



SATURDAY, NOVEMBER 10, 1934

No. 3393

Vol. 134

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## Economic Planning and Agricultural Production

SOCIETY, said Karl Marx, is a kind of organism on the growth of which conscious efforts can exercise little effect. That this is not the common view to-day is shown by the wealth of thought that is being devoted to 'planning', with the object of preventing the recurrence of economic crises and of securing, eventually, 'abundance for all'. Political and economic planning is now engaging the attention not only of economists and politicians, but also of those numerous professional men who usually ignore economists, as being too inhuman in their science, and politicians, as being all too human in their practice.

Most of the world's present economic and political troubles appear to have followed from man's failure to control his instincts of acquisition and pugnacity—'smash and grab' not being confined to the modern gangster; and so we find that the proposed ameliorative measures relate mainly to the reorganisation of our productive, distributive and monetary systems, and to projects for keeping the peace.

Science in the service of man, aided by capitalism mainly in the service of the few, has done wonders for production; but it has yet to solve the problems of exchange and distribution. From the point of view of the requirements of civilised man, maldistribution in Nature appears to be the rule rather than the exception, for not only are most useful minerals and plants very unequally distributed, but they are also often located in places difficult of access and exploitation. Valuable minerals are mostly found deep down in the earth; the enormous amount of gold in sea-water is present in such dilute concentration, as Haber found, that it cannot be economically extracted; and the upper air is not exactly the ideal location for the ozone required by modern industry and sanitation. Science and invention have, however, overcome many of these obstacles; new instruments, machines and processes have been devised for locating and extracting valuable minerals; the plant-breeder has provided economic plants that will grow in regions remote from their natural habitats; and engineers have so revolutionised transport that both natural and artificial products can now be conveyed expeditiously and economically to the uttermost parts of the earth.

In spite of all such achievements, however,

man has signally failed to effect anything like an equal—and some would say a fair—distribution of the world's wealth, either among nations or individuals; hence the spirit of evil in its hydra-headed shapes of want, fear, envy and discontent continues to stalk through the world, poisoning the well-springs of human happiness. If the world were ruled by reason, there is no doubt that every developed country would abjure war, would concentrate on producing those commodities for which it is best suited by its natural wealth, geographical position and the capabilities of its inhabitants, and would exchange them freely for commodities best produced abroad. How far and how fast the world has of late been departing from these ideals are well known; less well appreciated are the implications for Great Britain. Once the premier exporter of manufactured goods and the greatest international 'shopkeeper', and paying for imports of food and raw materials by exports and services, with a good margin to spare, Great Britain is now being forced into a policy of national self-sufficiency; and foremost among the problems now awaiting solution is that of food supplies: Can we afford to continue importing foodstuffs to the extent of about a million sterling a day? And if not, what changes are necessary in our agricultural economy? To this problem Sir Daniel Hall made a notable contribution in the address on the planning of agricultural production which he gave to the Agricultural Section of the British Association at Aberdeen.

The competition set up by intensive nationalism, according to Sir Daniel Hall, has destroyed the economic position of the British farmer, so that the nation has had to abandon free trade and to adopt protection. At the same time, internal competition alone, in which imports play but a small part, may be equally destructive of agricultural stability, checking enterprise and that development of production which the nation needs. This is the case for a planned agriculture. The various marketing boards can, by virtue of their monopoly, direct production along the lines that are most economic and best suited to the requirements of the consumer, but neither protection nor subsidies will suffice to bring about the required intensity of production; farmers, in consideration of measures giving them adequate returns, must submit to a certain amount of control; and an advisory body, acting behind the administration (and apparently having no relation to the Agricultural Research Council),

should be appointed to advise upon the guiding principles of the nation's agricultural policy and upon their application.

Sir Daniel Hall thinks that we could increase our production of home-grown food from about 38 per cent of our total requirements, the present figure, to about 60 per cent, within a generation, and that, in general, we should concentrate our efforts on products that employ labour, demand skill, and are costly to transport. Live stock products, fruit and vegetables come within this category, whilst cereals and sugar, being more cheaply produced abroad, should be mainly imported. In this way Sir Daniel ranged himself on the side of the 'Up-Horn' school in the perennial controversy whether 'corn' or 'horn' should predominate in our agricultural economy. This school of thought maintains that our agricultural land is best suited by Nature for growing grass and its derivatives, beef, mutton, milk and other dairy produce; that arable crops like wheat and sugar can be grown with greater security from adverse climatic factors, and more economically, in foreign parts than in Britain; that home-grown flour is not liked by our millers and the bread made from it is not to the popular taste; and that cheap corn is a fundamental requirement of a flourishing live stock industry. Our people require fresh food, whether milk, meat, eggs, fruit or vegetables, and this can best be grown at home.

The corn-dominant view is that England grows some of the best wheat in the world and with yields that are higher than those in most other countries. Thanks to mechanisation, production costs bid fair to fall to a level comparable with those in the great wheat-growing lands. Satisfactory 'hard' wheat can be grown in England, for example, Yeoman II, although perhaps not enough of it to meet all our needs. Wheat has always played an essential part in our cropping systems, and in time of blockade, as in 1917-18, its large-scale cultivation is imperative; in a future war there may not be time to plough up more than three million acres of grassland to grow cereals for human consumption, as we had to do in the last. Beef, mutton and lamb, are, and probably always will be, produced far more cheaply in Argentina and Australasia, and butter in Denmark and New Zealand, than in Britain; and the production of greatly increased quantities of fresh vegetables, fruit, milk and eggs is as feasible under an 'up-corn' policy as under an 'up-horn' policy. Moreover, increased beef production would necessitate

increased importation of feeding-stuffs, and so adversely affect the balance of trade. There is no foundation in fact for the contention that imported chilled or frozen meat is less nutritious than home-killed meat.

Loving compromise as we English do, it should not be impossible to frame a policy that would go far to satisfy the chief demands of these two opposing schools. It might, for example, be possible to combine an 'up-horn' with an 'up-corn' policy by extending our present area of cultivated land, for example, by improving upland pastures in the way Prof. Stapledon is now showing us, by reclaiming submarginal land (heaths, moorlands and estuarine lands) and improving much marginal land by draining and liming; and, generally, by improving all fertile land by the increased use of fertilisers. It has been estimated by one of the active planning groups in London that about sixty per cent of our total food requirements could be obtained by such measures, which would include the conversion of sufficient very poor land to provide  $2\frac{1}{2}$  million acres of good land, the substitution of more wheat and barley, grown wherever possible under mechanised conditions, for some of the oats and roots now produced, and a greatly increased production of pig-meat, eggs, fruit and vegetables.

Prof. Scott Watson, in his presidential address to the Agricultural Section of the British Association, advocated a substantial reduction in the area now under oats, which, owing to the development of motor traffic and other causes, has been steadily declining for some time past. A scheme like the above would involve large capital expenditure from public funds; and so, indeed, would any drastic scheme, but capital expended on land reclamation and improvement would continue remunerative for many years to come. The State is already supporting agriculture, directly and indirectly, to the tune of more than £45 million yearly (the figure for 1933), and it is conceivable that some of this amount might be diverted into more directly productive channels. Moreover, we have been expending hundreds of millions of pounds on keeping the unemployed in idleness, and some of this large store of potential energy might be converted into work on the land.

In Sir Daniel Hall's opinion, the continuance of the State subsidy for sugar-beet is open to question. That subsidy has cost the country some £40 million since its inception in 1923, and is still

costing more than £3 million a year. Although much may be said in favour of past policy—it has saved many arable farmers from bankruptcy, has given work to thousands of men during the campaign period in the winter months, has provided food for stock in the form of 'crowns' and 'pulp', and has ensured thorough cultivation and cleaning of the land upon which it is grown—Sir Daniel's contention that scientific research has so increased the yield of sugar from the sugar-cane that beet can no longer compete with it, is undeniable. In certain Continental countries, the cultivation of sugar-beet has been subsidised for many years, largely because the alcohol made from the sugar brings in a very high revenue to the State. We make practically no industrial alcohol from home-grown materials in Great Britain, but if we did there would be something to say on the other side.

Worthy of consideration in any scheme of agricultural production would be the establishment of industries like the manufacture of potato-starch and dextrine, and of strawboard from cereal straws, most of our requirements of which we now import; and there is good reason for believing that these industries could be instituted in such a way as to make them self-supporting within a short period of years.

The problems involved in planning agricultural production are thus seen to be both numerous and complex. Whatever the actual outcome may be, it is reasonably certain that if we abstain from our usual practice of 'muddling through', and adopt some definite policy, its nature will be determined as much by considerations of world and Empire relationships and home economics, as by the dictates of agricultural science. But economic planning, as Prof. Scott Watson points out, must not be regarded as a substitute for scientific education and research. Science will and must make its voice heard, and if the advisory body asked for by Sir Daniel Hall is appointed, it is to be hoped that he and other men of scientific outlook and attainments will be invited to take part in its counsels. Fortunately, British agriculture is now directed by a Minister who is alive to the value of scientific knowledge and method; but it will need all his ability and that of his colleagues and advisers to come to conclusions concerning the future of economic nationalism, and of international affairs, before any attempt can be made to map out a long term policy of home food production in Great Britain.

### Man's Line of Ascent

*Man's Place among the Anthropoids: Three Lectures on the Evolution of Man from the Lower Vertebrates.* By Prof. William King Gregory. Pp. vi+119+4 plates. (Oxford: Clarendon Press; London: Oxford University Press, 1934.) 6s. net.

IN "Man's Place among the Anthropoids" Prof. W. K. Gregory, of the American Museum of Natural History, has made a further contribution to a discussion which was initiated by Prof. F. Wood Jones in a lecture given in 1918 at King's College, London, on "The Problem of Man's Ancestry". In this lecture the belief held by most anatomists, namely, that man has sprung from the line of anthropoid apes, was attacked and rejected. The issue which was then raised by Prof. Wood Jones really extends far beyond the limits of anatomical inquiry; it concerns those who are seeking to unravel the evolution of human culture quite as much as those who are inquiring into the evolution of man's body.

Among students of human culture, we find those who believe that separate peoples may make the same invention or arrive at similar practices quite independently; we find others who maintain with even greater emphasis that such similarities never arise independently but are always traceable to borrowing—either from one another or from a common source.

We find anatomists divided into the same two schools. The orthodox view—the diffusionist theory—that similarity of structure implies similarity of descent—is upheld by Prof. W. K. Gregory. Prof. Wood Jones champions the cause of independent or parallel evolution. Prof. Gregory traces man to an anthropoidal origin; Prof. Wood Jones carries his lineage back to the tarsoids—the ancients of the monkey world. The orthodox Prof. Gregory accepts the anthropoid ape as the nearest of man's living relatives. The heterodox Prof. Wood Jones, while admitting the structural resemblances of anthropoids to man, rejects their kinship on the ground that such resemblances are really of the nature of anatomical mimicry. He regards the sole surviving tarsoid—the nocturnal *Tarsius spectrum* of the Bornean jungle—as having the best claim to human kinship.

It may help onlookers to understand the difficulties which students of man's evolution have to face if we continue to compare the methods used by students of human culture with those employed by morphologists in search of man's origin.

In accounting for the origin of new things or for the modification of the old, the student of culture has an easy task; the human brain has

creative powers which answers to all postulates. Where is the 'creative brain' which serves the needs of those who are seeking to unravel the history of the human body? Nowhere in his last book does Prof. Gregory specify the machinery which brings about the structural adaptations of the body of ape and man. He assures his readers he is not a Lamarckian, and yet on p. 8 we find him making the following statement about the early evolution of the shoulder girdle:

"When the stout paddles came to push against the ground instead of the water, new stresses and strains were initiated in the shoulder-girdle, so it is not surprising that under Natural Selection or some other potent influence, the cleithrum, which was the largest dermal element, became smaller, while the scapulocoracoid became larger."

This extract has certainly a Lamarckian flavour; the evolution of the shoulder girdle is ascribed to the "stresses and strains" which fall on it. In reality, Prof. Gregory presumes that the living flesh of the shoulder girdle is possessed of the virtues which are inherent in living nerve tissues—the power of profiting from experience.

Prof. Wood Jones is more explicit than Dr. Gregory as to the manner in which structural modifications are brought about. In "Man's Place among the Mammals" (1929)—to which Prof. Gregory's book is a reply—he makes his position clear thus (p. 31):

"That correlation, in the sense of harmonious change in the structure and function of a whole system of parts and organs, involves in its explanation some factor far more plastic, far more subtle, than any chance variation or mutation, has always been apparent to a certain section of students of Nature. . . . Since we have every reason to believe that these things are the outcome of the interaction of the environment and the animal, it seems not impossible that identical correlated adaptations might be manifested in different animals which having no intimate relation with each other, are subjected to the same range of environmental conditions".

Prof. Wood Jones is a confessed Lamarckian and here ascribes to the living body an evolutionary power of altering its structure, function and appearance according to demands made on it by its environment. It is thus possible for him to believe that the vast number of anatomical characters which man and the anthropoid apes have in common do not represent an inheritance from a common ancestor, as is Prof. Gregory's opinion, but are separate acquisitions forced on the bodies of man and ape by similarity of environment.

The position adopted by Prof. Wood Jones is almost identical with that taken up by the school

of cultural anthropologists which regards the human brain as being constituted alike in all races and therefore reacting to difficulties by finding the same modes of overcoming them at all times and in all places. Prof. Gregory, on the other hand, while by no means denying the possibility of independent or parallel evolution, yet regards it as exceptional and accepts similarity of structure as evidence of community of origin. In so doing he has the support of the vast majority of anatomists. Until we have obtained a more accurate knowledge of the means by which the structural adaptation of the body and brain is brought about and the rules which regulate the transmission of such adaptation or modifications from one generation to the next, we cannot be certain that our interpretation of anatomical evidence is right.

The differences between Prof. Gregory and Prof. Wood Jones are not so great as the similarities which unite them. Both believe that man's body has been evolved and that the means which have raised it from the lowest to the highest position among primate forms, are placed not outside the body but are inherent properties of its living flesh. Prof. Wood Jones's theory makes the greater demand on the powers of evolution; he presumes that humanity has arisen from a very lowly animal which differed from man both inwardly and outwardly, whereas Prof. Gregory seeks to bring him from a form which had already climbed to a high position in the primate tree and assumed both in body and in brain striking resemblance to man's estate.

Prof. Gregory claims that all recent discoveries of fossil man and of fossil anthropoid favour the anthropoid theory of man's origin and are against the Tarsian hypothesis advocated by Prof. Wood Jones. In making this claim Prof. Gregory has the support of most anatomists.

### Chemistry in Space

*Stereochemie: eine Zusammenfassung der Ergebnisse, Grundlagen und Probleme.* Herausgegeben von K. Freudenberg. Lief. 4. Pp. 481-638. 18 gold marks. Lief. 5. Pp. 639-798. 18 gold marks. Lief. 6. Pp. 799-958. 18 gold marks. Lief. 7. Pp. 959-1116. 18 gold marks. Lief. 8. Pp. 1117-1276. 18 gold marks. Lief. 9. Pp. 1277-1376. 10.80 gold marks. Lief. 10 (Schlusslieferung). Pp. xvi+1377-1509. 18 gold marks. (Leipzig und Wien: Franz Deuticke, 1932-33.)

PART I of Freudenberg's "Stereochemie" has already been reviewed somewhat fully in these columns (NATURE, April 22, 1933, p. 563), and a briefer notice must suffice to record the

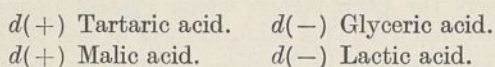
completion of Parts II and III and the index. In reviewing Part I, it was pointed out that the work of Pasteur, the real founder of stereochemistry, was not sufficiently appreciated, and, in particular, that his discriminating use of the term dissymmetry had been ignored, for example, by using the term '*anisotropy factor*' as a measure of the optical activity associated with an absorption band in a *dissymmetrically isotropic* medium. A similar neglect of fundamental definitions is shown at the beginning of Part II, where it is stated that "In stereochemistry the term '*asymmetric*' does not mean an absence of all symmetry but only of mirror-image symmetry". This is an unfortunate distortion, since *asymmetry* can only be defined accurately as implying an absence of *all* symmetry; and the absence of mirror-image symmetry is precisely the phenomenon which Pasteur defined as dissymmetry. This confusion was at one period just as prevalent in English writings on stereochemistry as it now appears to be in Germany. Indeed, on one occasion, the reviewer was accused in print of having himself invented the term which formed the title of Pasteur's lectures to the Société Chimique de Paris in 1860, and which is actually carved on a panel of his mausoleum in the Institut Pasteur in Paris; but it is to be hoped that so good a chemist as Freudenberg will in the next edition of his "Stereochemie" take the opportunity of correcting these errors in elementary geometry.

In the limited space available it is impossible to do justice to the painstaking work of the contributors to the thousand pages now under review. As an example of this thoroughness, it may be noted that Ebel in discussing the "Resolution of Racemates" not only enumerates eleven cases in which attempts have been made to effect this resolution by picking out enantiomorphous crystals of the *d* and *l* forms, but also attempts in eleven pages of tables to summarise the multitudinous cases in which this resolution has been effected by the use of ferments or of optically active acids, bases, etc.

Freudenberg's own contribution on "Configuration of Optically Active Compounds" begins with a lament that "No one has yet had the good fortune to be able to determine the arrangement in space of the substituents of an asymmetric carbon atom". It is therefore only possible to compare the "relative configurations" of related substances. This can be done most conclusively by carrying out substitutions in which the linkages to the asymmetric carbon are not disturbed, since in all other substitutions the risk of Walden inversions renders the results entirely untrustworthy.

By methods of this kind Freudenberg has himself converted dextro-rotatory tartaric acid into

dextro-rotatory malic acid (of opposite sign to the naturally occurring acid) and thence into lævo-rotatory glyceric acid and lævo-rotatory lactic acid (again of opposite sign to natural sarcolactic acid). Much confusion has arisen from the fact that configuratively related compounds such as these often differ in the sign of their optical rotations. Thus it has become customary to describe lævulose (or lævo-rotatory fructose) as *d*-fructose, because it has the same configuration as ordinary dextrose or *d*-glucose. Almost every optically active compound is therefore liable to have its nomenclature reversed, whenever a claim can be made that its configuration has been established relatively to that of some other related compound. Freudenberg proposes to get over this difficulty by writing his four acids as



In this system, sarcolactic acid, which has been known for half a century as *d*-lactic acid, is formulated as *l*(+) lactic acid; but readers who are not specialists in stereochemistry may easily be misled by the alteration from *d* to *l*; and even the insertion of a + or - sign may be ambiguous when the sign of the rotation is liable to be reversed by changes of concentration or of wave-length, as it is in all acids of the type cited above.

An important section of Freudenberg's article is devoted to the "Determination of Configuration with the help of Optical Activity". As a worker in the field of optical activity, the reviewer cannot share the faith of organic chemists in the validity of deductions made on this basis. Thus, even when it can be shown that analogous effects are produced in related compounds by changes of wave-length, temperature, solvent and concentration, or of substitution, he believes that the configurations of the compounds in question may nevertheless be reversed, as they certainly *must* be reversed, on passing from a methyl-ethyl to a propyl-ethyl carbinol of similar sign. Sooner or later, however, the problem of predicting the sign and magnitude of the rotation of an asymmetric carbon atom from the nature and configuration of its substituents, which has already been attempted by de Malleman, will certainly be solved, and the problem of relative configurations will then become subsidiary to the more fundamental problem of deducing the absolute configurations of optically active compounds of either sign.

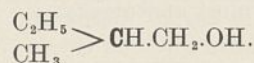
The "Physical Properties of Stereoisomeric Olefines" are discussed by Wassermann in an article of eighty pages, and R. Kuhn contributes a short article of eight pages on isomeric change in the same series of compounds. The latter author also describes, under the ambiguous title of

"Molecular Asymmetry", the optical activity of spiro-compounds, and of compounds in which molecular dissymmetry is produced by the impedance of free rotation. On the other hand, the impedance of free rotation in derivatives of ethane, for example, by the mutual influence of dipoles, figures largely in an article by Ebel, in which the posture assumed by saturated chains and rings is discussed.

Part II also includes an important article by Dr. Wagner-Jauregg on "Molecular Rearrangement in Optically Active Compounds", in which the phenomena of racemisation and of the Walden inversion are discussed; and it concludes with an article by Dr. Hans Beckmann, in which the biological behaviour of stereoisomers is described.

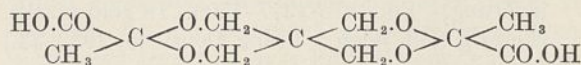
Part III includes an article of two hundred pages by Meisenheimer on the stereochemistry of nitrogen and of its homologues; Ziegler contributes an article on the stereochemistry of the homologues of carbon and of oxygen; and finally Pfeiffer contributes an article of 178 pages on "Complex Compounds". Several of the later sections of the book include supplementary paragraphs, so that they have been kept up to date during the necessary interval before publication. The book is therefore an exceptionally complete review of the subject and will be widely consulted by those who can secure access to so expensive a work.

[Added August 1, 1934.] Since this review was written, a solution of the problem of the absolute configuration of optically active molecules has been announced in a paper by S. F. Boys in the *Proceedings of the Royal Society* (A, 144, 655). In particular, the absolute configuration of lævo-rotatory amyl alcohol



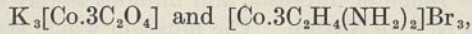
is illustrated by means of a figure (*loc. cit.*, p. 686) which shows that, when viewed from the radical -CH<sub>2</sub>.OH, the other three radicals attached to the asymmetric carbon atom are in clockwise order in the sequence C<sub>2</sub>H<sub>5</sub>, CH<sub>3</sub>, H.

A tentative solution has also been given by Kuhn and Bein (*Zeitschr. physikal. Chem.*, B, 24, 335; 1934) in the more complex case of a spiro-compound of the formula



which contains no asymmetric carbon atom, but was resolved by Böeseken in 1928. The same authors have also discussed (*Zeitschr. anorg.*

*Chem.*, 216, 321; 1934) the absolute configuration of co-ordination compounds of the type



where the complex ion has (like quartz) the symmetry of a three-bladed propeller. The phenomena are here extremely complicated, since most of these salts are strongly coloured, and give rise to very complex curves of rotatory dispersion; but a figure is given (*loc. cit.*, p. 339) which shows the configuration assigned to the forms of the two cobaltic salts, which are dextrorotatory in the red, but lævorotatory for sodium light. This figure is not easy to interpret without a model; but it can be translated as the equivalent of a diagram of a three-bladed propeller with the blades set as in a right-handed screw, so that if rotated in a clockwise direction it would move away from the observer.

T. M. LOWRY.

### Bird Exhibition and Study

*Autobiography of a Bird-Lover.* By Frank M. Chapman. Pp. xiii+420+59 plates. (New York and London: D. Appleton-Century Co., Inc., 1933.) 15s.

FRANK M. CHAPMAN in his autobiography tells of the cultivation of friendship with Nature for many years. He started in a bank, but in 1886 threw up a most financially promising career for the relative poverty of employment in the ornithological division of the American Museum at New York. His story is that of the rise of his sub-department from the dull and dusty crowded and unattractive cases of perched birds, thousands of such mounted 'specimens' with no study collections in reserve, to the finest and most attractive department in any science museum. His job was uphill work, entering, arranging and classifying collections, his soul saved by the employment of all his holidays and spare hours in the study of birds in the wild. Gradually the policy of the Museum evolved and determined itself, so that Chapman's life is a long story of explorations and Nature study, with intervals for the consolidation of his spoils.

At first, the author's attention was confined to the United States, but it soon passed to Mexico, Cuba, Trinidad and the West Indies region. Then come stories of the study of individual birds in all their surroundings, these as well as the birds to be carried home. Explorations in Colombia and Chile were concerned with zonal distributions and there were odd visits to the Old World and two years with the Red Cross. It is noticeable that the technique of such explorations is to find a favourable place in which to settle and study, and to drain it dry.

With all this, Chapman was a familiar figure in societies and at meetings, taking part in their discussions. There are tales of and shrewd observations on many naturalists, including statesmen such as Roosevelt and Grey who sought relief from their rather exacting occupations in the study of Nature. The former was his friend, so that it must have been pleasing to him in 1928 to receive the Roosevelt medal "for distinguished service", and he was clearly man-of-the-world enough to like being conjoined with C. E. Hughes and Lindberg. Assuredly all ornithologists will read so pleasant and so well-presented a book.

Ornithology was happy in having such a man as an executive officer; for he was a great "creative innovator in methods of exhibition". He made the studies upon which was built up that great hall of habitat groups of birds, the most astonishing and greatest exhibition of any natural history museum. Even as to any single one of the long series of exhibits, at first each devoted to a single species of birds, there is nothing in Great Britain comparable in any way.

The birds were studied in their own homes, and the attempt is made to show their natural attitudes and their growth from the nest; they have around them their own natural surroundings, vegetation, rock and earth, and the background is landscape suggested by the actual spot from which the birds came. The whole effect is one of space and freedom, and this is especially noticeable in the larger and more ambitious faunal groups, which are culled from many regions and environments. The picture of the pampas group is beautiful, with a dozen or so species of birds on its waters and between its reeds with flights overhead, recalling the word pictures of Hudson to whom it is dedicated. Finally, there is the great hall, often a place for social functions, with its huge dome, blue sky and clouds traversed by flights of birds, and, suspended to the same by invisible wires, realistically mounted birds, all soaring overhead. The lighting is realistic and we look up to see ducks, geese, pelicans, the albatross and condor all there fading into the distant sky. Fuertes had a genius for the artistic selection of the scenery and Jaques is an artist (not a scene painter), while Chapman in choosing the flamingo, spoonbill and other species, that must vanish as man's world grows, has preserved in the surrounds he gives them a record of priceless value for all times.

We have seen some of these habitat groups in New York and were surprised at the visitors, young and old, that thronged to see them, an everlasting source of enjoyment to the parents and a holiday visit for the children as keenly anticipated as a visit to the cinema or a play. As exhibits they are beautiful in themselves and

they are an educative study of great importance such as we trust we may one day see in the British Museum. The collection of species is valuable, but the undue accumulation of skins and dried bones, useful enough for the study of variation and evolution, may be carried too far in museums, which, if intended for the public, should exist as backgrounds for the study of animals in wild

Nature, their adaptation and fitting in to their natural environments. The world requires the widest range of interests, and millions to-day have learnt to love Nature. The museum which stands still and does not recognise this is doomed, while the one that evolves with the advances of the times will surely not lack the necessary support.

### Short Notices

*An Elementary Treatise on Pure Mathematics.* By N. R. Culmore Dockeray. (Bell's Mathematical Series.) Pp. xiv+566. (London: G. Bell and Sons, Ltd., 1934.) 16s. net.

THE development of modern geometry from its fundamental Euclidean basis marked the beginning of a new epoch in the teaching of school mathematics, for it led slowly to the removal of those artificial divisions which formerly encompassed arithmetic, algebra and geometry. Such a natural process, however, was not destined to stop at these subjects, and, in these days of advanced courses and scholarship classes, it is gradually, though surely, permeating analysis, which has too long regarded algebra, trigonometry and the calculus as distinct parts.

In the volume under review, a very welcome attempt has been made to sweep away these divisions, and analysis is here treated as a unified whole. A large part of the text has necessarily been devoted to the never ending subject of convergence, which is fundamental to the rigour demanded by modern mathematics. Limits, continuity and differentiation are dealt with quite early, and are followed by an interesting and exhaustive chapter on the exponential theorem and the logarithmic series. Next comes more convergence of series, this time, of complex terms, out of which is logically developed the expansions of the circular functions, both in series and in products. Chap. xi is devoted to a lucid discussion of Taylor's theorem, which is followed by a very practical chapter on the applications of the calculus to curves and curve-tracing. The treatment here is much fuller than usual and deals with the real difficulties that often confront a student. The book closes with more convergence and the expansions of trigonometrical functions as infinite products.

As the book has been written essentially for scholarship candidates and first year university students, no attempt has been made to treat analysis as a rational development of the continuum of real numbers, and the omission to deal with irrational numbers is due to the fact that this part of the subject has already been treated so well by G. H. Hardy in his "Pure Mathematics".

One wonders whether the course is not a little overbalanced on the side of theoretical convergence, in spite of its fundamental importance.

The text is clearly written and well printed, and a large number of exercises provided for practice. These are stated to be fairly simple, but whether the

student will think so is another matter, although in some cases valuable hints for solution are given.

Teachers should welcome such an admirable textbook as this, for it is undoubtedly a real contribution to school mathematics.

F. G. W. B.

*Das Tierreich: eine Zusammenstellung und Kennzeichnung der rezenten Tierformen.* Gegründet von der Deutschen Zoologischen Gesellschaft. Im Auftrage der Preussischen Akademie der Wissenschaften zu Berlin. Herausgegeben von F. E. Schulze und W. Kükenthal, fortgesetzt von K. Heider, seit 1927 von R. Hesse. (1) Lief. 57: *Pseudoscorpionidea I., Subord. Chthoniinea et Neobisiinea.* Bearbeitet von Dr. Max Beier. Pp. xx+258. 40 gold marks. (2) Lief. 58: *Pseudoscorpionidea II., Subord. C. Cheliferinea.* Bearbeitet von Dr. Max Beier. Pp. xxi+294. 48.75 gold marks. (3) Lief. 60: *Acarina; Tydeidae, Ereyneidae.* Bearbeitet von Dr. Sig Thor. Pp. xi+84. 12 gold marks. (Berlin und Leipzig: Walter de Gruyter und Co., 1932-1933.)

(1 and 2) THE sharply delimited group of false scorpions, which includes small tracheate arachnids 1-6 mm. in length, has attracted a considerable number of students, and the known species now number approximately 800, which are referred in this work to about 160 genera and 14 families. Dr. Beier gives a detailed account (19 pp.) of the external features of the order and a brief summary of the biology. He then subdivides the order into the three sub-orders noted in the title, the constituent families, genera and species of which are carefully defined and their discrimination aided by keys. 571 line drawings of diagnostic features are added, and the whole forms a critical and competent systematic survey.

(3) This part deals with two families of primitive, prostigmatic, terrestrial mites from a tenth to a third (rarely a half) of a millimetre in length, our knowledge of which has been built up chiefly during the last thirty or forty years. The earliest notice of the Ereyneidae was that by Réaumur, who in 1710 recorded and figured their occurrence on the region of the pulmonary opening of *Helix pomatia* and in the terrestrial streptoneuran *Ericia (Cyclostoma) elegans*, and added drawings of the dorsal and ventral aspects of this "insect des limaçons" now known as *Riccardoella limacum*. Dr. Sig Thor has dealt skilfully with these difficult families, in which he recognises 17 genera and about 85 valid species, the systematic characters of which are shown in 102 figures.



- (1) *The Journal of the Institute of Metals*. Edited by G. Shaw Scott. Vol. 53: Metallurgical Abstracts and Index to Volumes 51, 52 and 53 of the Journal. Pp. v+887. (London: Institute of Metals, 1933.) Not sold separately; £4 net (inclusive of two preceding "Proceedings" vols.).
- (2) *The Journal of the Institute of Metals*. Edited by G. Shaw Scott. Vol. 54. Pp. 326+22 plates. (London: Institute of Metals, 1934.) 31s. 6d. net.

(1) THIS volume comprises the metallurgical abstracts which have already been circulated to members of the Institute of Metals during 1933 in the monthly *Journal*. The whole range of metallurgical science and practice has been covered in the usual comprehensive manner. Besides the structure and properties of metals and alloys and the metal working processes, a wide variety of topics, from the electron theory of metals to the uses of aluminium paint, are covered in abstract form in this volume. An imposing list of abstractors' names is given, but a list of the periodicals abstracted would be much more useful.

(2) The thirteen papers presented at the March meeting of the Institute, together with Dr. H. Moore's presidential address and Prof. E. K. Rideal's May lecture on "Gases and Metal Surfaces" are now available as vol. 54 of the *Journal*. Prof. Rideal gives a lucid survey of recent advances in the physico-chemical study of the adsorption of gases by metals, in the course of which it is possible to discern several pointers to future methods of study of lattice structure. One of the most interesting of the papers is that by Prof. Portevin and Dr. Bastien on "Castability of Ternary Alloys", a subject of great practical importance in foundry practice which is slowly but steadily being investigated on sound physico-chemical lines. Research on the phenomenon of fatigue is represented by a communication from the National Physical Laboratory dealing with the influence of the intercrystalline boundary on fatigue characteristics. Other topics include the constitution of copper-iron-silicon alloys, magnesium-nickel alloys, and silver-beryllium alloys. The volume concludes with a full appreciation by Prof. Hanson of the late Dr. Rosenhain, a past-president of the Institute and the greatest modern exponent of physical metallurgy.

L. H. B.

*Die Flechten: eine Einführung in ihre allgemeine Kenntnis*. Auf Grund neuerer Forschungen und kritisch dargestellt von Prof. Dr. Friedrich Tobler. Pp. v+84. (Jena: Gustav Fischer, 1934.) 5.50 gold marks.

IN 1931, Prof. F. Tobler delivered at the invitation of the University of London three lectures on lichens. The publication under review is the outcome of these lectures. In it Prof. Tobler has endeavoured to put forward a well-founded, general and physiological conception of the group of lichens. He wanted to show and make clear what he and his school considered that a lichen was and what a lichen could do. He mentions four important characteristics of the lichen. The algae present in the form of gonidia must be more or less intimately connected with

fungal hyphæ, to insure free exchange of food-material. A morphological differentiation might be expected separating the lichen from even allied fungi. The physiological success of such a symbiosis is, of course, also necessary. Vegetative reproduction by such organs as soredia, for example, is an important feature in many species of lichens.

Prof. Tobler brings forward much new evidence in support of his view, that in the perfect lichen we have such a close union between alga and fungus, and such a balancing of physiological activities, that the resulting organism must be looked upon as a unity. He therefore disparages the use of the term consortium, as stressing too much the dual nature of the lichen. Prof. Tobler has written an interesting and useful pamphlet, though its appearance might be looked upon as symptomatic of modern views generally, rather than as creative of a quite new idea.

O. V. D.

*Leçons de zoologie et biologie générale*. Par Prof. Georges Bohn. (3): *Les invertébrés (Coelentérés et vers)*. (Actualités scientifiques et industrielles, 133.) Pp. 102. (Paris: Hermann et Cie, 1934.) 15 francs.

IN a brief account of the coelenterates, sponges and worms, in which structure is subservient to biology and life-history, is a number of explanatory references of interest to the general reader. Prof. Bohn records that at the time of the battle of the Yser, soldiers who had bathed several times in the sea off Pas de Calais and had been stung by the large jelly fishes were gravely indisposed and some died. This serves as an introduction to a short account of anaphylaxy. The swarming of *Heteronereis* is graphically described and referred to as an impressive scene of life and death—the males circling round the females and rendering the sea-water milky by their discharged sperms, the sudden rupturing of the bodies of the females and the liberation of the eggs, which are immediately fertilised, while the bodies of the females fall to the bottom and die. Interesting examples of life-histories, especially of rotifers and of parasitic worms, are given and afford opportunity for reference to parthenogenesis, heterogony and neoteny (as in *Caryophyllæus*).

*Life and Soul: Outlines of a Future Theoretical Physiology and of a Critical Philosophy*. By Max Loewenthal. Pp. 291+4 plates. (London: George Allen and Unwin, Ltd., 1934.) 8s. 6d. net.

THIS book expounds an attractive hypothesis of the nature of life and soul, which, no doubt, will appeal to the common-sense of the reader. The author develops the notion of a material which is capable of utilising the waste heat of the universe, and of being formed, in other conditions of temperature, electrical potential and pressure, of other elements than those found on the world's surface. As his 'archiplasm' is not supposed, however, to be an object of direct apprehension, much of the author's hypothesis is bound to remain in the serene realm of speculation.

T. G.

Use and Origin of *Yerba Maté*\*

By CAPT. T. A. JOYCE, O.B.E.

INFUSIONS from vegetable products are common throughout the world, but the particular infusion with which this address deals is that procured from the leaves and shoots of the *Ilex paraguayensis*, a shrub indigenous to Paraguay and to southern Brazil. After a process of drying, aided by fire, hot water is poured on the broken or powdered leaf, and the infusion is imbibed through a tube of silver or of native bamboo. From the centre of its origin it spread rapidly, like all valuable food products, to the Argentine, Chile and Peru, and, especially since the War, when many South American contingents were engaged, it has become more familiar in Europe than formerly.

The particular virtue of the drink is that it contains little or no tannin, combines favourably with a meat diet, and can be repeatedly refreshed by hot water without deleterious effects. In South America, especially amongst the Gaucho class, it used to take the place of fruit and vegetables, for it is an antiscorbutic of considerable value. Thousands of tons are used in South America annually.

Mixed with cold water, it provides a very refreshing beverage, but the normal method of taking the drink is in the hot infusion. When lukewarm it is regarded as a violent aperient. Two appliances are used, the *maté*, a gourd or silver cup in which the decoction is prepared, and a tube, the *bombilla*, through which the infusion is drunk. The word for the receptacle (*maté*) became transferred to the leaf and the drink; both are now generally known under that name, especially in Europe.

The first mention of the drink in published literature occurs in a book by Nicolás Durán, a Jesuit missionary in Paraguay in the early seventeenth century. Durán travelled through the province of Guaira and visited the Jesuit missions at Villa Rica, San Xavier, Loreto and San Ignacio; all these regions were, at that time, centres of *yerba maté* preparation and of distribution.

Translated from the Latin, Durán writes as follows:

"The most severe labour to which the Indians are put consists in being sent by their masters to Maracaiu, to collect the foliage of certain trees growing in the mountains and forests. These trees, not unlike laurels, but of a brighter green, flourish especially in moist and swampy woods.

The leaves, after being parched in a fire, are pounded in mortars, and, when reduced to dust, are packed in cases, and carried many miles on the backs of the Indians. On account of the unhealthiness of the climate, and the scarcity of food, which their poverty-stricken masters cannot provide, these unhappy Indians are forced to subsist on snakes, grubs and spiders. And so, worn out by contagious diseases and famine, they die. It is a pitiable picture, for, in return for their labour, all they receive when they return from this slavery is a beggarly two yards of cloth. Some even go home empty-handed, because the Spaniards themselves are extremely poor. The Spaniards sell the powder of this herb (which they call 'Herb' *par excellence*) to traders who come hither (Guaira), or rather exchange it for necessaries. And it often happens that 2,000 lbs. of this powder is given for a suit of common cloth, or 500 lbs. for a hat. Spaniards and Indians of both sexes drink this powder, mixed with hot water, once or twice daily, which proves a most efficacious emetic. So much are they slaves of this habit, that they will barter shirt, trousers or bedding for it. An instance is known where a woman stripped her hut of its roofing in order to buy this herb. They say too that their strength fails, and that they cannot live, if they are deprived of its use. The Indians take it at day-break and at frequent intervals during the day. It has come to be such a vice in these provinces that all the inhabitants of the River Plate, Tucuman and Chile make use of it. So that in Potosí, and throughout Peru, 1 lb. of this herb is sold for four golden crowns. This herb makes men gluttons, slaves to their bellies, and renders them averse to work of any kind. And its efficacy appears to lie more in the imagination of him who uses it than its own inherent virtue."

By the middle of the seventeenth century, Nicolas del Techo (du Toict), who became Superior of the Province of Paraguay, as a Jesuit missionary, writes of the use of the drink as follows:

"In Paraguay, for a long time, sugar and cotton, both produced in small quantities, were the chief wealth, till the leaves of a certain tree, growing in marshy grounds, commonly called the Herb of Paraguay, began to be in esteem. These leaves they dry in the fire and reduce to powder; then, mixing with hot water, the Spaniards and Indians, both men and women, drink of it several times a day; and, vomiting it up with all they have eaten, they find it creates an appetite. Many things are reported concerning this powder or herb; for they say if you cannot sleep, it will compose you to it; if you are lethargick, it drives away sleep; if you are hungry it satisfies; if your meat does not digest, it causes an appetite; it

\* Presidential address to Section H (Anthropology) of the British Association, delivered at Aberdeen on September 10.

refreshes after weariness and drives away melancholy and several diseases. Those who once use themselves to it cannot easily leave it, for they affirm, their strength leaves them when they want it and can't live long: and so great slaves are they to this slender diet, that they will almost sell themselves rather than want wherewithal to purchase it. The wiser sort (tho', moderately used, it strengthens and brings other advantages) will hardly ever make use of it; and, if immoderately used, it causes drunkenness and breeds distempers, as too much wine does. Yet this vice has not only overrun Paraguay, but Tucuman, Chile and Peru. And is near coming over into Europe; this Herb of Paraguay being valued amongst the precious commodities of America. At first the Spaniards were well pleas'd with their cotton garments and liquor made of honey. But afterwards, trade enhancing the value of this herb, covetousness and luxury encreas'd, to feed both which the Indians began to be enslav'd to make this powder. Labour made their numbers decrease, and that made the Spaniards poor again; to show us that very often the same methods we take to gather wealth serve to impoverish us."

The two quotations given above are couched in rather harsh terms in regard to the excessive use of the ilex; but the same could be written of tea, or any infusion, or of alcoholic drinks, if taken in excess. However, Southey, writing in 1817, avers that over-indulgence has been known to result in almost total mental aberration, lasting over many days; and the danger of serious infection, owing to the use of a common *bombilla*, which passes from lip to lip, is emphasised by many writers. Demersay adds that the constant imbibing of hot *maté*, alternating with draughts of cold water, is bad for the teeth, and suggests that the use of a silver *bombilla*, which can become unbearably hot, may cause cancer in the lip.

As regards the properties of the ilex, which have won for it so widespread a popularity, authorities are not quite in accord. Christy (1880) states that the leaf contains "the same active property as tea or coffee, in a proportion (nearly 2 per cent) intermediate between the two; a volatile oil; 16 per cent of an astringent principle; and about 10 per cent of a nutritious gluten, only a portion of which is dissolved in the infusion." He states further that the full benefit of the leaf is only obtained when it is chewed.

The "Handbook of Paraguay" (1894) gives the analysis as 0.45 caffeine, 20.88 caffeeo-tannic acid, an aromatic oil, gluten and a proportion of theine. However, we may conclude that the action of the infusion would be that of a cardiac and a nutritive, while the relatively small proportion of tannin would render it more digestible than tea. It is, perhaps, a little strange that the earliest authors

who record its use, Durán (1626-27), Leon Pinelo (1636) and del Techo (1649-72), quote it primarily as an emetic.

To leave aside for the moment the question of the actual discovery of the properties of *yerba maté*, the initial exploitation of the 'tea' was undoubtedly due to the Jesuit missionaries. The first Jesuit reservation was founded in 1609, the last in 1760, and the Jesuits were expelled in 1774. The missionaries encouraged the use of the leaf among their Indians, to whom it was served out with other rations; and Endlicher and Martius state that this was done to wean the natives from over-indulgence in fermented drinks. But there is no doubt that the revenues derived from the trade in the leaf became indispensable to these self-supporting communities, whose establishment is one of the most remarkable developments in the world's history. On the expulsion of the Jesuits, their mission houses and lands became Crown property, and the *maté* industry had become so prosperous that, in 1807, the profits derived from it were reckoned at £100,000 annually.

Long before this, in the seventeenth and eighteenth centuries, the leaf had become an article of trade to the western provinces of the Argentine, to Uruguay, Chile, Peru, Bolivia and Ecuador. The chief collecting region was the Maracayu district. Asunción was the outlying depot, whence the produce was sent by river to Santa Fé, on the Paraná, the chief depot for external trade. Frézier (1712-14) writes that the ordinary route was from Santa Fé to Jujuy in the Argentine by wagon and thence to Potosí in Bolivia by mule-back. Chile, according to Juan and Ulloa (1740-44), was supplied direct from Buenos Ayres, and passed supplies on to Peru.

The most vivid and detailed account of what had developed into a well-organised industry was given by the Robertsons in the first half of the nineteenth century. Then, the chief collecting regions, the *montes*, or woods where the ilex flourished, were near Villa Real, about one hundred and fifty miles up river from Asunción. The work of collecting was lucrative, but so arduous that it was usually performed by newcomers and men in debt. These concessionaires were financed or 'grub-staked' by merchants of Asunción, who expected repayment in the form of *yerba*.

Each concessionaire hired twenty to fifty workers, and the difficult journey through untracked forest to the ilex groves (*yerbales*) ended when a promising locality was reached; here, camping-ground was prepared for a stay of six months or so, with huts for the personnel and corrals for the mules and oxen. The *tatacua*, a

space some six feet square of hard-beaten earth, with a post at each corner, was made ready for the preliminary curing of the leaf, a simple process of scorching the masses of verdure over burning logs.

Nearby, the *barbacua* was prepared, an arch of boughs supported on trestles; upon this arch the ilex leaves, now readily separated from large twigs and boughs, were placed for the secondary drying. The fire built below the arch was carefully tended to prevent the leaves from burning, and to ensure

complete drying; and, when the process was complete, the *barbacua* and the ashes of the fire were removed, the ground swept and beaten smooth, and the dried ilex leaves placed on it, and pounded with wooden mallets.

The powdered or broken leaf was then packed tightly into sacks made from freshly flayed bulls' hides (*serones*), sewn up and left to dry. Each *seron* weighed 200–220 lb. when dry. A similar process is employed to-day.

(To be continued.)

### Ascorbic Acid (Vitamin C)

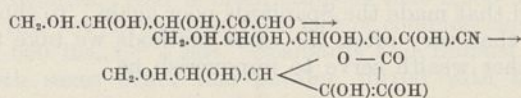
THE discussion on ascorbic acid (vitamin C) which was held in Section B (Chemistry) at the recent meeting of the British Association was, as the official title of the discussion indicated, mainly devoted to the chemical aspect of the subject. Perhaps the chief impression brought away from the meeting was of the astonishing advance made in our knowledge of vitamin C since Tillmans and Hirsch in 1932, after discovering that the vitamin could undergo a reversible oxidation without loss of potency, pointed out the great similarity between its properties and those of Szent-Györgyi's hexuronic acid (now known as ascorbic acid) and suggested that the latter substance might itself be the vitamin.

The speedy confirmation of this suggestion by Szent-Györgyi himself, followed by many other workers, led to an intensive study of the chemistry of ascorbic acid, which resulted in the synthesis of the compound (1933) dowered with the full antiscorbutic potency of the natural substance. As has so often happened, it has also led to the synthetic production of numerous substances of similar composition, none of which has so far been found in plants or animals, but some of which are possessed of substantial antiscorbutic power, in all cases up to the present considerably less than that of ascorbic acid itself. A new chapter in the study of the relations between physiological properties and chemical constitution has thus been opened and many interesting results have already been obtained.

Conflicting results were obtained by different investigators as to the constitution of ascorbic acid, but further experience has decided in favour of that worked out by Dr. E. L. Hirst and his colleagues at the University of Birmingham as against that of the Swiss workers Micheel and Kraft. Nevertheless, both formulæ served to inspire the successful synthesis of the acid, which was independently effected by the same method at Birmingham (Haworth and colleagues) and at Zurich (Reichstein and colleagues)—not the first

occasion, as Dr. Reichstein remarked, on which synthetic studies, though based on incorrect suppositions, have turned out successfully.

The original synthesis from *l*-xylosone by way of the hydroxynitrile



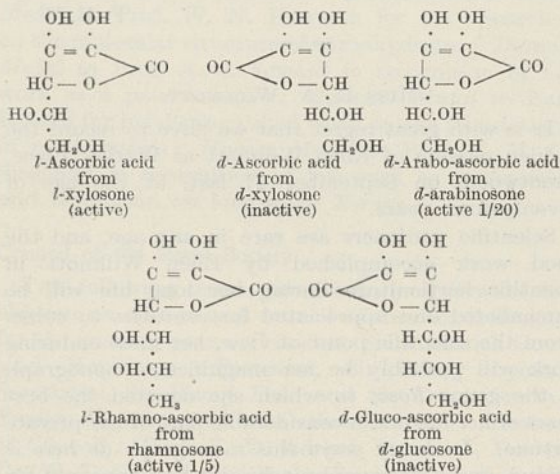
suffers from the disadvantage that the raw material of the synthesis is difficult to prepare in quantity. It is, however, a general method and can be applied to other osones, leading to the production of the corresponding 'ascorbic acids'. Among the results which followed rapidly on the synthesis of *l*-ascorbic acid were the preparation of *d*-ascorbic acid, from *d*-xylosone, and of the corresponding products from the arabinosones, *d*-arabo-ascorbic acid and *l*-arabo-ascorbic acid. Of these four isomerides, *l*-ascorbic acid has the full antiscorbutic potency of the natural acid; *d*-ascorbic acid is quite inactive, so far as it has been tested; *d*-arabo-ascorbic acid possesses about one twentieth of the activity of *l*-ascorbic acid and *l*-arabo-ascorbic acid is quite inactive. *l*-Rhamno-ascorbic acid, prepared from rhamnosone (Reichstein) has about one fifth of the activity of *l*-ascorbic acid, the highest value yet found in any analogue of the natural acid.

The osones of the hexoses yield the corresponding 'ascorbic acids' containing seven carbon atoms. The derivatives of *d*-glucosone and *d*-galactosone are inactive, whilst that of *l*-glucosone has a slight activity, about one fortieth of that of the natural acid.

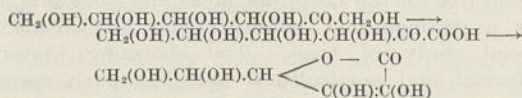
The tentative conclusion drawn from the data so far available is that the antiscorbutic activity of the substance is, in the first instance, correlated with the configuration of the fourth carbon atom, which in *l*-ascorbic acid is the optically active carbon atom of the ring. If the configuration about this carbon atom is dextro, as in *l*-ascorbic acid, the substance possesses anti-

scorbutic power; if the configuration is laevo, the substance is inactive (Reichstein). Haworth has also directed attention to the fact that the formulæ of *l*-ascorbic acid and *d*-arabo-ascorbic acid are identical with respect to the stereochemical arrangement of groups attached to the ring and only differ by the reversal of one OH-group in the side chain. The remaining part of the molecule, however, has a considerable effect on the degree of antiscorbutic power of the substance, as is shown by the great difference between the two compounds just referred to in this respect, the potency of *d*-arabo-ascorbic acid being only one twentieth of that of *l*-ascorbic acid.

The following formulæ illustrate these points. It has been assumed that the constitution of the ring is the same in all these substances, although this has not yet been proved in each case.



An alternative mode of synthesis of compounds of this class has been found, again by both groups of workers, which has the advantage that the raw material is easier to prepare. This process consists in the oxidation of the  $\beta$ -ketoses to form  $\beta$ -ketonic acids, the osonic acids, which readily undergo isomerisation to the corresponding ascorbic acid derivatives. For example, in the case of sorbose, we have the following changes:



In addition to opening up a new method for the preparation of further members of the ascorbic acid series, this synthesis has provided a rapid and cheap method for the production of *l*-ascorbic acid. Glucose is reduced to sorbitol and the latter oxidised to sorbose by Bertrand's method, making use of the action of an appropriate oxidising bacterium. The sorbose is then oxidised directly by means of dilute nitric acid (Haworth) or, in the

form of its di-acetone compound, by permanganate (Reichstein) and the product is isomerised by heating with water. So efficacious is the method that the synthetic acid is at present attainable at a cost less than that of sufficient oranges to contain the quantity purchased.

Turning now to the biological function of ascorbic acid, it is to be noted that the fundamental problem of the part which it plays in normal metabolism has not yet been solved. Szent-Györgyi attributes its physiological properties to its high reducing power and the reversible nature of its oxidation. Preliminary observations suggest that it may be a useful remedy in several diseases which have hitherto not been found amenable to medical treatment. Among these Szent-Györgyi mentions purpura hæmorrhagica, Werlhoff's disease, certain forms of hæmorrhagica nephritis and hæmophilia, pyorrhæa, etc. Protection against disease appears to depend on the level of content of the vitamin in the organism, and the curative effects so far observed suggest that humanity is suffering more gravely from a lack of vitamin C than has hitherto been supposed.

Another interesting fact mentioned by Szent-Györgyi is the effect of the vitamin on pathological pigmentation. Whereas it has no effect on normal pigmentation, its administration is stated to cause the disappearance of the pathological pigmentation which accompanies certain diseases, such for example as Addison's disease.

Until the clinical evidence is available, these claims must be considered as being *sub judice*, but the suggestion that ascorbic acid is capable of producing such effects will arouse great interest and no doubt will lead to a thorough investigation of the subject, in the course of which it is to be expected that some light will be thrown on the part played by ascorbic acid in the normal metabolism both of plants and animals.

Szent-Györgyi also suggested that only animals living normally under tropical conditions require a supply of ascorbic acid from external sources. The animals of our temperate zone—the dog, the rat, the fowl, etc.—are capable of synthesising the vitamin, whereas the guinea pig and the monkey require a constant supply in their diet. Man belongs to the latter group, and the suggestion is made that this points to some tropical region as the birthplace of mankind.

It will be seen that great progress has been made in the study of vitamin C, and the plentiful supply of the pure material which is now assured justifies us in looking forward to further advances in the near future, which can scarcely fail to provide the clue to the metabolic function of this vitamin in particular and to add greatly to our knowledge of metabolism in general. A. H.

## Obituary

PROF. O. V. DARBISHIRE

BORN at Conway in 1870, Otto Vernon Darbishire had the advantage of a varied education, passing his school years in Dresden and Florence and pursuing his university studies at Bangor, Oxford and Kiel. Thus he gained not only a wide outlook on life, but became also a good linguist—an inestimable advantage for a scientific worker. After graduating with honours in botany at Oxford, where he studied under Prof. Vines, he went to Kiel, and there took up first the study of Algæ, obtaining the Ph.D. degree. He then became assistant to Prof. Reinke and commenced his investigations into the structure and development of lichens, a study which he pursued throughout his life. He also turned his attention to the taxonomy of this group of plants, publishing an important monograph of the genus *Roccella* in the "Bibliotheca botanica" in 1899. By his researches and publications on lichens he became one of the leading authorities on this group of plants, and was entrusted with the determination of the lichens collected by the second Norwegian expedition of the *Fram* and also of those collected by the Swedish Antarctic expedition.

In 1898, Darbishire was appointed lecturer in botany in the University of Manchester, a post which he held until 1909 when he was appointed lecturer in the Armstrong College, Newcastle-on-Tyne. In 1911 he went to the University of Bristol, first as lecturer and head of the Department of Botany and afterwards in 1919 as the first holder of the newly established Melville Wills chair of botany. His duties in Manchester necessitated his specialising to some extent in plant physiology, and his wide interests led him to take an active part in the work of the Central Committee for the Survey and Study of British Vegetation, which afterwards developed into the British Ecological Society. Nevertheless, though his time was during the later part of his career fully occupied with heavy teaching and organising duties, he never lost his interest in lichens and even during the past few years he published several important contributions to lichenology in the *Annals of Botany*, in *Flora* and in the *Annales de Cryptogamie exotique*.

Darbishire was a good teacher and took an active personal interest in his students. While in Manchester, he undertook voluntarily for some years the instruction in botany of a class of small children, and the outcome of the experience so gained was the publication of a "Plant Book for Schools". He was equally successful with university students, and the botanical department at Bristol owes much to the energy with which he developed the botanical teaching in the University during the twenty-three years of his association with it. He took an active interest in other aspects of the students' life, acting as commanding officer of the Officers Training Corps during the War and for two years afterwards. Outside the University he interested himself in the work of the

Bristol Naturalists' Society and in that of the South Western Naturalists' Union, of which he was the president.

A few years ago, Darbishire met with a serious cycling accident, which incapacitated him almost completely for some considerable time. Happily his recovery, though slow, was sure, and he completely regained his powers, so that he could again undertake both his teaching and his research work. He was no doubt looking forward to the opportunity after his retirement, which was due next year, to devote more time to the investigation of lichens, and we might have expected further important contributions to botanical science. But alas, it was not to be. Taken ill very suddenly, he died after an operation on October 11 at the age of sixty-four years, leaving a widow and two young sons.

F. E. W.

MISS E. A. WILLMOTT

It is with great regret that we have to record the sudden passing of Ellen Willmott at Warley Place, Brentwood, on September 27 last, at the age of seventy-four years.

Scientific gardeners are rare in any age, and the good work accomplished by Ellen Willmott in scientific horticulture during her long life will be remembered and appreciated for centuries to come. From the scientific point of view, her most enduring work will probably be her magnificent monograph of the genus *Rosa*, to which she devoted the best years of her life and a considerable part of her private fortune. In many ways this monograph *de luxe* is unique, and nothing approaching it had appeared for nearly a century. It was in 1817 that Redouté first produced his beautiful folio plates of "Les Roses", but even that treasure pales in artistic and scientific significance before the accurate and life-like illustrations of Willmott's "Rosa". Such fidelity to Nature in a botanical work is extremely rare, and considerably increases its scientific value. In Alfred Parsons, Willmott discovered a scientific artist, and the careful reproduction of his drawings reflects the utmost credit on all concerned. Baker, who was responsible for the Latin diagnoses and bibliography, was a distinguished botanist who had made a special study of roses. The charming literary, historical and horticultural notes on each species were contributed by Willmott herself and were the result of many years' research and horticultural experience.

It is evident that the whole conception of the work, and the welding together of the artistic and scientific elements into a realistic whole with a universal appeal, were due entirely to the genius of Ellen Willmott, and her monograph on roses stands as a lasting monument to her artistic and scientific sensibilities.

C. C. HURST.

## News and Views

## Medal Awards of the Royal Society

THE following is a list of those to whom the Royal Society has this year awarded medals. The awards of the Royal medals have received the King's gracious approval: *Copley Medal* to Prof. J. S. Haldane in recognition of his discoveries in human physiology and of their application to medicine, mining, diving and engineering; *Rumford Medal* to Prof. W. J. de Haas for his researches on the properties of bodies at low temperatures, and, in particular, for his recent work on cooling by the use of adiabatic demagnetisation; *A Royal Medal* to Prof. S. Chapman for his researches in kinetic theory of gases, in terrestrial magnetism and in the phenomena of the upper atmosphere; *A Royal Medal* to Prof. E. D. Adrian for his work on the physiology of nerve and its application to the problems of sensation; *Davy Medal* to Prof. W. N. Haworth for his researches on the molecular structure of carbohydrates; *Darwin Medal* to Prof. A. C. Seward in recognition of his work as a palaeobotanist; *Sylvester Medal* to Earl Russell for his distinguished work on the foundations of mathematics; *Hughes Medal* to Prof. K. M. G. Siegbahn in recognition of his work as a physicist and technician on long-wave X-rays.

## Council of the Royal Society

THE following names have been put forward for election as officers and council of the Royal Society for the ensuing year: *President*, Sir Frederick Gowland Hopkins; *Treasurer*, Sir Henry Lyons; *Secretaries*, Sir Henry Dale and Sir Frank Smith; *Foreign Secretary*, Prof. A. C. Seward; *Other Members of Council*: Prof. E. D. Adrian, Dr. E. J. Butler, Dr. W. T. Calman, Mr. D. L. Chapman, Prof. A. W. Conway, Prof. W. H. Eccles, Prof. T. R. Elliott, Mr. P. P. Laidlaw, Sir Gerald Lennox-Conyngham, Prof. J. C. McLennan, Dr. F. H. A. Marshall, Sir Charles Martin, Prof. G. T. Morgan, Prof. R. Robison, Dr. Herbert H. Thomas, Prof. E. T. Whittaker.

## A. P. Borodin (1834-77)

ALEXANDER PORFIREVIČ BORODIN, the distinguished Russian chemist who was born on November 12, 1834, was the natural son of Prince Guedeanov. At an early age he was attracted to music and is better known as a composer than as a man of science. He studied chemistry under Zinin at St. Petersburg (Leningrad), graduating in medicine in 1858. He had a brief career as an army doctor, and after being appointed as professor of chemistry, was sent abroad with Mendeléeff and others to study under Bunsen, Kekulé and Erlenmeyer in Germany and under Wurtz at Paris. Borodin also went to Italy with Mendeléeff and studied at Pisa. Before returning to St. Petersburg in 1862, to take up his duties as professor, he commenced a series of investigations on the condensation reactions of aldehydes and discovered aldol simultaneously with Wurtz. He prepared and studied numerous double inorganic

fluorides and a few organic fluorides. Altogether Borodin published about twenty chemical papers, the last few dealing with the higher fatty acids. His leisure was mostly given to music and his musical friends (his wife, Katerina Sergeievna Protopova, was a pianist), but he found time to urge the claims of Russian women regarding education, and from 1872 he gave free lectures in chemistry for the St. Petersburg Women's Medical School, of which he was one of the founders. He died on February 16, 1877.

## Sir Alfred Gilbert, R.A.

IN connexion with the death of Sir Alfred Gilbert, the sculptor, which occurred on November 4, at the age of eighty years, it is interesting to note that originally he contemplated adopting the medical profession as a career; early changed, however, for that of a sculptor. St. Bartholomew's Hospital Medical School recalls, with legitimate pride, that among medals attached to the foundation, one, instituted in 1897, was in honour of Sir William Lawrence (a colleague in his day of Abernethy), surgeon at St. Bartholomew's from 1824 until 1865, and president of the Royal College of Surgeons in 1846 and in 1855. The medal was designed and executed by Gilbert. Cast in gold and chased, and  $2\frac{1}{2}$  in. in diameter, it was exhibited at the Royal Academy in 1897, together with an enlargement in plaster of Paris. The gift is awarded annually in association with a valued senior studentship in medicine and surgery. The obverse depicts the head of Lawrence, not in profile, but within a sculptured circle, looking directly towards the spectator, an unusual medallion presentation. The reverse carries a beautiful composite design, also within a sculptured border; a youth in the centre has two draped females on either side personifying Wisdom and Science, and they whisper words of counsel, embodying a line from Homer. Sir William Lawrence, who was born in 1783 and died in 1867, is thus worthily commemorated through the art of Gilbert.

## Research and Development Lectures

IN 1933 the British Science Guild established the Research and Development Lectures, with the special object of directing public attention to the importance of scientific research and of the utilisation of its results in the service of mankind. The first lecture of the series was given in May 1933 by Sir Harold Carpenter, on "Metals in the Service of Human Life and Industry". Early in 1934 the suggestion was made by Lord Melchett, president of the Guild, that the lectures should be given in the theatre of the Royal Institution, in which special equipment and facilities exist for the experiments and demonstrations it was desired to have. The proposal was accepted by the managers of the Royal Institution and arrangements were made by which the British Science Guild had the use of the lecture theatre on two occasions in May. On

May 2 Sir William Bragg lectured on "Refrigeration" and on May 30 Lord Rutherford on "Helium and other Rare Gases". These two lectures were attended by many members of both Houses of Parliament, and others engaged in public affairs, and at the first of them the Prime Minister presided.

THE success which has attended these lectures has encouraged the belief that the continuance of the series is desirable. The intention is to afford those concerned in the public affairs and industries of the country an opportunity of keeping themselves informed of scientific developments and of the progress of scientific research, particularly in its social and economic bearing and its applications to industry. The managers of the Royal Institution have agreed to co-operate with the council of the British Science Guild in the arrangement of a further programme of four lectures. The subjects have been chosen from four branches of science—electricity, acoustics, metallurgy and biology—in which there have been specially interesting developments in recent years. In each case, the lecturer will describe some notable scientific principle or discovery and trace its consequences down to the point at which the practical and industrial applications which have flowed from it have become matters of national or even wider significance. The following lectures, for the first of which the invitations have now been issued, will be on Wednesdays at 9 p.m.: Mr. C. C. Paterson, on "The Liberation of the Electron: Its Industrial Consequences" (Nov. 21); Dr. G. W. C. Kaye, on "Sound and Noise" (Dec. 12); Prof. C. H. Desch, on "The Microscope and the Metal Industries" (Feb. 6); Sir Frederick Keeble, on "The Fertility of the Earth" (March 6).

#### Developments in British Air Transport

THE recent air race to Melbourne has focused attention upon the possibilities of air transport to that particular part of the British Empire, and Sir Philip Sassoon, Under-Secretary for Air, has stated that the Air Ministry, the Post Office and Imperial Airways have been working for many months on plans for further development of commercial air transport. He emphasised the fact that this action on the part of the authorities was not in any way attendant upon the result of this race, but was the natural culmination of continuous investigation and methodical application of the improvements in the technique of aeronautics to air transport problems. He stated that he hoped to be able to announce within the next month or two, in conjunction with the Dominions and Colonies, plans that will result in the flying time between London and the Empire capitals being progressively and drastically reduced, and also that steps towards the desiderata of reasonably constant loads in both directions will be taken by further developing air mail traffic.

AIR mail traffic probably offers the simplest form of experiment in the system of carrying by relays of fast machines, the obvious solution to the problem, as the question of personal fatigue of the passengers does not affect the case. Having established optimum

conditions for this class of traffic, it will be possible to investigate the variations in it necessary when dealing with the human element. This will possibly prove more expensive in the first instance, as it will call for the use of special mail-carrying aircraft, which will not be hampered, either in their design or their proportion of time in the air to time on the ground, by considerations of passengers' comfort. With this class of machine it should be possible rapidly to approach times of the order established during the recent race. The present system of designing for and operating with a mixed traffic of mails, goods and passengers, with the additional necessity of running the air line as a paying commercial proposition so far as is possible, always presents the vague and incalculable problem of the personal element of the passengers' requirements. This can only be solved by the relative slow method of short steps in introducing improvements with elimination of the unsatisfactory ones by trial and error.

#### England-Melbourne Air Race

THE official times now announced for the Centenary Air Race from England to Melbourne are: Scott and Black (D.H. Comet), 64 hr. 48 min. 49 sec.; Parmentier and Moll (Douglas D.C. 2), 76 hr. 38 min. 12 sec.; C. J. Melrose (D.H. Moth), 79 hr. 17 min. 50 sec.; Stodart and Stodart (Airspeed Courier), 79 hr. 32 min. 30 sec.; Macgregor and Walker (Miles Hawk), 82 hr. 43 min. 34 sec.; Hewett and Kay (D.H. Dragon), 85 hr. 42 min. 28 sec.; Hansen and Jensen (Desoutter), 87 hr. 45 min. 21 sec. Mr. C. W. A. Scott and Mr. T. Campbell Black have therefore been given the prize of £10,000 as winners of the speed race; they have also been awarded the British Silver Medal of the Royal Aeronautical Society for their flight.

#### Inland Water Survey

WRITING in reference to our leading article on "Inland Water Survey" in the issue of NATURE of October 27, Mr. Alan Chorlton, M.P., says that while generally supporting the project for the institution of a survey at an early date, he considers there are other factors which should be taken into account. To arrive at the total of the water supplies of Great Britain without proper relation to where they are likely to be called for would be, he fears, to create another break in the development of water supply in the country. He alludes to an air survey for the positioning of aerodromes and notes that town and country planning call for something to be done to bring the Ordnance Survey up to date. It seems to him that consideration should be given to the general interrelation of all these matters in order to ensure that they will ultimately be properly co-ordinated. "A water survey should, at least, be undertaken with relation to the areas the water is required for: that is, a combination of survey with the recommended allocation".

As regards water supply generally, Mr. Chorlton finds that a statutory central water authority is not



yet a form of administration which the majority of water undertakers would agree to. "A great deal of education is still required before they will come into line. At present, common action is made possible through regional advisory committees and joint committees. For this reason it has not seemed advisable at present to press the statutory side of any control. If it has to come, it will be later, and it will grow out of the development of the situation indicated, by the continued consideration of those concerned in common problems. A logical ending to development by joint committees is a central one formed from representatives of those committees. There is much more agreement with common working, an inter-connexion of undertakings, with pooling of supplies, but the form of administrative guidance that should be finally instituted has not yet emerged."

#### Scott Polar Research Institute

THE building of the Scott Polar Research Institute in Cambridge is to be formally opened by the Chancellor of the University, Mr. Stanley Baldwin, on November 16. The speeches will be delivered in the Senate House, as the building itself is scarcely fitted for the number of people likely to attend the opening; but it will be inspected afterwards and flood-lit in the evening. The building itself is a memorial to the late Capt. Robert Falcon Scott, whose tragic death with four companions on his return from the south pole in 1912 will still be fresh in the memories of many. The architect was Sir Herbert Baker, and he has succeeded in erecting a building which is both practical for the activities of the Institute and of pleasant appearance. Over the front door is a bust of Capt. Scott by Lady Hilton Young (Lady Scott), and in the forecourt is a symbolic statue by her to the memory of the whole of the polar party. The memorial character is carried into the building in the form of an entrance vestibule with two high domes, painted by Mr. Macdonald Gill with maps of the two polar regions, embellished with the ships and the names of many noted explorers of the past. The three floors accommodate respectively the collections of polar equipment, the library of polar books and maps, and the pictorial collections. On the walls of the attic gallery are hung many of the watercolours painted by Dr. E. A. Wilson, a member of the polar party. There are also four small rooms for the use of the director, staff and research students. After November 16, the building will be open to the public on weekdays, 10 a.m.—4 p.m.

#### New Building of the Radcliffe Science Library

THE new building of the Radcliffe Science Library was opened by the Princess Royal on Saturday, November 3. In Convocation on the same day, on the motion of the Master of Pembroke, an address of thanks was presented to Her Royal Highness. The Master of Pembroke gave a brief account of the history of the Library from its foundation by Dr. John Radcliffe, physician to William III and Queen Anne, with its original domicile in the building now called the Camera, its removal to the Museum, and

its present status as a department of the Bodleian. The Princess Royal, through the Vice-Chancellor, expressed her gratification in being instrumental in throwing open facilities for scientific study which would be of the highest advantage not only to Oxford but also to the community at large. The new building is an extension of that erected in 1901 adjoining the Museum, and contains two large reading rooms, a three-deck bookstack and two rooms, one for rare books and the other for committees and similar purposes. Part of the first floor reading room has been set apart for mathematical teaching and research pending the erection of a mathematical institute. It is estimated that room will be available for a quarter of a million volumes. The new building, which has cost about £45,000, is the first stage in a scheme for the reorganisation and extension of the Bodleian Library, towards which the Rockefeller Foundation of New York is contributing three fifths of the total expenditure. At present the Radcliffe Science Library contains a number of books from the Bodleian which will eventually be moved to the main bookstack to be erected in Broad Street, thus setting free ample shelving for the scientific literature of future generations.

#### The Serial Universe

ON October 22 and 29, Mr. J. W. Dunne—in whose book, "An Experiment with Time", published a few years ago, evidence of apparent prevision of future events was presented, with a suggested explanation in terms of the character of the time concept—gave two lectures before the Royal College of Science Mathematical and Physical Society on "The Serial Universe". Mr. Dunne described the nature of a 'regress', in which every term except the first is defined by its relation to the preceding and following terms and which therefore produces an infinite series. He showed that if, in the traditional manner of physics, we regard the scientific description of the world as being necessarily based on the exploration of an objective system with independently existing instruments of observation, we are compelled to employ a concept of time which is regressive, though it has not hitherto been so recognised. Such a concept is adapted to our reasoning powers because we are self-conscious beings, and self-consciousness itself is essentially regressive. The difficulties of modern physics have arisen because attention has been concentrated on the first term only of the temporal regress, which lacks the vital double character of the succeeding terms. Mr. Dunne very acutely applied his ideas to the problems of relativity—attributing the appearance of 'imaginary' time in the Minkowski world to the rotation of the axis of second-term time though  $90^\circ$  into coincidence with that of first-term time—and to the quantum theory, in which the 'uncertainty' of Heisenberg's principle was found to be regressive and located in the instruments of observation instead of the world observed, which remained determinate. The substance of the lectures, considerably amplified, is to appear almost immediately in book form.

### Mummy Wheat

POPULAR belief in the viability of wheat grains which have been interred in ancient tombs, sometimes thousands of years old, has during the past few years been severely shaken by morphological and physiological tests on genuine mummy wheat, and also by bringing into question the authenticity of other so-called specimens. But in many people's minds, the possibility of mummy wheat being viable seems still to exist. A survey of this subject was given in NATURE of May 2, 1931, p. 675, where genuine mummy wheat and the more questionable cases were discussed. In NATURE of August 19, 1933, p. 271, an example of some so-called mummy wheat from an Indian tomb was shown to be actually a recent one, the whole idea having been based, at the best, on a misunderstanding. The possibility of the inordinate longevity of some seeds clearly never fails to appeal to the imagination. An article reviewing work on this subject appeared in NATURE of September 23, 1933, p. 469. On September 6 last, Sir E. A. Wallis Budge offered, through the medium of the *Times*, to supply samples of wheat obtained from a nineteenth dynasty tomb in Western Thebes, to responsible institutions in order that the germinating capacity of these seeds could be tested. Although the results of all such tests have not been announced so far, attention should be directed to a report by Mr. W. H. Parker, director of the National Institute of Agricultural Botany, Cambridge, which appeared in the *Times* of October 29. After subjecting the seeds to strictly controlled germination tests, every grain had completely decayed within sixteen days, and had become attacked by a growth of mould. Morphological examination of the embryos before the tests had also indicated that the sample was incapable of germination.

### Early Man in East Africa: Further Investigation

NOTWITHSTANDING the close and expert scrutiny to which Dr. L. S. B. Leakey's evidence for the early occurrence of man in Kenya has been subjected, the far-reaching effect of the conclusions to which it leads make it eminently desirable that no means of verifying and substantiating the data should be neglected. The geological evidence of deposits in Kenya, where volcanic action has been marked, has proved notoriously difficult of interpretation; and the announcement is, therefore, welcome that Prof. P. G. H. Boswell, of the Imperial College of Science, whose views on the interpretation of deposits with which relics of early man are likely to be associated carry considerable weight, is to proceed to Kenya for the purpose of investigating with Dr. Leakey the conditions of the discovery of relics of early man in East Africa. Prof. Boswell will leave London during the current month and he and Dr. Leakey will be joined in Kenya by Mr. E. J. Wayland, director of the Geological Survey of Uganda, who is at present home on leave. Mr. Wayland's extensive studies of the prehistory of man in Uganda, as well as his knowledge of geological conditions in Kenya and Tanganyika, will be of invaluable assistance in

arriving at what, it may be hoped, will be final and decisive verdicts on the important questions which have given rise to controversy.

### Samaria

THE article contributed to the *Times* of November 3 by Mr. J. W. Crowfoot, in connexion with the exhibition illustrating the excavations of Samaria now open at the rooms of the Palestine Exploration Fund at 2 Hinde Street, London, W., gives a very informative view of the general results which have been achieved by recent work on the site of the city of Ahab. It is evident that the joint expedition, for which Harvard University, the Palestine Exploration Fund and other bodies are responsible, has not only added a great deal to the map of ancient Samaria, as Mr. Crowfoot says, but it has also reached a most important phase in its undertaking in the proposed extension of the investigation on the north side of the site, where it is possible that the principal gate of the city may lie. The superior character of the stone work of the Israelitish levels was already known from the work carried out by the expedition of Harvard University in pre-War days. This skill in the construction of fortifications is confirmed by the discovery of the remarkable bastion to which Mr. Crowfoot refers. Even more suggestive of the influences at work in the northern kingdom are the remarkable ivories which have been discovered and are regarded as a corroboration of the reference by the prophet Amos to the "ivory couches" of Samaria, which these remains of plaques and other carvings once adorned. It may be trusted that the reference by Mr. Crowfoot to the dependence of the projected excavation on the provision of funds is a reminder rather than a warning.

### Ancient Monuments in Cyprus

THE address on the "Ancient Monuments of Cyprus", delivered by Sir Charles Peers at the meeting of the Royal Empire Society on November 5, afforded ample justification—if justification were needed—for the appeal issued in the spring of this year by the influential Cyprus Committee, of which Lord Mersey is chairman, for funds for the preservation of these monuments. Sir Charles, as the result of a visit of inspection to the island, on which he was accompanied by Sir George Hill, director of the British Museum, was in a position to assure his audience, and through them, a wider public, of the unique character and exceptional interest of the long series of monuments, many of them of surpassing beauty, which extends from prehistoric times to the Turkish occupation. To the archæologist the island of Cyprus, which gave its name to the metal first put to practical uses by men, and which was a meeting place of the cultures of the Mediterranean, of Egypt, and of Asia, is a source of the material of prehistory of which the potentialities have yet to be explored systematically; while the historian and the student of art may here view within its restricted compass a sequence of Phœnician, Greek, Roman, Byzantine, Gothic, Renaissance and Turkish, scarcely surpassed,

if indeed equalled, in riches elsewhere—such riches, for example, as the Gothic buildings or the village churches with their painted decorations, to which Sir Charles referred. Since attention was directed recently to the danger which threatens the antiquities of the island, an inspector of antiquities has been appointed; this is only a partial discharge of the responsibility entailed by Britain's occupation of Cyprus since 1878, and its formal status as a colony since 1925, now that the inhabitants have fallen on evil days through the economic depression. On historical and æsthetic grounds, the Cyprus Monuments Fund (6 Pall Mall, London, S.W.1), for which several thousand pounds will be needed, deserves the fullest support.

#### Elements and Isotopes

THE first Friday evening discourse of the new session at the Royal Institution was delivered on November 2 by Dr. F. W. Aston, who took as his subject "Elements and Isotopes". That a chemical element could consist of isotopes of different atomic mass was first observed by Soddy when working on the products of radioactivity. Proof that this was true of the elements generally could only be obtained by direct atomic analysis. This was achieved by the mass-spectrograph, and with it the search for isotopes has been carried on continuously for the past fifteen years. Wide differences of properties among the elements necessitate very varied methods of obtaining the atomic rays required for the analysis. In some cases the technical difficulties are great; it is only during the last year that satisfactory results have been obtained with the rare earth group. Of the common elements, all but four, palladium, iridium, platinum and gold, have now been analysed and some 247 isotopes identified, a few by less direct optical methods. Elements of odd atomic number appear curiously limited to two isotopes, but elements of even atomic number can have many more, eleven in the case of tin. By means of modern instruments, it is possible to compare the masses of atoms to one part in ten thousand, an accuracy which it is expected to increase in the near future. These isotopic weights are required in order to test theories of nuclear structure, which have recently become of the greatest importance on account of the discovery of transmutation and of artificial production of radioactive isotopes.

#### Exploration of Nanda Devi

NANDA DEVI, with an altitude of 25,645 ft., in the Kumaun Himalayas, is supposed to be the highest mountain entirely within British territory. The area in which it lies is so rugged and unapproachable that even the base of the main peak defied assault until this year, though in 1907 Dr. T. G. Longstaff made an attempt via the Rishiganga gorge. In a letter to the *Times* of November 2, Mr. H. Rutledge gives a preliminary account of an expedition to Nanda Devi led by Mr. E. E. Shipton this year. In June, with Mr. Tilman and a few native carriers, Mr. Shipton forced a way up the precipices of the Rishiganga

gorge to the source of the river and explored the northern flank of Nanda Devi. Before the monsoon broke, they retreated northward and during July and August explored the Arwa, Bhagat-Kharak, and Satopanth glaciers before returning to their main task. Once more they ascended the Rishiganga gorge, mapped the southern basin of Nanda Devi, climbed a considerable distance up the peak and discovered a way that in the proper season would no doubt lead to the top. Finally, in September they crossed the difficult Sonadunga col and descended to the south. Mr. Shipton is returning to Great Britain next month.

#### Sixty Years' Progress in Naval Construction

SIR ARTHUR JOHNS, director of naval construction, for his Andrew Laing lecture to the North-East Coast Institution of Engineers and Shipbuilders on November 2, took for his subject "Progress in Naval Construction". Beginning with a comparison of the Navy in 1874 and 1934, he dealt in turn with materials, the development of the capital ship and of cruisers, torpedo vessels, submarines, aircraft on warships, model experiments, welding and stability and strength. Nothing perhaps was more striking than the figures he gave regarding tonnage, horse-power and speed. The displacement tonnage of our fighting ships in 1874 was 825,000 as compared with 1,275,000 of to-day, while the corresponding figures for horse-power are 590,000 and 9,500,000. A cruiser of 1874 had engines of 4,500 horse-power and a speed of 14 knots; a cruiser of to-day develops 72,000 horse-power and has a speed of 32½ knots. Though Sir Arthur Johns' review was necessarily a cursory one, it was a valuable authoritative review of the main lines of progress and contains references to many of the most interesting vessels ever launched. He paid an eloquent tribute to the work of William Froude, whose theory of a propeller's operation is still the simplest and most representative, and whose method of computing the skin resistance of full-sized ships has stood the severest tests. Regarding the stability of ships, this has been the bugbear of naval architects since the thirteenth and fourteenth centuries, and even after Bouguer had defined the meta-centre and shown how its position was determined, Atwood in a paper to the Royal Society proved to his own satisfaction that the meta-centre was a mere mathematical curiosity, useless to the naval architect. It was the researches of White and John after the capsizing of the *Captain* in 1871 which made a marked advance in our knowledge of the stability of a ship and of the features which improve or adversely affect it.

#### Coal Mining in Great Britain

SIR RICHARD REDMAYNE delivered the presidential address to the Institution of Civil Engineers at the opening meeting of the new session on November 6. Sir Richard has been for many years associated with coal mining in Great Britain, and it was appropriate that he should discuss aspects of the industry. In tracing its development, he pointed out that the growth of the railway and the application of steam

to shipping gave a great impetus to the coal trade, the output in 1845 being three times that of 1800. Great progress has been made during the past fifty years in the technique of coal mining, and in many collieries the only manual labour now used in the actual coal-getting is shovelling the machine-cut coal at the face on to a band- or jig-conveyor. In 1900, 1.47 per cent of the coal raised in Great Britain, and 24.9 per cent of that raised in the United States, was machine-mined; in 1932 the figures were 38 and 68.3 per cent respectively. Natural conditions in the United States, however, are better suited than those of many British coal-fields to this mode of working. The methods of supporting the roofs and sides of underground roads are now undergoing considerable change; of the 20,000 miles of main roadways in coal mines of Great Britain, 1,800 miles are supported by steel arches, and there are in addition about 900,000 steel props used in and about the workings. The ultimate possible demand for steel supports in Great Britain is 370,000 tons a year, a quantity which would provide employment for at least 10,000 workers. Turning to the subject of accidents, Sir Richard said that, of the larger coal-producing countries, the most favourable figures are shown by France with a death-rate of 1.0 in a thousand; other figures are 1.1 for Great Britain and Belgium, and 4.8 (bituminous coal) and 3.9 (anthracite) for the United States. The future of the coal trade is dependent, in Sir Richard's view, on increased scientific research and the discovery of new uses for coal.

#### University Degrees in Engineering

IN the *Engineer* for November 2 is the first of a series of articles on "University Degrees in Engineering", and the subject is referred to in a leading article. One aspect of this question, namely, the new regulations for 'external' degrees in engineering of the University of London, was discussed in *NATURE* of August 12, 1933, p. 222. It is well known, says the *Engineer*, that regulations and customs governing the granting by British universities of degrees in engineering are not uniform, each university being a law unto itself. The values of degrees, therefore, differ greatly. While it is admitted that to ask the universities to reduce themselves to a dead level of uniformity as regards the standard of their products would be to aim a blow at the very root of the conception behind university instruction and education, yet it is impossible to shut one's eyes to the fact that some measure of standardisation of the conditions under which engineering degrees are granted is overdue. As an impartial observer, the *Engineer* considers that unless the problem is attacked thoroughly and soon, the reputation of university degrees for engineers will suffer a severe decline. How the regulations differ is shown in the first of the articles in the series, which deals with engineering degrees granted by the Universities of Glasgow, Aberdeen, Edinburgh and St. Andrews. The survey is based on information contained in official publications and it should be of use to those about to select a centre of engineering education and

also to those called upon to assess the value of British engineering degrees or of those who hold them.

#### Iron and Steel Institute: Co-operation with Local Technical Societies

ARRANGEMENTS have been made by the Council of the Iron and Steel Institute and the councils of various local technical societies for extending existing arrangements for co-operation between the Institute and such bodies. To this end, the Council of the Institute has agreed to extend the maximum age of associate membership from twenty-four years of age, as previously fixed, to thirty years of age in the case of associate members who are also members of local technical societies taking part in the scheme. It has also agreed to supply each year to the local societies, for presentation and discussion at local meetings, certain papers which have been presented at general meetings of the Iron and Steel Institute. One or two joint meetings each session between members of the local societies and members of the Iron and Steel Institute resident in the particular district will be arranged. It is hoped by these means usefully to extend the existing co-operation between the Institute and local technical societies, and particularly to encourage the study of problems connected with the manufacture and metallurgy of iron and steel, especially among the younger members of those societies. The secretary of the Iron and Steel Institute, 28 Victoria Street, London, S.W.1, will supply further information on request.

#### Picture Telegraphy

METHODS of transmitting pictures by telegraphy have been known for the last ten years. In a suitably constructed photoelectric cell, the electric current through it can be made proportional to the light falling on it. If a picture in the form of a film negative be moved between a constant source of light and a cell in such a way that the light beam passes successively, line after line, through each minute area of the picture, the current transmitted will vary in intensity. The receiver is complicated, but the amount of light from a local source varies with the current received and falls on a photographic film which moves in step with the original film. A photoelectric cell can only distinguish light from darkness. Unlike the eye, it cannot distinguish form and colour. Photographs can be transmitted in this way by both wired and radio telegraphy. A recent remarkable achievement was the photograph of the Duke of Gloucester sent from Australia by the Marconi facsimile system of radio picture telegraphy. A still greater achievement was the transmission of the pictures on ten feet of cinematograph film showing the arrival of Scott and Campbell Black at Melbourne. An example of a news picture sent by the ordinary telegraph services between London and various Continental towns was the funeral of King Alexander at Belgrade. For ordinary commercial purposes, we think that picture telegraphy might be more widely used with advantage. Possibly the facilities it gives have not been sufficiently advertised.

### Commercial Insulin

WE have received from Messrs. Burroughs, Wellcome and Co., London, a phial of "Wellcome" brand insulin prepared from crystalline insulin. This is the first commercial insulin to be made from the crystals and is available in 5 c.c. phials at 20 units per c.c. When insulin was first placed on the market some ten years ago, the potency of the material was only a few units per milligram. For some time now, however, the potency of many commercial insulins has approximated that of the pure crystals, but this is the first time that the crystalline material has been employed for the preparation of insulin solution on the commercial scale. Crystals were first made by Abel in 1926: the problem was further investigated by Harington and Scott in 1929, and more recently Scott has shown that the ease with which crystals can be obtained from amorphous insulin depends on the presence of small quantities of zinc (or some other metals), and that all crystals prepared by the pyridine-brucine or saponin methods contain this element.

### Announcements

LORD D'ABERNON, chairman since 1929 of the Medical Research Council, has been elected a fellow of the Royal Society under Rule 12, which provides that the Council may recommend for election in any calendar year not more than two persons who "have rendered conspicuous service to the cause of science, or are such that their election would be of signal benefit to the Society".

MR. F. J. MARQUIS and Prof. W. W. Jameson have been appointed to fill vacancies in the membership of the Industrial Health Research Board of the Medical Research Council.

DR. KENNETH MELLANBY has been appointed Wandsworth scholar at the London School of Hygiene and Tropical Medicine. The purpose of the scholarship is research in tropical medicine, and the appointment is for a period of two years.

THE Director of the Geological Survey and Museum reports that Jermyn Street Museum is now vacated, and the library and collections have been transferred to the new Museum in Exhibition Road, South Kensington. The library is not yet in order, but the geological maps, British and foreign, are now available for consultation by the public. Admission may be obtained by the side entry in the courtyard between the Science Museum and the Geological Survey Museum.

THE next series of lectures and demonstrations on tropical hygiene at the London School of Hygiene and Tropical Medicine, which are intended for men and women outside the medical profession proceeding to the tropics, will be given by Lieut.-Col. G. E. F. Stammers and Sir Malcolm Watson on December 10-14 inclusive, 3.30-5 p.m. each day. The synopsis and other particulars can be obtained from the

Organising Secretary, Ross Institute of Tropical Hygiene, Keppel Street, Gower Street, W.C.1.

THE Secretaries of the Fourth International Congress for Applied Mechanics held in Cambridge last summer are about to go to press with the *Proceedings* of the Congress. So that the data contained may be at the disposal of all actively interested in the subject, the Organising Committee is prepared to issue copies at a price of £1 including postage (which sum does not actually cover the cost of printing and distribution). So that an adequate number of copies may be printed, those desirous of availing themselves of this offer are advised to make application forthwith to the Organising Secretary, Engineering Laboratory, Cambridge, England. The volume will contain the seven general lectures *in extenso*, abstracts of about 140 sectional papers and other data relating to the Congress.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A research student (qualified medical practitioner) for six months at the Institute of Pathology and Research, St. Mary's Hospital, Paddington, London, W.2—The Secretary (Nov. 12). A head of the Department of Continuative Education, Loughborough College—The Principal (Nov. 16). A lecturer in engineering at the Widnes Municipal Technical College—The Secretary, Education Office, Town Hall, Widnes (Nov. 16). A temporary junior assistant at the Experimental Station, Porton, near Salisbury—The Chief Superintendent, Chemical Defence Research Department, 14 Grosvenor Gardens, S.W.1 (Nov. 17). A lecturer (woman) in mathematics and science (biology) at the Training College for Women, Langham Tower, Sunderland—Chief Education Officer, Education Offices, 15 John Street, Sunderland (with stamped addressed envelope) (Nov. 19). An electric traction engineer to the New Zealand Government Railways—High Commissioner for New Zealand, 415 Strand, London, W.C.2 (Nov. 24). An explosives chemist for the Royal Gunpowder Factory, Waltham Abbey—The Principal Clerk, Central Office, Royal Gunpowder and Small Arms Factories, Enfield Lock, Middlesex (Nov. 24). An assistant to the Secretary of the Institution of Naval Architects—The Council of the Institution, 2 Adam Street, Adelphi, W.C.2 (Dec. 1). An assistant lecturer in mechanical engineering at the Manchester Municipal College of Technology—The Principal (Nov. 26). A University demonstrator in pathology at the University of Cambridge—Prof. Dean, Department of Pathology, (Dec. 1). Librarian at the British Postgraduate Medical School (University of London)—The Dean, British Postgraduate Medical School, New Public Offices, Whitehall, S.W.1. A professor of modern experimental physics at the National Central University, Nanking, and a professor of hydraulic engineering at the National Chekiang University, Hangchow, China—Universities China Committee in London, 91 Gower Street, London, W.C. A research fellow (experience in gas analysis) at the Liverpool Heart Hospital—The Secretary, Miss Lewis, 14, Cook Street, Liverpool.

### 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.]

#### Direct Introduction of Deuterium into Benzene without Heterogeneous Catalysis

THE transference of deuterium to benzene from hydrogen gas or from water at the surface of finely divided metal catalysts has been realised by Horiuti, Polanyi and Ogden<sup>1</sup>, and unsuccessful attempts to achieve a similar object have recently been recorded by Farkas, Farkas and Rideal<sup>2</sup> and Murray, Squire and Andrews<sup>3</sup>.

We are studying the direct introduction of deuterium into the aromatic nucleus by means of ordinary electrophilic reagents, that is, without heterogeneous catalysis, and it may be of interest if some of our results for benzene itself are set out for comparison with the above catalytic studies.

The reagent employed for the introduction of deuterium into this hydrocarbon was concentrated aqueous sulphuric acid. It was prepared from sulphur trioxide and the appropriate quantity of heavy water. When benzene was treated with anhydrous sulphuric acid extensive sulphonation took place, but this was largely avoided by the use of 90 per cent acid. When the latter acid and benzene were brought together hydrogen exchange readily occurred.

Quantities of benzene and aqueous acid each containing the same number of atoms of hydrogen ( $\frac{1}{3}\text{C}_6\text{H}_6 + \text{H}_2\text{O} + x\text{SO}_3$ ) were shaken together for various periods at the room temperature. The benzene was neutralised, dried and burnt, and the density of the combustion-water was determined. When the sulphuric acid had the ordinary hydrogen-isotope ratio the combustion-water had the same density as ordinary water to within the accuracy of the density measurements (1 in  $10^6$ ). When, however, the acid had an enhanced deuterium content, a part of this isotope became transferred to the benzene, which on combustion yielded heavy water. For times of shaking up to 24 hours the proportion of deuterium thus transferred increased with the time. The following two experiments with a specimen of 90 per cent sulphuric acid prepared from water having a density of 2,149 parts per million above normal will give an idea of the velocity of the exchange (the equilibrium constant is being determined):—

Time of shaking (hours)	Excess density in p.p.m. of	
	H <sub>2</sub> O of residual (H <sub>2</sub> O + xSO <sub>3</sub> ). By diff.	Combustion H <sub>2</sub> O from C <sub>6</sub> H <sub>6</sub>
3	2060	89
24	1199	950

Results will later be reported showing that certain substitution products of benzene undergo spontaneous exchange of their nuclear hydrogen atoms with the hydrogen of water or acids much more readily than does benzene itself.

It is well known that the familiar substitution effects of reagents such as sulphuric acid require the assumption of 'abnormal' polarisation, that is, polarisation in a direction contrary to that of the

ordinary ionisation of the reagent (for example,  $\delta^- - \delta^+$  OH-SO<sub>3</sub>H). The existence of an aromatic substitution dependent on 'normal' polarisation  $\delta^+ \delta^-$  (H-SO<sub>3</sub>H), that is, one corresponding to the ionisation, is here demonstrated for the first time. Evidently the reaction is facile, though undetectable except by the use of an isotopic indicator.

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C. G. RAISIN.  
C. L. WILSON.

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London.  
Oct. 30.

<sup>1</sup> *Trans. Faraday Soc.*, **30**, 663; 1934. Cf. NATURE, **134**, 377, Sept. 8, 1934.

<sup>2</sup> *Proc. Roy. Soc., A*, **148**, 639; 1934.

<sup>3</sup> *J. Chem. Phys.*, **2**, 714; 1934.

#### Composition of Cosmic Rays

THE new information regarding the absorption of high energy photons and electrons, presented at the recent International Congress on Nuclear Physics, suggests an improved interpretation of certain cosmic ray phenomena. Three distinct components of cosmic rays have been recognised. Eckart's analysis<sup>1</sup> of the depth *v.* ionisation data shows clearly the presence of two components in the cosmic rays which reach the earth's surface. These components have mean absorption coefficients of about 0.6 and 0.06 respectively per metre of water. Gross<sup>2</sup> and Compton and Stephenson<sup>3</sup> find that the high altitude data from stratosphere balloons also indicate the presence of two components, the more penetrating of which is probably identical with Eckart's less penetrating component. Let us call these components *A*, *B* and *C* in the order of their penetrating power.

Following the theories of Størmer, Lemaître and Vallarta, and others, we can calculate the minimum energies of electrons, protons and alpha particles which reach the earth at a given latitude through the earth's magnetic field. Corresponding to these minimum energies, there will be minimum ranges in the atmosphere. Component *A*, which is relatively most prominent near the top of the atmosphere, is affected less by the earth's magnetic field than component *B*. Its penetration corresponds either to the range of alpha particles capable of traversing the barrier of the earth's magnetic field, or to photons with the absorption coefficient of the shower producing radiation.\* Our approximate calculations show a close correspondence between electron ranges†

\* This suggestion of photons for component *A* has been put forward by P. M. S. Blackett, because of the close correspondence between its rate of absorption and that observed for the shower-producing radiation, which seems to consist of photons. It is also doubtful whether alpha particles could retain their integrity with kinetic energies hundreds of times greater than that ( $3 \times 10^7$  electron volts) with which they are bound together. Compton and Stephenson found the assumption of either photons or alpha particles to be consistent with their high altitude data. A comparison of the new high altitude ionisation measurements of Bowen, Millikan and Neher, with the earlier ones of Regener and Picard at slightly lower magnetic latitudes, however, suggests an effect on this component due to the earth's magnetic field. This would require a charged particle rather than a photon composition. High altitude measurements now under way at lower magnetic latitudes, where the effect of the earth's field is greater, should serve to distinguish between the alpha particle and the photon hypotheses.

† Using a less complete theory, Compton and Stephenson<sup>3</sup> calculated that the electrons would have slightly greater penetration than the protons. The new results, which take into account the radiation excited by the particles on traversing matter, make their component *B* correspond to positrons rather than to the protons which their calculation favoured.

and component *B*. The minimum ranges for protons penetrating the magnetic barrier should be greater than for electrons, which suggests identifying protons with component *C*, though the presence of the strong component *B* prevents using existing depth-ionisation data to make this identification definite. These comparisons will be given in detail elsewhere. We wish here to point out that if component *B* is identified with electrons (positrons or negatrons), and *C* with protons, certain cosmic ray phenomena find a simple explanation.

Recent theoretical studies have shown that for the very high energies involved in cosmic rays, the probability that electrons shall lose energy by photon excitation increases rapidly with the energy, and should represent the most important method of energy dissipation. This deduction is supported by Anderson and Neddermeyer's measurements of electron energy losses, as reported to the Congress. For protons, however, the theory indicates that energy losses by photon excitation should be of negligible importance. This difference between the action of electrons and protons would account for the higher absorptivity of the former, assuming that both types of particles have roughly the same distribution of energies. An equally important difference is that the electrons will form a prolific source of secondary radiation, showers, etc., whereas the protons should be accompanied by relatively feeble secondary rays. Component *B* should thus be the primary 'shower-producing radiation'.

The increasing importance of component *B* as compared with *C* at higher altitudes must accordingly result in an increased proportion of secondary radiation. We would thus explain the following phenomena:

1. The increasing importance of the transition effect at higher altitudes, as found by surrounding an ionisation chamber with several centimetres of lead.\*

2. Rossi's new observation, as reported at the Congress, that the ratio of the frequency of showers to the frequency of coincidences increases at high altitudes (up to 3,500 metres).

If protons require less energy to penetrate the atmosphere than do electrons, the slowest protons reaching sea level had initially, at the top of the atmosphere, less energy than the slowest electrons. Therefore the protons should be more affected by the earth's magnetic field than the electrons, because they had less energy and therefore smaller mass when under the influence of the field. This would mean that at a given level the penetrating component *C* should show stronger magnetic effects than component *B* and its secondary radiation. Rossi has measured the difference between the number of rays coming from the west as compared with the east, at 45° zenith angle, and found this difference to be greater for the rays penetrating 8 cm. of lead than for the total radiation. Also, Johnson's measurement of the shower-producing radiation, using three counters not in line, showed a smaller west-east difference than that for the coincidence-producing radiation. This phenomenon is likewise explicable if it is the electrons of high initial energy which produce the showers, whereas the initially slower non-radiating

protons which contribute to the coincidences are more easily deflected by the earth's field.

There is another possible reason why the electrons (and therefore the showers) show a smaller east-west effect than the protons (and therefore the total primary radiation): It may be that component *B* consists of negatrons as well as positrons, whereas component *C* contains only particles of positive charge, namely, protons. Johnson's observations at high altitudes in Peru that more rays come from the west than from north or south, however, is difficult to reconcile with any negatively charged particles prevented from reaching the earth by the field there used. This points to the conclusion that the electron component of cosmic rays consists at least predominantly of positrons.

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18 Norham Gardens, Oxford.

H. A. BETHE.

Physical Laboratories, Bristol.

Oct. 29.

\* C. Eckart, *Phys. Rev.*, **45**, 851; 1934.

† B. Gross, *Z. Phys.*, **83**, 217; 1933.

‡ A. H. Compton and R. J. Stephenson, **45**, 441; 1934.

### Secondary Emission from Elements Bombarded with Neutrons

WE have measured the absorption of the complex radiations from Po+Be in various elements, using a Geiger-Müller counter as a detector. The source of Po+Be (3.5 mc.) was enclosed in a glass tube and shielded with a cylinder of lead 2.5 cm. in thickness. The walls of the counter, which was placed 12 cm. from the source, were of aluminium, 0.18 mm. thick. The absorbing material was in the form of large slabs placed between the source and the counter. The following results have been obtained:

	C	Al	Fe	Zn	Sn	Sb	Ba	Hg	Pb
At. Weight	12	27	54	64	120	122	138	201	208
$\mu$ in cm. <sup>-1</sup>	0.050	0.095	0.195	0.182	(0.00)	(0.06)	0.098	0.279	0.300
$H/\rho$ in cm. <sup>2</sup> gm. <sup>-1</sup>	0.034	0.037	0.025	0.025	(0.00)	(0.010)	0.026	0.021	0.026

It is seen that tin shows no detectable absorption; antimony, which follows tin in the periodic system, shows an abnormally low absorption. A plate of lead, 8 mm. in thickness, interposed between the absorbing screen and the counter, reduced the number of kicks to half. It would appear, then, that the apparent low absorption in tin and antimony is to be ascribed to more absorbable secondary radiations produced by the passage of the primary rays through these elements. It seems probable that the softer radiations are of the nature of  $\gamma$ -rays, and arise from excitation of nuclear levels of elements near tin in the periodic table. It will be necessary to use stronger sources of neutrons and a modified technique in order to investigate these secondary soft radiations in greater detail, and we hope shortly to be able to report more fully on their nature.

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In the course of observations of the neutrons produced by the bombardment of elements with

\* Cf., for example, A. H. Compton (*Phys. Rev.*, **43**, 387; 1933) whose curve *a*, Fig. 3, shows the increase with increasing altitude of the fraction of the cosmic rays removed by 2.5 cm. of lead.

accelerated heavy hydrogen ions, we have noticed repeatedly the production of remarkably strong ionising radiations when silver was placed in the beam. Silver is close to tin in the periodic table and it is probable, therefore, that the effects observed by Dr. Ollano are due to the neutrons in the radiation from  $Po+Be$ , and that the phenomenon is general in elements in that part of the periodic table.

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Oct. 27.

#### Vision in the Ultra-Violet

IN a letter in *NATURE* of September 15, p. 416, Mr. Goodeve refers to a paper by Saidman and Dufestel<sup>1</sup> on vision in the ultra-violet. Mr. Goodeve is probably unaware of a more recent paper by Saidman<sup>2</sup> on the same subject, where evidence is given of vision down to the mercury line 3130. Furthermore, Saidman has pointed out another remarkable fact worthy of note; that is, that vision at short wave-lengths is possible only in young people; the limit of visibility recedes towards longer wave-lengths with increase in age.

I can support this statement from the case of my own eyes. Twenty-five years ago, I was able to see the 3650 mercury line very well (I did not try with shorter wave-lengths, on account of the difficulty of excluding diffuse light). At the present time, at the age of sixty-seven years, I cannot see the 3650 line at all. My sight, in other ways, has remained perfectly normal, except the inevitable far-sightedness and slight hypermetropia. I can see the *K* line of calcium (3933) quite well.

This continuous retrogression in the limit of visibility is, without doubt, due to progressive absorption with age by the crystalline lens. As Saidman has remarked, the determination of the limit of visibility would give an indication of the age of the crystalline lens.

Nevertheless, certain precautions are necessary when determining this limit. It is necessary, in particular, to avoid all traces of diffuse light. Saidman used a mercury lamp with filters; but the number of intense lines is not large enough to fix a precise limit. From this point of view, a richer spectrum, such as that of iron, or even a continuous spectrum would be better; but there must be complete elimination of diffuse light. The use of a double spectroscop would probably be necessary in order to get a perfectly pure spectrum.

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Oct. 18.

<sup>1</sup> *C.R.*, 182, 1173; 1926.  
<sup>2</sup> *C.R.*, 196, 1537; 1933.

#### Development of the Spark Discharge

It has recently been shown<sup>1</sup> that in the lightning discharge a preliminary discharge from cloud to ground occurs before the passage of the main stroke in the reverse direction. The luminous intensity of this preliminary discharge is much lower than that of the succeeding main stroke and its velocity of propagation is considerably smaller. The main stroke begins at the moment the preliminary leader reaches the ground and follows the leader path in the reverse direction.

Now it has been observed in the laboratory for some years that when an impulse voltage is applied to an asymmetrical gap (such as a point-plane gap) the voltage of the impulse being insufficient to cause spark-over, a discharge proceeds from the high voltage point electrode towards the plane electrode, the length of the discharge varying with the applied voltage. Under conditions favourable for observation, this discharge can be followed almost to the plane electrode when the voltage is just insufficient to cause spark-over. It is natural therefore to suppose that this preliminary discharge forms the conducting path for the main discharge when spark-over occurs, thus providing an exact analogue of the lightning discharge. The difficulties of observing this are connected with the short time available for the development of the preliminary discharge and its weak visual intensity.

To overcome these difficulties a camera was constructed consisting of a wide aperture lens and a

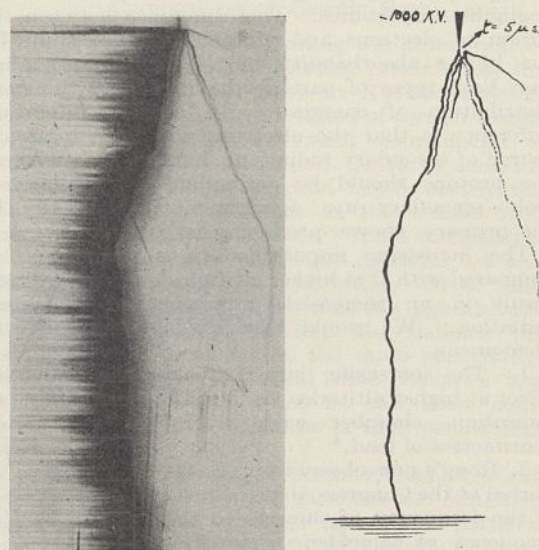


FIG. 1.

rotating film having a peripheral speed of 40 metres per second. With this resolving power, it has been possible to photograph the preliminary discharge well separated from the subsequent main discharge at voltages of the order of one to two million volts. The photographs show the course of the preliminary leader for something like 16-20 per cent of the electrode spacing, the luminosity falling off with distance from the initiating electrode. But over this distance the main discharge is seen to follow the path of the leader in all its details, and there is some evidence that where branching of the leader stroke occurs, the subsequent main stroke branches likewise. In Fig. 1 is shown on the left a record of the discharge between a negative point at -1,000 k.v. and a grounded plane, 40 inches apart; and on the right a sketch indicating the extent to which the leader can be followed in the original.

Evidence obtained from Boys's camera investigations indicates that the speed of the camera here used can give rise to no displacement of the image of the main discharge. We therefore interpret an observed diminution in the separation between leader and main discharges as arising from the time occupied in the progress of the leader.



An important consequence of these investigations is that the interval between the start of the leader discharge and the occurrence of the rapid main discharge should be equal to the time lag of spark-over as measured by one of us<sup>2</sup> and should vary with the type of gap used. This is found to be the case, measurements of time-lag on the photographic film and on an oscillograph agreeing within 10 per cent. It is concluded that the time-lag of spark-over is the time taken for the leader stroke to bridge the gap between the electrodes.

It is found that leader strokes form whether the high-tension electrode is positive or negative. They also form from the grounded electrode upwards if the field is sufficiently concentrated there and reduced in intensity at the high-tension electrode. It is to be expected that with the types of gap so far investigated, the visual intensity of the leader stroke should diminish rapidly with increasing distance from the high-tension point since the average gradients for positive and negative polarities are only about 6-10 k.v. per cm. and the average speeds of formation of the leader strokes are only about  $6-20 \times 10^6$  cm. per second respectively. The greater speed of formation of the leader stroke in the lightning discharge corresponds to the greater uniformity of the field and the higher average gradients prior to the lightning discharge. It has been found in support of this view that an increase in the applied voltage over the minimum voltage required to produce spark-over results in an increased length of the leader stroke having sufficient intensity to be recorded photographically. The velocity of the leader is increased and the time-lag, as is well known, is diminished by this procedure.

We wish to thank the members of the High Voltage Laboratory, Metropolitan-Vickers Electrical Co., Ltd., for assistance with the impulse generator and cathode ray oscillograph used in this preliminary survey of the spark discharge development; the South African Institution of Electrical Engineers for the loan of a camera used in a subsidiary investigation; Mr. Olaf Bloch of Messrs. Ilford, Ltd. for assistance with photographic material; and Mr. A. P. M. Fleming, director and manager of the Research and Education Departments of the Metropolitan-Vickers Electrical Co., Ltd., for permission to publish this account.

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Oct. 18.

<sup>1</sup> Schonland and Collens, *Proc. Roy. Soc., A*, **143**, 654; 1934.  
<sup>2</sup> Allibone, Hawley and Perry, *J. Inst. Elec. Eng.*, November, 1934.

### A High-Frequency Water Jet, and Ultrasonic Flame

IF two capillary jets of water impinge upon one another, one may observe several interesting things, some of which are recorded below. Fig. 1 shows the double nozzle used. It is made of glass with holes about 0.5 mm. in diameter at the tips, and is provided with a spreader. A water pressure of about 0.3 atm. was used.

Fig. 2 is a picture of the jet by reflected light. It is remarkable in that it shows stationary corrugations (probably Rayleigh waves such as formed by an

obstacle touching a stream) on the flat surface of the jet, and space periodicity, due to the pulsation of

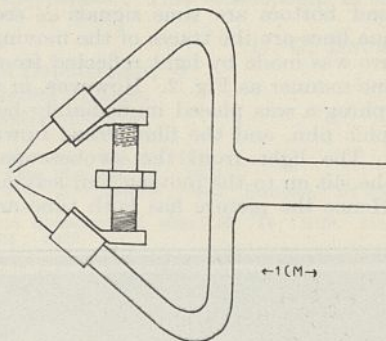


FIG. 1.

droplets (Plateau) in the tangential streamers. The jet emits a faint note of high frequency. The intensity of the note can be greatly increased by blowing a jet of air against the film or any of its streamers.

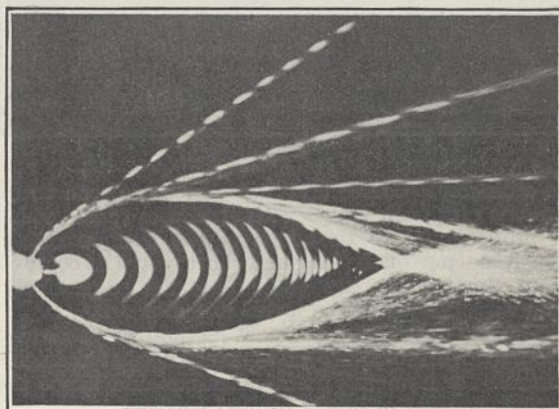


FIG. 2.

Fig. 3 is a spark photograph of the jet in transmitted light. It is seen that the droplets in any one of the streamers all have the same size, and that the droplets in all the streamers have the same frequency

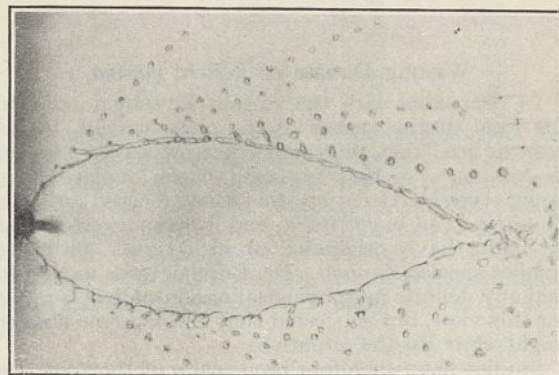


FIG. 3.

spacing. The stroboscope shows that this is the frequency of the emitted note. The stroboscope also shows waves of this frequency travelling outward from the nozzles and riding over the stationary corrugations.

Fig. 4 shows the manner of propagation of these waves. In this picture the stationary corrugations are seen as a vertical plaid. The horizontal lines at the top and bottom are time signals  $\frac{1}{10}$  sec. apart. The oblique lines are the traces of the moving waves. The picture was made by light reflected from the jet in the same manner as Fig. 2. However, in this case a slit diaphragm was placed immediately before the photographic film, and the film jerked upward past the slit. The light from the stroboscope flashed through the slit on to the moving film leaving a time record. Hence the picture has both time and space

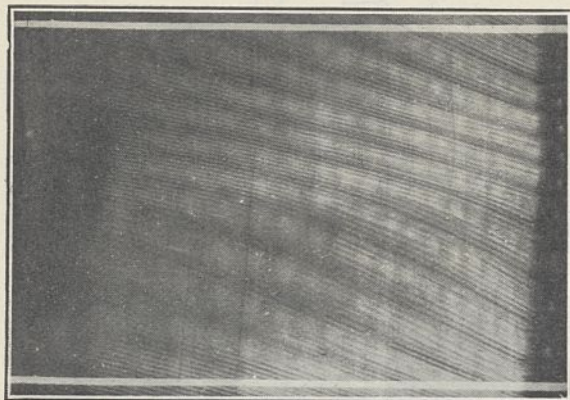


FIG. 4.

co-ordinates. Coarse and fine waves are seen to be present and both travel with the same speed, which is proportional to the slope of the oblique traces. The frequency of the long and short waves as counted from this picture are 600 and 4,200 respectively. The wave-length of the latter is 1.2 mm.

The jet seems to be a new method of producing droplets of uniform size, and one can apply Rayleigh's formula for studying their pulsations and hence the surface tension of newly formed surfaces.

This double nozzle when used with burning gas gives a noiseless ultrasonic flame.

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#### Wasting Disease of *Zostera marina*

IN connexion with the various investigations into the local disappearance of the grass wrack<sup>1</sup>, it has been noticed that the smaller narrow-leaved form of *Zostera marina* has, in some cases, replaced the larger type. Attention was thus focused on this *Z. marina* var. *angustifolia*, and it was suggested that it might have originated from a cross with the smaller species *Z. nana*. Dr. Butcher<sup>2</sup> was unable to find any definite morphological or anatomical support for this view, but suggested that chromosome studies might clear up the situation.

Studies have therefore been made of the root tips of *Z. nana* and of five stocks of *Z. marina* from localities so wide apart as south-west Ireland and north-east England. All the material showed a somatic complement of 12 chromosomes but, on the other hand, investigation of the size and structure of the chromosomes gave a clearly marked distinction between *Z. nana* on one hand and all forms of

*Z. marina* on the other. The complements of all stocks of the latter are indistinguishable, and consist of six pairs of comma-shaped chromosomes of which one pair carries large satellites, and the spindle fibre attachment is characteristically sub-terminal. In *Z. nana* the chromosomes are at least twice as large and there are much more clearly marked differences in size among them, chromosomes with median spindle fibre attachments are conspicuous and the satellites on the largest pair of chromosomes are relatively small. Fig. 1 gives typical plates from the two species ( $\times 2250$ ).

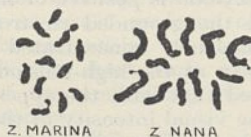


FIG. 1.

The differences between the chromosomes of the two species seem to be sufficiently marked for them to be distinguishable in a hybrid, but in the narrow-leaved form of *Z. marina* the complement is identical with that of the type; thus the probability that the former is not a hybrid seems to be almost a certainty. That the difference may be an ecological one is suggested by the observation that, in the localities examined, the width of the leaf in *Z. marina* was directly proportional to the depth of the water, the very narrow-leaved forms being longest exposed by the fall of the tide and the broadest not exposed at all. The *Z. nana* forms a zone still farther up the shore than the narrowest *Z. marina*.

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<sup>1</sup> NATURE, 132, 277, Aug. 19; 483, Sept. 23; 752, Nov. 11; 1004, Dec. 2; 1933, 133, 912, June 16, 1934, 134, 143, July 23; 416, Sept. 15; 573, Oct. 13; 1934.  
<sup>2</sup> B.E.C. Report, 1933.

#### Specific Action of Œstrin

IN a communication concerning the effect of œstrin upon certain vestigial structures in the male mouse, Burrows<sup>1</sup> has made the interesting suggestion that this effect may be specifically upon the derivatives of the Müllerian apparatus, and points out the possible use of this in embryology.

I have recently concluded an examination of the oviducal epithelia of the mouse, to be published elsewhere, and from this it appears that, while the outer portion of the Müllerian duct gives rise to structures lined with epithelia the behaviour of which is intimately affected by the march of events in the ovary, the inner portion produces epithelia one of which exhibits a behaviour which is apparently unique (the extrusion of nuclei and associated phenomena) but which yet cannot be closely related to any cycle.

It will be interesting to see whether further inquiry shows that one part of the Müllerian duct vestigial in the male is more sensitive to œstrin than another part functional in the female.

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<sup>1</sup> Burrows, H., NATURE, 134, 570, Oct. 13, 1934.

### Infra-Red Spectra of Silica

AN experimental investigation of the infra-red absorption of transparent silica between 1.0 and 7.5  $\mu$ . has resulted in the correction and extension of existing data, with the consequent possibility of formulating a set of vibration frequencies which appear to have more significance than those hitherto put forward. Pending detailed publication it may be useful to summarise some of the results.

Absorption coefficients and wave-lengths have been measured using a wide range of thicknesses of fused silica and crystalline quartz and a considerable improvement in both accuracy and resolution has been effected. Many new bands have been found in crystalline quartz; on the other hand, one recorded by Plyler<sup>1</sup> at 2.72  $\mu$  was definitely absent, as were also several bands reported by Parlin<sup>2</sup> in fused silica between 2 and 4  $\mu$ . Another of these, near 2.73  $\mu$  (Drummond), shows such markedly different intensities in different specimens that it is unlikely that it is due to silica at all. There are grounds for attributing it to dissolved CO<sub>2</sub>.

TABLE 1.

	Total No. of bands	No. ascribable to harmonics	No. ascribable to combinations	No. of bands omitted
Fused Silica	14	11	—	3
Quartz ( $\omega$ )	38	18	10	10
Quartz ( $\epsilon$ )	29	14	8	7

The absorption spectra of fused silica and of the ordinary and extraordinary rays in quartz have been examined. That of fused silica is the simplest, and of fourteen bands, eleven can be fairly well represented as harmonics of five frequencies. (Two very weak bands and that at 2.73  $\mu$  are omitted.)

The spectra of quartz are more complex, but bands corresponding to those of fused silica can be picked out, the associated five frequencies deduced and further bands ascribed to additional harmonics and combinations. The numbers of bands included in this scheme are indicated in Table 1.

TABLE 2.

(Frequencies are in cm.<sup>-1</sup>; \* indicates reflection measurements)

	$\nu_1$	$\nu_2$	$\nu_3$	$\nu_4$	$\nu_5$
Fused Silica	1120	935	799	746	659
Quartz ( $\omega$ )	1129	937	797	751	663
Quartz ( $\epsilon$ )	1131	932	800	751	666

$\nu_x - \nu_y$ (Fused)	461	276	140	87
" ( $\omega$ )	466	274	134	88
" ( $\epsilon$ )	465	266	134	85
Raman Effect (Fused)	444; 500	263	?	?
Effect (Crystalline)	464	265	126	85
Far Infra-red (Fused)	472*	?	116	85
( $\omega$ )	476*	263	130	95; 82
( $\epsilon$ )	507*	?	?	?

There are several simple numerical relationships between these five frequencies (for example,  $2\nu_1 = 3\nu_4$ ;  $\nu_2 = 2\nu_1 - 2\nu_5$ ;  $2\nu_3 = \nu_2 + \nu_5$ ;  $4\nu_2 = 5\nu_4$ ;  $5\nu_3 = 6\nu_5$ ), and they may, therefore, not be true fundamentals but be themselves formed from a simpler set of frequencies. Each of them, however, occurs in an independent harmonic series in the observed absorption spectra.

These quasi-fundamentals are, further, related to

the far infra-red spectrum<sup>3</sup> and to the Raman effect<sup>4</sup>, as may be seen by taking differences between  $\nu_5$  and each of the others. This relationship is set out in Table 2.

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<sup>1</sup> Plyler, *Phys. Rev.*, **33**, 48; 1929.<sup>2</sup> Parlin, *Phys. Rev.*, **34**, 81; 1929.<sup>3</sup> Barnes, *Phys. Rev.*, **39**, 566; 1932. Lecomte, "Le Spectre Infra-rouge", pp. 145-6.<sup>4</sup> Gross and Romanova, *Z. phys.*, **55**, 744; 1929. Menzies, *Phil. Mag.*, **8**, 504; 1929.

### Synthesis of Ascorbic Acid (Vitamin C) by means of Tissues *in Vitro*

THE Tillmans technique of titration against the indicator 2:6-dichlorophenol indophenol has been modified by Harris and Ray<sup>1</sup> for the estimation of ascorbic acid in trichloroacetic acid extracts of different materials. By employing the same method, slightly modified by the introduction of glacial acetic acid before titration<sup>2</sup>, we have been for some time investigating the nature of the precursor and mechanism involved in the synthesis of ascorbic acid by the rat, a species known to be independent of an external source of the vitamin.

The production of ascorbic acid by means of the liver, kidney and spleen tissues of the rat from glucose, fructose, galactose, mannose, arabinose and xylose has been studied. The minced tissues (0.2 gm.) were incubated at 37° in phosphate buffer of pH 7.4 (5 c.c.) or in a mixture of the phosphate buffer (2 c.c.) and Ringer-Locke solution (3 c.c.) for 3 hours with and without the different sugars (20 mgm.). Rather unexpected results were obtained, as will be seen from the following table, which gives average figures. Mannose appears to be almost unique among the sugars investigated in being converted into ascorbic acid by all these tissues under the stated conditions, and the amount of ascorbic acid formed is significant. The values obtained with the other sugars appear to be within the range of individual variations.

Ascorbic Acid (mgm.)  
formed per gm. tissue after incubation with sugar.

	Spleen	Kidney	Liver
Glucose	- 0.025	- 0.036	- 0.107
Fructose	- 0.050	+ 0.075	- 0.130
Galactose	0	- 0.050	- 0.060
Mannose	+ 0.350	+ 0.320	+ 0.300
Arabinose	- 0.010	+ 0.040	- 0.038
Xylose	- 0.022	+ 0.010	+ 0.025

The mechanism concerned in the dehydrogenation of mannose into ascorbic acid is under investigation. It is interesting to note that Ray<sup>3</sup> has, meanwhile, observed that in pea-seedlings mannose has a remarkable influence on the formation of ascorbic acid. This would indicate a similarity between the mechanisms involved in the above transformation occurring in the animal and plant tissues investigated.

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<sup>1</sup> Harris and Ray, *Biochem. J.*, **27**, 303; 1933.<sup>2</sup> Guha and Gosh, *Current Science*, **2**, 390; 1934.<sup>3</sup> Ray, *Biochem. J.*, **28**, 996; 1934.

## Research Items

**Early Records of Californian Indians.** Mr. J. P. Harrington, of the Bureau of American Ethnology, has recently discovered the manuscript, which had long been missing, of the earliest, and indeed the only, account of the Indians of California dating from the period of the Spanish occupation, which is worthy of the name of an ethnological treatise. The author, Fr. Jerónimo Boscano, was a Franciscan missionary, born in the island of Mallorca in 1776, who worked at San Juan Capistrano from 1812 until 1826 and died in 1831. The Indians of San Juan Capistrano whom he described are a north-western sub-division of the San Luiseño Indians of the San Luis Rey Mission, who speak a dialect of the Aztec family of languages. They had almost disappeared before they came under modern scientific observation. A version of Boscano's account was published in 1846; but the manuscript proves to be far more valuable than was expected, as it contains data not in the published version, and, indeed, the two supplement one another in important particulars. The treatise centres around the cult of Chinigchinix, who had once lived among the people as a prophet. On his death, it was believed, he was translated to heaven, leaving no visible remains behind. From heaven he continued to watch his people, and to judge and punish them for wrong-doing. In addition to his account of their cult the author describes the relation of the people to their chiefs, their marriages, their principal feasts and their calendar together with some miscellaneous customs. The temple of Chinigchinix was so sacred that no boy or girl was allowed to approach it, and it was an effectual sanctuary for anyone guilty of any crime. Mr. Harrington has published a translation of the manuscript (*Smithsonian Miscellaneous Collect.*, 92, No. 4) and is also preparing a full commentary on the material it records.

**Petroglyphs in the Society Islands.** A study of stone remains in the Society Islands (*Bull.* 116, Bernice P. Bishop Museum, Honolulu) by Mr. Kenneth P. Emory, based partly on material collected by Dr. E. S. C. Handy in 1923 and partly on that collected by the author as a member of the Bernice P. Bishop Museum's Expedition to the Tuamotu Archipelago on various occasions between 1925 and 1931, describes, among other matters, a number of petroglyphs which have been discovered on Tahiti, Huahine, Raiatea, Borabora and Maupiti. In Tahiti the petroglyphs are on large boulders, but in the Leeward Islands on slabs of marae as well. Their uniformity and conventionality prove that the making of petroglyphs was a well-established practice. The motives are the turtle, which predominates, the human figure, concentric circles, circles and dots, and the canoe. They fall within the period of the historical inhabitants, but there is no means of dating them. Human figures at Tipaeni, Tahiti, are traditionally said to commemorate the wife and twin children of one Tatauri, who took refuge there, but this has the appearance of a local legend rationalised to fit the carving. Most petroglyphs are wrought by pecking. None of the groups is organised to portray an event or to form a decorative ensemble. The figures are added one after the other by the same or different artists without regard to preceding figures. The turtle, the predominating figure, was the food of the

gods, eaten only by chiefs and keepers of the marae. The figures are sacred symbols and not drawn in the spirit of decorative art, though some idea of embellishment may be present. The petroglyphs discovered in various localities indicate that incising or pecking of figures on stone is almost universal in Polynesia, Samoa being a notable exception.

**Siamese Fishes.** Mr. Henry W. Fowler describes many new fishes from Siam collected by Mr. Rodolphe Meyer de Schauensee (Zoological Results of the De Schauensee Third Siamese Expedition, Part I.—Fishes. *Proc. Acad. Nat. Sci. Philadelphia*, 86, 1934). Most of the material is from the northern regions, and the results are of much value as a contribution to the ichthyology of Siam. Some fishes from Bali, Dutch East Indies, are also included, obtained from the markets, at the seashore and in fresh waters. In Lake Bratan, Central Bali, which is a small body of fresh water in the crater of an extinct volcano, without visible communication with other waters (elevation 4,040 ft.) fishes were angled with a hook baited with rice, dressed with a sauce, which formed an effective bait. Three handsome new gobies were obtained from south-east and southern Bali. The Siamese collection contains upwards of 4,500 specimens, of which more than half are cyprinoids. There are 50 new species represented by 9 new genera or sub-genera. All these are carefully recorded and described, and the colours noted whenever possible; the whole work is beautifully illustrated.

**Marine Fauna of the West Indies.** Recent reports of the collections obtained by the first Johnson-Smithsonian Deep-Sea Expedition to the Puerto Rican Deep (*Smithsonian Miscellaneous Collections*, 91, Johnson Fund, 1934) are "Three New Deep-water Fishes from the West Indies" by George S. Myers, "New Brachiopods" by G. Arthur Cooper, "Two New Nematodes" by B. G. Chitwood (Nos. 9, 10, 11, Pub. 3238, 3241 and 3243, April) and "Three New Amphipods" by Clarence R. Shoemaker, "New Mollusks of the Family Turritidae" by Paul Bartsch (Nos. 2, 12, Pub. 3229 and 3246, May, June). In the first, the family Triacanthidae is revised, Mr. Myers including in it the new genus and species *Johnsonina eriomma*, closely related to *Hollandia hollandi* described by Poey in 1861 from near Havana, but peculiar in having a large eye-like spot under the origin of the dorsal fin. Several rare and interesting brachiopods were collected and a new nematode of special interest was taken from the lizard *Anolis cristatellus*, which appears to belong to a group composed as a rule of parasites of arthropods (*Parathelandros*). Many of the mollusks belong to the Turritidae, which are very difficult to classify, and it was found that the nuclear characters here, as elsewhere, are useful for systematic purposes. A large number of new species are described and several new genera.

**Immature Stages of Scolytidae.** For some years Mr. J. C. M. Gardner of the Forest Research Institute at Dehra Dun, India, has been making a study of immature stages of Indian Coleoptera. Amongst other families his work on the Cerambycidae has proved of considerable value. In his latest paper ("Immature Stages of Indian Coleoptera" (15), (Scolytidae), *Ind.*

*For. Rec.*, 20, Pt. 8, Delhi: Manager of Publications, Aug. 15, 1934) he deals with the destructive family the Scolytidæ or so-called bark beetles. As Mr. Gardner says, "the morphology of adult Scolytidæ has been intensively studied but with the exception of studies of a few species, notably by Hopkins (1909), Russo (1926) and Schedl (1931) very little is known of larval and pupal structure". Coleopterists are not yet unanimous on the subject as to whether the description of the adult, however complete, requires to be supplemented by descriptions of the immature stages. Mr. Gardner is, as his work well shows, an advocate of the latter. The grouping of the Scolytidæ, or certain genera in the Scolytidæ, is by no means an agreed matter, and here the assistance of the immature stages might lead to a settlement of certain contested points. The paper in question is an attempt to make a beginning in the classification of Scolytid larvæ. It is restricted to some 17 genera, the larvæ of 25 species being described. The author states that he has not succeeded in finding characters to separate Scolytid larvæ as a whole from those of the Curculionidæ.

**Spermatogenesis of the Phasmidæ.** Very little has been known of the spermatogenesis of the Phasmidæ. A comparative account by Maurice Favrelle of seven species belonging to as many genera has recently been published ("Recherches sur la Spermatogenèse des Phasmes mâles d'origine bisexuée". Suppl. 17, *Bull. Biol. de France et de Belgique*, 1934). An unpaired X-chromosome is present in each case, the number of chromosomes ranging from 21 to 53 in the different genera. The size of the chromosomes varies inversely with the number, so that the total amount of chromatin remains approximately constant. In *Carausius juvenilis* the X-chromosome frequently divides precociously in the first maturation division, and non-disjunction of the X-chromosomes occasionally takes place in the second division. The spermiogenesis of the group is also described.

**A New Parasite in the Blood of Birds.** A new protozoan parasite found in the blood of *Leptocoma zeylanica* is described by I. Froilano de Mello and Macario Raimundo (*Proc. Indian Acad. Sciences*, 1, No. 2, 97; 1934). This new species, *Hæmoproteus raymundi*, exhibits a particularly simple schizogonic cycle. Merozoites arise as a result of the nuclear division of free trophozoites, and the former remain free among the cells of the host tissue. They finally attack the red blood corpuscles as schizonts, but no intracellular stage has been detected at any phase of the schizogonic cycle.

**Microbiology of the Upper Air.** Ever since Pasteur demonstrated the presence of micro-organisms in the atmosphere, bacteriologists have desired to know more about the forms of life which can exist in the higher layers of air. Several attempts have been made to investigate this question, and the results of a recent study appear in the *Proceedings of the American Academy of Arts and Sciences*, 69, No. 8, 315-340 ("The Microbiology of the Upper Air" by Bernard E. Proctor, August 1934). Preliminary tests with Petri dishes exposed from the cabin of an aeroplane indicated the need for an improved collecting apparatus which would reveal the presence of dust and other particles. A current of air, collected by a Venturi tube placed above the upper wing of the aeroplane, was caused to flow through a sterilised

filter of oiled paper. This was later examined microscopically and finally used as inoculum for plates of nutrient agar. Forty-five flights were made, and collections obtained at heights up to 20,600 ft. Bacteria and moulds were obtained from the greatest height, whilst yeasts and pollen grains were found above 16,000 ft. The majority of bacteria were the common spore formers of soil and water, and it is interesting, though perhaps not significant, that no pathogenic organisms were obtained. Various species of the genera *Aspergillus* and *Penicillium* were the chief moulds, and 29 species of bacteria have been identified. The results are extensive and carefully tabulated, but show that the microbiology of the atmosphere is constantly changing, and that the factors which control it are not yet fully understood.

**Intracellular Inclusions in Plant Virus Diseases.** Much interest has centred round the formation of peculiar vacuolate bodies in the cells of plants infected with certain virus diseases. They have been thought to be aggregations of virus particles, but Dr. F. M. L. Sheffield, of the Rothamsted Experimental Station, has shown that they should be regarded as reactions of the host cells to virus infection. In a recent paper ("Experiments Bearing on the Nature of Intracellular Inclusions in Plant Virus Diseases", *Ann. App. Biol.*, 21, No. 3, pp. 430-453, Aug. 1934), she publishes further evidence for this conclusion. Inclusion bodies or X-bodies produced by three distinct diseases have been studied, namely, *Aucuba* mosaic of tomato, *Hyoscyamus* III disease, and tobacco mosaic. The last-mentioned virus produces amoeba-like bodies which persist for some weeks. Artificial coagulants such as salts of molybdic acid and lactic acid cause the cytoplasm of healthy cells to form small bodies similar to those produced by virus infection. Attempts to inhibit the formation of X-bodies were not successful.

**Climatic Changes in Central Asia.** A contribution to this much debated problem is made by Messrs. H. de Terra and G. E. Hutchinson in a paper in the *Geographical Journal* of October on the change shown by Tibetan highland lakes. Pangong Tso lies north of the Himalayas at an altitude of 13,915 ft. Built paths along the lake border have been impassable in places for years: the eastern outlet is now considered unfordable: recorded depths have increased: beach lines can be traced below water-level: old alluvial fans on the border have been cut by waves, and lastly, lagoons are traceable to inundation. These and earlier observations dating back fully a century give proof of changes in level. Morari Tso and other lakes in Ladakh also show evidence of recent rises. The chief water supply of these lakes is from glaciers or snow-fed rivers, and it seems obvious to associate the rise in level of the lakes with an increased amount of melting water, or in other words with evidence of glacier retreat. But of this the writers contend there is no sign in recent years and they believe that the cause is one of increased precipitation. The meteorological records at Leh show an increase in precipitation synchronous with the lake rises. This increase has been shown by Dr. C. E. P. Brooks to have been apparent throughout almost all temperate Asia for the thirty years prior to 1910.

**The Texas Earthquake of August 16, 1931.** Though its greatest observed intensity was not more than 8 of the Rossi-Forel scale, this earthquake affected an area, it is estimated, of 450,000 sq. miles, and was

recorded by the more sensitive instruments in Europe. Prof. Perry Byerly has made a careful study of the seismograms obtained at fifty-four stations (*Bull. Amer. Seis. Soc.*, 24, 81-99, 303-325; 1934). From those at nine neighbouring stations, he finds that the epicentre lay in lat.  $30^{\circ} 53' N.$ , long.  $104^{\circ} 11' W.$ , that is, in the Jeff Davis Mountains and close to the continuation of the Apache Mountain fault to the south-east. The travel-time curve of  $P$  shows a definite break at about  $16^{\circ}$  from the epicentre, indicating a first-order discontinuity at a depth of about 300 km. Beyond a distance of  $75^{\circ}$ , the curve has two branches, the upper part of which is interpreted as indicating that the discontinuity at the depth of about 2,400 km. is of the first order, at which the speed of  $P$  waves drops discontinuously. From the direction of the first motion on the records, it is concluded that the earthquake may have been caused by movement along a fault directed about  $N. 35^{\circ} W.$ , upward on the east side and downward on the west.

**Vowel Sound Perception.** Part 3 of vol. 33 of *Archivio di Fisiologia* contains an account of the measurements made by Messrs. A. Gemelli and G. Pastori of the minimum duration of vowel sounds which allows of their proper perception. By means of an oscillograph, the vibrations produced when words of two syllables like 'nulla', 'mito', 'sasso', 'tonno', etc., were pronounced softly in the ordinary tone of voice by three subjects whose voices had mean pitches of 261, 326 and 480 per second were recorded and analysed. Both curves and analytical tables are reproduced, and include 'open' vowels like the 'a' in 'sasso' and 'close' ones like the 'o'. Although there is some difficulty in allowing for differences which determine the 'musicality' of speaking voices and for the effects of the preceding and following sounds, the authors conclude that the minimum duration of a vowel sound for its proper recognition depends principally on the number of oscillations which take place in the time and to a less extent on the time itself.

**Automatic Wilson Chamber for Cosmic Rays.** P. M. S. Blackett has published a detailed description of his expansion chamber, which is set off by the simultaneous discharge of two Geiger-Müller tube counters (*Proc. Roy. Soc.*, Sept.). When a fast particle in a gas leaves an ionised track, the latter broadens by diffusion, and in the cloud chamber the ions are immobilised as soon as droplets condense on them. In order to give tracks not broader than 1 mm., the expansion has to be complete within about 0.015 sec. from the passage of the ionising particle. The chamber is designed with a light piston made tight with a rubber diaphragm; the air below this diaphragm is allowed to escape by a valve operated by an electromagnet, which is controlled by the Rossi coincidence counting circuit through a thyratron. Chambers of this type have been operated in a solenoid and in the gap of a large electromagnet.

**Heavy Hydrogen.** A review of research on the isotopes of hydrogen and on heavy water by L. Farkas has appeared in *Die Naturwissenschaften* (22, 614, 640, 658; 1934). The articles deal with the possible structure of the nucleus of heavy hydrogen, the use of heavy hydrogen in the investigation of the structures of the nuclei of other elements, the spectroscopy of heavy hydrogen, chemical reactions and

equilibria in which it plays a part, the ortho- and para-modifications of heavy hydrogen, its physical properties and those of heavy water, the methods of preparation, the determination of heavy hydrogen and a detailed discussion of its reactions. There are numerous literature references. These articles present the most recent data of the subject in a well-classified form.

**Ignition Temperatures of Gases.** Dr. H. F. Coward (*J. Chem. Soc.*, 1382; 1934) has published the results of a series of experiments made by the late Prof. H. B. Dixon on the ignition temperatures of gases, the method being that of concentric tubes. The supporting atmosphere (air or oxygen) was passed up through a wide porcelain tube, the temperature of which was slowly raised by an electrically heated external platinum spiral. The combustible gas was passed up through a narrow tube, coaxial with the other, terminating in an orifice at the centre of the wider tube. As the temperature rose, a point was reached at which inflammation occurred, and this temperature was recorded by means of a thermocouple just below the orifice of the inner tube. One important result of the work was the discovery that small amounts of nitrogen peroxide in the air or oxygen reduced the ignition points; it was also found that small amounts of iodine in the atmosphere raise the ignition points of hydrogen, carbon monoxide and methane, and that various compounds of bromine raise the ignition point of methane. Dr. Coward, who gives a careful and interesting report of the experiments, discusses the results in the light of current theories. The experiments included the effects of pressure and moisture. The results of determinations in which the effects of hydrogen and of moisture on the ignition of carbon monoxide were examined are particularly interesting.

**Electrodeposition of Rubber.** Electrodeposition has been proved to be a practical process for the manufacture of many articles including rubber and rubber-coated goods; for example, motor and cycle tubes and rubber-covered screens for sieving coke. A paper by Dr. D. F. Twiss describes the method in technical detail (*J. Inst. Elec. Eng.*, Oct.). Rubber latex consists normally of a suspension of minute negatively charged rubber globules in an aqueous serum. Under electrolytic stress the globules tend to migrate against the electric current. If the current enters by zinc or a porous diaphragm, electrodeposition of the rubber can be effected. Deposits obtained in this way can be dried and vulcanised, and form the basis of several commercial manufacturing processes. The use of latex in this way obviates the need for the heavy machinery used in ordinary rubber manufacture and eliminates the preliminary milling treatment of the raw rubber. This improves the ordinary mechanical properties of the product. In the production of ebonite-coated articles, the current enters the aqueous serum through the article itself, which therefore forms the anode. At present the method can only be used economically for the production of layers less than one centimetre thick. The success of this process in practice is evidence of the advantages arising from its use. On account of the low temperature of vulcanisation, bright organic colours can be used which under ordinary vulcanising conditions would suffer serious discoloration. It is very useful therefore when making upholstery goods.

## The Red Sea Biological Station of the University of Egypt

By DR. CYRIL CROSSLAND

THE decision of the University of Egypt to build a biological station in the Red Sea, and the advantages of the site selected at Ghardaqa (Hurgada) have already been discussed in these columns<sup>1</sup>. The station is now in use. Further experience shows that the heat and humidity of the northern part of the Red Sea need not deter visitors whose only free time is the summer vacation. The lower tides and more regular winds make outdoor work easier then, and the temperature of the water is normal for the tropical fauna.

The Anglo-Egyptian Oilfields' steamers communicate with Suez twice a week and supply fresh provisions and water. In consequence, the usual diffi-

pier extending across the shore reef, 150 metres from the beach.

3. There is no general aquarium or central tank room, each worker having a room 5 m.  $\times$  5 m., with cement and other tanks.

4. It is no small advantage of the desert site that marks on reefs, cages, etc., put out in the sea, are safe from human disturbance.

The buildings are of wood, with asbestos roofs, as in a maritime climate comfort depends on free movement of air rather than on insulation.

The pier and laboratories are shown in the accompanying illustration (Fig. 1), with the laboratory fleet; namely, two sailing boats and a launch. On

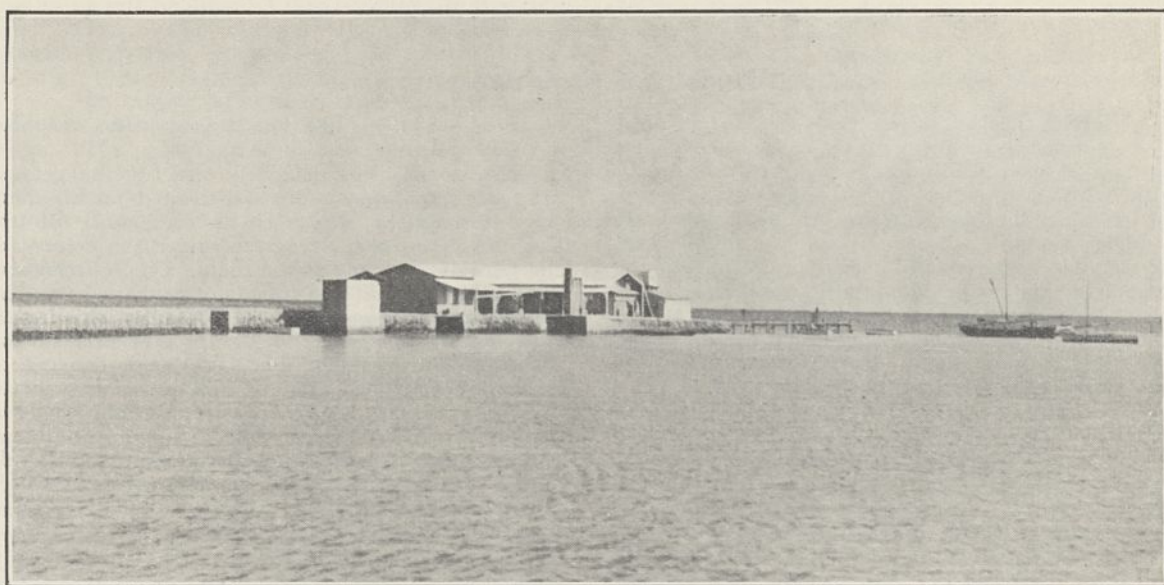


FIG. 1. The Red Sea Biological Station of the University of Egypt.

culties of desert life are not felt. There is also a post and telegraph office with which the station is connected by telephone.

Every variety of coral reef is to be found within easy reach of the Laboratory. The patches in harbour, 50 yards or less from the Laboratory, are as rich growths as any in the world; outside these are two distinct barriers, the inner of which, if it was formed by coral growth, shows little now and is certainly not extending. They form together with the intervening waters a remarkably rich collecting ground, and there are abundant facilities for practical experimentation on the reefs and their slopes and on the shores.

The station is on a somewhat novel plan, the desert site having several distinct advantages:—

1. The buildings are scattered over a considerable area so that all are open to every breath of wind.

2. The water at the pier-end is as pure as that miles off-shore in temperate seas and for all ordinary purposes filtration is not necessary. To take full advantage of this, the laboratory is placed as near to the sea-water supply as possible, namely, on a

the pier end, the thermograph and tide gauge are just visible. Then the little lean-to shed containing the sea-water pump is seen with the small tank above.

The long building contains three biological research rooms and one chemical room; the latter, though without concrete tanks, can be used also for biological research, as it has circulating water and a movable aquarium bench. The building in front of the main laboratory combines store and a laboratory for rough work, and in front of this again is a store for fuel for the launch.

Fresh water is brought by boat, from which it is pumped to the small tank on top of the slender masonry tower appearing in front of the laboratory, whence it flows to the main tank on shore. The air compressor is in the lean-to against the end wall of the laboratory.

The buildings at the shoreward end of the pier comprise office, stores, workshops, power house and garages, with bungalows for the staff and visitors. Huts for servants and sailors are at a little distance behind. The station thus takes the form of a village.

Effort has been made to deliver water in the laboratories as little changed as possible from that at the pier head; all the pipes and taps are of celluloid; the pump, electrically driven, is stoneware lined. The concrete tank is as small as possible, its water being renewed two or three times in the 24 hours. This arrangement has proved eminently successful. Corals, some alcyonarians, echinoderms and fish seem able to live in the tanks indefinitely; the huge scarlet nudibranch, *Hexabranchnus sanguineus*, *Chromodoris quadricolor*, the gaily coloured *Balistes aculeatus*, the great anemone *Actinia quadricolor* and its active hunter, the bright little fish *Amphiprion bicinctus*, are among the species which have been kept alive for many weeks.

The launch is open, 35 feet long, with 30 H.P. paraffin engine and auxiliary sail as a safeguard. It is fitted with a winch for hauling nets, circulating sea-water pump, hand-winch for water bottles, and a Lucas sounding machine. Of the two sailing boats, the larger brings freshwater from the Oilfields' piers

and the smaller is used for fishing. Dredges and trawls of the usual kinds are provided, together with the simpler oceanographical apparatus.

Microscopes and all ordinary glassware and reagents are provided for biological and physiological work and for chemical researches. The library is at present small, but it contains the reports of the principal tropical expeditions, etc., and a series of periodicals.

Applications for accommodation should be made to the Director and should include approximate dates of arrival and departure, the work it is intended to do, and any special arrangements desired. On arrival in Egypt, a telegram should be sent (address Biological Station, Hurghada) on receipt of which the Director will arrange passages from Suez. Living accommodation at the station consists of three small bungalows, simply but comfortably furnished, and a cook is provided.

<sup>1</sup> NATURE, 124, 991, Dec. 27, 1929.

### Solid Products of Carbonisation of Coal

**D**URING the last fifteen years, a flood of publications on the properties of cokes has appeared, much of it scientifically interesting, but uncorrelated with industrial practice. When large-scale processes, for example, the blast furnace, are in question, this is understandable, for conditions are complex and often elude experimental control. Although such difficulties are less evident with small-scale operations, such as the open and closed domestic fires, there is no large volume of published careful experimental work about them. Nevertheless, these publications have shown that the behaviour of a fuel in an open grate can be related to its properties ascertainable in the laboratory. Now a brochure issued by the South Metropolitan Gas Co.\* reveals that its chemical staff has been studying this subject for a decade past. It is a comprehensive monograph disclosing a considerable body of work which is, in a large measure, parallel in scope and conclusions with previously published results. The experimental methods used, some of which are novel, will interest students of coke.

Converging evidence detailed points to 700° as the critical temperature dividing 'high' and 'low' temperature carbonisation. The South Metropolitan Gas Co. carries on both types of manufacture, and the experimental work recorded covers both. As few

\* South Metropolitan Gas Company: Chemical Department. The Solid Products of the Carbonisation of Coal. Pp. 123+4 plates. (London: South Metropolitan Gas Co., 1934.) 3s. 6d. net.

concerns are in this position, the experience recorded is of special importance.

Mention may be made of one test of general interest. A library room was heated on alternate days throughout winter with coal and "Metro-Coalite" in an ordinary grate under the control of the normal occupant of the room. Careful measurements showed that the weight of coal used was the greater in the proportion of 1.37 to 1. This higher efficiency compensates for the greater cost of the "Metro-Coalite", and is a necessary consequence of its lower proportion of volatile matter. The fuel with the higher carbon content has the advantage as a source of radiation, and from this point of view, volatile matter in coal is not merely an objectionable source of smoke, but rather an expensive luxury.

The advantage of high carbon content is greatest with high temperature cokes, and in suitably designed appliances this advantage is being increasingly realised. The South Metropolitan Gas Co. was active in developing grates designed to burn cokes, and experimental work in the subject is recorded. A recent estimate places the number of coke-burning grates sold last year at 69,000. Such a measure of popularity is to be explained by the fact that high efficiency is combined with cheapness of fuel and economy of labour. As the fuel is smokeless, the popularisation of such appliances is an important contribution to public hygiene. H. J. H.

### Psychological Needs in Animals

**P**ROF. DAVID KATZ (Rostock) in an address on "Some Problems of the Psychology of Needs" to Section J (Psychology) of the British Association at Aberdeen pointed out that the study of needs seems to be one of the most important tasks of modern psychology. A general view of the whole range of needs (vital, social, artistic and religious) must first be undertaken. Once this has been achieved, two other tasks remain to be investigated: (1) the objects which serve the satisfaction of needs, (2) the methods by which the needs

are satisfied. Different needs all reveal the same fundamental laws, but no other need offers, from the point of view of content and method, such a profitable object of investigation as the satisfaction of hunger.

The laws of the satisfaction of hunger reveal the fundamental dynamic relations of all needs, how they are influenced by inner and outer factors and by historical factors which are partly rational and partly irrational. The concept of need may in some fields be more helpful than the concept of instinct,



particularly in such cases where we meet an amazing plasticity in the adaptation of the behaviour to unusual conditions.

By means of a film, Prof. Katz showed the results of investigations on the dissolution of the family in hens. Many factors influence the process of the dissolution of the family. In general, the family lasts so long as a certain physiological state of the hen exists. But in addition to this physiological state, there exist psychological factors which influence the duration of the family group. The hen keeps the chicks the longer the fewer their number, and this irrespective of their size. The dissolution of the family takes place in an active way, the hen actually driving away her chicks. The maternal drive, however, seems to revive again in the presence of danger. The chicks when driven away by the hen keep together for a certain time, forming a gynopædium.

In a second film, Prof. Katz showed the results of interesting experiments carried out on the localisation of sounds by dogs. A dog is trained to run to a small screen behind which a noise, of about half a second's duration, is produced by means of an electric buzzer. Several screens are then placed in a row, the buzzer is sounded, and the dog has to locate the noise by running directly to the appropriate screen. The performances of the dog in locating the noises are amazing. The dog is even successful in distinguishing between two screens when the two are not more than 25 cm. apart, although its own distance from them both at the start is about 5 m. Scarcely any error appears when the dog sits in the centre of a circle of about 10 m. diameter, and 64 screens are distributed at equal distances on the circumference of the circle.

Dr. B. P. Wiesner showed two films demonstrating maternal behaviour in the rat. The studies on these subjects support the point of view of purposive psychology to a considerable extent, but also show that the activities of the animals are not regulated by the achievement of the 'purpose'; many activities are pursued well beyond this point and apparently without relation to field situation or to 'necessity' (*Beduerfnis*). The experiments were extended to a study of the physiological factors underlying maternal behaviour. Observations suggest that the exteroceptors normally engaged in the performance of maternal activities are not necessary for their occurrence but only for their direction. Endocrine factors originating in the pituitary gland (anterior lobe) are probably at the basis of maternal activities. It is possible to produce maternal behaviour in virgin rats by extracts from this gland.

### Inversion of *d*-Camphor

IN recent years, Messrs. Asahina and Ishidate, of the University of Tokyo, have been engaged in the investigation of derivatives of camphor and have collected some useful data bearing upon the constitution of these compounds. The results are published in the *Berichte der deutschen chemischen Gesellschaft*.

Although the camphor molecule contains two dissimilar asymmetric carbon atoms, it can, by reason of certain limitations imposed upon it by ring-closure, give rise only to two optical isomerides, namely, *d*-camphor and *l*-camphor, both of which are known and are designated as 2-keto-camphane

and 6-keto-camphane respectively. Similarly, 3- and 5-keto-camphanes form another optical pair, *l*-epi-camphor and *d*-epi-camphor. Now it has been known since 1914 that each camphor can be transformed into the epi-camphor of opposite sign, but in the August issue of the *Berichte*, Asahina and Ishidate explain how they have been able to effect the conversion of *d*-camphor into *d*-epi-camphor and the latter into *l*-camphor, thus inverting the molecular configuration, but in claiming to be the discoverers of *d*-epi-camphor, they have obviously overlooked the preparation of this substance by Furness and W. H. Perkin in 1914.

The complete cycle of changes as described by the Japanese authors in the inversion of *d*-camphor involves the preparation of 2-5-diketo-camphane from campherol, a product of animal metabolism, but, since Bredt and Goeb prepared the same diketone in 1920 by the oxidation of bornyl acetate, derived from *d*-camphor, to acetoxy-camphor and further oxidation of the hydrolysed product, it is obvious that life-processes are not an essential feature of the transformation.

Campherol was characterised as a mixture of at least two and probably four hydroxy-camphors, from which 5-hydroxy-camphor was isolated in the pure condition. On oxidation with chromic acid, this gave 2-5-diketo-camphane, a tautomeric mixture, of which the keto-modification could be stabilised by repeated recrystallisation from acetic acid. Hydrogen cyanide attaches itself exclusively to the 5-keto group of this compound, whereby a new 'asymmetric centre' is developed so that two stereoisomeric hydroxyacids are formed after hydrolysis. Resolution of this mixture is, however, unnecessary, because after reduction of the 2-keto group to methylene, the hydroxyacid group is reoxidised to carbonyl. The resulting product is 5-keto-camphane (*d*-epi-camphor), the configuration of the original asymmetric atoms remaining unaffected. The next step is to oxidise *d*-epi-camphor with selenium dioxide to 5-6-diketo-camphane or *d*-camphorquinone (the optical isomeride of ordinary *l*-camphorquinone from *d*-camphor). Reduction of this compound gives a mixture of 5-hydroxy-6-keto-camphane and 6-hydroxy-5-keto-camphane, the methyl ethers of which can be separated. Further reduction of the former with sodium amalgam gives *l*-camphor (6-keto-camphane), thus completing the inversion.

### University and Educational Intelligence

LONDON.—Dr. L. J. Witts, since 1929 assistant physician to Guy's Hospital, has been appointed professor of medicine (St. Bartholomew's Hospital Medical College); Prof. Geoffrey Hadfield, professor of pathology in the University of Bristol, has been appointed professor of pathology (St. Bartholomew's Hospital Medical College). The following appointments have been made in the British Postgraduate Medical School: Mr. A. A. Miles, demonstrator in the Department of Pathology at the University of Cambridge, to be reader in bacteriology; Dr. R. S. Aitken, first assistant to the Medical Unit at the London Hospital, to be reader in medicine; Dr. J. C. Moir, assistant to the Obstetric Unit at University College Hospital, to be reader in obstetrics and gynaecology; Dr. Earl J. King, assistant professor of medical research and director of the Sub-Department

of Biochemistry at the Banting Institute, University of Toronto, to be reader in pathological chemistry; Mr. Lambert Rogers, assistant director of the Surgical Unit at the Cardiff Royal Infirmary, to be reader in surgery.

OXFORD.—In a public lecture delivered at Merton College, Dr. R. T. Gunther, University reader in the history of science, dealt with several names of members of that College who had been distinguished in past times for their scientific achievements. Especially worthy of remembrance were Thomas Bradwardine (born 1290) and Simon Bredon (c. 1380); these two, with Mandith (c. 1340) and one or two other members of the College, may claim to be the first European authors on trigonometry. In later times, William Merle was the first to keep a meteorological record. Sir Henry Savile (1549–1622), who founded the chairs of geometry and astronomy, was Warden of the College, as also, in 1645, was the great William Harvey.

### Science News a Century Ago

#### Halley at Greenwich

On November 14, 1834, Francis Baily, president of the Royal Astronomical Society, read a paper to the Society entitled "Some Account of the Astronomical Observations made by Dr. Edmund Halley, at the Royal Observatory at Greenwich". He said that Halley was appointed to the post of Astronomer Royal after the death of Flamsteed, on December 31, 1719, and held it until his own death in January 1742, a period of twenty-two years. The instruments used up to 1719 were Flamsteed's property and were removed after his death; and Baily gave some information on the re-equipment of the Observatory. Except for those of the solar eclipse of November 27, 1722, the transit of Mercury of October 29, 1723, and the lunar eclipse of March 15, 1735–6, none of Halley's observations had been published. His other observations from October 1721 until December 1739 were contained in four small quarto volumes preserved at the Observatory. On one occasion, these had been lent to Henderson, and while in his custody had nearly been destroyed by fire. Through the representations of Baily to Capt. Beaufort, however, the Admiralty caused a transcription of their contents to be made. The transcription was in one volume of 518 pages and it was presented to the Royal Astronomical Society.

#### The Internal Heat of the Earth

The first definite observations on the heat of the earth at considerable depths appear to have been made in 1740 in the lead mines of Giromagny in the Vosges. Later on, observations were made in mines in Germany, Cornwall, Italy, South America and Mexico. All these observations were based upon the temperature of the air in the mines. P. L. A. Cordier and F. Reich in France, however, placed their thermometers in the rock itself. A century ago the matter attracted considerable attention, and a short time after the Edinburgh meeting of the British Association, Prof. John Phillips with others descended the shaft of a coal mine at Monkwearmouth, Durham, where coal was being worked at a depth of 264 fathoms, and made observations on both the tem-

perature of the air and the temperature of the rocks. The observations were made on November 15, 1834, and the results were published in the December issue of the *Philosophical Magazine* in a communication from Phillips entitled: "On Subterranean Temperature, as observed at a Depth of Five Hundred Yards below the level of the Sea in Latitude 54° 55' North". The augmentation of temperature was stated to be 1° F. for 59.36 feet, or in round numbers, 1° F. for 20 yards.

#### A Floating Steam Fire Engine

The destruction of the Houses of Parliament by fire on October 16, 1834, had directed attention to the urgent need for improved fire engines on shore and on the River Thames. Steam fire engines for use on shore had already been invented, and in November 15, 1834, the *Mechanics' Magazine* published a letter from W. Baddeley which set out a plan for a self-propelled floating steam fire engine. In his letter, Baddeley said that some years previously he had made suggestions for the improvement of the hand-worked fire float belonging to the London Assurance Company but, he said, "the *ne plus ultra* of fire-extinguishing machinery would be a steam floating fire engine of about thirty horse power. The boat, an iron one, should be built as sharp as possible, and not to draw above ten or twelve inches water. The power of the steam-engine should be capable of being applied to the pumps or the paddles at pleasure. To render such a machine as efficacious as possible, a small fire should be kept constantly burning, so as to keep the water at a temperature of about 100° or 150°."

#### Toronto Horticultural Society

This Society was established on May 1, 1834. The president is the Hon. George H. Markland. Mr. Knight, Dr. Lindley, Dr. Hooker, and others, are constituted foreign honorary members . . . and all the secretaries of all horticultural societies whatever, corresponding members. Such a Society is likely to do an immense deal of good in a comparatively new country, and we would recommend the secretaries to have their eye on the agricultural exhibitions of the British seedsmen, with a view of procuring from them seeds of improved varieties of grain and other cultivated plants. Implements and machinery may be copied from engravings in books, and modes of culture may be learned from the same source; but seeds and roots cannot be conveyed by pictures or descriptions from one country to another. (*Gardener's Magazine*, November 1834.)

#### Botanical Collections made by Thomas Drummond

The indefatigable Thomas Drummond, the assistant naturalist in Capt. Sir John Franklin's overland expedition, bids fair to make as valuable botanical collections in the extreme southern territories of the United States as he did in the British possessions in North America. From Louisiana, whence, among other interesting plants, he has added to our gardens the rare *Nuttallia Papaver* and *Sarracenia psittacina*, he has entered the province of Texas; and from the embouchure of the Rio Brazos, and from San Felipe de Austin in the interior, he has sent very valuable despatches, both of the animal and vegetable productions. (Dr. W. J. Hooker in the *Botanical Magazine*, November 1834.)

## Societies and Academies

## PARIS

Academy of Sciences, October 8 (*C.R.*, 199, 649-688). MAURICE D'OCAGNE: A singular traditional heresy concerning the theory of the endless screw. PAUL MONTEL: Some limitations for the moduli of the zeros of polynomials. DAVID WOLKOWITSCH: A purely geometrical study of Painvin's complex. G. POLYA: Some theorems analogous with Rolle's theorem, connected with certain linear partial differential equations. PIERRE HUMBERT: The symbolical calculus with two variables. ALEXANDRE GHICA: Series of harmonic functions. MICHEL LUNTZ: The movement of a perfect fluid round a deformable contour. THÉODORE IONESCU and Mlle. IONICA CERKEZ: An ionised gas rectifier for alternating currents of medium voltage in the magnetic field. ROBERT CORDONNIER: The circular magnetic dichroism of solutions of cuprammonium hydrate and of the corresponding salts (nitrate and sulphate). JAMES BASSET and MAURICE DODÉ: The direct oxidation of iodine and iodides at ultra-pressures. At the optimum temperature (300° C.) with mixtures of oxygen (33 per cent) and nitrogen and at a pressure of 3,600 kgm./cm.<sup>2</sup> only 2 per cent of iodine pentoxide is formed by the direct oxidation of iodine. With potassium iodide the oxidation is more complete, 40 per cent of potassium iodate being formed at 410° C. Mlle. MARTHE MONTAGNE: The constitution and properties of the keto-anils. LOUIS CHASSEVENT: The formation of definite crystallised compounds at the commencement of the hardening of siliceous cements. Examination by X-rays leads to the conclusion that in the reaction between colloidal silica and solution of lime there is a definite crystallised compound, hydrated monocalcium silicate. ALBERT DEMOLON and E. BASTISSE: The dispersion of the clay colloids of soils and of sediments. LÉON BERTRAND and PAUL GOBY: The Trias and Infralias of the neighbourhood of Grasse and of Bar. JOSUÉ HOFFET: The structure of the western Haut-Laos. G. KEMPP and J. P. ROTHÉ: The existing phenomena of nivation and accumulation of snow in the Hautes-Vosges. BERNARD TROUVELOT, MARC RAUCOURT and JEAN CASTETS: Remarks on the mode of physiological action of the active principles of *Solanum tuberosum* toward the larvæ of *Leptinotarsa decemlineata*. JEAN LOISELEUR: The chemical phenomena which accompany the resorption of irradiated tissue.

## ADELAIDE

Royal Society of South Australia, April. J. A. PRECOTT: Single value climatic factors. A critical discussion of a number of proposed climatic ratios involving estimates of rainfall efficiency in terms of rainfall and temperature or saturation deficiency. Evidence is brought forward that saturation deficiency is a good measure of evaporation and that the most satisfactory climatic factor likely to be obtained should include rainfall and saturation deficiency. Conditions for the efficient use of rainfall-temperature ratios involve constant vapour pressure, with the dew point as the zero from which the temperature is to be measured. Maps of Australia are presented giving revised data for the mean annual values for temperature, relative humidity, saturation

deficiency, vapour pressure and for the Meyer ratio of rainfall to saturation deficiency. J. DAVIDSON: The monthly precipitation-evaporation ratio in Australia, as determined by saturation deficit. Mean monthly values for saturation deficit have been calculated for a number of meteorological stations in each State of the Commonwealth of Australia, from temperature and relative humidity records. These values have been expressed in terms of evaporation by reference to evaporation records for the respective capital cities. From the information obtained, together with rainfall records, the areas in which the mean rainfall (recorded) exceeds the mean evaporation (calculated) were defined for each month; a map of Australia has been prepared showing the area and months in which rainfall exceeds evaporation as determined by saturation deficit.

## CAPE TOWN

Royal Society of South Africa, July 18. FLORENCE RICH: Contributions to our knowledge of the freshwater algae of Africa. (11) Algae from a pan in Southern Rhodesia. A collection from a pan at Old Ngamo, five miles north of Ngamo station; it is the first collection from the Rhodesias to be examined systematically and is very rich, especially in desmids. The affinities of the algae are much more with Central Africa than with South Africa, the general facies being that of a small tropical lake, though this pan dries up more or less completely during the dry season. The collection was made midway through the dry season, and the conditions were evidently very favourable for sexual reproduction, for about fifty species were observed to be in that state. This included twenty-five species of desmids, ten of which were previously known only in the vegetative state. E. NEWBERY: On a corrosion problem. R. F. LAWRENCE: New South African Solifuge.

## SYDNEY

Royal Society of New South Wales, September 5. J. C. EARL and A. W. MACKNEY: Action of nitrous acid on dimethylaniline (3). The decomposition of *p*-nitroso-dimethylaniline nitrate in glacial acetic acid is submitted to closer study. Operating under controlled conditions, namely, with vigorous stirring at 33° C., the principal product formed has been identified as 2,4-dinitro-dimethylaniline, accompanied by smaller quantities of *p*-nitro-dimethylaniline and *p*-nitrophenyl methyl nitrosamine. The production of nitro and dinitro dimethylaniline is accounted for by the ordinary nitration and oxidation processes to be expected under the conditions employed. The *p*-nitrophenyl methyl nitrosamine, forming in small quantities only, is regarded as a secondary product. ADOLPH BOLLIGER: Volumetric micro-determination of ortho-nitrophenols with methylene blue. An alkaline or alkaline earth salt of the ortho-nitrophenol in aqueous solution is transferred to a cylindrical separating funnel containing chloroform. In some instances the free nitrophenol can be used as such. The standardised methylene blue solution is added from a burette and the thiasine phenolate formed is extracted with chloroform. The following were found to be suitable for titration with methylene blue: 2,4 dinitrophenol, 2,6 dinitrophenol, 2,6 dinitro-*p*-cresol, 2,4 dinitro-resorcinol, picric acid, and 2,4 dinitro-naphthol.

## Forthcoming Events

[Lectures marked with an asterisk are open to the public.]

## Sunday, November 11

BRITISH MUSEUM (NATURAL HISTORY), at 3 and 4.30.—  
M. A. Phillips: "Mammals".\*

## Monday, November 12

BRITISH MUSEUM (NATURAL HISTORY), at 11.30.—Miss  
D. Aubertin: "Collecting Insects in Dalmatia".\*

UNIVERSITY OF LEEDS, at 5.15.—Prof. A. Harden: "The  
Chemistry of Fermentation".\*

UNIVERSITY COLLEGE, LONDON, at 5.30.—Prof. A. C.  
Hardy: "Principles and Problems of Pelagic Ecology"  
(succeeding lectures on November 19 and 26).\*

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—W. Thesiger:  
"The Lower Hawash and the Dankali People".

## Tuesday, November 13

KING'S COLLEGE, LONDON, at 5.30.—W. Allard: "Canal  
Headworks—Canals—Drainage—River Training".\*

INSTITUTE OF PHYSICS, at 8.—Informal discussion on  
"Thermostats". Opening speakers: Prof. A. V. Hill,  
L. G. Carpenter, Dr. J. L. Haughton.\*

PHARMACEUTICAL SOCIETY, at 8.30.—Prof. J. B. S.  
Haldane: "Idiosyncrasies in Men, Animals and Plants".

BRITISH INSTITUTE OF PHILOSOPHY—(at University Hall,  
14, Gordon Square, London, W.C.1).—H. W. B. Brown:  
"The Biological Status of Pleasure".\*

ROYAL SOCIETY OF MEDICINE (PSYCHIATRY SECTION), at  
8.30.—Dr. David Forsyth: "Psychology and Religion"  
(Presidential Address).

## Wednesday, November 14

BRITISH ACADEMY, at 5.—Prof. A. G. van Hamel:  
"Aspects of Celtic Mythology" (Sir John Rhys Memorial  
Lecture).

## Thursday, November 15

CHEMICAL SOCIETY, at 8.—Discussion on "Chemical  
Problems in Agricultural Science" to be opened by Sir  
John Russell.

## Friday, November 16

UNIVERSITY COLLEGE, LONDON, at 5.30.—Prof. H.  
Freundlich: "The Colloid Chemistry of India-Rubber"  
(succeeding lectures on November 23 and 30).\*

FOURTH INTERNATIONAL CONGRESS OF PHOTOGRAMMETRY,  
November 16—December 2. To be held in Paris.

## Official Publications Received

## GREAT BRITAIN AND IRELAND

Annual Report of the Director of the Meteorological Office presented  
by the Meteorological Committee to the Air Council for the Year  
ended March 31, 1934. (M.O. 368.) Pp. 60. (London: H.M. Stationery  
Office.)

Birkbeck College (University of London). The Calendar for the  
Year 1934-35. (112th Session.) Pp. 259. (London.)

South Metropolitan Gas Company: Chemical Department. The  
Solid Products of the Carbonisation of Coal. Pp. 123+4 plates.  
(London: South Metropolitan Gas Co.) 3s. 6d. net.

Transactions of the Royal Society of Edinburgh. Vol. 58, Part 1,  
No. 4: Bishop James Kennedy, an Anthropological Study of his  
Remains. By Dr. David Waterston. Pp. 75-111+10 plates. 8s. 6d.  
Vol. 58, Part 1, No. 5: Notes on the Kidston Collection of Fossil  
Plant Slides. No. 5: On the Structure of Two Lower Carboniferous  
Lepidodendroid Stems, one of the Lepidophloios Wünschianus Type  
and the other of the Lepidodendron Fuliginosum Type; No. 6: On  
the Structure of Two Lepidodendroid Stems from the Carboniferous  
Flora of Berwickshire. By Dr. Mary G. Calder. Pp. 113-124+2  
plates. 2s. 3d. Vol. 58, Part 1, No. 6: The Feeding Mechanism of the  
Cumacean Crustacean *Diastylis bradyi*. By Ralph Dennell. Pp. 125-  
142. 2s. 3d. Vol. 58, Part 1, No. 7: On the Morphology and Cytology  
of *Puccinia prostris*, Moug., a Micro-Form with Pycnidia. By Ivan M.  
(Lamb. Pp. 143-162+2 plates. 3s. 3d. Vol. 58, Part 1, No. 8: The

Metamorphic Rocks of North-East Antrim. By Prof. E. B. Bailey  
and Dr. W. J. McCallien. Pp. 163-177+2 plates. 3s. (Edinburgh:  
Robert Grant and Son; London: Williams and Norgate, Ltd.)

The Institution of Automobile Engineers: Research and Standard-  
ization Committee. Third Annual Report, July 1st, 1933—June 30th,  
1934. Pp. 14. (London: Institution of Automobile Engineers.)

Technical Publications of the International Tin Research and  
Development Council. Series C, No. 2: The Beneficial Use of Tin  
Compounds in Lubricants. By Dr. E. W. J. Mardles. Pp. 5. Series  
A, No. 11: A Reflectivity Method for measuring the Tarnishing of  
Highly-Polished Metals. By L. Kenworthy and J. M. Waldram. Pp.  
241-252. (London: International Tin Research and Development  
Council.)

## OTHER COUNTRIES

U.S. Department of the Interior: Geological Survey. Bulletin 850:  
Quicksilver Deposits of Southwestern Oregon. By Francis G. Wells  
and Aaron C. Waters. Pp. vi+58+23 plates. 30 cents. Water-Supply  
Paper 658: The Industrial Utility of Public Water Supplies in the  
United States, 1932. By W. D. Collins, W. L. Lamar and E. W.  
Lohr. Pp. iv+135+1 plate. 15 cents. Water-Supply Paper 740:  
Surface Water Supply of Hawaii, July 1, 1931, to June 30, 1932.  
Pp. v+121. 10 cents. (Washington, D.C.: Government Printing  
Office.)

Advisory Department of the Imperial College of Tropical Agricul-  
ture. Report on the Agricultural Department, St. Vincent, for the  
Year 1933. Pp. v+30. (Trinidad: Imperial College of Tropical  
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