECHO SOUNDING IN THE PACIFIC OCEAN.**—The method of echo sounding has been illustrated by the voyage of the U.S. destroyer *Stewart* across the Atlantic, through the Mediterranean, across the Indian Ocean and into the Pacific. Profiles of depths have been published by the Hydrographic Office of the Navy Department at Washington. When steaming on a north-westerly course between Manila and Hongkong, a rapid decrease of depth from 2140 to 300 fathoms was recorded at five-minute intervals over a distance of nine miles. After passing the bank into deeper water again, the course was turned sharply to south, then east, then north-west again so as to obtain further soundings. It is evident that the method of echo sounding is of very great value for detecting and surveying hitherto unsuspected shallows. In the Pacific and Indian Oceans it is of further interest in connexion with Darwin's theory of upgrowing coral reefs on subsiding foundations. Fuller details and a map of the Stewart Bank in lat.  $17^{\circ} 16' N.$ , long.  $118^{\circ} 34' E.$ , are given in an article by Prof. W. M. Davis, of Harvard, in *Science* for October 30.

**WEATHER IN THE WEST INDIES.**—The annual summary of the weather for 1924 by Mr. Oliver L. Fassig, meteorologist in charge of the West Indies and Caribbean Service, in co-operation with the Weather Bureau of the U.S. Department of Agriculture, has recently been issued. For the first time during the last four years, since the establishment of the West Indies Climatological Service, the total annual rainfall for the section as a whole was above the normal; the average rainfall was 66.67 in., or 7.39 in. above the normal. The result is based upon reports from more than 500 stations. The rainfall on the whole was well distributed through the year. The areas of lightest rains, about 30 in., are the Bahamas and Turks Islands in the north, and the Islands of Curaçao, Aruba, and Bonaire off the coast of Venezuela. The areas of heaviest precipitation are the Central American States from Costa Rica to Guatemala, with annual amounts varying from 118 in. to 147 in. The number of days with appreciable rainfall varied from 64 in the Bahamas to 212 in Nicaragua. The average temperature in 1924 for the entire section was  $78^{\circ}.7 F.$  or  $0^{\circ}.9$  above the normal; temperatures are said to have been above the normal for every month of the year. Two hurricanes passed over the Lesser Antilles during August; the storm of August 27-31 was one of the most destructive in recent years, doing much damage along its path, while in the Virgin Islands the estimated wind velocity was more than 100 miles per hour during the night of August 28-29.

**ATOMIC STRUCTURE.**—The November issue of the *Philosophical Magazine* contains a paper by Sir E. Rutherford and Dr. J. Chadwick describing their experiments on the scattering of  $\alpha$ -particles by light elements like aluminium and magnesium and by heavy elements like gold and uranium. The velocities of the  $\alpha$ -particles were varied by interposing sheets of

mica in the paths of the rays, and the number of particles scattered at an average angle of  $135^{\circ}$  was counted. No divergence from the scattering deduced on the assumption that the inverse square law of repulsion holds within the atom could be detected in the cases of gold, platinum, silver, copper, and uranium, but in aluminium and magnesium the number scattered in the observed direction for speeds of the  $\alpha$ -particles, giving them ranges of about 5 cm. in air, was considerably less. This decrease was confirmed by measurements of the scattering at  $90^{\circ}$ . The authors consider that these facts point to the central nuclei in the aluminium and magnesium atoms being surrounded by a shell of negative charges beyond which is a further shell of positive charges.  $\alpha$ -particles which penetrate the outer shell are repelled by a field due to the difference of the nuclear positive and the negative shell charges, and are therefore less scattered than those which do not approach the centre of the atom so closely.

**A NEW WESTON CELL.**—The preparation of a reproducible Weston cell with a low temperature coefficient is described by W. C. Vosburgh in the *Journal of the American Chemical Society* for October 1925. The reduction in the temperature coefficient is effected by introducing tin, lead, or bismuth into the cadmium amalgam electrode. The presence of tin caused an increase from 1.01805 volt to 1.01901 volt at  $25^{\circ}$ , while the temperature coefficient was reduced to about two-fifths that of the Weston cell. Lead gave a cell of electromotive force 1.01918 volt at  $25^{\circ}$ , but the temperature coefficient was greater than that of the cell containing tin. The introduction of bismuth changed the electromotive force of the Weston cell to 1.01976 volt at  $25^{\circ}$ , the temperature coefficient being positive and equal to the negative coefficient of the cadmium-tin amalgam electrode. The values of the electromotive force were constant over the periods of time during which they were examined.

**THE SEPARATION OF SILVER FROM HALOGEN COMPOUNDS BY STRONG ILLUMINATION.**—Experiments to show that silver is separated from its halogen compounds by light, without the use of a photographic developer, are described by P. P. Koch and H. Vogler in the *Annalen der Physik* for September. Most of the work was done with silver bromide, which was used either in a fine powder or in a gelatin film shaved off from a soaked photographic plate; a number of these films were piled on one another to make a small slab to be placed in the Debye-Scherrer camera. When the preparation was made in red light the ring system, obtained by passing X-rays through it on to a photographic film, showed in both cases the simple cubic lattice of silver bromide as described by Wilsey, with lattice constant  $a = 2.89 \times 10^{-8}$  cm. When the silver bromide was exposed to strong light before being placed in the camera, the ring system of silver was superposed on that of silver bromide, and when the silver bromide was removed from these preparations by an acid fixing bath, the ring system of silver alone was produced. The dimensions of the minute silver crystals, as determined by the breadth of the rings, were more than 24 Å.U., so that it appears that the silver crystallises round a comparatively small number of "buds," formed at the commencement of the illumination. It is shown that 31 per cent. of the silver in the plate was separated out by strong illumination. The X-rays used did not separate an appreciable quantity of silver from silver bromide, but this was not true of silver chloride. No silver was separated from silver iodide by the action of light,

The Chemistry of Painting.<sup>1</sup>

IT is noteworthy that the modern oil picture is apt to darken, or lower in tone, while, on the other hand, not only the oil pictures of the fifteenth century, but also in many cases the oil pictures of later schools, such as the Dutch school, have altered little from the day they left the studio. It must not be supposed that all modern pictures suffer equally from this defect; some artists have successfully avoided it, but in other cases the lowering of tone has been very serious.

An examination of the information to be obtained from old manuscripts describing painting methods from the twelfth century up to the time of Vasari is in favour of the view not only that oil was used as a medium throughout this period,—at any rate in the north,—but also that there is no suggestion of any special mystery in the nature of the medium itself. The oils used were linseed and walnut, and, later on, poppy; and the methods of preparation and purification did not differ widely from those used to-day, but when exactly repeated, they do not yield an oil which enables the difficulties of the modern painter to be overcome.

When we turn from the oil to the pigments, we find that many of the pigments used to-day are those which have been used throughout the history of painting, and many modern pigments are undoubtedly preferable to those used in earlier times, and are more permanent. We are driven to the conclusion that the troubles of the modern artist are due not to his materials, but his methods, and are, moreover, due not to his pigments, but to the medium in which the pigments are ground, namely, oil. It therefore becomes necessary to study carefully, not so much the chemical as the optical properties of oil, and the optical principles underlying oil-painting.

Pigments can be regarded as if they are little particles of coloured glass, and their apparent opacity is due to their high refractive index. It therefore follows that when ground and mixed with a medium like oil, which has a fairly high refractive index, their so-called opacity will depend upon their having a much higher refractive index than oil.

The oil painter then must know the comparative opacity of his pigments, and such a table has been prepared by Prof. Laurie, by grinding the pigments in liquids of higher and higher refractive index until they proved transparent by transmitted light under a  $\frac{1}{4}$ -in. objective. White lead, for example, ground in bromonaphthalin is found to consist of transparent doubly refractive crystals, thus confirming the researches of Green under high pressure. In this table the pigments are arranged not only in order of opacity, but also according to their position in the spectrum, from red

to blue. In order to understand the reason for that double grouping it is necessary to consider the properties of the linseed oil film. The dry film in oil in course of time becomes yellow, and also gradually increases in refractive index. The yellowing of the oil will obviously affect pigments at the blue and green end of the spectrum more than those at the red and yellow end; and the slow rise in refractive index will make the more transparent pigments deeper and more translucent in tone than the more opaque.

The pigments of the artist's palette can be divided roughly into two groups—those to be used for solid painting and those to be used for glazing. For example, cobalt blue is in itself a permanent pigment, but it consists of transparent blue particles; consequently the light penetrates deeply into a mixture of cobalt blue and oil, and if such a mixture be painted on thickly, the yellowing of the oil will finally result in cutting out the whole of the reflected spectrum, the mixture of oil and cobalt blue therefore becoming black.

Early methods of oil-painting as revealed by certain unfinished pictures—such as the two unfinished Michael Angelos in the National Gallery—illustrate these principles. Starting with a white gesso, the light and shade were put in in tempera, the white gesso being kept for the whites, and in some cases even colour was laid on in tempera—the modelling, for example, of a robe being done in bright red on the white gesso. The egg or size medium, being of low refractive index, gave the full value to the brilliancy of the pigments, and also has proved, under the test of time, not to change. A thin glazing of transparent oil colour on this foundation, while suffering degradation from the yellowing of the oil, would increase in brilliancy from the rise in refractive index of the oil making the pigment more transparent, and allowing more light to be reflected from the tempera pigment below.

At a later stage in the history of oil-painting, while the preliminary painting in tempera was abandoned, the white gesso surface was still used, and the high lights of white lead and oil painted as thinly as possible, so as to ensure reflection from below. With Rubens the custom of transparent shadows and solid lights came in, but, here again, as the pictures of the Dutch school show, the practice was still continued of painting thinly on a white gesso, and where white lead was used for a solid light, it was ground very stiffly with a minimum of oil.

These pictures are of great interest, as showing how far the ancient methods can be adapted to the requirements of the modern artist, as has been shown by Mr. Sims, R.A., whose portraits of the King and Prof. Hay are interesting examples of painting in egg alone, and doing the first painting in egg and finishing in oil.

## Geological Survey in Great Britain.

THE "Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for the year 1924" (H.M.S.O., price 2s. 6d.) gives proof of energy and increasing usefulness in all branches of the institution. As a result of the strengthening of the staff of late years it has become possible to carry on field-work in so many as nine districts. Branch offices have been established at Newcastle-on-Tyne, Whitehaven, Manchester, and York, and thus the work of systematic surveying has been facilitated, and a closer touch has been maintained with all parts of the kingdom than was

formerly possible. This leads to the securing of many records of temporary excavations and other works that might otherwise have been lost. The results of the year's work are presented in a volume of undoubted value, but we find in it a report by the Geological Survey Board, a report by the director, an introduction on coal-field revision by the director, and detailed reports on the Districts by the district geologists, all touching upon more or less the same subjects. Repetition under such conditions is inevitable.

In the field-work the first importance has been

<sup>1</sup> From lectures delivered by Prof. A. P. Laurie to the students of the Royal Academy of Arts, London, on Wednesday, November 11, and subsequent dates.

attached to the 6-inch surveying of coal-fields and their surroundings, and to the revision of those which have been surveyed on that scale but have not been re-examined within the last thirty years. At the same time the information collected concerning the mineral resources of Great Britain, the value of which has been abundantly recognised, is being kept up-to-date by periodic visits of members of the staff to working mines and by maintaining contact with new developments. The information is published in the Special Reports on the Mineral Resources of Great Britain, of which it is stated that twenty-eight volumes have been issued and two more are in the press.

The Districts in which systematic surveying is in progress include the south-eastern counties. The Aldershot sheet of the 1-inch map, which has special claims as illustrating a military and residential centre, is being surveyed for the first time on the 6-inch scale. Maps and memoirs on the Hertford, Dartford, Brighton and Worthing sheets were published during the year. Inquiries relating to underground sources of water are especially numerous in this part of the country, and a close watch is kept on deep borings. The records of some recently examined appear in an appendix, with a map showing the underground limits of the Lower Greensand, one of the most important sources. The absence of this formation at Fobbing, in Essex, has been proved by a boring which entered Cambrian rocks underlying Gault at a depth of 1127 feet. In the Midland District the Flint map and memoir have been published and those relating to Wrexham are well advanced. The Birmingham and Wem sheets have been published and the memoirs written. The surveying of the Wolverhampton, Shrewsbury and Stafford sheets is in progress. In the Lancashire District revision is proceeding in the Rochdale and Manchester area. A special feature in this revision is the attempt to decipher the succession of the Millstone Grit and Lower Coal Measures by means of *Goniatites* as zone-fossils. In the Yorkshire District work in progress in the Huddersfield sheets carries on eastwards the work done in Lancashire. The explorations in the concealed Yorkshire and Nottinghamshire

coal-fields, one of the most important reserves of coal in Britain, are receiving careful attention. In the Cumberland District progress has been made in the Whitehaven and Brampton sheets. The Carlisle, Silloth and Longtown sheets with the corresponding memoir are on the point of publication. In the Northumberland and Durham District revision has been carried on in the Ford, Alnwick and Rothbury sheets and some work has been done in the Morpeth and Newcastle sheets. The Norham, Berwick and Holy Island sheets are being engraved.

In Scotland attention was centred chiefly on the lowlands and coal-fields, but, as the director points out, Highland geology has not been neglected. Six Highland memoirs were written or corrected for press, including that on the Tertiary and Post-Tertiary geology of Mull, etc., in which is described one of the most intricate regions that it has fallen to the Scottish Survey to interpret. In the Lowlands the Kilmarnock sheet is completed and the Ayr sheet well advanced. In Lanarkshire the older rocks underlying the production strata to the south of the central coal-field are being re-examined. The economic memoir on Area VI. (Bathgate, Wilsontown and Shotts) has been published, and second editions of other memoirs are in hand.

Special mention must be made of the bequest to the Geological Survey by the late Dr. Kidston of his collection of fossil plants, photographic negatives and manuscripts. The acquisition of these beautiful specimens will make the Museum one of the principal centres of systematic Carboniferous palaeobotany in the world, when it becomes possible to exhibit them. The preliminary plans for the new Museum and Survey Offices at South Kensington are now under consideration—the building will adjoin the Natural History Museum on one side and the Science Museum on the other. The two national geological collections will then be in close communication, the one biologically arranged and illustrating the evolution of forms of life on the globe, the other stratigraphically arranged and illustrating the stage in evolution attained at each successive period of the globe's history.

### The Principal Botanical Garden, Leningrad.

By Prof. BORIS FEDTSCHENKO (Leningrad).

THE Botanical Garden was founded at St. Petersburg in 1713 by Peter the Great as a Druggist's Garden. In 1824 it was reconstructed into a scientific institution under the name of the "Imperial Botanical Garden," and in 1917, at the beginning of the Revolution, it was renamed "The Principal Botanical Garden of the Russian Republics."

The former activity of the Garden is well known, but it is of interest to make a brief survey of the present activity of this institution. It can be said that, on the whole, the Botanical Garden has successfully survived the difficult times of the War and of the revolution. The buildings are now nearly in the same condition as formerly, or better, since in 1924 the Garden was allowed a sum of money for the reconstruction of all the houses which had fallen partially into disrepair at the time when the coal supply was insufficient. The staff, both scientific and technical, is now no smaller than before the War; the number of principal departments of the institution is now twelve—before the War there were eight. The director of the Garden is Prof. B. Issatchenko, the well-known botanist who recently visited the great European botanical gardens.

One of the principal departments of the Garden is that for the cultivation of living plants. The large number (about twenty-four) of hot-houses and temperate houses are well stocked with many interesting tropical and subtropical plants from all parts of the world; in the rockeries and beds and in the grounds there are many cultures of herbaceous and woody plants chiefly from Northern and Central Asia, from Siberia, North America, and so on. Every year the Garden receives from correspondents a large stock of bulbs, seeds, etc., of new and interesting plants for cultivation; tropical and subtropical plants are received from other Gardens in exchange. The department of living plants is under the direction of Prof. Komarov, a well-known botanist and traveller.

The Herbarium of the Garden is the centre for the systematic and geographical exploration of the flora of Russia. The immense collections (about three million specimens) are stored in what is probably the largest Herbarium house in Europe. The building is of four stories and was built in 1913, the ground-floor being the library of the Garden. The principal work of the Herbarium at present is the

compilation of a flora of Asiatic Russia under the direction of Prof. Boris Fedtschenko, chief of the Herbarium, and some other specialists and volunteers. Local floras of Turkmenistan and south-east Russia, among others, are also being worked up. Recently much work has been done on South American plants. Herbarium specialists are preparing monographs on Tulipes, Artemisia, Tamarix, Gramineæ, Leguminosæ and many other groups of plants. Every year most of the botanists of the Herbarium staff go to the different countries of Russia and adjacent Asia for botanical and geographical studies; this year some are in Turkmenistan, Persia, and in Mongolia.

The cryptogamic department, formerly a part of the Herbarium, is now separated under the direction of A. A. Elenkin and is carrying on intensive studies upon Russian mosses, lichens, algæ, and fungi.

The geo-botanical department, under the direction of Prof. N. Kuznezov, has in hand the making of a geo-botanical map of the European part of Russia. This map is now ready on the scale of 1 : 2,500,000, and the staff of the geo-botanical department is working on the more detailed maps.

One of the most recent departments of the Botanical Garden is that of acclimatisation, under the direction of W. Sukatshef. The purpose of this department is to introduce into cultivation new and interesting plants from different parts of Russia and from adjoining countries. This department has special grounds for the cultures of perennial, herbaceous, and woody plants, as well as for the experimental nurseries of different varieties of fruiting trees and shrubs.

The museum of the Garden since 1891 has been under the direction of N. Monteverde; it has received very large and interesting collections in the last few years. A special section of the museum is working on the study of medicinal plants, which is of great importance for human welfare and health.

There are two departments of the Garden which deal chiefly with practical problems: one is that of seed studies, where numerous analyses of seeds and germination tests are made. Scientific studies on seeds are also carried on. Two important and interesting problems have recently been worked out: the first upon the difference between winter and summer wheat and barley, the other in distinguishing correctly between living and dead seeds.

The other department with many practical problems is that of phytopathology, in which specimens of plant diseases sent from different parts of Russia are studied, and new plant parasites are described.

The department of plant physiology is working on several physiological problems, chiefly dealing with assimilation. The department of hydrobiology is carrying on studies upon the cryptogamic plants of

the plankton of Russian rivers and lakes, particularly in the Leningrad region.

The Library of the Garden is the richest botanical one in the country, and it has a large stock of recent and back publications of the Garden for exchange.

The Garden has now three affiliated gardens: one of these is in a suburb of Leningrad, another in Omsk (Western Siberia), and the third in Vladivostok (Eastern Siberia).

The results of the scientific studies of the staff are published by the Garden in numerous botanical articles and larger works, although handicapped by the very small sums granted for publications. The principal and the oldest publication of the Garden is *Acta Horti Petropolitani*, started in 1872, now under the direction of B. Fedtschenko. This journal contains chiefly voluminous works such as those of Komarov, Fedtschenko, Roshewitz, and other botanists of the Garden. The *Bulletin* of the Garden is chiefly for the publication of short articles on all branches of botany. The *Morbi Plantarum* and the *Annals of the Department for Seed Study* are the special organs of the departments of plant pathology and of seed study.

Recently the Garden has commenced the publication of three new periodicals: *Conspectus litteraturæ botanicæ*—an abstract journal chiefly for Russian botanical literature. Without this it would be very difficult to know of all the botanical publications which are now appearing in large numbers every year in different parts of Russia. Another new publication of the Garden is *Notulæ systematicæ ex Herbario*; this contains chiefly descriptions of new species and genera from all parts of the world from the specimens in the Herbarium of the Garden. In this publication, as well as in the others, contributions are received both from the staff of the Garden and from botanists in other parts of Russia (including Ukraina, Caucasus, Turkestan, Siberia). A similar publication, *Notulæ systematicæ ex Instituto Cryptogamico*, deals with the cryptogams.

Every year the Garden sends botanical expeditions to study plants in different parts of Russia and Asia. The most important journeys have been into Central Asia, Transbaicalia, Mongolia, Persia, etc.

The facts given above show that the Botanical Garden in Leningrad is at the height of its activities in botanical study, and that excellent opportunities are afforded for solving important problems. Now, as formerly, the Garden is in correspondence with the chief botanical institutions of the world. Any question upon the flora of Russia or Russian botanical literature, or regarding botanical research in Russia, will be gladly answered from the Garden or by the present writer.

### Stone-dusting Tests in England and America.

THE Safety in Mines Research Board has just issued a pamphlet<sup>1</sup> which will be of great interest to mining engineers both in the United States and in Great Britain. It contains the first fruits of that arrangement for co-operative research which was made last year between the U.S. Bureau of Mines and the British Safety in Mines Research Board, and is published under the joint names of the two directors of research, Mr. G. S. Rice and Prof. R. V. Wheeler.

The investigations begun in the large steel gallery at Eskmeals by the Home Office Committee on the efficacy of "stone-dusting" in preventing coal-dust

<sup>1</sup> Mines Department. Safety in Mines Research Board. Paper No. 13. Stone Dust as a Preventive of Coal Dust Explosions. Comparative Tests. By G. S. Rice and R. V. Wheeler. Pp. 15. (London: H.M.S.O., 1925.) 3d. net.

explosions were soon supplemented by the researches made in the experimental mine at Bruceton, near Pittsburgh, by the Bureau of Mines. But the results obtained at the two stations showed differences which led to the assumption that the Pittsburgh coal was much more sensitive to ignition than the Altofts Silkstone used as the standard at Eskmeals. Such an assumption rendered futile any comparison between the two sets of experiments, and the conclusions drawn in one country could not be applied, it was thought, to the conditions of the other. The first step in co-operation was taken when a consignment of Altofts Silkstone was sent to Bruceton, and a similar supply of Pittsburgh coal was received at Eskmeals. The experiments carried out at the two

stations now described show that the behaviour of the two coal-dusts is very much the same when the experimental conditions are similar; and the conclusion is drawn that the differences between the results at the two stations are due to the greater severity of the American tests. At Bruceton the experimental mine is driven into an actual coal-seam and has a cross-section of 58 square feet; the powder-charge used as the source of ignition is 4 lb.; the dust is spread on cross-beams near the roof as well as on side shelves and on the floor. At Eskmeals the original experiments were carried out in a circular steel gallery of  $7\frac{1}{2}$  feet diameter; the later comparison-experiments were made in a smaller steel tube 38 inches in diameter with a charge of 28 oz. of blasting-powder.

Again, in a number of experiments where small percentages of gas were present with the dust, the Americans used their natural gas containing, besides methane, some 15 per cent. of higher paraffins—ethane, propane, etc.—which ignite more readily than the pure methane derived from coal. The conditions both of ignition and of propagation were therefore more favourable at Bruceton than at Eskmeals. It is a clear gain to have established that the standard coals used at the two stations are so nearly similar that the varied experience obtained in one country can be applied, under the same working conditions, to the other.

### The Data for Weather Forecasting.

METEOROLOGISTS are being urged to extend the periods covered by their forecasts, and in a recent paper<sup>1</sup> Exner has worked out the correlation coefficients between contemporary monthly pressure departures at Stykkisholm (Iceland) and those of seventy other places distributed over the earth. The data handled are from 1887 to 1916, and the monthly departures of pressure and temperature for all the stations are most generously printed at length for the benefit of other workers: their mean square values also are tabulated and briefly discussed.

Relationships in the North Atlantic had previously received considerable attention, from Exner and others; so the results in the present paper, though of the greatest value, are not in general surprising. There is a region of close positive relationship extending from Baffin's Bay to Norway, and one of negative relationship near the Azores, in winter extending from the Bermudas to Italy, with an outlying region in Japan: with places in the southern hemisphere there is little connexion.

An important feature of the paper is its hope of inauguration of a programme of calculation of which the present 840 coefficients form but a small fraction. If all were worked out, there would be more than 120,000 contemporary monthly relationships between 143 variables, 71 of pressure and 72 of temperature. But, though Exner does not suggest any extension, this would not be enough; for with many places, especially in the southern hemisphere, there are essential effects produced after six months. These non-contemporary effects are vital for forecasting, and if we were to correlate a monthly value at one place with values from seven months before to seven months after at other places, we should multiply our coefficients by 15.

There is much to be said for the plan adopted in Walker's two papers on world-weather of using quarterly values. With twenty "centres of action," the total number of coefficients, including time intervals of  $\pm 2$ ,  $\pm 1$ , 0 quarters, is then 7600, and a number

<sup>1</sup> "Monatliche Luftdruck- und Temperaturanomalien auf der Erde: Korrelationen des Luftdrucks auf Island mit dem anderer Orte." *Sitzber. d. Akad. d. Wiss. in Wien*, Abt. IIa, 133 Bd., 7 u. 8 Hefte, 1924.

of stations may be added without a prohibitive amount of labour.

Exner's argument for dividing the year into twelve rather than four periods is that he proposes in this way to distinguish real from accidental relationships, the former being distinguished by a smooth, regular series of values during the year.<sup>2</sup> But it has not been shown that statistical criteria applied to quarterly values have failed; and as the largest of twelve errors in Exner's coefficients has a probable value of 0.35, a smooth series is as accidental as a fairly irregular one.

It is a matter of sincere congratulation that Exner's great ability is being directed to the elucidation of these questions of commercial as well as scientific importance.

<sup>2</sup> "Regelmässige Verlauf durch die zwölf Monate," *loc. cit.* p. 329.

### University and Educational Intelligence.

CAMBRIDGE.—Mr. J. A. Chadwick has been awarded the Arnold Gerstenberg Studentship (for moral philosophy and metaphysics). Mr. Chadwick took the Natural Sciences Tripos Pt. I. in 1923 and the Moral Sciences Tripos in 1925; he was recently elected to a fellowship at Trinity College.

A grant of 50*l.* has been made to Miss Marion F. Bridie of Birmingham to facilitate her research as to the ultimate effect of education among the mentally deficient.

LEEDS.—The West Yorkshire Coal Owners' Association has given 25,000*l.* to the appeal fund. In accepting the gift, the council of the University passed a resolution stating that the success of the University's Department of Mining is due in large measure to the co-operation of the industry, not only in the form of subscriptions, but also through assistance given on the Mining Advisory Committee, by facilities offered to students for gaining practical experience, and in other ways. The annual grants made through the Association amount to nearly 10,000*l.*, and these are to be continued at the rate of 1000*l.* a year.

The following appointments have been made:—Mr. W. Murphy to be demonstrator in experimental physiology, and Dr. Arthur Raistrick to be research assistant in geology.

LONDON.—Mr. Hilary Jenkinson has been appointed as from August 1 last to the University readership in diplomatic and English archives tenable at King's College. Mr. Jenkinson is the editor of volumes of the Surrey Archæological Society and Surrey Record Society, and is the author of numerous works on palæography.

It has been resolved to institute an M.A. degree in geography for external students.

The following doctorates have been conferred:—*D.Sc. (Chemistry)*, Mr. J. M. Johlin (University College), for a thesis entitled "The Surface Concentration of Colloids at a Liquid-Gas Interface"; *D.Sc. (Entomology)*, Mr. H. P. Hacker, for a thesis entitled "How Oil Kills Anopheline Larvæ," and other papers.

THE effect on school-holidays and on the various branches of education in every country of a fixed date for Easter is being investigated by the League of Nations' Special Committee of Enquiry into the Reform of the Calendar. This Committee, on which the Rev. T. E. R. Phillips, Secretary of the Royal Astronomical Society, represents Great Britain, has been devoting particular attention to the question of the fixing of Easter and now wishes to conclude its general inquiry. While the need of fixing this festival

has been felt more especially in economic circles, certain replies received by the Committee seem to show that a similar desire exists in educational circles, since, if Easter be fixed, the date selected would be of great importance from the point of view of holidays, holiday courses, etc. A circular-letter has accordingly been sent to all the Governments asking them, before December 15 next, for the views of their Education Departments and other educational authorities.

THE Secretary for Scotland, in consultation with the Minister of Labour, has appointed a Committee "to inquire into and advise upon the public system of education in Scotland in relation to the requirements of trade and industry, with particular reference to the adequacy of the arrangements for enabling young persons to enter into and retain suitable employment." The Committee will be composed of the Right Hon. Lord Salvesen (chairman), Dr. R. S. Allan, Prof. T. Hudson Beare, Mrs. Charles Douglas, Mr. James Elder, Mr. William Lorimer, and Mr. D. J. Macdonald. Mr. James Clark, H.M. Inspector of Schools, and Mr. W. H. Lowe-Watson, Ministry of Labour, will be joint secretaries. All communications should be addressed to the joint secretaries at the Divisional Office, Ministry of Labour, 44 Drumsheugh Gardens, Edinburgh.

A THIRD series of "Methods and Problems of Medical Education" has been issued by the Division of Medical Education of the Rockefeller Foundation. These publications contain brief descriptions of clinics, laboratories, and methods of teaching in different parts of the world. The articles are not copyright, and permission to reprint or otherwise to utilise them is not necessary. It is hoped that the material may be of assistance to those planning improvements in buildings and methods. The present volume deals with nineteen departments of physiology, anatomy, pathology, biochemistry, pharmacology, surgery, and obstetrics. The articles are written by the heads of the departments and are illustrated with plans and views. They include descriptions of the department of physiology and the Molteno Institute, Cambridge; the department of anatomy, University of Leyden; the pathological laboratory of the Johns Hopkins University and Hospital; the department of surgery, Peking Union Medical College; and the obstetrical unit, Royal Free Hospital. Brief details are appended of the staffing, finance, and lines of research and instruction given in the various institutions.

FROM the Northern Polytechnic, Holloway, London, we have received a prospectus for 1925-26 containing particulars of the three-years' course in architecture which has lately been recognised by the Royal Institute of British Architects as qualifying those who obtain a first- or second-class pass in the school examination for exemption from the R.I.B.A. intermediate examination. The Polytechnic is the only institution in Great Britain which offers courses of university grade in rubber technology. The senior day course is described as suitable for university graduates working for higher degrees who select as their subject for research problems connected with rubber. The advanced day and evening courses offer suitable preparation for the examinations for the associate diplomas awarded by the Institution of the Rubber Industry (A.I.R.I.). A Rubber Trades School has also lately been established to provide boys of fourteen to fifteen with the necessary basic training in rubber workshop practice and allied subjects previous to entering the rubber industry. The full term of apprenticeship is five years, of which the first year is spent as a full-time day course at the school, while in subsequent years the boys attend the school two evenings a week.

## Early Science at Oxford.

November 30, 1683. Some Iron ore, which was dug at Wassall in Staffordshire, and had been lately calcined, was observed to draw ye needle: it being true, that scarce any Iron ore will apply to ye magnet, unless it has first undergone ye fire; This gave matter to a quære, whether fire may not be supposed to make these ores attract the needle? A little peice of a sewing needle, about  $\frac{1}{4}$  of an inch long, being placed on a peice of paper, and a loadstone applied under ye paper, was seen to raise its self on its greater end; upon applying ye other pole of ye loadstone ye peice of needle affected to raise its self on its point. There followed some discourse concerning ye sawing of Diamonds, with ye hair of a man's head, as fetters are commonly saw'd off, by Prisoners, with a steel virginal string. A letter from Dr. John Bagly gave an account of some observations, he had lately made on ye *Lumbricus Latus*; particularly that in every joint of ye worm, there appears an insect, not unlike an ant, which may be seen with ye bare eye; He says a patient of his voided roo yardes of this sort of worm in 24 hours.

1686. Dr. Plot communicated ye following curiosities: A large shell which had its turnings from ye left to ye right contrary to almost all shells hitherto described. In the Catalogue of Shells preserv'd in ye Ashmolean Repository 'tis called *Buccino-cochlea atrovubens*, a Sinistra in dextram obvoluta, mucrone obtuso, lutescenti. A sort of amphibious Crabfish from ye Island of Barbados, which when they return to sea, keep their course soe directly forward, that they usually climb over rocks, houses, and what other obstacles soever; rather than take any compasse.

The Society desired an account of ye number of Christenings and burials in Paris and London in ye years 1670 and 1671.

December 1, 1685. Dr. Bernard gave an account, that the Eclipse of the Moon the night before, could not be observed here by reason of a thick fogge at that time.

He also gave an account of a fat man that lived a fortnight together upon Tea alone, and by these meanes cured himself of a fitt of the Gout. Other Instances of fasting were mention'd: One John Scot in ye time of K. Hen: 8th fasted 30 or 40 dayes together in an Abbey at Edenburgh, and 32 daies in ye Castle there: He also did the like at Rome; and fasted 50 daies in prison at London. This is affirmed by Bp. Spotswood in his history of Scotland A.D. 1539. One Cisely de Ridgeway being condemned fasted 40 daies in prison, and was therefore pardoned: Dr. Plot produced a copy of her pardon, wherein her fasting 40 daies was mention'd; It was dated Anno 31mo Edv. 3ij. Dr. Plot said, he was credibly informed, that a Dog being casually locked up in a study at Canterbury, fasted 24 daies together, and afterwards recovered. Mr. President said, his sister told him, she had a hen, that lived without meat and drink 9 weekes together, being by chance shut up among some faggots, and afterwards recovered. She was observed to drink much, as soon as she was released.

There was read a paper proposing a way to remember numbers by words, ye vowels whereof may represent figures; with a large scheme of instances in Chronology to that purpose.

Dr. Plot shew'd us ye skins of ye Ottar fish and of ye *Canis marinus* or dog-Fish, which is not ye same with ye Sharke or *Canis Charcharias*.

December 2, 1684. The President, Director, and Secretary being all out of town, we had no meeting for a fortnight.

## Societies and Academies.

LONDON.

**Royal Society, November 19.**—**J. W. Pickering** and **R. J. Gladstone**: The development of blood plasma. Pt. I.: The genesis of coagulable material in embryo chicks. An excess of material which is protective against the inception of clotting exists in the plasma of early embryos. This material does not possess antithrombic properties. Antithrombic material can be prepared by heating embryonic blood to 60° at the stage of development prior to the appearance of prothrombin. The inception of the coagulation of embryonic blood may occur, at room temperatures, prior to the agglutination and lysis of thrombocytes.—**D. J. Scourfield**: On a new type of crustacean from the Old Red Sandstone (Rhyinie Chert Bed, Aberdeenshire), *Lepidocaris rhyiniensis*. This form only reaches about 3 mm. in length in the fully grown adult. Both sexes in various stages of development are found. Owing to the semi-transparent nature of the Chert and the excellent preservation of minute structures therein, it has been possible to reconstruct the animal in practically all its external details. A new order of Branchiopoda, the Lipostraca, has been formed to receive it. Considered as a whole, *L. rhyiniensis* does not seem to have led to any subsequent development. It was in many ways more specialised than any living anostracan, and probably fitted into a very peculiar environment. The absence of all certain traces of "pond life" organisms other than *L. rhyiniensis* seems to confirm the theory that the water in which the Rhyinie Chert bed was deposited may have been hot and highly charged with silica.—**J. R. Norman**: The development of the chondrocranium of the eel (*Anguilla vulgaris*), with observations on the comparative morphology and development of the chondrocranium in bony fishes. For purposes of comparison, the development of the chondrocranium in the herring (*Clupea*) and the salmon (*Salmo*) has been studied. A general comparative account of the morphology and development of the chondrocranium of bony fishes has been included. It is concluded that the hyomandibular of bony fishes represents the epal element of the hyoid arch, and is homologous with the hyomandibular of selachians; the interhyal of bony fishes is a new structure. The condition of hyostyly has been independently acquired in the two groups.—**J. Needham** and **Dorothy Needham**: The hydrogen-ion concentration and oxidation-reduction potential of the cell-interior before and after fertilisation: a micro-injection study of marine eggs. A study of eggs of four echinoderms, of one tunicate, and of one polychaete worm has been made by the method of micro-injection. The conclusions rest on appearances seen in 3300 injected eggs. The internal pH of all eggs studied is in the close neighbourhood of 6.6. It does not change on fertilisation, nor are any subsequent rhythmical changes to be seen. On cytolysis it is lowered to a point below 5.0 and above 4.0. The rH varies more than the pH, but it is within the limits 19 to 22; it does not change on fertilisation or cytolysis. Vital staining and micro-injection give diametrically opposite results.—**R. R. Armstrong**: Studies on the nature of the immunity reaction. (i.) The protective power of sera, prepared by immunising rabbits with pneumococcal vaccine, can be measured accurately against measured doses of living pneumococcal cultures, using mice as test objects. Immunity is developed in a very characteristic manner, whether it be following experimental inoculation in the rabbit

or the natural stimulus of a lobar pneumonia in man. An inductive phase, lasting from three to five days, is followed by an outpouring of protective antibodies into the serum, at a rapidly increasing rate, a maximum concentration of protective substance being reached on the eighth day after inoculation. Strict correlation is found to exist, within certain limits, between the size of the dose of vaccine administered and the degree of immunity developed. (ii.) The pneumococcus combines proportionally with its homologous protective anti-bodies to form a "sensitised" vaccine. On inoculation, a sensitised vaccine liberates the greater part of its charge of anti-bodies, rapidly conferring a slight degree of immunity, and afterwards excites an active immunity in a manner comparable with that of raw vaccine. Sensitisation, however, leads to a reduction in the intensity and to delay in the immunity response, compared with that following an equal dose of raw vaccine.—**R. J. Ludford**: The cytology of tar tumours. Tumours were produced by painting regularly the skin of mice with tar. Epidermal cells show changes associated with the process of keratinisation, pathological conditions, hypertrophy and degeneration, being of common occurrence. Sebaceous glands in the thickened epidermis surrounding tar tumours show marked hypertrophy. The secretion process is essentially the same as in the normal gland. Penetration of the *panniculus carnosus* by tumour cells induces reaction on the part of the muscle fibres, seen in an increase in sarcoplasm and in number of nuclei, and also in the behaviour of cytoplasmic organs.—**Eric Ponder**: The inhibitory effect of blood serum on haemolysis. The reaction is described by equations similar to absorption equations; the inhibition is probably due to the formation of a loose physical compound between the lysin and the serum proteins. The reaction is little influenced by temperature within the experimental range.—**L. Brull** and **F. Eichholtz**: (1) The effects of calcium and potassium ions on urine secretion as studied in the whole animal. In the intact anaesthetised dog, potassium chloride injected intravenously increases the urine flow to a much higher extent than injection of corresponding amounts of sodium chloride. Potassium or calcium chloride, either isolated or combined, have no constant nor specific effect on chlorides output; the intact animal behaves as it does towards sodium chloride, using its general power of concentrating chlorides. When the pituitary body is removed, and the kidney has consequently lost its power of concentrating chlorides, the animal reacts to calcium and potassium ions as in the lung-heart-kidney preparation. Hence in the lung-heart-kidney preparation reactions of the kidney can be studied and elucidated under simplified conditions. (2) The secretion of inorganic phosphate by the kidney. Infusions of sodium or potassium solutions increase the output of inorganic phosphate and also the urine flow, but in a smaller proportion. Small amounts of calcium chloride may increase the phosphorus output; large amounts diminish or even abolish inorganic phosphate secretion. This decrease of phosphate in the urine is generally accompanied by an increase of the phosphate level of the serum.—**F. Eichholtz**, **R. Robison**, and **L. Brull**: Hydrolysis of phosphoric esters by the kidney *in vivo*. The isolated kidney, perfused by means of the heart-lung preparation, which is unable to concentrate the normal inorganic phosphates of the blood serum, is able to concentrate and to hydrolyse added organic phosphates, and to excrete their phosphorus as inorganic phosphates in the urine in a much higher concentration than that of the inorganic phosphates in the serum. In the whole animal in which the



urinary inorganic phosphates have sunk to a minimum, injected organic phosphates are excreted, after an initial stage, entirely in inorganic form. It is considered that normally a considerable part, if not all, of the urinary phosphates are derived from the organic phosphates of the serum, by hydrolysis in the cells of the kidney under the action of the kidney enzyme.

**Mineralogical Society, November 3.**—C. S. Garnett: The dissociation of dolomite. Further evidence in support of the conclusion that true dolomite dissociates under the influence of heat in a single step and not in two stages as formerly supposed. The setting of semi-burnt dolomite with water is due to free lime and not to a mixture of magnesium oxide and calcium carbonate.—B. J. Tully: A new refractometer. The special features of this new refractometer are thorough rigidity and an exceptionally large and flat field of vision due to the long optical system employed, the shadow edges being straight instead of curved as in older types. All adjustments for focusing, lighting, etc., being independent of the main body which contains the optical system and graticule scale in a dust-proof enclosure, little damage is possible by inexperienced usage.—A. Russell: Notes on some new British localities for barytocalcite and alstonite. Barytocalcite is found at Ayleburn Mine, Northumberland, 2 miles north of Alston, where it occurs, abundantly and well crystallised, with blende in brown limestone; Heartycleugh Mine, West Allendale, Northumberland, in small quantity with barytes; and Lolly Scar Mine, Nidderdale, Yorkshire, massive and in small crystals with fluor, chalcopyrite, witherite, etc. Alstonite, massive and in crystals of the usual habit, was found as a single specimen in the witherite vein worked in Ushaw Moor Colliery, near Durham.—G. T. Prior: The meteoric iron of Vaalbulb and meteoric stones of Witklip and Queens Mercy, South Africa. A mass of meteoric iron weighing 26 lb. was found on Vaalbulb farm, Prieska Division, Cape Province. It is a coarse octahedrite having about 7 per cent. of nickel, with a ratio of iron to nickel of about 13. The Witklip stone fell on May 26, 1918, on the farm Witklip in Carolina District, Transvaal, after a loud explosion and a flash of light. It is a grey chondrite resembling Cronstad. Only a few grams appear to have been preserved. The Queens Mercy stone is also a grey chondrite which fell on April 30, 1925, about 20 miles from Matatiele, Cape Province, after the appearance of a bright light and a loud detonation. The stone, which measured about 1½ ft. in length, was broken up by the natives and only a few fragments have been recovered.

**Society of Public Analysts, November 4.**—G. D. Elsdon and Percy Smith: The determination of palm kernel oil and butter in margarine. The Reichert, Polenske and Kirschner values of a series of mixtures of palm kernel oil and butter fat in mixtures of other oils and fats have been determined. The differences between the calculated and observed values are very much less in the case of palm kernel oil than in the case of coconut oil; the relationship between the Reichert and Polenske value of a given mixture may assist in deciding on the relative proportions of palm kernel oil and coconut oil present.—Clive Newcomb: The determination of alcohol and ethyl chloride in chloroform. Alcohol is removed by washing with water in a special apparatus, and by determining the density of the chloroform before and after the washing a measure of the amount of alcohol is obtained, whilst the difference between the density of the washed chloroform and that of pure chloroform affords a

measure of the amount of ethyl chloride.—H. Atkinson: The volumetric determination of soluble sulphates by means of barium chloride and potassium stearate. Sulphates in fairly dilute solution can be determined by precipitating them with excess of standard barium chloride solution, and titrating this excess with standard potassium stearate solution, the end point being shown by B.D.H. universal indicator. Metals forming insoluble stearates (*e.g.* aluminium, zinc, calcium, magnesium) are removed by precipitation with the potassium stearate solution prior to the titration of the sulphate. The limit of error in the method is of the order of 0.05 c.c. of a 0.1 N solution.

**Linnean Society, November 5.**—Marius Maxwell: The home of the eastern gorilla.—Miss E. Bronlton: Validity of certain species in Neuropteris, Brongn.

November 19.—H. S. Holden and S. H. Clarke: On the seedling structure of *Tilia europæa*.—L. R. Crawshay: Sponge fishery investigations in the British West Indies. The investigations were instituted by the Colonial Office in 1920. Among the problems requiring attention are that of depletion of the sponge beds through unrestricted removal of the sponges over many years past, and the cultivation of sponges from planted cuttings. The latter offers undoubtedly valuable possibilities of development of a sponge fishery along the best lines for the improvement and extension of its resources. The general subject of sponge-fishery control can only properly be dealt with in the light of knowledge gradually to be obtained by study of the living sponges, and especially in regard to the relationships of the chief market types, and their form-variations, age, growth and growth-rate, and reproduction.—G. Claridge Druce: Recent additions to the British flora.

**Mathematical Society, November 12.**—H. B. C. Darling: Expansion of the elliptic integrals  $u$  and  $E(u)$  in series of sines of multiples of the amplitude.—H. Hilton and Sybil D. Jervis: On plane quartic curves with a triple point.—C. G. F. James: (1) On cycles of corresponding points in Cremona transformations. (2) Generation of quadratic plane transformations by means of double projection.—P. A. MacMahon: Euler's  $\phi$ -function and its connection with multipartite numbers.—W. P. Milne: The harmonic and equianharmonic envelope of a cubic surface.—C. A. Stewart: The integration of linear partial differential equations with constant coefficients and distinct characteristics.—E. C. Titchmarsh: A series inversion formula.—C. E. Weatherburn: On congruences of curves.—E. M. Wellish: Electric and magnetic displacement currents.—F. J. W. Whipple: (1) On well-poised series, generalised hypergeometric series having parameters in pairs, each pair with the same sum. (2) Well-poised series and other generalised hypergeometric series.

**Royal Anthropological Institute (Indian Section), November 17.**—E. H. Hunt: Hyderabad cairn burials. At "Maula Ali, South," last May, five burials were opened. Finds included the bones of a hare in a pot; bovine teeth; much iron; pottery showing new features; and a fine gold spiral, with a large number of minute gold rings; other rings were of silver, plated with gold. These burials differed in type from those of Raigir and elsewhere in that the cist slabs were vertical, and overlapped at the ends. In the north slab, a large round hole had been cut, bringing these underground burials into line with the surface "holed dolmens" of Rajunkalur. In May 1923, further investigations

were made, with Mr. L. Munn, into the ancient iron industry of the Hyderabad State. No limiting date can be placed on the smelting of iron in South India. Continued study of the literature of the subject yields little, though excellent descriptions of surface conditions are given by the older writers. Destruction of these remains is rapid, their chief enemy being the cultivation of castor seed. At least six distinct types of burials can be distinguished, and the total period covered must extend to thousands rather than hundreds of years. Some types must be far older than others, but before any attempt at "sequence dating" can be begun, there must be much organised and careful excavation. There is urgent need for the provision of some central collecting station where type-specimens of pottery, beads, rings, human and animal remains, articles of gold, silver, copper, and iron, etc., can be collected for comparative study. England appears to be the natural place for this, but, so far, no museum affords the requisite housing space.

Royal Statistical Society, November 17.—G. Udny Yule: Why do we sometimes get nonsense-correlations between time-series?—a study in sampling and the nature of time-series. (Presidential address.) When graphs are plotted of (1) the standardised mortality in England and Wales, 1866–1911; (2) the proportion of Church of England marriages to all marriages during the same years, they shew a very close relationship, measured by a coefficient of correlation of more than +0.9. Such a correlation is completely nonsensical; but the fact that we can get such correlations leads us to mistrust the serious arguments that have sometimes been based on time correlations. Even though two simple functions of time are completely independent when the correlation is considered over a long period, short "time-samples" tend to give correlations departing as far as possible from the truth and approaching  $\pm 1$ . Turning to empirical series, a method of classification is suggested based on the "serial correlations" for the series, that is, the correlations between terms distant from each other by 1, 2, 3, . . . units of time. The dangerous class of series is that for which not only the serial correlations for the series itself but also those for its first differences are all positive. Applying the method of serial correlations to the analysis of Sir William Beveridge's index-numbers for wheat prices in Western Europe, 1545–1844, and also to rainfall at Greenwich, 1815–1924, the differences of the former series are found to be oscillatory, as in Sir William Beveridge's periodogram analysis, while the latter appears to be mainly random.

## PARIS.

Academy of Sciences, October 12.—J. Costantin: Two new experimental stations of *Pleurotus Eryngii*. An account of two attempts to grow this edible fungus at Guignecourt-sur-Vence (Ardennes) and the forest of Fontainebleau.—André Blondel: Measurement of the photometric yields of optical apparatus.—A. Vayssière: The nymphosis and metamorphosis of a *Protopistoma foliaceum*.—E. Bataillon: New technical methods for the study of gastrulation and germinal localisations in the batrachians.—Georges J. Rémondos: The extension of Picard's theorem to multiform functions.—E. Baticle: The correction of the effects due to permanent expansions or contractions in concrete arches.—Thadée Peczalski: The cementation of metals by volatile salts. Study of the effects of prolonged heating of iron and copper in contact with fused chromium chloride and fused

nickel chloride. The penetration of copper by nickel under these conditions is shown by micro-photographs.—L. Meunier and A. Bonnet: The fluorescence of the colouring matters of plants. The fluorescence under Wood's light is of value in the characterisation of commercial tinctorial extracts.—Volmar: The photolysis of the ethylenic dibasic acids. Fumaric, maleic, mesaconic, itaconic and citraconic acids have been exposed to ultra-violet light under comparable conditions, and the volumes of gas produced measured. The unsaturated acids are more easily decomposed by ultra-violet light than the corresponding saturated acids. The *cis* isomers are more readily decomposed than the *trans* isomers.—A. Gruvel: A fishing map of a part of the western coast of Morocco.—C. T. Popesco: Movements of sleep and awakening compared in *Desmodium canadense* ungrafted and grafted.—Risbec: The production of light by a nudibranch mollusc from New Caledonia. This mollusc, named provisionally *Triopa fulgurans*, emits a series of short bright flashes when disturbed.—J. Athanasiu: The nervous mechanism of the rhythmicity of the myocardium.—P. Lasareff: The change in the electrical conductivity of the visual purple during illumination. The retinal purple of the frog was dissolved in solution of bile salts, and submitted to prolonged dialysis. The increase in the electrical conductivity produced by illumination was determined and could be expressed by the formula  $\sigma = a - be^{-dt}$ , where  $\sigma$  is the electrical conductivity,  $a$  and  $b$  constants,  $t$  the time, and  $d$  a constant depending on the light intensity. These experiments are regarded by the author as giving an experimental basis to his ionic theory of luminous sensations.—Samec: The chemico-colloidal properties of the components of starch.—P.-Cappe de Baillon: The embryogenesis of double monsters in phasmids (*Carausius morosus*).—Pierre P. Grassé: The vacuome and Golgi apparatus in Euglena.

## MELBOURNE.

Royal Society of Victoria, September 24.—G. A. Ampt and E. J. Hartung: Occurrence of helium in a spa gas, Victoria. A distinctly radioactive spa gas from Hepburn, Victoria, was analysed for helium by standard methods. The volume composition proved to be: carbon dioxide 97.0, nitrogen 2.55, oxygen 0.46, inert gas 0.045 per cent. The last was shown to be a mixture of argon and helium, with traces of neon. Its average molecular weight was 35.1, as determined by an Aston density balance, and corresponded with 13.4 per cent. of helium. The volume concentration of helium in the spa gas was therefore 6 parts in 100,000. This is the first recorded occurrence of helium in any Australian natural gas.—E. F. J. Love: A low-lag thermocouple with a novel type of insulation. A method of insulating wires and thermojunctions by means of a thin film of rubber, deposited from solution in benzene—petroleum motor spirit—and afterwards vulcanised with sulphur chloride. Couples so insulated are found to have a very small lag and have proved of service in some recent experiments on meat refrigeration. As the materials required are regular articles of commerce and the operations simple, the method may find other applications.—D. K. Picken: Geometry, the basic physical science; a modern equivalent to Euclid. This is the final paper of a series published in the *London Math. Soc. Proc.* (ser. 2, vol. 23, pt. i.) and in the *Math. Gaz.* (Dec. 1922, Oct. 1924). An attempt is made to recover the point of view of the Greek philosopher-geometers, while embodying all the essential relevant ideas

that have accrued in modern times. This paper discusses the fundamental definitions and axioms of geometry—especially the necessary axioms of order—and a natural logical sequence of propositions. The "complete angle" method is used to resolve outstanding difficulties in the proof of Euc. i. 8.—A. W. Turner: Sensitising powers of parasite proteins. By using Dale and Laidlaw's isolated sensitised guinea-pig uterus technique, the biological relationship of some metazoan parasites (Nematoda, Trematoda, and Arthropoda) were investigated: Uteri sensitised by proteins from one species of a genus may exhibit non-specific sensitiveness towards another species; but after being desensitised to the non-specific factor, delicate specific sensitiveness towards the sensitising proteins remained. If first desensitised against the sensitising proteins, uteri exhibit no non-specific sensitiveness. There is an analogy between this phenomenon and group agglutination and precipitation. The method may be useful for specifically diagnosing mutilated parasites.—A. J. Ewart, Lesley R. Kerr, and E. M. Derrick: Contributions to the flora of Australia (30). An account is given of the first results of the examination of a collection of plants made by Prof. Ewart during a visit to Central Australia in 1924. It consists mainly of new or additional records, the new species being kept for a later paper. Attention is directed to the existence of a large belt of timber of *Casuarina Decaisniana* south of the McDonnell Ranges, the existence of which may prove of considerable importance in connexion with the approaching extension of the railway from Oodnadatta to Stuart in the McDonnell Ranges. The character of the vegetation in many areas north of the McDonnell Ranges indicates the existence of land valuable not merely for grazing but also in the future for quickly ripening summer grain crops. Far from being a desert, much of this land is highly fertile and has a rainfall of 12 to 20 inches. Interspersed with these areas are, however, large tracts of sandy porcupine grass country representing a difficult problem of economic handling and treatment.

## VIENNA.

Academy of Sciences, October 15.—G. Weissenberger, R. Henke and L. Bregmann: Divalent phenols and their ethers.—G. Weissenberger, R. Henke and E. Sperling: The behaviour of deka-hydro-naphthalin.—M. Kohn and S. Sussmann: Some tri- and tetra-halogen-phenols.—R. Weiss and K. Woidich: On 1-phenyl-naphthalin and its derivatives.—J. Pollak and E. G. Fülnegg: On derivatives of resorcin.—H. Michel: The fall and finding of a meteoric stone at Lanzenkirchen, Lower Austria. Eye-witnesses in Wiener Neustadt report that on August 25, 7.30 p.m., a fireball emerged from between the clouds, burst asunder and fell to earth in rapidly fading pieces. After 20 to 30 seconds, according to the distance of the observer, several shot-like detonations followed by irregular thunder roll for a minute were heard. The meteor left a vivid shining track. Next day Herr Flickentanz found a peculiar hole in his meadow. Half a metre deep was a meteoric stone weighing more than 5 kgm., the size of a child's head.—O. Fürth and J. Marian: On the decomposition of hexose-diphosphoric acid in the mammalian organism.—E. Cartellieri: Contributions to our knowledge of the absorption system of Rafflesiaea Brugmansia.—O. Koller: A new species of *Barbus* from Albania, from the stream Fandi Vogelj.—J. Schädler: Scharizerit, a new mineral from the dragon cave at Mixnitz in Styria, has a high nitrogen content.

## Official Publications Received.

- Bergens Museums Aarbok 1924-25. Hefte 1. Naturvidenskabelig række. Pp. 38+18+54+11+46. (Bergen.)
- Sydney University Reprints. Series 1 (Agriculture and Veterinary Science), Vol. 1, Nos. 1-7. Series 2 (Botany), Vol. 1, Nos. 1-17. Series 3 (Chemistry, Organic and Inorganic), Vol. 1, Nos. 1-32. Series 6 (Geology and Geography), Vol. 1, Nos. 1-20. Series 9 (Medical Sciences—Non-Clinical), Vol. 1, Nos. 1-15. Series 11 (Physics, Mathematics and Astronomy), Vol. 1, Nos. 1-7. Series 12 (Social Science—Economics, Education, History, Philosophy and Psychology), Vol. 1, Nos. 1-10. Series 13 (Zoology), Vol. 1, Nos. 1-23. (Sydney.)
- United States Department of Agriculture. Department Bulletin No. 1336: Biological Studies of the Green Clover Worm. By Chas. C. Hill. Pp. 20. (Washington: Government Printing Office.) 5 cents.
- Annual Report of the Meteorological Committee to the Air Council for the Year ended 31st March 1925. (M.O. 274.) Pp. 64. (London: H.M. Stationery Office.) 1s. 9d. net.
- Union of South Africa: Department of Agriculture. Science Bulletin No. 40 (Division of Chemistry Series No. 60): Chemical Investigations in regard to Citrus. By Dr. Chas. F. Juritz. Pp. 22. (Pretoria: Government Printing and Stationery Office.) 3d.
- Aeronautical Research Committee. Reports and Memoranda, No. 975 (Ae. 189): Autorotation Measurements on a Model Aeroplane with Zero Stagger. By F. B. Bradfield and L. P. Coomb's. (A.2.e. Stability, Calculations and Model Experiments, 93—T. 2072.) Pp. 7+4 plates. (London: H.M. Stationery Office.) 6d. net.
- Transactions of the Royal Geographical Society of Australasia (Queensland). Reports of the Great Barrier Reef Committee. Vol. 1. Edited by Dr. J. P. Thomson and C. Helley. Pp. xii+175+25 plates. (Brisbane.) 10s.
- Annual Report on the Working of the Museum Department during 1924-25. Pp. xi. (Malta: Government Printing Office.)
- Ministry of Finance, Egypt. Petroleum Research, Bulletin No. 9: Preliminary Geological Report on Gebel Khoshera Area (Western Sinai). By F. W. Moon and Dr. H. Sadek; with Appendix by T. H. Withers (On a new Crab from the Miocene). Pp. v+40+14 plates. (Cairo: Government Publications Office.) 10 P.T.
- Methods and Problems of Medical Education. (Third Series.) Pp. 242. (New York: The Rockefeller Foundation.)
- Field Museum of Natural History. Geological Series, Vol. 4, No. 4: On the Head of the Macropetalichthyids, with certain Remarks on the Head of the other Arthroides. By Erik A. von Stensiö. (Publication 232.) Pp. 85-197+plates 19-31. (Chicago.)
- Statens Meteorologisk-Hydrografiska Anstalt. Årsbok, 5, 1923. 3: Vattenståndet vid Rikets kuster. Pp. ii+21. (Stockholm.) 2 kr.
- Government of the Gold Coast. Report on the Survey Department for the Period April 1924-March 1925. Pp. 26+3 plates+2 maps. (Accra: Colonial Secretariat; London: The Crown Agents for the Colonies.) 2s.
- Field Museum of Natural History. Zoological Series, Vol. 12, No. 9: The Long-Clawed South American Rodents of the Genus *Niotomys*. By Wilfred H. Osgood. Reports on Results of the Captain Marshall Field Expeditions. (Publication 229.) Pp. 111-125+1 plate. Zoological Series, Vol. 12, No. 10: New Coral Snakes from Peru. By Karl P. Schmidt and F. J. W. Schmidt. Reports on Results of the Captain Marshall Field Expeditions. (Publication 230.) Pp. 127-134+2 plates. Zoological Series, Vol. 12, No. 11: A Review of the Fishes of the Genus *Signalosa*. By Alfred C. Weed. Reports on Results of the Captain Marshall Field Expeditions. (Publication 233.) Pp. 135-146. (Chicago.)
- Forest Bulletin No. 63 (Botany Series): Eucalyptus Trials in the Simla Hills. By R. N. Parker. Pp. 27. (Calcutta: Government of India Central Publication Branch.) 8 annas; 10d.
- British Honduras. Annual Report of the Forest Trust for the Year ended 31st March 1925. Pp. 25. (Belize.)
- Animal Breeding Research Department: The University, Edinburgh. Report of the Director for the Year April 1st, 1924, to March 31st, 1925 (being the 5th Annual Report). Pp. 21. (Edinburgh.)
- Occasional Papers of the Society for the Preservation of the Fauna of the Empire, No. 1: The Tsetse-Fly Problem and its Solution. Pp. 10. (London.)
- Proceedings of the Geologists' Association. Vol. 36, Part 3, October 25. Edited by A. K. Wells. Pp. 203-320. (London: Edward Stanford, Ltd.) 5s.
- Journal of the Indian Institute of Science. Vol. SB, Part 1: Lecher Wire Measurements. By S. R. Kantebet. Pp. 10+5 plates. (Bangalore.) 1 rupee.
- Svenska Hydrografisk-Biologiska Kommissionens Fyrskjeppsundersökning, år 1924. Pp. 39. (Göteborg: Elanders Boktryckeri Aktiebolag.)
- University of Illinois Engineering Experiment Station. Bulletin No. 148: Radio Telephone Modulation. By Hugh A. Brown and Charles A. Keener. Pp. 49. 30 cents. Bulletin No. 149: An Investigation of the Efficiency and Durability of Spur Gears. By Prof. C. W. Ham and J. W. Huckert. Pp. 94. 50 cents. (Urbana, Ill.)
- Egyptian Government: Anti-Malaria Commission. The Mosquitoes of Egypt. By T. W. Kirkpatrick. Pp. xii+224+24 plates+2 maps. (Cairo: Government Publications Office.) 30 P.T.
- Ministry of Agriculture and Fisheries: Intelligence Department. Report on the Work of the Intelligence Department of the Ministry for the Three Years 1921-24. Pp. 163. (London: H.M. Stationery Office.) 5s. net.
- Aeronautical Research Committee. Reports and Memoranda, No. 973 (Ae. 188): The Lateral Control of a Biplane by Combined Use of Ailerons and varying Leading Edge Slots. By Dr. G. P. Douglas, F. B. Bradfield and A. S. Hartshorn. (A.2.a. Stability, Calculations and Model Experiments, 92—T. 2069.) Pp. 14+12 plates. (London: H.M. Stationery Office.) 1s. net.
- Transactions of the Royal Society of Edinburgh. Vol. 54, Part 2, No. 4: A Monograph on the General Morphology of the Myxinoïd Fishes, based on a Study of Myxine. Part 6: The Morphology of the Vascular System. By Prof. F. J. Cole. Pp. 309-342+5 plates. (Edinburgh: R. Grant and Son; London: Williams and Norgate, Ltd.) 6s.

## Diary of Societies.

SATURDAY, NOVEMBER 28.

JUNIOR INSTITUTION OF ENGINEERS (at Shipping Engineering and Machinery Exhibition at Olympia), at 3.—T. E. Dimbleby: Introduction as an Aid to an Industrial Revival (Lecture).

MONDAY, NOVEMBER 30.

ROYAL SOCIETY, at 4.—Anniversary Meeting.

ROYAL IRISH ACADEMY, at 4.15.

INSTITUTE OF ACTUARIES, at 5.—D. Houseman: Some Notes on the Changes made by the New Law of Property Acts, with special reference to Life Assurance Practice.

INSTITUTION OF ELECTRICAL ENGINEERS (Western Centre) (at South Wales Institute of Engineers, Cardiff), at 6.—J. H. Thomas: Switch-gear Developments during the Past Twenty Years (Lecture).

ROYAL SOCIETY OF ARTS, at 8.—Dr. R. Lessing: Coal Ash and Clean Coal (Cantor Lecture II.).

TUESDAY, DECEMBER 1.

INSTITUTION OF CIVIL ENGINEERS, at 6.—H. A. Reed: Trafford Wharf Reconstruction at the Manchester Docks.

INSTITUTION OF AUTOMOBILE ENGINEERS (at Royal Society of Arts), at 7.—Capt. R. K. Hubbard: The Requirements of the Military Motor Vehicle.

INSTITUTION OF ELECTRICAL ENGINEERS (North-Western Centre) (at 17 Albert Square, Manchester), at 7.—T. Carter: The Engineer; his Due and his Duty in Life (Lecture).

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—T. H. B. Scott: Lourdes Revisited.

INSTITUTE OF METALS (Birmingham Local Section) (in the Chamber of Commerce, New Street), at 7.—Discussion on The Production of Sound Ingots.

INSTITUTION OF AUTOMOBILE ENGINEERS (at Broadgate Café, Coventry) (Coventry Graduates' Meeting), at 7.15.—G. H. Day: Some Notes on Service.

SOCIETY OF CHEMICAL INDUSTRY (South Wales Section) (at Technical College, Cardiff), at 7.30.—C. Bateman: Manufacture and Neutralisation of Ammonium Sulphate.

INSTITUTE OF METALS (North-East Coast Local Section) (in the Electrical Engineering Lecture Theatre, Atkinson College, Newcastle-on-Tyne), at 7.30.—Dr. M. Cook: The Solidification of Metals.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND (at 29 Elmbank Crescent, Glasgow), at 7.30.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Middlesbrough Branch) (at Cleveland Scientific and Technical Institution, Middlesbrough), at 7.30.—G. Butler: The Products and By-Products of a Modern Iron and Steel Works.

INSTITUTE OF MARINE ENGINEERS (at Shipping Engineering and Machinery Exhibition at Olympia), at 8.—A. C. Hardy: Motor Ship Progress in 1925.

RÖNTGEN SOCIETY (at British Institute of Radiology), at 8.15.—R. J. Stephenson: A Study of Interrupters for Induction Coils.—Dr. E. A. Owen: Oscillographic Observations on Induction Coils and Transformers.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Z. le Rouzic: Les Monuments mégalithiques du Morbihan; leur définition, leur destination et leur âge d'après les dernières découvertes aux environs de Carnac.

WEDNESDAY, DECEMBER 2.

GEOLOGICAL SOCIETY OF LONDON, at 5.30.—R. D. Oldham: The Depth of Origin of Earthquakes.

INSTITUTION OF CIVIL ENGINEERS (Students' Meeting), at 6.—H. F. Molony: Escalators on the Central London Railway.

INSTITUTION OF ELECTRICAL ENGINEERS (Wireless Section), at 6.—H. A. Thomas: The Performance of Amplifiers.

INSTITUTION OF ELECTRICAL ENGINEERS (South Midland Centre) (at Birmingham University), at 7.—Prof. S. P. Smith: An All-Electric House.

INSTITUTION OF HEATING AND VENTILATING ENGINEERS (at Shipping Engineering and Machinery Exhibition at Olympia), at 7.30.—J. E. Boaz: The Requirements of Ablutionary and Recreative Bathing Establishments as affecting the Heating and Ventilating Engineer.

SOCIETY OF PUBLIC ANALYSTS AND OTHER ANALYTICAL CHEMISTS (at Chemical Society), at 8.—Dr. J. S. Owens: Measuring the Smoke Pollution of City Air.—Dr. O. L. Brady: 2:4-Dinitrophenylhydrazine as a Reagent for Aldehydes and Ketones.—G. Jørgensen: The Determination of Phosphoric Acid as Magnesium Ammonium Phosphate.—C. H. Thomson: On the Effect of "Blowing" on the Composition of Certain Fatty Oils.

ROYAL SOCIETY OF ARTS, at 8.—Lt.-Col. Sir Alan H. Burgoyne: The Future of the Motor Car.

ENTOMOLOGICAL SOCIETY OF LONDON, at 8.

THURSDAY, DECEMBER 3.

ROYAL SOCIETY, at 4.30.—W. A. Bone and G. W. Andrew: Studies in Catalytic Combustion. Part II. The Union of Carbon Monoxide and Oxygen in contact with Nickel Copper and other Oxides.—F. H. Constable: Immobile Groups of Atoms with Strong Specific External Fields as the Cause of Catalytic Activity.—S. C. Roy: On the Law and Mechanism of Monomolecular Reaction.—F. A. Williams: The Effect of Temperature on the Viscosity of Air.—R. W. Fenning: Gaseous Combustion at Medium Pressures. Parts I and II.—R. K. Schofield and E. K. Rideal: The Kinetic Theory of Surface Films. Part II.—*To be read in title only*.—H. B. Dixon and G. Greenwood: On the Velocity of Sound in Mixtures of Gases.—A. Fage and L. F. G. Simmons: An Investigation of the Air-Flow Pattern in the Wake of an Aerofoil of Finite Span.—W. L. Webster: Magneto-Striction in Iron Crystals.—R. W. James and W. A. Wood: The Crystal Structure

of Barytes, Celestine, and Anglesite.—O. Maass and J. H. Mennie: Aberrations from the Ideal Gas Laws in Systems of One and Two Components.—R. G. Lunnion: Fluid Resistance to Moving Spheres.—W. G. Palmer: The Adsorptive Equilibria of Binary Gaseous Mixtures.—I. Sandeman: The Secondary Spectrum of Hydrogen at Higher Pressures. II.—P. A. M. Dirac: The Fundamental Equations of Quantum Mechanics.

LINNEAN SOCIETY OF LONDON, at 5.

ROYAL AERONAUTICAL SOCIETY, at 5.30.—Prof. B. Melville Jones: The Control of Stalled Aeroplanes.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Prof. S. P. Smith: An All-Electric House.

GLASGOW UNIVERSITY ALCHEMISTS' CLUB, at 7.30.—A. Stevens: Arctic Exploration.

INSTITUTION OF STRUCTURAL ENGINEERS, at 7.30.—H. G. Lloyd: A Method of Testing Concrete Blocks.

CHEMICAL SOCIETY, at 8.—B. Lewis and E. K. Rideal: On the Budde Effect in Bromine. Part I. The Photoactive Constituent in Wet Bromine. Part II. The Kinetics of the Reaction and the Light Absorption of Wet and Dry Bromine.—R. Gamie and C. K. Ingold: The Influence of Carbon Rings in the Velocity of Reactions involving their Side-chains. Part I. The Hydrolysis of Cyclic and Open-chain Malonic Esters.—H. V. A. Briscoe, P. L. Robinson, and G. E. Stephenson: The Density of Boric Oxide Glass and the Suspected Variation in the Atomic Weight of Boron.

INSTITUTION OF MECHANICAL ENGINEERS (Glasgow Local Meeting).—Sir John A. F. Aspinall: Some Railway Notes Old and New (Thomas Hawksley Lecture).

INSTITUTION OF MECHANICAL ENGINEERS (Manchester Local Meeting).—H. F. L. Orcutt: Characteristics and Uses of Ground Gears.

FRIDAY, DECEMBER 4.

INSTITUTION OF WATER ENGINEERS (at Geological Society), at 10.30 A.M.—Dr. J. C. Thresh and J. F. Beale: Recent Studies relating to the Purification of Water, and the Action of Various Waters on Lead and Copper Pipes.—Dr. W. Rushton and P. A. Aubin: Further Observations on the Biology of Jersey Waterworks.—W. N. McClean: An Analysis of Scottish Rainfall Records.—Lt.-Col. J. R. Davidson: The Afforestation of Watersheds.—H. E. Stilgoe: The London Water Supply (Lecture).

ROYAL ASTRONOMICAL SOCIETY (Geophysical Discussion), at 5.—Sir Gilbert Walker: Vortical Theories in Meteorology, followed by E. V. Newnham. Chairman, Sir Napier Shaw.

SOCIETY OF CHEMICAL INDUSTRY (Manchester Section) (at 16 St. Mary's Parsonage, Manchester), at 7.—M. Barash: A Standard Method for the Determination of the Agglutinating Value of Coal.—C. M. Keyworth and Dr. R. B. Forster: The Separation of R., G., Schaffer and Crocein Acids and their Arylamine Salts.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—Pictorial Group Meeting.

PHOTOMICROGRAPHIC SOCIETY (at 4 Fetter Lane), at 7.—T. Thorne Baker: The Role of Photomicrography in the History of Plate Making.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—A. E. Bowyer-Lowe: Super Heterodyne Reception.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (at Literary and Philosophical Society, Newcastle-upon-Tyne), at 7.30.—G. Constantinesco: Transmission of Power—the Present and the Future.

GEOLOGISTS' ASSOCIATION (at University College), at 7.30.—Dr. W. D. Lang: The Submerged Forest at the Mouth of the River Char, and the History of that River.—S. W. Woolridge: Some Phases in the Structural Evolution of the London Basin.

SATURDAY, DECEMBER 5.

GILBERT WHITE FELLOWSHIP (at 6 Queen Square, W.C.1), at 3.—Miss G. Lister: Swiss Memories (Lecture).

## PUBLIC LECTURES.

SATURDAY, NOVEMBER 28.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—E. Lovett: The Luck of an Old Shoe.

MONDAY, NOVEMBER 30.

UNIVERSITY COLLEGE, at 4.30.—Prof. Y. Henderson: The Efficiency of the Heart and its Measurement. (Succeeding Lecture on December 1.)

UNIVERSITY OF LEEDS, at 5.15.—Dr. G. W. C. Kaye: X-Rays in Industry.—At 8.—Sir Henry Hadow: Chamber Music, illustrated by the Elizabethans and J. S. Bach.

TUESDAY, DECEMBER 1.

KING'S COLLEGE, at 5.30.—Miss Hilda D. Oakeley: The Philosophy of Aristotle; Theory of Art. Characteristics of Aristotle's Genius.

THURSDAY, DECEMBER 3.

FINSBURY TECHNICAL COLLEGE, at 4.—F. H. Carr: The Scientific Basis of Industry (Streatfeild Memorial Lecture).

FRIDAY, DECEMBER 4.

ST. THOMAS'S HOSPITAL, at 5.—Prof. F. G. Parsons: The Earlier Inhabitants of London.

SATURDAY, DECEMBER 5.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Miss M. A. Murray: Travel and Transport in Ancient Egypt.