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## The Dyestuffs Industry and its Lessons

THE story of the dyestuffs industry has often been told, at least in part. Few accounts have been more vivid than that given by Mr. C. J. T. Cronshaw, managing director of the Dyestuffs Group, Imperial Chemical Industries, Ltd., in his Jubilee Memorial Lecture of the Society of Chemical Industry. No such glimpse of the industry from inside has been vouchsafed us since Mr. James Morton gave us the story of Caledon Jade Green and later of Caledon Brown. Mr. Cronshaw's lecture, however, was far more than mere recapitulation. He succeeded not merely in revealing some of the difficulties and problems which the industry presents to those engaged in it, but also its ever-changing aspects and its intricate and intimate relations with other industries.

It would be difficult to find an industry more essentially dynamic than that of dyestuffs. Its very success in ousting the natural colouring matters proved but the prelude to adventure. The wider range of shades, the greater brilliance and enhanced fastness of the synthetic colours led to more and more searching demands. Not merely textiles but almost every other material in common use has come to the industry with its demands for colour, and the newer industries, like the rayon industry have often made but halting progress until those demands were met. Despite its vicissitudes, despite the long struggle for mere existence, the British industry has an honourable share of the outstanding advances to its credit, and those in the post-War period are not unworthy of comparison with the discoveries from which the industry took its birth.

The career of the late Dr. Duisberg in itself gives some clue to the astonishing fecundity of the industry. An impressive feature of the brilliant discoveries of this great industrialist is their close connexion with the most recent advances of his day in organic chemistry. Equally significant is the illustration his discovery of phenacetin affords of the relation between the dyestuffs industry and other branches of the organic industry. When all allowance is made for the stimulus provided by the discovery of the therapeutic properties of acetanilide, Duisberg and Hinsberg really commenced their research through the necessity of finding an outlet for the *p*-nitrophenol which was accumulating at an alarming rate as a result of the very success of the manufacture of the benzo-purpurins.

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The discovery which first led the Bayer Co. into the field for which it has since become world famous has been repeated again and again in its essential features. It is the very intimacy of the links between the dyestuffs industry and other industries which makes possible the astonishing versatility of the chemist in this industry and the immense range of products which he can provide. Unless his intermediate products and by-products found outlet in other industries as vulcanisation accelerators for rubber, antioxidants for rubber or oils and fats, preservatives for wood and other materials, as gum inhibitors, for the control of insect pests and animal or plant diseases, in the manufacture of fine chemicals, pharmaceutical products, and synthetic resins, as softeners, solvents and the like for lacquers and varnishes, finishing agents of all kinds for the leather and textile agents, the resources of the industry would be severely limited by the dead weight of waste products which it would be compelled to carry.

Under modern conditions, this factor is even more important. The growing demand of the colour-using industries for novelties for specific purposes could scarcely be met in the range required or at an acceptable price but for the way in which intermediate products and by-products can be used for many different and unrelated purposes. Nor are the relations static. The reaction of the synthesis of indigo on the manufacture of indigo, and its influence on the displacement of the Weldon and Deacon processes for chlorine by the electrolytic process, are paralleled again and again within the dyestuffs industry as in its relations with other industries. For example, the introduction of sulphonated fatty alcohols as detergents has given an impetus to the use of fatty compounds for other purposes including dyestuffs, and the dyestuff chemist is no longer content to restrict himself to the use of methyl, ethyl and even butyl alcohol. The delicate balance between by-product and main product, the utilisation of waste materials, the competition of raw materials and alternative routes, is proceeding almost as freely to-day over the field of aliphatic chemistry as in the past it has done in the aromatic field.

The existence of such complex relations makes it easy to understand why a man like Dr. Duisberg could find intense satisfaction in the leadership of such an industry despite the brilliancy of his earlier scientific work. He at least could never be said to have left the field, and his career seems to under-

line the argument advanced by Mr. Cronshaw in support of the view that the chief factor in the decline of the industry in Great Britain—a decline which no one noticed at the time—was lack of foresight on the part of the originators of the industry themselves.

The facts speak for themselves. Perkin was a rich man when he retired in 1874 at the age of thirty-six. Nicholson retired six years earlier when forty-one, also wealthy, and though Greville Williams remained until 1877 he was then only forty-eight. On the face of it the very success of the industry was its undoing. There were no long years of drudgery and inadequate reward. The industry prospered from the start, and the dyeing trade received the new products well. The future prospects were equally bright. The textile industries were peculiarly ready for the exploitation of the new dyes. The cotton and wool trades were both on the threshold of great expansion, while Mansfield's isolation of benzene from coal tar had provided the industry with unlimited raw material on its doorstep.

Perkin, in fact, could scarcely have made his discovery at a more appropriate or auspicious time, and the explanations advanced of his withdrawal from the industry are unconvincing. He at least recognised that the dyestuffs industry was founded on scientific discovery and developed side by side with it. None the less he did not see that the greatest service he could have rendered to research in Great Britain was to retain the leadership of the industry he had brought into being; instead, the leading technologist of his day turned his back on the industry at an age when his powers of leadership should have been ripening, alike in the consolidation of results achieved and in the inspiring of other workers with his own enthusiasm.

In the light of to-day, it seems incredible that at a time when organic chemistry was still young and vigorous, and when the science as we know it to-day was rapidly taking shape on the foundations laid by Kekulé's theory, a mind such as Perkin's should have turned away from this field. The history of the next decade alone sufficiently endorses Mr. Cronshaw's words: "the industry languished because the pioneer spirit and the creative instinct which brought it into being abandoned it too early, little knowing that what they had accomplished was the merest scratch on the surface. There remained whole new worlds to conquer". Other factors there were undoubtedly,



but the charge of lack of foresight appears to be only too well founded.

Without foresight, neither in pure nor in applied science does Nature readily yield her secrets, and success in the dyestuffs industry has always depended largely on the receptivity of ideas and the creative powers which are associated with vision. The displacement of the natural colouring matters merely intensified the struggle for the survival of the fittest among the synthetic dyes themselves. In the marketing to-day of products designed to meet more and more the demands of

the user in regard to shade, the fabric or purpose for which the colour is required, the conditions of fastness, the method of application and other factors, the industry depends more than ever upon the exercise of just those qualities which are inherent in all enduring scientific work. Indeed, in any scientific industry to-day success depends upon the continuous application alike in the laboratory, in the works or in the management of the assiduous search for facts, the eternal vigilance and the creative instinct and vision which are of the spirit of science itself.

## Reviews

### Relativity and Cosmogony

*Relativity, Gravitation and World-Structure.* By Prof. E. A. Milne. (The International Series of Monographs on Physics.) Pp. x+365+4 plates. (Oxford: Clarendon Press; London: Oxford University Press, 1935.) 25s. net.

IN 1932, Prof. E. A. Milne pointed out that, if the galaxies were initially concentrated in a small volume, those with highest speeds would by now have reached the greatest distances; we might in this way account for the well-known observational result that their radial velocities are approximately proportional to their distances. This idea has grown in less than three years into the large treatise now before us. The original idea is almost lost in the subsequent accretions; but the spirit of it remains. The outlook throughout the book is that the cosmological problem is primarily a matter of kinematics. Dynamics, wherever it appears, is treated as the servant of kinematics.

A review of the book must necessarily be a review of the theory that it promulgates. It is characteristic of modern researches on world-structure that the same physical theory is often expressed in many variant forms, both mathematical and conceptual. A confusion of tongues has descended on those who would build a tower whose top may reach unto heaven! On opening Milne's book, it is soon apparent that we shall be asked to learn a new language, but it is not so clear that the language is going to be used to describe a new world. Most of his critics have occupied themselves with the question, not whether Milne's theory is right, but whether it differs from current relativity cosmology. On this point the book is not so helpful as it might have been. Making all allowance for the author's natural desire to present his theory in his own way uncontaminated by conceptions or terminology

which he dislikes, we think it is hard on the reader that he should be kept waiting until §463 to learn whether the Milne universe differs from the ordinary 'expanding universe', or whether it is the same universe described in another way. When at last we are shown that there is a definite observable difference, we are left mystified as to how the difference has arisen.

A 'cosmological principle' is placed in the forefront of the discussion, namely, that a number of equivalent observers arrive at the same description of the universe relatively to themselves—not only of its laws, but also of its actual material contents. Milne explains that this principle is merely a specification of the particular system which he has chosen to investigate, and is not supposed to be a law of Nature. To use the term 'principle' in this way seems unfortunate. When later he finds, in the system so specified, particles the properties of which are like those of cosmic rays, we congratulate him on the happy resemblance of his selected model to the actual universe. But we fail to see that he has in any way accounted for cosmic rays. The particles occur in his model because, in specifying his model, he put them there. That he did so undesignedly does not affect the question.

For the determination of location in space and time, the only means of exploration permitted is interchange of light-signals. Milne will not allow his observers to transport scales or clocks. He argues that observers elsewhere could not be provided with "rigid-length scales, copies of our own, because we could not say *a priori* what we meant by their being copies". I do not think the National Physical Laboratory would have any difficulty in issuing instructions by which an observer, say, in the Andromeda Nebula, could construct a standard metre; and I do not see the force of Milne's objection to determining lengths in all parts of the universe in this way. To exclude such methods



has the drawback that it divorces a great part of practical physics from the theory. When I visit the Cavendish Laboratory, I do not find its occupants engaged in flashing light-signals at each other, but I find practically everyone employing rigid scales or their equivalent. Sooner or later, the theory must face the task of identifying the significance of these rigid-scale measurements in terms of its symbols; otherwise the greater part of experimental physics will be outside its purview.

It is well known that when the means of exploration is confined to light-signals, we reach Weyl's theory in its original form with entirely indeterminate gauge. Our first impression was that this might be the origin of Milne's departure from current theory—that he had adopted a different gauge-system, having disallowed the rigid-scale measurements which would have refuted it. But by p. 34 Milne seems to have returned to orthodoxy; and the physicist's favourite transportable clock, namely, the atom, is being freely used. If we may "make an immediate recognition" that two carbon atoms are identical clocks, why may we not make an immediate recognition that the grating spaces of two diamonds are identical standards of length?

Milne's system of particles forms a spherical expanding universe and agrees in this respect with the systems studied, by Friedman and Lemaitre. But there is a difference in the law of motion, so that a particle in Milne's system does not follow a geodesic. So far as I can make out, the difference has arisen in the following way. In the Lemaitre model, observers who are at rest in the spherical co-ordinate system would give a precisely similar description of the universe and are therefore "equivalent observers" in Milne's sense; but, owing to the accelerated expansion of the universe, they are accelerated away from one another as judged by the Doppler effect. Milne, on the other hand, postulates that his equivalent observers shall be in uniform relative motion as judged by the Doppler effect; his universe must therefore have a constant, instead of an accelerated, rate of expansion. He has accordingly changed the law of gravitation so as to give a uniform expansion.

There is a passage in the book (§69) which suggests that it is only the analytical difficulty which has prevented Milne from considering equivalent observers with accelerated motion. If the uniformity of the expansion is not an essential part of the theory, it follows that his alteration of the accepted law of gravitation is not an essential part of the theory. Perhaps therefore when he has extended the theory in a way which he seems to be already contemplating, we may yet celebrate the return of Prof. Milne to the folds of orthodoxy.

A. S. E.

## A History of Civilisations

*A Study of History.* By Prof. Arnold J. Toynbee. (Issued under the auspices of the Royal Institute of International Affairs.) Vol. 1. Pp. xvi+476. 21s. net. Vol. 2. Pp. vii+452. 21s. net. Vol. 3. Pp. vi+552. 21s. net. (London: Oxford University Press, 1934.) 3 vols., 52s. 6d. net.

SINCE it is commonly agreed that western civilisation has now reached a supreme crisis in its history, since disillusionment, rife among laymen and men of science alike, is poisoning the well-springs of the spirit, and since the most passionate desire of men of goodwill is to discover means of overcoming our present difficulties, any book which can help us to get our bearings and to see our problems in true perspective must command much closer attention than in easier times. Prof. Toynbee's superb and philosophic "Study of History", of which the present volumes are the first section, is such a book.

The plan of the whole work has been conceived on a grand scale. Regarding civilisations, like other manifestations of life, as entities which must be born, which may grow, and which, pending an evolution not yet completed, are doomed to die, Prof. Toynbee has taken the life-histories of civilisations present and past as the objects of his study. His book will therefore examine the circumstances of their genesis and growths, their breakdowns and disintegrations. It will investigate certain major phenomena in their history: universal churches, the centres of the spiritual travail which accompanies the downfall and precedes the birth of most civilisations; universal States, the receptacles into which civilisation's earlier and smaller political articulations are usually poured before the end; 'heroic ages', the temporal no-man's lands between related civilisations, through which the outer barbarians of the time, loosed for a while from their established anchorage, wander during the throes of social decay and birth. It will explore the contacts of civilisations in space and their contacts and rhythms through time. All this analysis will then be focused on the present outlook of Western civilisation—doubtless with the object of offering our troubled age such guidance as history can give those whose capacity for learning from the experience of others is not blunted by their own preoccupations; and the book will finally close with a survey of the inspirations of historians.

The present volumes do not cover the whole of this immense ground, but are limited to finding civilisations for comparative study, establishing their suitability for this purpose, and examining



the conditions of their birth and growth. The developed civilisations, about which enough is known for Prof. Toynbee's purpose, number about a score. They include Western civilisation and its living contemporaries—the Orthodox Christian, Islamic, Hindu and Far Eastern civilisations; and, among earlier examples, the Hellenic (or Greco-Roman), Sumeric and Egyptian civilisations in the Old World and the Mayan and Andean civilisations in the New World. In Prof. Toynbee's view, these ten civilised societies, together with ten or twelve more which the "Study" describes in some detail, are neither links in a continuous chain nor cells in a single growing tissue, but separate entities, each with a life of its own.

On this assumption, some twenty cases of birth and successful growth have to be explained. Usually the genesis and development of civilisations (in the plural) or civilisation (in the singular) are attributed to environment or racial superiority. Prof. Toynbee, in a closely reasoned and impressive argument, rejects both alternatives. His own explanation is hard doctrine. In his view, neither the birth nor the subsequent growth of a civilisation can be accounted for on the flattering assumption of racial superiority or by the quasi-automatic operation of environment. On the contrary, both genesis and development are the outcome of a stern and difficult relationship between men and their surroundings; and examples of abortive and arrested civilisations clearly show that this relationship, which he calls "Challenge-and-Response", by no means necessarily or inevitably produces birth or growth.

The conception of challenge-and-response is simple in essence and complex in its working out. Changing circumstances, Prof. Toynbee argues, confront societies, like individuals, with problems for solution; these problems constitute challenges; and out of the effort and suffering which response to them entails, civilisations are born and grow. In the case of the earliest civilisations which emerged from the primitive societies that were their forerunners, the challenges were mainly external and material; in the case of later civilisations affiliated to predecessors already civilised, the challenges have been mainly internal and spiritual. If either challenge or response is too easy, only a poor civilisation or none at all will result. If, at the other extreme, a challenge is overwhelmingly severe, though a tremendous effort at response may sometimes bring a civilisation to bud, it will neither flower nor bear fruit. But provided that the limits of capacity are not overstepped, the more severe a challenge and the greater the effort required to respond to it adequately, the richer will be the spiritual quality of the resultant civilisation.

Growth is a continuation of the same process. It is to be measured not in terms of material expansion or technical advance, but in terms of spiritual development and the transfer of the field of action from outward and material problems to inward and spiritual concerns. A growing civilisation is in unstable and not stable equilibrium, the instability resulting from the very fact that a successful solution to any problem by virtue of its sheer success in time causes fresh problems to emerge; until at last, if solutions are no longer achieved, breakdown begins.

The process of challenge-and-response, as analysed by Prof. Toynbee, works through the individual members of a changing creative minority, who must first spiritually withdraw for a time from active social life while the mystery of creation takes place in their own soul, and who, if they are to be socially effective, must then return to the far more formidable task of converting the majority of their fellows to understanding and effort. That so complex and difficult a process should sometimes succeed and sometimes fail is not surprising. But it is an advantage of Prof. Toynbee's analysis that it eliminates hocus-pocus and conceit from attempts to explain the birth and growth of civilisations and places responsibility for their development on the shoulders of the individuals from whom alone initiative can finally come.

So much for the inadequate summary which is all that can be given in a review limited in length to about a word for each of Prof. Toynbee's fifteen hundred pages. A subject so large, treated on a canvas so vast, obviously exposes an immense area for criticism and attack. The objection that, in taking all the civilisations he can find as his subjects of study, Prof. Toynbee has included too much, may be summarily dismissed since it is the very range of his material and his endeavour to find common features in its diversity of detail that constitute the central intellectual interest of his inquiry. Neither does it matter much, if at all, that he is not himself a first-hand authority over most of the field but has drawn freely on the labours of others. An architect need not personally make or lay all the bricks in his house; and Prof. Toynbee is an architect of ideas. Nor, finally, is it very important that here and there he turns to conjecture to fill in gaps in our knowledge of perished civilisations, for what records have survived to our time is far more a matter of chance than what stages they must have traversed in the process of birth and growth. Specialists may indeed question now and again Prof. Toynbee's handling and interpretation of detail; but since he always gives both his evidence and his reasoning, his readers can agree, qualify or dissent for themselves. Certainly men of science who use the



empirical method in other fields will not object to Prof. Toynbee for using it in the study of human history.

Since the "Study" is not yet complete, a final appraisal is not now possible. Some of its central propositions are, however, sufficiently apparent. Prof. Toynbee regards civilisations as plural and not singular—an opinion which, though fundamental to the entire work, will certainly excite much criticism. Given the facts, which he sets forth very fairly, many readers indeed will agree with him, and will reject the technique of those schools of historians who attempt to cram into the crannies of a single *a priori* mould the infinite complications of civilised history. On the other hand, Prof. Toynbee's argument equally implies that the life-histories of civilisations contain recurring and significant regularities, an inference which will also be challenged by the different school which regards history as altogether patternless. Recurrence and significance, however, are largely questions of the scale, framework, and concepts of study; and if it be granted that civilisations are plural, if civilised societies as a

species can be distinguished from primitive societies by their common features of size, longevity and rareness, and if some of the civilisations which have been born have also died, then negatively there can be no *a priori* reason why significant regularities should not recur, while positively Prof. Toynbee's *a posteriori* conclusions as regards birth and growth, the only portions of his subject so far studied in detail, certainly ring too true to common experience to be dismissed out of hand.

A book is more than the facts and arguments it contains; and no sympathetic reader can rise from Prof. Toynbee's "Study" without paying tribute to the vitality, imagination, and generosity of spirit which suffuse its pages. Treading a path which few forerunners have sought or found, he takes his readers up to a high place and shows them all the kingdoms of the earth stretched out in a great vista across space and time. "The supreme task of the age," wrote *The Times* on its hundred-and-fiftieth birthday, "is a large enough inspiration." To the accomplishment of that task the "Study" should contribute.

JULES MENKEN.

### Short Notices

Air Ministry: Meteorological Office. *British Rainfall, 1933: Seventy-third Annual Volume of the British Rainfall Organization. Report on the Distribution of Rain in Space and Time over the British Isles during the Year 1933, as recorded by over 5000 Observers in Great Britain and Ireland.* (M.O. 375.) Pp. xvii+293+4 plates. (London: H.M. Stationery Office, 1934.) 15s. net.

THE general rainfall of 1933 was below the normal for the first time in eleven years, the percentage of the average of the 35 years 1881-1915 being only 80 for the British Isles as a whole, 82 for England, 80 for Scotland, 76 for Wales and 77 for Ireland. Only an area in north-eastern England and a very small area in Hampshire had more rain than the normal in consequence of one or two heavy storms. During the first quarter of the year, rainfall was more or less up to normal, there being a considerable excess in February, but October, and September in England, were the only other wet months. June was remarkable for the exceptional number of violent thunderstorms, though the month was scarcely more impressive in this respect than June 1914. There were also heavy storms here and there in the later summer months, but the event of the year was undoubtedly the great snowstorm of February 23-26 in Ireland, Wales and part of England. This is commemorated in the frontispiece showing a road heavily blocked with snow in Co. Carlow. An observer at Crickhowell in Breconshire, who was overtaken by the blizzard whilst on the mountains with some local farmers looking for sheep, states that they considered themselves lucky to have escaped with their lives,

especially as they repeatedly had to take shelter in the rocks to avoid choking, so thick was the drift and so fierce the gale.

As usual, this time-honoured annual contains some original papers. These deal with percolation and evaporation at Grayshott in Hampshire by S. E. Ashmore, average rainfall over the county of London by J. Glasspoole, and experiments with rain-gauge shields in exposed situations by F. Hudleston. Dr. Glasspoole's paper shows the influence of relief on average rainfall even within the small area of London; but it seems to us a pity that he should have selected the now somewhat antiquated period 1881-1915 upon which to base the average rainfall of London. It is now realised that meteorological averages are not stable. In any event there is nothing sacrosanct about the 35-year period 1881-1915, even though it may be useful in our generation as a standard of comparison for other periods.

L. C. W. B.

*Gmelins Handbuch der anorganischen Chemie.* Achte Auflage. Herausgegeben von der deutschen Chemischen Gesellschaft. System-Nummer 35: *Aluminium.* Teil A, Lieferung 1. Pp. iv+284. (Berlin: Verlag Chemie G.m.b.H., 1934.) 43 gold marks.

It seems to be uncertain to whom should be ascribed the first successful isolation of the metal aluminium. Davy, Faraday and Berzelius all seem to have met with a certain amount of success, but in 1856 Berzelius stated that after many unsuccessful or only partially successful attempts by Davy, Oersted, Wöhler and himself to isolate the metal, it was



Wöhler who ultimately succeeded in 1827. Accordingly, Wöhler is generally given credit for the discovery, but in recent years Fogh has put forward a strong claim of priority on behalf of Oersted (1824-25), and has shown that Oersted's method of reducing anhydrous aluminium chloride with potassium amalgam and distilling off the mercury from the product can be made to give satisfactory results.

The origin of the important product kaolin is still somewhat obscure, although it is clear that kaolin results from the degradation of complex minerals, principally through the agency of carbon dioxide. Disintegration of potash felspar may have been effected in three different ways, namely: (1) by the pneumolytic and hydrothermal action of volcanic gases; (2) by the action of atmospheric carbonic acid; and (3) by the action of vegetable acids from decayed organic matter. According to R. Schwarz and R. Walcker, kaolin and laterite are not to be regarded as primary products of weathering, but rather as secondary compounds synthesised from the potash, alumina and silicic acid which are formed during the continuous hydrolytic dissociation of potash felspar. Such a theory would account for both the comparative scarcity of kaolin and also the simultaneous formation of other so-called products of weathering. A table is given which shows the varying amounts of bauxite and laterite produced in various countries during the years 1925-31.

The different metallurgical processes in use are described fully, particularly the Hall-Hérault process, in which remarkable success was achieved by the happy combination of a number of ideas, every one of which had already been in use for some time. The remainder of the volume is devoted to the classification of the various physical properties of the metal.

*Handbuch der biologischen Arbeitsmethoden.* Herausgegeben von Prof. Dr. Emil Abderhalden. Lief. 420. Abt. 2: *Physikalische Methoden*, Teil 3, Heft 4. *Nachweis der biologisch wichtigen Körper durch Fluoreszenz und Fluoreszenzspektren.* Von Charles Dhéré. Pp. 3097-3306. (Berlin und Wien: Urban und Schwarzenberg, 1933.) 11.50 gold marks.

In turning over the pages of this section of Abderhalden's great encyclopædia, one is impressed with the wealth of information imparted, much of which must be new to anyone not keeping abreast of current literature on the subject. The treatment is in four parts: (1) introduction (5 pages); (2) apparatus and methods (64 pages); (3) physical chemistry of fluorescence phenomena (20 pages); (4) a special part (96 pages).

The second part brings together in easily readable form detailed descriptions of a very wide range of apparatus and accessories, together with good practical accounts of their functions or applications. In the next part, dealing with the physical chemistry of fluorescence, one finds a robust treatment of the fundamental principles and methods of experiment in general terms, but not in such detail as to serve as

a laboratory manual. Finally, in the special part, the work reaches its culminating point in the proving and identification of biological materials by fluorescence, and here the fruits of many thousands of applications are garnered. Carbohydrates, glucosides, fats, phosphatides, proteins, porphyrins, chlorophyll, animal principles, alkaloids (especially the numerous cinchona bases), and several other classes of substances command individual consideration. The book is well printed, the figures are good and the bibliography is rich in its detail.

*Die Chemie des Pyrrols.* Band 1: *Pyrrol und seine Derivate: Mehrkernige Pyrrolsysteme ohne Farbstoffcharakter.* Von Hans Fischer und Hans Orth. Pp. xii+460. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1934.) 28 gold marks.

THIS monograph on pyrrole chemistry satisfies a need which has long existed, for it is thirty years since an adequate account of the group has appeared. No author could be better qualified for the present task than Hans Fischer, whose life-work has been to extend, and in many directions to create, the knowledge of the chemistry of both the simpler pyrroles and of the polynuclear pyrrole derivatives.

The volume under review contains the simpler pyrroles and the polynuclear pyrroles without pigment character; a second volume is to discuss the pyrrole pigments, the porphyrins and chlorophyll, etc., and the physiological side of pyrrole chemistry. The work consists of a discussion of different types of pyrroles, their reactions and the methods for their synthesis, and provides at the same time a dictionary of all the pyrrole derivatives which are known. Particularly valuable are the preparative methods which are given, and the authors' observations on the most suitable means of synthesis of a given pyrrole should be most useful to future workers. As supplements are included an account of the derivatives of maleic acid obtained on oxidative degradation of pyrroles, which are therefore important for determination of constitution; also recommended methods for the preparation of starting materials for pyrrole synthesis. Consultation is facilitated by an elaborate index. K. F. A.

*Manual of Safety Requirements in Theatres and other Places of Public Entertainment.* Issued by the Home Office, 1934. Pp. ii+106. (London: H.M. Stationery Office, 1935.) 2s. 6d. net.

THIS is a valuable, because most practical, summary of precautions against accidents of all kinds in places of public entertainment, with careful explanation of the reasons for them, and examples of disaster following neglect, and the 'requirements', mainly structural, and other 'conditions' to be observed by licensees. Suggestions for improvement of any future edition are welcomed, and will no doubt be forthcoming to a book so considerably planned and clearly expressed. There is an excellent index, and diagrams are provided for the more important safety devices. Everyone responsible for public entertainments should be acquainted with this manual.



## Canadian Water Power Developments during 1934

By DR. BRYSSON CUNNINGHAM

THE exploitation of hydro-electric power in Canada continues to make substantial progress, and as will be seen from the graph reproduced in Fig. 1, from a report<sup>1</sup> recently issued by the Dominion Water Power and Hydrometric Bureau; the rate of development, despite the stagnation in trade, has not perceptibly slackened since the pronounced upward trend set in some fifteen years ago. Although no new large water power undertakings were initiated during 1934, the continuation of work on a number of installations previously under construction led to the completion of new installations aggregating 214,965 horse-power, which were brought into operation during the year. The total installation for the Dominion at the end of 1934 was 7,547,035 horse-power.

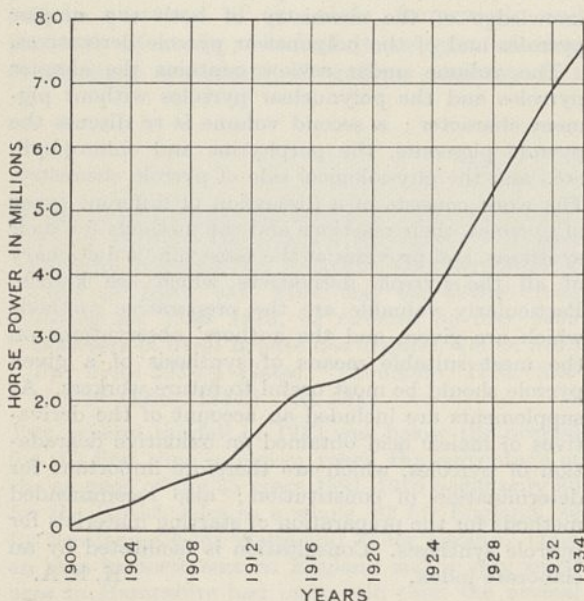


FIG. 1. Development in hydro-electric power in Canada during the twentieth century.

The distribution of this total among the various provinces is set out in the accompanying table.

The figures given in the table are based on data relating to rapids, falls and power sites, the actual fall or head of which has been measured or, at least, carefully estimated. There are, however, many rivers and streams in the Dominion which have not yet been recorded, nor their power capacity determined. These can only become available for tabulation as survey work proceeds, and much remains to be done in the less-explored districts of the north. Also, apart from definite studies of particular projects, no account has been taken of power concentrations which are feasible

on rivers and streams of gradual gradient, where economic heads may be created by the formation of impounding dams. As the actual water-wheel installation throughout the Dominion is found to average a development of power 30 per cent in excess of the tabular values for such cases, it is legitimate to infer that the present recorded water power resources of Canada will permit of a turbine installation aggregating about 43,700,000 horse-power, so that the realised power development at the present time is little more than 17 per cent of the ultimate possible development. The figures in the table represent, in fact, the *minimum* water power possibilities of the Dominion.

In a previously issued statement<sup>2</sup>, the Hon. Thomas G. Murphy, Minister of the Interior, commented on the situation and said that "the

AVAILABLE AND DEVELOPED WATER POWER IN CANADA, JANUARY 1, 1935.

Province	Available 24-hour power at 80 per cent efficiency		Turbine installation
	At ordinary min. flow	At ordinary six months flow	
1	2	3	4
	h.p.	h.p.	h.p.
British Columbia	1,931,000	5,105,500	717,717
Alberta	390,000	1,049,500	71,597
Saskatchewan	542,000	1,082,000	42,035
Manitoba	3,309,000	5,344,500	390,925
Ontario	5,330,000	6,940,000	2,355,755
Quebec	8,459,000	13,064,000	3,703,320
New Brunswick	68,600	169,100	133,681
Nova Scotia	20,800	128,300	116,367
Prince Edward Island	3,000	5,300	2,439
Yukon and North-West Terr.	294,000	731,000	13,199
Total	20,347,400	33,619,200	7,547,035

recovery in power demand remarked in 1933 gained in momentum during 1934 and the records of electrical output compiled by the Dominion Bureau of Statistics indicate that the total output for 1934 will not only greatly exceed that for 1933 but will have established an all-time record". In point of fact, it actually attained an increase of nearly 19 per cent over the previous record of 1930.

The increase in power installation during 1934 is principally accounted for by the completion of the Rapide Blanc development (about 160,000 horse-power) of the Shawinigan Water and Power Co. on the St. Maurice River, and by the installation of an additional unit (50,000 horse-power) for the Beauharnois Light, Heat and Power Co., near Montreal. The latter undertaking has already been described in NATURE<sup>3</sup>, so that it is only necessary to refer to the former. Through the courtesy of the Shawinigan Co., which has kindly



supplied particulars and photographs, it is possible to give a brief account of the important work at

addition, there are two smaller gates situated near the main gates for minor flow regulation.

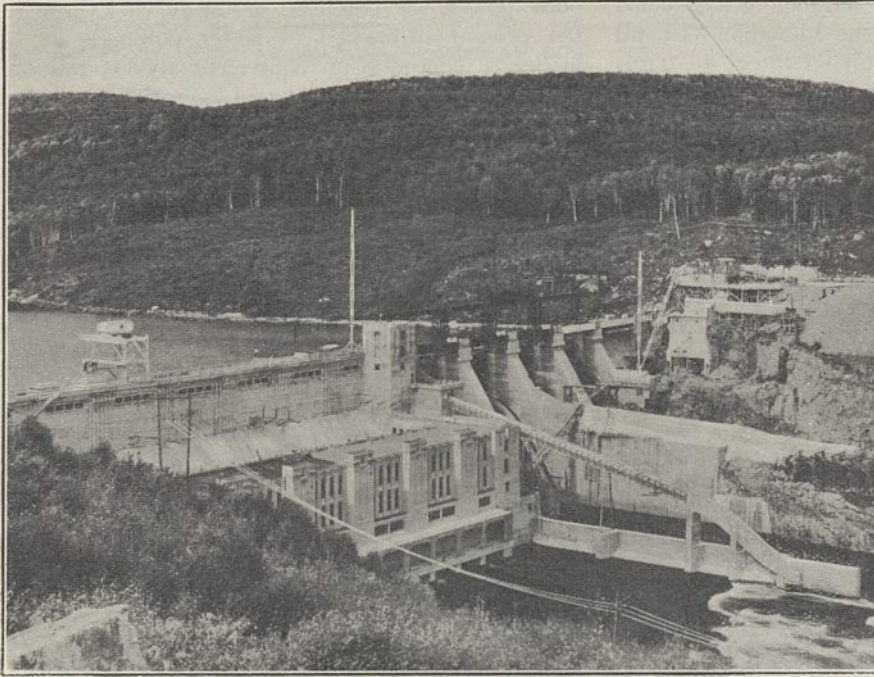


FIG. 2. Rapide Blanc power house and dam.

Rapide Blanc. The Company has previously exploited, practically to the full extent, the hydraulic possibilities of the lower St. Maurice River, which discharges into the St. Lawrence at Trois Rivières, and their installations at Grand'mère, Shawinigan and La Gabelle, which were visited by the writer in 1927, have been described in NATURE<sup>1</sup>.

A view of the structural work of the dam and the exterior of the power house at Rapide Blanc is given in Fig. 2, while Fig. 3 is a view of the interior of the power house showing the arrangement of the turbines. Unlike the installations of the Company elsewhere, there are no falls at Rapide Blanc, and the rapids themselves, before their submergence, were of no spectacular significance.

The development is best described as a typical medium head water-power station, the main dam and power house being located on the St. Maurice River at a point about 115 miles above Shawinigan Falls, which, in turn, are about 20 miles distant from Trois Rivières. The dam is of the usual standard gravity section, with the intake structure forming an integral part at the western end. Flood regulation is secured by the use of four steel regulating gates, electrically operated, and suitably protected against extremes of weather. Three of these gates are 50 feet wide by 36 feet deep, for the passage of 40,000 cu. ft. of water per second each, at normal water-level. The fourth gate is also 50 feet wide, but only 16 feet deep. In

The water from the impounded area passes into the pump house through riveted steel penstock tubes, varying in diameter from 23 ft. to 19 ft., the shell thickness being approximately  $\frac{3}{4}$  in. The power house (Fig. 3) will eventually contain six turbine generating units, of which four have been installed during 1934. The water wheels, supplied by the Dominion Engineering Works, Ltd., are rated at 38,000 horse-power each under 108 feet head and work at 109.1 rev. per min. Maximum efficiency is guaranteed as at least 90 per cent. The electrical generators, contracted for by the Canadian Westinghouse

Co., are of the vertical type, each rated at 36,000 k.v.a., generating current at 11,000 volts, 85 per cent power factor, three phase, 60 cycles

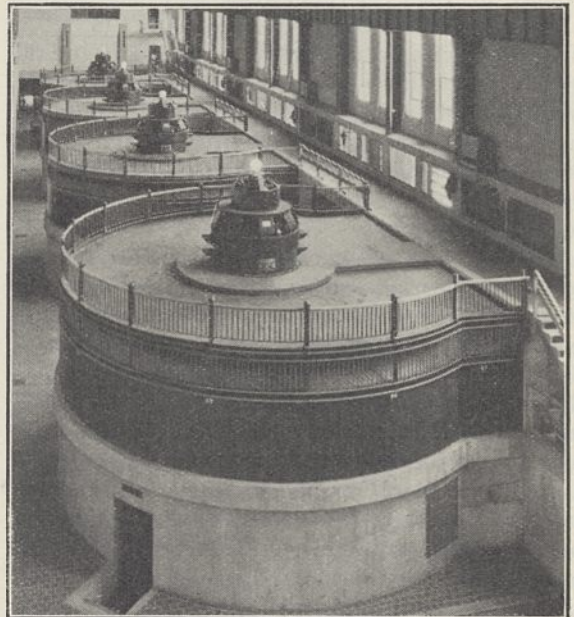


FIG. 3. Interior of Rapide Blanc power house, showing arrangement of the turbines.

and 109.1 r.p.m. An unusual feature of the machines is that air is taken in for ventilating



purposes through the tops of the generators, as the main thrust bearings are located below the rotors. Power is transformed from 11,000 volts to 230,000 volts in outdoor water-cooled transformers, supplied by the Canadian General Electric Co., and is transmitted direct to Trois Rivières by means of an overhead transmission line, 120 miles long. With the addition of this installation, the Shawinigan Water and Power Co. possesses a combination of power plants aggregating 809,200 electrical horse-power and 55,000 hydraulic horse-power.

The enormous importance to Canada of its hydro-electric installations may be gauged from the fact that the investment represented by the present development of seven and a half

million horse-power is conservatively estimated at 1,743,000 dollars and, while it is difficult to assign a precise figure to the coal equivalent of developed horse-power, the potential saving of coal through the present utilisation of water power is on a moderate computation equivalent to 36½ million tons per annum. The realised saving, dependent, as it is, on the actual output of the plants in operation, was during the year 1934, of the order of 17 million tons of coal. The total installation gives a notable ratio of 697 horse-power per 1,000 of the population.

<sup>1</sup> "Water Power Resources of Canada", Paper No. 1813, Department of the Interior, Ottawa.

<sup>2</sup> "Hydro-electric Progress in Canada in 1934", Paper No. 1784, Ottawa.

<sup>3</sup> NATURE, 131, 788; 1933.

<sup>4</sup> NATURE, 120, 334; 1927.

## The Classification of Coals

By DR. R. LESSING

THE complexity of the heterogeneous conglomerate, coal, can be appreciated if it is considered that it represents the accumulation of vast masses of a large variety of vegetable materials under different climatic and topographical conditions, and their gradual metamorphosis by biological, chemical and physical agencies extending over geological periods which have proceeded to, or are arrested at, varying stages of development. The component portions of a single plant differ widely in their morphological and phytological characteristics and more especially in their chemical composition, that is to say, in the general quantitative relationship of the cellulosic, lignitic, resinic groupings and their quota of normal inorganic plant constituents and accessories, and likewise in the qualitative properties of each of them. Assume this mixtum compositum of raw materials to be subjected to bacterial, enzymatic and chemical decay under varying conditions of wind and water, oxidation, dehydration and carbonisation, rest and disturbance, pressure of superimposed strata and disruptive earth movements, let these phenomena occur in different sequence, at different stages of 'coalification' and with different potency in each region, and you will sympathise with the researcher who attempts to piece the jig-saw puzzle of coal constitution together. He is faced with complexity in the smallest fragment examined under the microscope or by chemical analysis, in any lump taken from the domestic scuttle, when surveying a coal seam throughout its depth and along its bedding plane or a series of seams overlying each other in a single coal pit, when comparing the commercial products of any district or the deposits

of the coalfields in different countries and continents.

Such considerations will demonstrate the difficulty of fitting the many hundreds of more or less definite forms in which coal occurs and their transitional modifications into a rigid system of classification. Moreover, classification is required for many purposes. The geologist, the palæobotanist, the chemist, the combustion or carbonisation engineer, the coal miner, and the coal salesman will all view the problem from their particular point of view, and will insist that any methodical grouping shall give the special information that satisfies their own curiosity or is helpful in their limited sphere of activity.

The older classifications of Karsten (1826), Regnault (1832), Gruner (1873), Hilt (1873), Schondorff (1875), and others were originally based on the character, and later the yield, of the coke obtained in the crucible test, and on the length of flame of the burning coal. This method has persisted on the Continent ever since, for commercial purposes, though admittedly deficient unless supplemented by other data. Attempts at correlating various properties led to the adoption of the ratio of 'fixed carbon' to volatile matter, the 'fuel-ratio', as a standard of comparison, particularly in America. In 1900, C. A. Seyler proposed a classification on the basis of the carbon/hydrogen ratio, and elaborated his scheme in recent years by incorporating the graphical representation of Ralston's isovols and isocals, and applying Parr's correction for mineral matter content. Seyler's classification is capable of expansion by plotting other characteristics, such as caking and agglutinating power, oxidisability, oxygen requirement



on combustion, hardness and liability to 'slacking' or weathering. He visualises an atlas of the coals of the world in which the carbon and hydrogen axes correspond to longitude and latitude and the iso-functional lines to altitude, isotherms and other features of an atlas of physical geography.

All attempts at coal classification prior to 1919 had dealt with commercial coals, that is, the mixed product of collieries in certain localities or at best the fuel extracted from individual seams. The values used in drawing up coal charts were obtained by unstandardised methods of analysis, often of doubtful definition or accuracy, whilst the materials examined represented average samples, in most cases containing an undue percentage of adventitious mineral matter apart from the 'inherent' ash.

In that year Dr. Marie C. Stopes described in the *Proceedings of the Royal Society* the four visible ingredients of banded bituminous coal—fusain, durain, clarain and vitrain—isolated mechanically from hand specimens from Hamstead Colliery in Staffordshire. Reference had been made frequently in the literature to the banding of coal, to the dull (matt) and bright (glanz) nature of the laminations, and to the peculiar lenticular inclusions of mineral charcoal (mother-of-coal). This paper constituted the first attempt to consider coal in detail from a petrological point of view. The possibility thus shown, of isolating distinct and identifiable components from any lump of banded coal, has proved a most fruitful factor in the furtherance of coal research during the past fifteen years, and its significance has penetrated even into the realm of industry. The isolated components were shown to be different and typical in their chemical composition and morphological structure, to be associated with mineral matter in characteristic amount and composition, to have different coking values and to contain groups of organic compounds and plant residues in defined ratios.

The subdivision of coal into the four visible Stopes ingredients has been widely accepted in Great Britain and in most European countries. American workers have not felt able to adopt it in its entirety, owing partly to differences in the character of their coals and partly to difficulties in terminology. They are adhering to the subdivision into Thiessen's anthraxylon and attritus, roughly comparable to clarain-vitrain and durain respectively. The fact that vitrain, clarain, durain and fusain are group designations and were put forward by Dr. Stopes as merely representing portions of hand specimens distinguishable macroscopically has not been sufficiently appreciated by subsequent authors; hence new observations on other coals have in some cases been interpreted as contradicting the original descriptions.

In a recent paper "On the Petrology of banded Bituminous Coal"<sup>1</sup> Dr. Stopes re-states her case and sums up the results of research arising from her original paper. She goes further than that; encouraged by the additional knowledge obtained since its publication and in order to clarify the position, Dr. Stopes proposes a much more comprehensive, though perhaps more ambitious, scheme of classification. The new schedule<sup>2</sup>, which during the last two years has been discussed in detail by the British and American members of the Coal Research Club and others, provides for the further subdivision of the macroscopic components into smaller groups, to which the generic term 'macerals' has been given, analogous to the minerals composing a rock. These are connotated by the suffix *-inite*. A maceral is named generally according to the kind of tissue from which it is mainly derived and of which in its mummified form the bulk of the unit consists. If wood, cork, cortex, cuticles, spore exines or resin was the raw material, the maceral is called xylinite, suberinite, periblinite, cutinite, exinite or resinite respectively. Completely jellified plant material is ulminite, whilst re-precipitated ulmin compounds form collinite. Fusainised xylem or other lignified tissues are fusinite and the yet little explored matrix of durain or 'residuum' is termed micronite. The combination of individual macerals present in the hand specimen (having suffix *-ain*) are vitrinite, fusinite, clarinite and durinite.

In order to allow for the distinction between vitrains with and without structure, Potonié's terms pro-vitrain for the former and eu-vitrain for the latter are adopted, and in the case of vitrain the sub-groups ulmain, collain, periblain, suberain and xylain have been interposed between the main component and its macerals, to denote their principal characteristics.

The schedule may at first glance appear complicated, and some may gibe at the mass-production of new terms. These are, however, not meaningless words, but signify distinct elements which have been recognised and defined by the microscopist and the chemist. Whilst the technique of identification and isolation of macerals has yet to be developed, the schedule forms a well thought out skeleton into which existing knowledge and future observations can be fitted. The scheme is obviously of a tentative nature and mainly intended for the bituminous portion of the coal range, and not so much for coals of lower rank (peat, brown coal, lignite), but its potential bearing on coal research and practical coal classification should not be underrated.

Classification hitherto had to be applied to complex mixtures. It could be based with advantage even to-day on the characteristics of the



main components of coal. If, however, in future by the combination of petrological and analytical data, the physical and chemical properties of the small units of the coal complex can be ascertained, the composite value of the fuel will be assessed with much greater accuracy than is possible at present. What may, therefore, appear to-day as a somewhat academic problem, may to-morrow have a very definite effect on practical coal politics. The coal producer, knowing that he can only sell the coal which he happens to find in his pit, usually stands aloof from attempts to codify coals in

anything but a 'use' classification. In Great Britain, even schemes for grading coal by size and freedom from ash and moisture have so far been regarded with disfavour. The modern requirements of the industrial consumer, however, make more rigorous demands on the properties of coal used in his processes and indicate the necessity of defining these in terms different from the non-descript 'Derby Brights' beloved by the British householder in the past.

<sup>1</sup> "Fuel in Science and Practice", Jan. 1935, 14, 4-13.

<sup>2</sup> Copies can be obtained from Dr. M. C. Stopes, Norbury Park, nr. Dorking, England.

## Obituary

PROF. GANESH PRASAD

WE regret to announce that Prof. Ganesh Prasad died on March 9, with unexpected suddenness. Born in Ballia, a small town in the United Provinces, India, on November 15, 1876, Prasad took the D.Sc. degree of the University of Allahabad at the age of twenty-two years, and then studied at Cambridge and Göttingen as a Government of India scholar. After serving for ten years as a professor of mathematics in his native province on his return from Europe, in 1914 he joined the University of Calcutta as the Ghosh professor of applied mathematics. He left this post four years later to join the Benares Hindu University as its University professor, but came back to Calcutta in 1923, this time as the Hardinge professor of pure mathematics, which post he occupied until the time of his death. While he was in the Benares Hindu University, he was also the principal of the Arts and Science College for about two years.

Prof. Prasad was the first in India to create a school of mathematical research. Many of the papers on mathematics published by young Indian investigators in the last twenty years bear an acknowledgment of indebtedness to him for guidance and help. He founded the Benares Mathematical Society in 1918, and was its life-president. He had been for many years the president also of the Calcutta Mathematical Society.

One of the earliest contributions made by Prof. Prasad was his dissertation entitled "The Constitution of Matter and Analytical Theories of Heat" (1903), in which he dealt with the difficulty of interpreting differential coefficients when the molecular constitution of matter is taken into account. His papers on applied mathematics, published in various journals, dealt likewise with problems in which he skilfully applied his knowledge of the theory of functions of a real variable to potential problems in which the differential coefficients became infinite or did not exist. His later researches were on the theory of Fourier series and other branches of the theory of functions of a real variable. At the time of his death he had in hand the completion of a long memoir on "The Expansion of Zero", which he had promised to contribute to the first issue of the journal of the

newly created National Institute of Sciences, India, of which he was a member of council.

Prof. Prasad was well known as a teacher, and his textbooks on the differential and integral calculus are still in use in many Indian universities. His Patna University readership lectures on "The Place of Partial Differential Equations in Mathematical Physics" were published in 1924, and since 1928 he had devoted a good deal of his time to the writing of books on higher mathematics and on the history of the subject.

Prof. Prasad was much loved and admired by his numerous pupils, to whom he was always a source of great inspiration. He was a man of wonderfully simple habits, and remarkable energy and powers of endurance. He had a marvellous memory. When he was a principal—to mention but one example—he recognised all the students (more than one thousand in number) and remembered not only their names but also numerous details about them.

GORAKH PRASAD.

DR. SHEPHERD DAWSON

By the death of Dr. Shepherd Dawson on March 26 at a relatively early age, experimental psychology in Great Britain has suffered a great loss. For a period of many years, his experimental contributions have been published in the technical journals (mostly in the *British Journal of Psychology*). All have been marked by careful attention to the requirements of scientific method. In later years his attention was directed towards the statistical problems of psychology, and a few years ago he published a book on statistics.

Shepherd Dawson's earliest published work on various problems of vision already showed his quality as an accurate and painstaking experimentalist. After he succeeded H. J. Watt as principal lecturer in psychology, logic and ethics at Jordanhill Training College, Glasgow, he did not lose his interest in experimental research. At meetings of the British Association he had generally some original investigation to report. Probably the best known of his later contributions to experimental psychology was his



work on "Persistence" carried out in collaboration with Prof. E. P. Cathcart. He had a real liking for apparatus, and few years passed during which he did not demonstrate at the meetings of the Scottish branch of the British Psychological Society (of which he was, at one time, president) some ingenious piece of apparatus which he had devised for practical work at Jordanhill. He was closely associated with the work of Conn on the effects of encephalitis lethargica on intellectual development.

When, last year, Shepherd Dawson became president of Section J (Psychology) of the British Association, he chose characteristically a subject both more scientific and more practical than that of most of his immediate predecessors, namely, "Psychology and Social Problems", in which he dealt with such urgent practical problems as the negative correlation between intelligence and fertility.

Shepherd Dawson's interests lay almost entirely in the measurable aspects of psychology and not in introspective investigation or in theoretical psychology. Within this field of the measurable, his interests were wide. His own investigations were of a very varied nature, and he was widely interested in the work of others. He was generous in his gift of time and thought to all who asked his advice. All who knew him will mourn his untimely end.

R. H. T.

SIR GEORGE SCOTT, K.C.I.E.

WE regret to record the death on April 4, at the age of eighty-three years, of Sir James George Scott. Sir George Scott was well-known as an administrator in Burma, more especially for his success in dealing with the less-advanced tribes, concerning whom his writings are the best, and in some instances the only, authority.

James George Scott, the second son of the Rev. George Scott of Dairsie, Fife, was born on December 25, 1851. He was educated in Germany and at University College School, London, the University of Edinburgh, and Lincoln College, Oxford. He went to Perak as a war correspondent in 1875, and in 1879 joined the staff of St. John's College, Rangoon, where through contact with his pupils he laid the foundations of that knowledge of, and affection for, the peoples of Burma, which became the ruling force of his later life. After witnessing French operations in Tonking as a correspondent of *The Times* in 1884, he served in a political capacity with the British expedition to Upper Burma and later joined the Government service as an Assistant Commissioner. In 1887-88 he was employed in the Shan States and assisted in the pacification of the rebellious Shans.

After serving on the Anglo-Siamese Boundary Commission in 1889-90, Scott was made superintendent of the Northern Shan States, and by his courage and personality made effective British influence over wild tribes who hitherto had been irreconcilable. From this time onward his career was a succession of difficult and responsible positions, each of which was in a sense a recognition of his previous success by promotion to a more difficult undertaking. Among

these were service on the commissions which settled the Franco-Burmese and the Siam-Burmese boundaries. His knowledge of the Burmese peoples was put to good use when he was made responsible for the five volumes dealing with Upper Burma in the Census of 1901. He was made a K.C.I.E. in 1901, having been a Companion of the Order since 1892. In the following year Scott became Political Agent and Superintendent of the Southern Shan States and remained in that office until he retired in 1910. After his retirement his leisure was occupied in writing.

Scott was a ready and versatile author. His publications in book form began so long ago as 1882 with two volumes entitled "The Burman: His Life and Notions" published under a Burmese pseudonym, while the first book to appear under his own name was "France and Tonking", published in 1885. Among his other works, apart from a number of novels, may be mentioned "Burma as it was, as it is, and as it will be" (1886), "Burma, a Handbook of Practical Information" (1906), a comprehensive account in which he was assisted by experts, "The Mythology of Indo-China" (1918), "Burma from the earliest Times to the Present Day" (1924) and "Burma and Beyond" (1932), in which he recast and supplemented much of the information relating to tribes on the fringe of the British sphere of influence in his earlier works. He was also a contributor to Hastings' "Encyclopædia of Religion and Ethics" and various scientific periodicals.

PROF. W. J. SINCLAIR

PROF. WILLIAM JOHN SINCLAIR, who died at Princeton, New Jersey, on March 25, made many important contributions to our knowledge of fossil vertebrates, and added much to the palæontological museum of Princeton University, of which he had been director since 1927. He was born at San Francisco on May 13, 1877, and received his Ph.D. from the University of California in 1904. He removed to Princeton in 1905, became assistant professor in 1916, and was appointed professor of palæozoology in 1930.

Prof. Sinclair was specially interested in fossil mammals, and his most noteworthy work was his memoir on the fossil marsupials of Patagonia, published in 1906 in the reports on the Princeton University Expeditions to Patagonia, 1886-99. He concluded that the close resemblance between the Patagonian fossil Sparassodonts and the living Tasmanian Thylacine could only be explained by a former land connexion between South America and the Australian region.

WE regret to announce the following deaths:

Sir John Collie, chief medical officer of the Metropolitan Water Board, known for his work on the psychology of fraud, on April 4, aged seventy-four years.

Colonel W. G. King, C.I.E., distinguished for his work in connexion with public health in India, on April 4, aged eighty-three years.



## News and Views

## The Formosa Earthquake

ON April 21, at 6.2 a.m. (local time), the most destructive of recorded earthquakes in Formosa devastated the two north-west provinces of Taichu and Shinchiku. According to the latest official figures, 3,152 persons were killed and 8,991 injured, while 19,217 houses were destroyed and 18,472 damaged. In the great earthquake of March 17, 1906, the corresponding numbers were 1,249, 2,378, 5,667 and 3,233. According to the Tokyo correspondent of *The Times* (April 22), the centre of the earthquake was in the upper reaches of the Koryuki river, the area of greatest damage being 50 miles long and 25 miles wide. The focus is placed by the Japanese seismologists as near the surface at a point 25 miles north-east of Taichu. At Taiho, fires broke out after the earthquake, and it is feared that the town will be completely destroyed. Taichu suffered less, only about a hundred of 50,000 inhabitants being killed. Thus, the area chiefly affected runs from Taichu along a line parallel to the coast, but stopping short of Taihoku. It is of some interest to note that this great shock occurred in a district in which earthquakes have been infrequent during the present century. The principal zones are those in the districts of Kagi in central Formosa, and Karenko and Giran on the east coast. To the Kagi centre belonged the earthquake of 1906 during which the crust was dislocated along a fault about 30 miles in length. According to Omori (*Imp. Earthq. Inv. Com. Bull.*, 1, 53-72; 1907), the displacement seems to have been unique. In the western half, the ground on the north side was sheared relatively eastward and depressed, while, in the eastern half, the south side was sheared westward and depressed.

## Rural Water Supplies in Great Britain

THE subject of national water supplies again came up in the House of Commons on April 20 when on the motion for the adjournment Mr. A. Greenwood raised the question of the expenditure incurred by authorities in rural areas on the provision of new supplies, and inquired the Government's intentions in regard to the Water Supply (Exceptional Shortage Orders) Act which will lapse at the end of the present year unless steps are taken to extend it. Mr. Alan Chorlton expressed regret that the water survey which at long last has been agreed to does not extend to allocation, and asked what steps are being taken within the Ministry of Health to set up a central body as advocated in the report of the water authorities. Mr. G. H. Shakespeare, Parliamentary Secretary to the Ministry of Health, in reply, gave no indication whether a continuance of the emergency legislation will be necessary, but stated that the grant of one million pounds voted in aid of rural schemes last year has fostered the promotion of schemes estimated to cost three times that amount and is expected to do as much again during the current year. Out of just over 2,000 parishes requiring permanent sources

of supply, schemes for 1,600 parishes have been prepared and are in various stages of realisation. He alluded to the recently formed Water Survey Committee, and stated that two meetings have been held and that the Committee is actively pursuing its inquiries into the actual water supplies of the country.

## Award to Sir Aurel Stein

IT is announced that the gold medal of the Society of Antiquaries of London has been awarded to Sir Aurel Stein. The services to archæology of Sir Aurel Stein, which are thus recognised by what may be regarded as the highest award in Great Britain for archæological studies, are too well known to need recapitulation. His journeys in the Central Asiatic desert, and his excavations among its sand-buried cities, pursued almost without intermission for more than thirty years at a cost of great personal hardship borne with never-failing endurance, have rewritten a long chapter in the history of Asiatic civilisation which had been lost, and brought to light the unsuspected glories of an art which had grown out of the otherwise unrecorded contacts of the classical world and India with the Far East. His explorations of the lands of the North-West Frontier of India, among other discoveries, have retraced the march of Alexander the Great and illuminated the course of one of the great campaigns of world history. While regret is universal that a nationalist policy in China should have put an end to Sir Aurel's investigation of the great complex of mountain and desert of Central Asia, by which he was unravelling the causes which led to the decay of this arena of a great civilisation, by diverting his activities to other fields, it may, should his hopes of discovery in Persia be realised, add still further to the indebtedness of archæological knowledge to his genius in exploration.

## Indian Art in Great Britain

IT is not surprising, in view of the long and intimate connexion of Great Britain and India, to learn that a search has revealed a number of examples of Indian art in public and private collections in Great Britain, which in the aggregate and in artistic quality and historic interest is impressive. In the last few months, Dr. K. N. Sita Ram, curator of the Central Museum, Lahore, according to a note in *The Times* of April 20, has been engaged in a comprehensive survey of the examples of Indian art and archæology in museums and art galleries throughout the British Isles. After identifying and cataloguing the Buddhist sculptures from Amravati in the British Museum, at the suggestion and with the co-operation of the Museums Association he has examined some fifty collections, travelling so far afield as Elgin, Dublin and Belfast. Not only did he assist in rearranging and relabelling these collections, but he also advised on spurious or indifferent specimens, and in a number of instances discovered treasures which had been overlooked or of which the interest



had been unrecognised. As a result of his inspection, choice specimens from private collections in several instances have now been placed in local museums. Among the rarer and more unexpected of his finds are examples of Buddhist sculpture from Java at Edinburgh, Dublin, Elgin and Hawick, fine paintings of the Rajput, Kangra, and Moghul Schools at Halifax, Manchester and Edinburgh, and sculptures of the great Gandhara period and South Indian bronzes in many collections. Dr. Sita Ram, it is stated, is confident that without unduly depleting local collections, it is possible to get together ample material from Java and India now in the British Isles to provide for the central museum of Asiatic art and antiquities, which those who are interested in British national collections are convinced is an urgent need of the present time.

#### Calendar Reform

THE International 'Fixed Calendar' League, 1 Regent Street, London, S.W.1, has issued a topical pamphlet entitled "How to Fix Easter and Establish Calendar Reform". The arguments for and against calendar reform bear some resemblance to the movement in favour of a 24-hour time system, which met with little encouragement from the public when it was given a trial by the B.B.C. last year. There is little solid, compelling argument in favour of either, though it would be a convenience in the long run to rationalise our methods of reckoning the hours of the clock and the days of the year. It is claimed that the fixation of Easter would result in great public convenience, and that the equalisation of the number of days in each month, and in each quarter, would simplify statistics based on monthly and quarterly returns. There are two rival schemes for calendar reform. In the first there are twelve months, each quarter containing 31 + 30 + 30 days, and in the second thirteen months, each of 28 days. The stabilisation of the week and the month is to be obtained in either scheme by counting the 365th day in an ordinary year as Year Day, and by counting the 366th day in a Leap Year as Leap Day, neither day having a place in any week. The International Fixed Calendar League casts a shadow on the respectability and balance of its arguments by exhibiting an intemperate preference for the 13-month plan as compared with the 12-month plan; it is claimed, for example, that the 13-month plan "would help research in science, health, etc." but that the 12-month plan would not! It is extremely interesting to compare Pamphlet *E* for general consumption, with Leaflet *L*, "Fixed Calendar Benefits for Labour" (which was not sent to NATURE Office), in which the League indulges in an attempt to enlist the sympathies of the Labour movement in its scheme for calendar reform.

#### Geographical Distribution of Unemployment

In the issue of *Planning* dated March 26 (16 Queen Anne's Gate, London, S.W.1) some important facts relating to the geographical distribution of unemployment are emphasised with the aid of a diagram,

wherein Great Britain is divided into two halves. The first half, consisting of the Midlands, South and South-West England, contains 6,319,000 insured persons between the ages of 16 and 64 years, while the second half, consisting of North England, Scotland and Wales, contains almost the same number, namely, 6,221,000. Yet the first half has less than 650,000 claimants to unemployment benefit and assistance, while the second half has nearly 1,300,000, or more than two thirds of the total registered unemployed. If the comparison is confined to claimants for transitional payments and allowances—that is, to the able-bodied unemployed coming under the Unemployment Assistance Board—the contrast is far more striking. Less than a quarter of these cases occur in the first or more prosperous half and more than three quarters in the depressed half. Moreover, as there are large areas which are fairly prosperous even in the second half, the real concentration of the problem of able-bodied unemployment for long spells is far narrower than regional figures show. Another striking fact brought out is the relative insignificance of protracted unemployment among women workers.

#### Printing by Wireless

ACCORDING to a report in *The Times* of April 20, a new instrument for wireless telegraphy, which will either handle the morse code or transmit and receive messages in plain letters, has recently been produced by Messrs. Siemens and Halske of Germany, and is being demonstrated at the London offices of Messrs. Siemens-Schuckert. The instrument can be operated by any ordinary wireless set with an output of one or two watts, the frequency of the output signal being adjusted to be 900 cycles per second. The mechanism consists of a short roller with a two-turn spiral or helix rotating over a paper tape and carbon paper, which are fed underneath. On the arrival of a signal, paper and carbon are lifted sharply up against the helix by a blunt knife-edge and, depending upon the duration of the blow, either a line or dot is printed. The duration of the dot is about 1/500 of a second, while the system is capable of passing messages at a speed of about 50 words per minute. No very elaborate means of synchronism between transmitter and receiver is required, and the apparatus is almost entirely free from atmospheric and other forms of electrical interference. This new radio-telegraph printer is intended primarily for use in conditions where line-telegraphy is not possible, or where interference makes other methods of communication impossible. At a demonstration in London, signals were received from the Königs-wusterhausen Station in Germany, using 8 kilowatts and sending out its ordinary service of news.

#### Science in Everyday Life and the Schools

THE British Science Guild has recently organised a series of lectures on science which are intended to bring before the pupils of secondary schools some of the remarkable advances in scientific knowledge and in its applications to everyday life which are being



made at the present time. The first two lectures were delivered in March to girls from London secondary schools by Mr. C. C. Paterson, director of the Research Laboratories of the General Electric Co., Ltd., Wembley, and have now been issued by the Guild as a pamphlet (Pp. 20. 1s.) entitled "The Electron Liberated; its Industrial Consequences". They deal with the emission of electrons from hot and illuminated surfaces and the uses made of them in modern electrical engineering, in particular in the production of light. The mysterious dual character of the electron as a missile and a group of waves is not forgotten, and the necessity for more and better knowledge of its properties is insisted on. The Guild is to be congratulated on the inaugural lecturer, to whom thousands of electrical engineers listened with such pleasure on the subject last year. The sooner other schools can have the benefit of lectures of this type, the better it will be for our future citizens.

#### Industrial Administration, at Loughborough College

FACILITIES for training in industrial administration and management are now increasing in Great Britain, the latest development being that at Loughborough College, where a Department of Industrial Administration was inaugurated last year. The courses provided are of an intensive nature, extending over short periods, and the aim is to provide a kind of staff college for industry where executives may be given an insight into a larger range of administrative practice than they would be likely to obtain in the ordinary way. The scope of the new department is thus somewhat different from those now well established at the Manchester College of Technology, or the London School of Economics, which provide courses extending over one or two academic years. The facilities provided at Loughborough include week-end, ten-day and longer courses adapted to the degree of experience of those attending. Instruction includes lectures, organised reading, group discussions, personal discussion of individual problems and visits to works and offices. It is intended that the week-end courses should be confined to executives with practical experience in the same industry, and in the first instance, these are being provided for engineering executives and will deal with such special topics as costing, rate-fixing and progress control. In the prospectus of the Department, it is pointed out that the various courses are of especial value to owner-managers who have not been able to acquire experience in other businesses, and to executives whose experience has been confined to a restricted field.

#### Meteorology of the South Seas

APIA OBSERVATORY, in Western Samoa, is under the control of the Department of Scientific and Industrial Research, New Zealand, and the work is directed by Mr. J. Wadsworth, formerly in the Meteorological Office, Air Ministry, who has recently presented his report for 1932 to the Observatory Board in the form of a compact and very clearly printed little volume of 114 pages. The report is a

summary of observations in terrestrial magnetism, seismology, meteorology and atmospheric electricity. Synoptic weather charts were made on every day of the year, the data being collected by the wireless station at Apia from twenty observing stations in other groups of islands in the South Pacific, and sometimes from passing ships. Since May 1932 a daily weather report has been exhibited at the Post Office and Customs House in Apia, at the request of local shipowners. Considering the small size of the staff, which consists of the director and two scientific assistants and four locally recruited clerks, the amount of work accomplished, especially on the purely meteorological side, seems highly satisfactory. Upper winds were measured with the aid of pilot balloons on seventy-eight occasions; the usual meteorological instruments were maintained, while in addition a Piché evaporimeter and a Wilson radio integrator were read daily at 9 a.m. The meteorological summaries are so detailed that a very clear idea can be formed of the weather experienced from day to day in this part of the South Seas; they include, also, less detailed climatological summaries from other groups of islands. An even fuller programme was contemplated, for arrangements were being made for re-conditioning and bringing into use a spectroheliometer which was obtained on loan from Mount Wilson Observatory.

#### Standardisation of Insecticides and Fungicides

THE standardisation of insecticides and fungicides has for some years been a matter of discussion among both the users and manufacturers of these chemicals, and requests from farmers and growers that the content of active materials in these products should be guaranteed resulted in the publication by the Ministry of Agriculture of specifications of a number of those most generally in use (Advisory Leaflet No. 9). To meet the recent great development in the employment of insecticides and fungicides, a further publication has now been issued by the Ministry, namely, Bulletin 82, "Specifications and Methods of Analysis for Certain Insecticides and Fungicides" (London: H.M. Stationery Office, 3d. net). In this bulletin, the specifications already published have been brought up to date, and additional specifications for certain compounds such as copper fungicides, not previously dealt with, have been included. In addition, agreed methods of analysis, drawn up in connexion with the specifications, are supplied. Both specifications and analytical methods have been accepted by the Association of British Insecticide Manufacturers, the Government Laboratory, the National Farmer's Union and the Ministry of Agriculture. Purchasers are strongly advised to require a guarantee that materials supplied comply with these specifications, for, by so doing, they ensure that they obtain standard products of high quality.

#### Lancashire Sea-Fisheries Research

THE report for 1932 (No. 41) on the Lancashire Sea-Fisheries Laboratory at the University of Liverpool (1933), edited by Dr. R. J. Daniel, is in



future to be incorporated with the *Proceedings and Transactions of the Liverpool Biological Society* and not issued separately. The present report includes accounts of experimental lobster rearing by W. C. Smith, plaice marking in the Irish Sea by R. J. Daniel and R. A. Fleming, and a comparative study of the abdominal musculature in Malacostraca (Part III) by R. J. Daniel. This last paper is a continuation of Dr. Daniel's work on the muscles of various Crustacea which have been published in the Lancashire Sea-Fisheries Reports in 1927, 1929 and 1932, and describes the musculature of *Lophogaster typicus* and *Gnathophausia zoëa*. The weight of evidence shows a close affinity between the Euphausiacea and the lower decapods, although there are apparent similarities between *Meganyctiphanes* on one hand and *Lophogaster*, *Gnathophausia* and *Praunus* on the other. It is concluded by the author, after very careful consideration, that the former represents a true relationship (homology) and that similarities between mysids and euphausiids are due to convergence. These researches on the abdominal muscles are carefully and beautifully worked out and are accompanied by fine drawings.

#### Welfare Problems in India

IMPENDING constitutional changes, which will affect welfare administration in India, add particular significance to two articles by Mr. Cedric Dover in the January issues of *Mother and Child* and the *Quarterly Review*. He discusses the organisation and condition of maternal and child welfare in India, and the needs and defects of welfare legislation. Maternal mortality rates are 4-20 times, and infant mortality rates 3-4 times as much as the averages obtaining in England, and are closely correlated with communal prosperity and housing conditions. An interesting biological correlation is that between climatic conditions and frequency of conceptions, the maximum number occurring in Bombay during the period of minimum humidity (January-April). Both articles emphasise the need for centralisation and greater co-ordination of welfare activities. A consolidated Public Health Act for all India is regarded as the primary essential of welfare legislation, and a commission on legal reform is suggested, which will recognise that "the main object of law is the prevention of dysgenic, and the encouragement and establishment of eugenic forces", unimpeded by traditional beliefs. The operation of Hindu, Mohammedan and Christian laws under one administration is dismissed as "an anachronism that needs no emphasis".

#### Commercial Timbers of the Punjab

A Forest Bulletin, No. 84, in the Economy Series of the Imperial Forest Research Institute, Dehra Dun, has been recently issued (Delhi: Manager of Publications, 1934) entitled the "Identification of the Commercial Timbers of the Punjab" by K. A. Chowdhury, wood technologist. The Indian Research Institute has been a pioneer in getting together information on the timbers of a definite region, having undertaken intensive research in the timber

resources of India during the past twenty years; with the result that the number of timbers now sold in the market is much greater than it was a few years ago. This fact, states the author, has resulted in difficulties in identification of some of the species which have now come upon the market. The aim of the Bulletin, and a predecessor on Burma timbers, is primarily to show the differences of the anatomical structure of some of the more commercial timbers of the Punjab, and the way to identify them on the spot with the assistance only of a hand lens and pocket knife. Brief notes are also given on the strengths, seasoning properties, durability, working qualities and uses for each species: these latter add greatly to the practical value of the publication. The commercial woods of the Punjab, of which a proportion are temperate species, both conifer and broad-leaved species, are comparatively few in number and their identification is by no means difficult. Those who make use of this Bulletin will find the excellent low power ( $\times 10$ ) photomicrographs of considerable assistance. The species dealt with include the Himalayan conifers, deodar, spruce and silver firs, several pines and broad-leaved trees such as walnut, several oaks, boxwood, poplar and alder; and the Plains species, such as sál, mango, tun, sissoo, tamarix and so forth.

#### Chemical Research in Czechoslovakia

UNINFLUENCED by the economic depression, which has been felt in Central Europe as keenly as elsewhere, the various schools of chemical research in Czechoslovakia have continued their activities with undiminished energy, as is apparent from the papers published in vol. 6 of the *Collection of Czechoslovak Chemical Communications*. In inorganic chemistry, Dr. Škramovský's 'stathmographic apparatus' has found further application in the study of complex inorganic salts such as the bismuth oxalates. The apparatus automatically records photographically the change in weight of a substance with, for example, increasing temperature. Striking dehydration curves have been obtained and results are found to vary according to well-defined circumstances. Thus copper sulphate crystals from aqueous solutions show quite different behaviour from those from alcoholic solutions. Further, inoculation with lower hydrated salt causes characteristic changes in the curves photographically recorded. The stathmographic method thus seems to promise a new field of investigation in inorganic chemistry. In physical chemistry, the Prague polarographic school has published further work especially in connexion with the catalytic evolution of hydrogen at the dropping mercury cathode, which can be made use of in micro-analytical tests. Revenda's work in Prof. Heyrovský's laboratory has extended the applicability of polarographic analysis to the anions. In organic chemistry, the *Collection* includes results of researches by Prof. Votoček and his collaborators on new conversions of sugars to furane compounds. New glucosyl-alkyl-amines are described, and the constitution of fuco-hexonic and rhodeo-hexonic acids has been worked out.



### American Geophysical Union

THE American Geophysical Union, established in 1919 as the American National Committee of the International Union for Geodesy and Geophysics, held its annual congress this year at Washington, on April 26-28, and one of its sections met again at Berkeley, California, on June 20-21. All the seven sections of the Union, for geodesy, seismology, meteorology, terrestrial magnetism and electricity, oceanography, volcanology, and hydrology, met at Washington. Only the hydrology section was represented at Berkeley, where its meetings were associated with the Western Inter-State Snow Survey Conference. The report of the Union is this year published in two volumes (reproduced direct from typescript, as in recent years), of which the first, of 257 pages, relates to the General Assembly and the first six sections; the second volume is still larger, of 370 pages, and forms a striking illustration of the attention now being devoted in the United States to the many aspects of hydrology—a subject almost neglected in Great Britain. The volumes contain very many short scientific papers of great interest, as well as formal reports on work in progress.

### Mining Research at Birmingham

WE have received the report of the work of the Mining Research Laboratory in the University of Birmingham during the year 1933, which has again been financed by the British Colliery Owners' Research Association and by the Miners' Welfare Fund. This executive board of mining research is doing excellent work under the chairmanship of Dr. J. S. Haldane. Again this year silicosis is investigated, but in accordance with Dr. Haldane's repeatedly expressed opinions, the work appears to be confined to the determination of 'free' silica; Dr. W. Jones's investigations are not referred to. Nystagmus, which was carefully investigated previously, is not specially discussed, although the investigation of underground illumination no doubt will play a very important part in minimising the incidence of this distressing and costly complaint. Much appears to have been done with regard to the production of gas of high calorific power from coal or coke oven gas, and various investigations tending to improve atmospheric conditions underground as well as investigations into the physiology of the miner will no doubt prove of great value in the future.

### Calculations for Draughtsmen

THE Association of Engineering and Shipbuilding Draughtsmen has recently added to its useful series of pamphlets one on "Some Notes on Deflection", by Mr. W. R. Thomson, and another on "Mechanical Design of High-Speed Salient-Pole A.C. Rotors", by W. R. Needham. In the first of these the author gives a logical account of the principles of deflection of cantilevers and simply supported beams. No advanced mathematics is used, rough sketches being sufficient to give the figures necessary for the deflection calculations, which are made by slide rule. In the second pamphlet, Mr. Needham deals with shafts

and bearings, shaft stresses, critical speeds, rotor bodies, rotor poles, coil supports and balancing. The stresses in high-speed rotors are of a very high order, and the centrifugal force of a single pole and coil, says the author, at the overspeed may exceed a million and a half pounds. The overspeed in some hydro-electric machines may exceed the normal by as much as 100 per cent.

### Bibliography of Seismology

A NEW volume (No. 12) of the Publications of the Dominion Observatory (Ottawa) is, we are informed, to be devoted to the bibliography of seismology. The first part, issued recently, contains notices of memoirs for the first quarter of the present year. It may be noted that vol. 10 of the Publications includes the titles of 2,000 memoirs for the years 1929-33. A still earlier series, in which notices of 1,200 memoirs appeared, was issued under the auspices of the Eastern Section of the Seismological Society of America and was published in vol. 17-19 of the *Bulletin* of the Society. Both series were prepared by the present editor, Mr. E. A. Hodgson, who has now the assistance of twenty-four collaborators. All the important countries in which earthquakes are studied are represented on this list, with the exception, we regret to notice, of Great Britain.

### Diseases of Swedes

A NEW bulletin (No. 74) issued by the Ministry of Agriculture (H.M. Stationery Office, 1s.) is concerned with two diseases of swedes. Experiments with pure culture have shown that canker, which affects the seed-bearing plant, and dry rot which attacks the roots, are both due to the same fungus, *Phoma Lingam*. This fact is of importance, as infected seed would be likely to result in an infected root crop. The disease is not serious in England, but has become prevalent in New Zealand; and since most of the seed used there is obtained from Great Britain the question of infection is important. Methods of seed sterilisation have been sought with no great success, but evidence has been obtained that weeds afford a serious source of infection. Good cultivation would, therefore, seem as necessary as clean seed if spread of the infection is to be avoided.

### Population Problems

THE third General Assembly of the International Union for the Scientific Investigation of Population Problems will be held in Berlin on September 9, at 11 a.m., in the rooms of the University. An International Congress will be held in Berlin on September 10-15 under the auspices of the International Union. The Congress will have the following divisions: (1) Population Statistics; (2) Biology and Race Hygiene; (3) Social, Economic and Psychological Problems of Population; (4) Medicine and Hygiene. The business office of the Congress is, Berlin W 62, Einemstrasse 11.

### Congress of Anthropology

THE sixteenth Congress of Anthropology and Prehistoric Archaeology will be held at Brussels from



September 1-8. It will consist of the following sections: morphological and functional anthropology, blood groups, human palæontology, heredity and selection, psycho-sociology, criminal anthropology, ethnography, folk-lore and history of religions. Further information can be obtained from the general secretary, Dr. Dekeyser, 9 rue des Sablons, Brussels.

#### The Sky in May

VENUS continues to be a brilliant evening object. Both its brilliance and its eastern elongation are still increasing. Mars passed through opposition on April 6, and is now an evening object. It will be stationary on May 19. The planet is very conspicuous in the southern sky just before midnight. Mars has been very close to  $\gamma$  Virginis during the last week in April. This star is worth examining with a small telescope as it is a double star which is easily resolved, the two components, whose magnitudes are 3<sup>m</sup>65 and 3<sup>m</sup>68, being six seconds of arc apart. Jupiter is in opposition on May 10. The planet is rather far south of the equator. Saturn is still a morning object. The moon will occult the bright star  $\delta$  Geminorum on May 7. Both disappearance and reappearance will be visible at Greenwich, taking place at 21<sup>h</sup>59<sup>m</sup> and 22<sup>h</sup>56<sup>m</sup> G.M.T. respectively.

#### Announcements

PROF. A. C. SEWARD, professor of botany in the University of Cambridge, has been elected a member of the Norwegian Academy of Science and Letters, and also an honorary fellow of the Indian Academy of Sciences, Bangalore.

As a token of their admiration, the friends of Sir Arthur Evans in the Mediterranean have subscribed towards the cost of a portrait-bust of himself to be presented to him in recognition of his pioneer work in the exploration of the Mediterranean bronze age civilisation at Knossos. The presentation took place on April 14 in the Museum at Candia in the presence of a numerous body of friends and admirers.

THE thirteenth award of the Faraday Medal of the Institution of Electrical Engineers will be presented to Dr. F. B. Jewett, of New York, at the ordinary meeting of the Institution to be held on May 2. The presentation will precede the twenty-sixth Kelvin Lecture, which will be delivered by Sir William Bragg, on "The Molecular Structure of Dielectrics".

THE forty-first James Forrest Lecture of the Institution of Civil Engineers will be delivered on May 14 by Prof. O. T. Jones, Woodwardian professor of geology in the University of Cambridge, who will speak on "Geophysics".

THE Royal Geographical Society has made the following awards for 1935: Murchison Grant, to Mr. R. P. Bishop, for his surveys in British Columbia and other services to geography; Back Grant to

Mr. Wilfred Thesiger, for his journey through the Danakil country, 1933-34; Cuthbert Peek Grant to Mr. A. R. Glen, for his work in Spitsbergen, particularly his leadership of the Oxford University Expedition, 1933; Gill Memorial to Mr. E. E. Shipton, for his plane-table surveys of the inner Nanda Devi basin and the neighbouring watersheds.

PROF. W. L. BRAGG will deliver the twenty-fifth annual May Lecture to the Institute of Metals on May 8 in the hall of the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1, at 8 p.m. The subject of Prof. Bragg's lecture will be "Atomic Arrangements in Metals and Alloys". Tickets of admission can be obtained from the Secretary of the Institute of Metals, 36 Victoria Street, London, S.W.1.

DRS. ACHARD, Lapique and Mayer of Paris, Polcard of Lyons and Bouin and Viès of Strasbourg have been elected members of the section of biological sciences in the French Superior Council of scientific research, and Drs. Martin, director of Institut Pasteur, and Roussy, of the faculty of medicine of Paris, extraordinary members.

THE August Forel foundation of the German Academy of Natural Sciences at Halle, which is to award a prize every two years for researches in the subjects in which Forel was specially interested (eugenics, the alcohol problem, study of ants and the central nervous system), has recently made its first award to Dr. Graf, who is head of the department of industrial physiology at the Kaiser Wilhelm Institute of Dortmund.

AN index to the *Astrophysical Journal* covering the issues of January 1920-June 1932 (vols. 51-75) will be published in May. It can be obtained, price 2.60 dollars, including postage, from the University of Chicago Press, 5750 Ellis Avenue, Chicago, Illinois.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A lecturer in zoology in the University of Capetown—The Secretary to the High Commissioner of the Union of South Africa, Trafalgar Square, London, W.C.2 (April 30). A lecturer in the Engineering Department, College of Technology, Leicester—The Registrar (May 4). A junior scientific officer in the Scientific Research Pool, Air Ministry—Chief Superintendent, Royal Aircraft Establishment, South Farnborough, Hants (May 4). A temporary engineering assistant in the Directorate of Works, War Office—The Under-Secretary of State (C.5), The War Office, S.W.1 (May 6). Inspectors in connexion with Agricultural and Horticultural Education and Research under the Ministry of Agriculture and Fisheries—The Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1 (May 13). A physicist in the Radium and X-Ray Therapeutic Departments of the General Infirmary, Leeds—The Secretary (May 18). A lecturer in mathematics at the Royal Technical College, Glasgow—The Secretary.



## Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 659.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

### Winter Feeding of the Tick, *Dermacentor andersoni*, Styles

ONE of us (J. D. G.)—recently engaged in investigating the feeding habits of ticks at the Dominion Entomological Station at Kamloops, British Columbia, with special reference to the dissemination of disease—at the end of September, 1934, brought to the zoological laboratory at the University of Alberta, Edmonton, a limited number of adults of *Dermacentor andersoni* (native at Kamloops) for winter study. In contrast to their behaviour through the summer months, these ticks consistently refused to feed when brought to Edmonton in the autumn. Incidentally, one

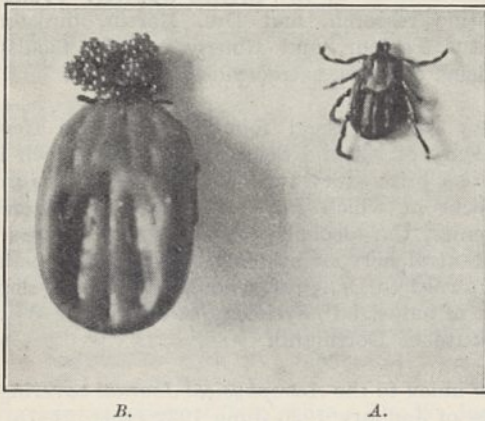


FIG. 1. A. Adult female tick (*D. andersoni*) unfed. B. Engorged female, at the commencement of egg-laying, February 10, 1935.  $\times 3$ .

individual placed on a sheep at Kamloops, as early as the beginning of September, had refused to engorge and was finally removed after two weeks. This observation appears to agree with the experience of the Rocky Mountain Laboratory at Hamilton, Montana, where thousands of ticks are reared annually.

In all, eight adults were used on domestic rabbits and man (J. D. G.) during November and December, but although willing to attach or to shift their positions and re-attach, none of them attempted to engorge (or if they attempted it, did not succeed) during the six days that constituted the test period in each case.

The ticks being useless for practical purposes whilst behaving like this, it was suggested by the other of us (W. R.) that if appropriate modification could be induced in the physiological state of the host, the parasite might exhibit a corresponding change of behaviour upon attachment. The scheme of controlled illumination originally used on the *Junco*<sup>1</sup>, resulting in the conversion of a sexually dormant autumn individual into a fully sexed spring bird in a few weeks and evidently conducive to profound changes in physiology and metabolism, suggested an obvious method of treatment which was accordingly adopted.

On December 14 a domestic rabbit was provided with a cage in which illumination could be precisely controlled, and for the week following was restricted to a day of seven hours duration. On the eighth and subsequent days the period of illumination (ordinary electric light bulbs) was increased by ten minutes daily. A month later an adult, unfed tick (which had received no illumination or analogous treatment) was placed on the rabbit. It attached almost immediately and was replete at the end of two weeks. (The normal summer engorging period for *D. andersoni* is nine days.) Two more adults were then simultaneously applied but both, unfortunately, were females. One of these had failed to feed on man at the end of November but now, after two days of indecisive attachments, began to engorge and was replete on the fifteenth day. Eight days after removal it began to lay eggs, inevitably infertile (Fig. 1). The second individual changed positions spasmodically for a week, when engorgement ensued.

Depletion of the stock of adult ticks permitted the use of only one other. This was first placed on an untreated rabbit, on which it remained attached for five days without signs of engorgement. It was then transferred to the illuminated host, caged under an opaque capsule strapped to the skin of the rabbit, with intervening water baths absorbing the heat from the illuminating bulbs. It attached itself permanently on the fourth day, when engorgement commenced.

An additional supply of newly emerged adult ticks was received from Kamloops on February 18. In view of the fact that by this date the days had been lengthening for two months, three were at once placed on an ordinary stock rabbit. Two attached and began engorging on February 19. The third has failed to engorge to date.

The limited material that has been available would, no doubt, make a lengthy discussion of these results premature. The most suggestive points are self-evident. They seem to be sufficiently novel, however, to justify publication at this stage and to warrant repetition and expansion in the future.

WILLIAM ROWAN.  
JOHN D. GREGSON.

University of Alberta,  
Edmonton.  
March 1.

<sup>1</sup> Rowan, W., "Relation of Light to Migration and Developmental Changes", NATURE, 115, 494; 1925.

### The Antihæmorrhagic Vitamin of the Chick OCCURRENCE AND CHEMICAL NATURE

IN earlier papers<sup>1,2</sup> a new deficiency disease in chicks has been described which is characterised by a tendency to large hæmorrhages. It has been ascribed to the lack of a specific antihæmorrhagic factor which is different from vitamin C. More recent work has demonstrated that the factor in question is a fat-soluble vitamin occurring in hog



liver fat, in hemp seed and certain vegetables, such as tomatoes and kale, and—to a less degree—in many cereals. Beef muscle, calf brain and beef lungs desiccated at low temperature are ineffective when they form 20 per cent of the diet, but 20 per cent of dried hog liver will prevent the disease.

The antihæmorrhagic vitamin cannot be identical with A and D, since very large doses of these vitamins in the form of concentrates or fish liver oils are ineffective. Commercial ( $\alpha$ ,  $\beta$ ) carotene or 4–10 per cent of fresh wheat-germ oil do not prevent the disease, but large amounts of wheat-germ oil (24 per cent) afford some protection. 3–4 per cent of hog liver fat will completely suppress the symptoms.

The vitamin occurs in the easily soluble non-sterol fraction of the non-saponifiable matter. In hog liver fat it is not destroyed to any great extent by 12 hours heating as a layer 1–2 mm. deep on a boiling water bath, but it appears that there is some loss during the concentration process. When the petrol-ether solution of the non-saponifiable concentrate is shaken with 90 per cent methyl alcohol, the vitamin remains in the petrol-ether. It resembles in these respects vitamin E. Further concentration by means of chromatographic adsorption and vacuum distillation using a standardisation method of Schönheyder described below is under investigation.

Since hog liver fat is many times as active as wheat-germ oil, it is very unlikely that the antihæmorrhagic vitamin is identical with vitamin E. I therefore suggest the term *vitamin K* for the antihæmorrhagic factor.

It has not been possible to demonstrate the requirement of the antihæmorrhagic vitamin for other animals than chicks, but this point is being investigated further.

H. DAM.

Biochemical Institute,  
University, Copenhagen.  
March 19.

<sup>1</sup> Dam, *NATURE*, **133**, 909; 1934.

<sup>2</sup> Dam and Schönheyder, *Biochem. J.*, **28**, 1355; 1934.

#### MEASUREMENT AND BIOLOGICAL ACTION

IN a recent paper<sup>1</sup> a deficiency disease in chicks was described, the main symptoms of which were a tendency to large hæmorrhages, certain pathological changes in the gizzard and anæmia. The blood of chicks suffering from this disease has a considerably prolonged clotting time, which is undoubtedly connected with these symptoms. McFarlane *et al.*<sup>2</sup> have made the same observation on chicks reared on an insufficient diet.

The clotting time has been determined in the following ways: (1) The brachial vein was opened by a slight cut and 2–3 ml. blood allowed to drop slowly, during  $\frac{1}{2}$ – $\frac{3}{4}$  minute, into a small porcelain bowl. The time from the vein puncture until complete clotting is called clotting time, which for normal chicks is 1–5 minutes, while it may be several hours for the sick animals. In spite of the roughness of the method, it differentiates between sound and sick animals, and the results are in accordance with those obtained by the following more exact method of measuring the clotting time. (2) The carotid artery is dissected free, a cannula is inserted into the lumen of the vessel and by means of a record syringe 2–3 ml. blood is aspirated and then placed in paraffin

coated tubes previously cooled to 0° C. The tubes are centrifuged and the supernatant plasma is removed with pipettes into tubes, corked and stored in an ice box. This plasma will clot only after addition of a clotting agent (embryonic tissue or lung tissue juice).

Normal and sick plasma show an enormous difference in the clotting time under the same conditions and towards the same clotting agent (technique: Albert Fischer<sup>3</sup>). By increasing the concentration of the clotting agent a sick plasma can be made to clot as quickly as the normal. The concentration of the clotting agent which clots the normal plasma in 3 min. is called 10. That multiple of the concentration 10 which is necessary to clot a sick plasma in 3 min. will be a quantitative expression of the morbidity of the animal. The plasma of a sick animal will become perfectly normal in a few days by adding a sufficient amount of vitamin K.

The quantitative determination of vitamin K is based upon the curative method. One unit of vitamin K is the smallest amount which during a certain time can bring a sick animal with a certain degree of morbidity to the normal state with respect to the clotting time.

It is difficult to explain theoretically the prolonged clotting time of the blood from a sick animal since there are no morphological changes in the blood, or changes in the fibrinogen or calcium content. A change of pH is also not the cause. The content of the thrombokinase in the tissue of the sick animals is not reduced, nor is there any increase in the content of antiprotrombin in the plasma. *The investigations have shown, however, that in normal plasma a component is present which accelerates the clotting of the plasma from sick animals, even if the concentration of the normal plasma is very small (a few per cent).*

It is supposed that lack of vitamin K causes a decrease of the clotting accelerating component in the blood. The nature of this component as well as its possible rôle in animal and human pathology is now under investigation.

F. SCHÖNHEYDER.

Biochemical Institute,  
University, Copenhagen.  
March 19.

<sup>1</sup> Dam and Schönheyder, *Biochem. J.*, **28**, 1355; 1934.

<sup>2</sup> McFarlane *et al.*, *Biochem. J.*, **25**, 358; 1931.

<sup>3</sup> Albert Fischer, *Pflügers Archiv*, **225**, 737; 1930.

#### Loss of Velocity of Neutrons in Heavy Water

WE have made some experiments on the Fermi effect produced in silver, when the neutrons are allowed to pass through a layer of heavy water. We used double-walled cylindrical glass vessels which could be filled with ordinary water or heavy water of 98 per cent purity. The neutron source, a tube containing radon mixed with beryllium powder, was placed in the narrow inner tube of this double-walled vessel.

The vessels were of two different sizes: the smaller ones contained 8.8 gm. D<sub>2</sub>O or 8 gm. H<sub>2</sub>O, the difference of radii of the inner and outer cylindrical surfaces of the liquid being 9.5 mm.; the larger vessels contained 26 gm. D<sub>2</sub>O or 23.4 gm. H<sub>2</sub>O, the difference of radii being 15.5 mm. During exposure, a silver receiver was pressed against the outer walls of the vessel surrounding the source, and the activity measured afterwards under standard conditions with



a Geiger counter. With each type of vessel we counted the impulses due to induced activity (*a*) when the vessel was empty, (*b*) when it contained heavy water, (*c*) when it contained ordinary water. The results are shown in the accompanying table; the figures are the total number of counts obtained in thirty experiments for each entry. The ratio of the figures in Column *a* is equal very approximately to the ratio of solid angles subtended in both cases.

Absorbing layer	Empty vessel ( <i>a</i> )	Vessel with heavy water ( <i>b</i> )	Vessel with ordinary water ( <i>c</i> )	<i>b/a</i>	<i>c/a</i>
9.5 mm.	1556	1898	4043	1.22	2.6
15.5 mm.	654	1335	4173	2.04	6.4

We see that the efficiency of neutrons in producing the Fermi effect is considerably increased when the neutrons pass through a comparatively thin layer of heavy water. This increase must be ascribed to the slowing down of neutrons resulting from their collisions with diplons. The effect is smaller in heavy than in ordinary water because in a head-on collision with a dipton the neutron loses only two thirds of its velocity. Calling  $d_1$  and  $h_1$  the coefficients by which the efficiency of neutrons is multiplied when they pass through 9.5 mm. heavy and ordinary water,  $d_2$  and  $h_2$  the corresponding coefficients for the thickness 15.5 mm., we see that  $d_2/d_1^2$  is greater than  $h_2/h_1^2$ . This means that a small increase of the thickness of the scatterer corresponds to a relatively greater increase of the coefficient *d* (heavy water) than of the coefficient *h* (ordinary water). This difference is probably due to the fact that in the case of collisions with diplons the effective scattering takes place mostly in the backward direction, while in the case of collisions with protons the scattering is always in the forward direction. For this reason, in our arrangement multiple scattering must play a more prominent rôle in heavy than in ordinary water.

Experiments on the slowing down of neutrons in compounds of hydrogen were made by Westcott and Bjerger<sup>1</sup>, who were led to the conclusion that the mean free path of the neutron in the scatterer decreases with their velocity and that their efficiency in silver is inversely proportional to the energy. Assuming that the cross sections of diplons and protons for collisions with neutrons are only slightly different, we find that the ideas put forward by Westcott and Bjerger account also in a satisfactory way for our experiments.

We have satisfied ourselves that the effect of heavy water described in this letter is not due to neutrons produced in heavy water by the gamma rays of radium C', because with the small quantity of radon (40 millicuries) at our disposal, no radioactivity could be detected in silver exposed to a tube containing radon but no beryllium and surrounded by 26 gm. heavy water.

H. HERSZFINKIEL.  
J. ROTBLAT.  
M. ŻYW.

Mirosław Kernbaum Radiological Laboratory,  
Warsaw.  
March 18.

<sup>1</sup> C. H. Westcott and T. Bjerger, *Proc. Camb. Phil. Soc.*, **31**, 145; 1935.

<sup>2</sup> T. E. Banks, T. A. Chalmers and F. L. Hopwood, *NATURE*, **135**, 99, Jan. 19, 1935.

### Atmospheric Condensation Nuclei

WE have measured the diffusion coefficients and the rates of fall under gravity in air of atmospheric condensation nuclei. The values obtained for the diffusion coefficients are fairly consistent, the average being about  $D = 18 \times 10^{-6}$  cm.<sup>2</sup>/sec. The well-known relation between mobility in an electric field and diffusion coefficient gives mobility =  $D \times eN/P$ . If *e* is the electronic charge,  $eN/P$  is very nearly 40, and the corresponding mobility is  $7.2 \times 10^{-4}$  cm./sec./volt/cm., which is a probable average value for the mobility of the large atmospheric ion.

The values obtained for the rate of fall show more scatter, but observations made with two apparatus of quite different construction agree in giving a mean value of about  $0.7 \times 10^{-4}$  cm./sec. Comparing the rate of fall under gravity with the mobility, we have  $mg \times 300/e = 0.7/7.2$ . This gives for the mass of the condensation nucleus  $m = 1.6 \times 10^{-16}$  gram. If it be assumed that the nucleus is composed for the greater part of water, the radius corresponding to this mass is  $3.4 \times 10^{-6}$  cm. This is in good agreement with values derived by the application of the Stokes-Cunningham law to mobility data.

Details of the experimental methods employed will be given in a later publication. From results already obtained, it appears that by these methods it will be readily possible to investigate the sizes of condensation nuclei under different conditions. The question of variation in the size of the nuclei has been the subject of much discussion, but no method of making measurements appears to have been hitherto available.

J. J. NOLAN.  
University College,  
Dublin.  
Feb. 16.

V. H. GUERRINI.

### Titration Curve of Vitamin B<sub>1</sub>

THE titration curve technique furnishes a convenient method of studying the constitution of ionisable organic compounds the possibilities of which seem to be insufficiently appreciated by many organic chemists. From one relatively simple operation, information can be obtained as to the combining weight, the number of acid and basic groups in the molecule, and their several dissociation constants. With the aid of the 'formaldehyde curve' method, it is possible to identify which of the various *pK* values in a given complex ampholyte, acid, base or salt relate to amino, carboxyl or hydroxyl, or sulphhydryl groups<sup>1</sup>. These measurements can be done on a very small amount of material, for example, no more than a milligram or so when dealing with a substance of the molecular dimensions of vitamin C<sup>2</sup> or B<sub>1</sub>.

Our first observations on vitamin B<sub>1</sub> were made with a crystalline specimen of the dihydrochloride kindly provided by Prof. B. C. P. Jansen in 1931, and more recently we have examined also specimens of a higher degree of purity obtained in 1934 through the courtesy of Prof. Jansen and of Prof. R. A. Peters. Essentially similar results were obtained on all specimens, whether derived from yeast or from rice polishings. This supports the view that the crystals represent the vitamin itself in a substantially pure state.

The vitamin dihydrochloride at dilutions around *M*/20 in water has a *pH* value of approximately 3.



On titration with alkali, the curve of a group with  $pK$  value of 4.9 is the first to appear. The combining weight of the vitamin dihydrochloride, determined from the amount of alkali taken in the neutralisation curve of this group, is  $330 \pm 3$  per cent. This is in good agreement with 337 for  $C_{12}H_{16}ON_4S \cdot 2HCl^3$ , but does not agree with 355 for  $C_{12}H_{16}ON_4S \cdot 2HCl, H_2O$  or  $C_{12}H_{18}O_2N_4S \cdot 2HCl^4$ , or 357 for  $C_{12}H_{20}O_2N_4S \cdot 2HCl^5$ .

On continuation of the titration with alkali, a further curve is reached with  $pK$  value of about 9. This curve, however, takes approximately twice the alkali titre of the first. Its most striking peculiarity is that equilibrium is only slowly attained. After each separate addition of alkali the  $pH$  undergoes a sharp rise, but then gradually sinks again to a more acid value, equilibrium not being reached until 10–15 minutes. A corresponding slow change in equilibrium to a more alkaline reaction is encountered during subsequent back-titration with hydrochloric acid. These observations point to the presence in the molecule of a distinctive 'pseudo acid' arrangement which is transformed to a labile acid group under the influence of alkali. Such pseudo acids are already known to exist in certain synthetic compounds in the pyrimidine and allied series<sup>6</sup>.

On back titration with hydrochloric acid it is found that the titrable amount of the  $pK9$  group has diminished as a result of the action of the alkali. Even in a titration carried out at room temperature, a loss of 10 per cent or more may occur, depending on the length of time the solution is permitted to remain at the alkaline reaction. This finding suggests that the variations which have been noted in the biological activity of different specimens of vitamin  $B_1$  obtained by different workers may be due (as previously hinted<sup>7</sup>) to a variable degree of inactivation brought about through contact with alkali.

In presence of a solution of 5 per cent formaldehyde the  $pK$  4.9 curve undergoes a slight shift to a more acid reaction. The magnitude of the shift is less than that to be expected for a primary amino group. The labile group at  $pK9$  is not appreciably affected by formaldehyde. This finding is in keeping with the earlier belief that vitamin  $B_1$  activity does not involve presence of an  $NH_2$  group<sup>8</sup> (cf. Williams's formula<sup>9</sup>).

We are able to add that conclusions somewhat similar to the above have been reached by Ogston and Moggridge<sup>10</sup>, who have kindly informed us of their results prior to their publication, and to whom we communicated our earlier findings.

Our detailed results will be published later, and observations are proceeding on the behaviour of certain scission products of the vitamin and of a number of synthetic analogues.

T. W. BIRCH.  
LESLIE J. HARRIS.

Nutritional Laboratory,  
Cambridge.  
April 15.

<sup>1</sup> Harris, Birch and Harris, *Biochem. J.*, **24**, 1080; 1930.

<sup>2</sup> Birch and Harris, *Biochem. J.*, **27**, 595; 1933.

<sup>3</sup> See Windaus et al., *Nachricht. Göttingen*, 342; 1932. Williams, *J. Biol. Chem.*, **57**, 517; 1935. Kinnersley, O'Brien and Peters, *Biochem. J.*, **29**, 701; 1935.

<sup>4</sup> Windaus et al., *Nachricht. Göttingen*, 342; 1932. Jansen, *Rec. trav. chim.*, **52**, 366; 1933.

<sup>5</sup> Van Veen, *Z. Physiol. Chem.*, **208**, 125; 1932.

<sup>6</sup> Quoted by Jansen (private communication). See also Hilbert, *J. Amer. Chem. Soc.*, **54**, 2076; 1932. Bergmann and Johnson, *Ber.*, **66**, 1492; 1933.

<sup>7</sup> Harris, "Ann. Review Biochem.", **2**, 257; 1933.

<sup>8</sup> McCollum and Simmonds, *J. Biol. Chem.*, **33**, 55; 1918. Peters, *Biochem. J.*, **18**, 858; 1924.

<sup>9</sup> Williams, *J. Amer. Chem. Soc.*, **57**, 229; 1935.

<sup>10</sup> Ogston and Moggridge, *Biochem. J.*, **29** (in press).

### Critical Phenomena in the Oxidation and Self-Inflammation of Hydrocarbons

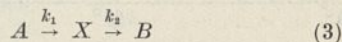
In 1933 Townend and Mandlekar<sup>1,2,3</sup> discovered a new phenomenon in the self-inflammation of mixtures of air and hydrocarbons. They showed that on reaching a certain pressure there was a sharp reduction (100°–200° C.) in the inflammation temperature. Similar effects occur in oxygen mixtures<sup>4,5,3</sup>.

Townend and Mandlekar considered that the data were insufficient for drawing a final conclusion as to the character of the above-mentioned phenomenon, and advanced a tentative hypothesis in which ignition in the higher temperature range was considered to pertain mainly to the thermal decomposition products of intermediate compounds (probably aldehydes); ignition in the lower temperature range would occur when temperature and pressure conditions favoured the survival and further oxidation of these bodies.

An alternative explanation has occurred to us in which, in addition to the direct oxidation  $A \rightarrow B$  (1) with velocity  $w_1$  there is a reaction which proceeds catalytically with a velocity  $w_2$  according to the equation  $A + X \rightarrow B$  (2) where  $X$  is the catalyst. The velocity  $w_1$  of the first reaction depends upon the temperature:

$$w_1 = ae^{-E/RT}.$$

$X$  is an intermediate product of the oxidation and is formed in a reaction differing from the first in that:



The maximum concentration of  $X$  depends on the ratio  $k_1/k_2$  and it is natural to suppose that this ratio, and with it  $[X]_{\max.}$ , decreases, with increase of temperature. As a rough approximation we may assume that

$$w_2 = k [X]_{\max.} e^{-E_1/RT}.$$

It is clear that the reaction velocity  $w_2$  will be very small at both low and high temperatures on account of the smallness of  $e^{-E_1/RT}$  and  $[X]_{\max.}$  respectively in the two cases. However, over a temperature range between these two limits,  $w_2$  may be relatively large.

If the above hypothesis is correct, the velocity of oxidation of the hydrocarbon,  $w = w_1 + w_2$ , should increase rapidly with temperature over a very wide range of pressure, and should then pass through a maximum into a region where there is a negative temperature coefficient. On still further increase of temperature, the velocity  $w$  becomes more and more dependent upon  $w_1$  alone, and should again increase according to Arrhenius's equation.

In order to test the above hypothesis, the velocity of oxidation of pentane in mixtures containing  $C_5H_{12} + 8O_2$  was studied in quartz vessels at various pressures below the ignition limit over a temperature range 300°–500° C.

The velocity is represented by  $1/t_{50\%}$ , where  $t_{50\%}$  is the time in minutes during which the pressure rise reaches half its maximum value. At low temperatures a fairly large period of induction is observed, after which there is a rapid reaction accompanied by chemiluminescence. Up to 337°–345° C., as is evident from the experimental curves given in Fig. 1, the reaction velocity increases rapidly with temperature in all cases up to a sharply defined maximum. In the



temperature interval from 350° to 500° C., the velocity increases very slowly and then, above 500° C., rapidly again, so that for example at  $P=20$  cm. and  $T=562^\circ$  C., explosion takes place after a period of induction of 7 seconds. The shape of the curves is similar at quite different pressures, and it is natural to draw the conclusion that with increase

the numerical values of the quantities, are both completely arbitrary, depending upon the units of measurement which may be selected".

The Stroud system is fully described in a paper which I read to the Educational Section of the British Association at the Liverpool meeting in 1923, published in *Engineering* of September 28 of that year. An example will illustrate its main features. The dynamical equation  $f = ma$  is a definitional equation defining force, and according to Stroud each symbol contains its own units and dimensions; the equation is true in all units if only the units are written down with the numerical values when these are known. For example, a train of mass 100 tons acquires a speed of 60 miles per hour in 5 minutes, what is the average force?  $f = 100 \text{ tons} \times 60 \text{ miles/hour}/5 \text{ min.}$  If the force is wanted in tons weight, one ton wt. =  $1 \text{ ton} \times 32 \text{ ft./sec.}^2$  Whence, dividing one by the other and cancelling dimensions, we get  $f = 11/12 \text{ ton wt.}$

The Stroud system has been applied by him and others to all branches of physics and enables one to treat the science in symbols without reference to units, as I have done in my letter. In electrical science, for example,  $f = ce'/K_0r^2$  is a definitional equation defining electric charge  $e$ , and  $K_0$  is a dimensional constant, which is assumed to depend

solely upon the medium; it covers therefore our ignorance of the mechanism by which the force is transmitted. The charges  $e$  and  $e'$  can be in ampere-hours, coulombs, c.g.s.e.s. or e.m. units, electronic charges or any other units, provided these are written down with their numerical values. The same applies to all other equations, hence it provides a means of discussing problems in the science such as, "the fundamental dimensions of  $\mu_0$  and  $K_0$ ", irrespective of systems of units. It is as easy to work in electrons and 'magnetons' as in c.g.s. or any other units. Hence the natural system of units which Prof. Wilberforce presents does not influence any of my conclusions.

I notice that Prof. Wilberforce heads his letter "Dimensions of Electric and Magnetic Units", whereas mine was headed "Fundamental Dimensions of  $\mu_0$  and  $K_0$  in Electrical Science". I hope that this is the cause of the difference of opinion between us and that now it is clearly stated, he will agree with my deductions.

JAMES B. HENDERSON.

38, Blackheath Park,  
London, S.E.3.  
Feb. 26.

#### Do Whales Descend to Great Depths?

DR. F. D. OMMANNEY, in his letter in *NATURE* of March 16 (p. 429), is of opinion that whales cannot descend with impunity below very moderate depths. In his "Discovery" Report on "The Vascular Networks of the Fin-Whale" he limits their normal dives to about 130 ft. and now, in his letter, to 35 fathoms or 210 ft.

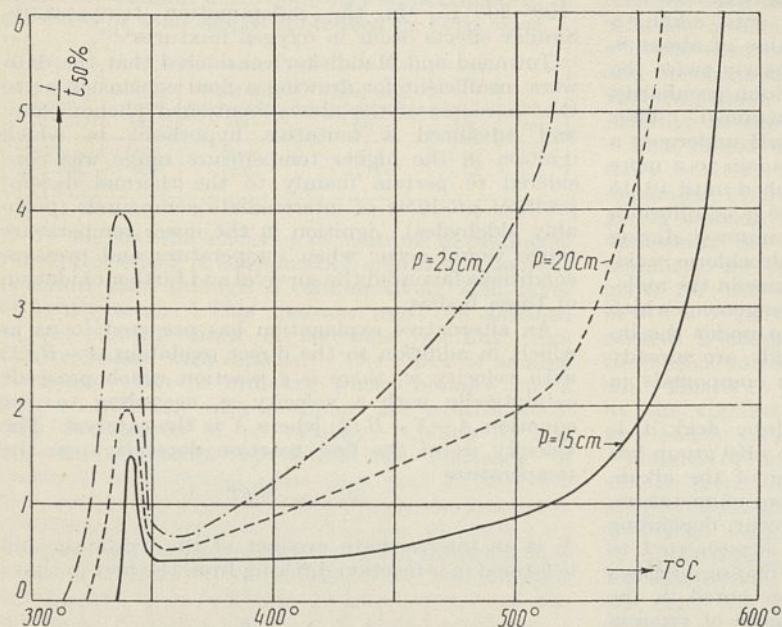


FIG. 1.

of pressure we should observe two regions of thermal ignition—at low (c. 300° C.) and at high (above 500° C.) temperatures. These have in fact been observed for a series of hydrocarbons by Prettre, Dumanois and Laffitte<sup>3</sup> and by Townend and Mandlekar and others.

M. NEUMANN.  
B. AIVAZOV.

Institute of Chemical Physics,  
Leningrad.  
Jan. 7.

<sup>1</sup> D. T. A. Townend and M. R. Mandlekar, *Proc. Roy. Soc., A*, **141**, 484; 1933.

<sup>2</sup> D. T. A. Townend and M. R. Mandlekar, *Proc. Roy. Soc., A*, **143**, 168; 1933.

<sup>3</sup> D. T. A. Townend, L. L. Cohen and M. R. Mandlekar, *Proc. Roy. Soc., A*, **146**, 113; 1934.

<sup>4</sup> M. Neumann and V. Estrovitch, *NATURE*, **133**, 105; 1934.

<sup>5</sup> H. F. Coward, *J. Chem. Soc.*, 1382; 1934.

<sup>6</sup> Prettre, Dumanois and Laffitte, *C.R.*, **191**, 329; 1930.

#### Fundamental Dimensions of Electric and Magnetic Constants $\mu_0$ and $K_0$

THE letter from Prof. Wilberforce in *NATURE* of February 16, criticising my letter in the issue of January 19 on the above subject, shows me clearly that the system introduced into the teaching of dynamics and physics by Prof. Wm. Stroud more than fifty years ago, of allowing all the symbols in equations to contain their own units, is not so well known as I assumed or as it ought to be. This is clearly proved in the introductory paragraph; referring to the dimensions of  $\mu_0$  and  $K_0$  Prof. Wilberforce writes: "... these dimensions, and not merely



Old-time whalers, like Scoresby, experienced in the capture of whales by means of rowing boats and hand harpoons or simple gun harpoons, were of the opinion that Greenland whales and certain other whales, when harpooned and trying to escape, do descend to much greater depths and this, except for a temporary exhaustion, without being any the worse.

As may be gathered from what Scoresby says, the whalers were of this opinion for a number of very good reasons:

(1) The amount of whale-line which had to be coiled into the whale-boats, in different localities, depended on the depth of the water.

(2) In deep water, when a whale 'sounded', or tried to reach the bottom, the amount of whale-line it 'took' or drew out was limited and was obviously in proportion to its size and diving powers.

(3) When the whale was 'sounding' and drawing out the line, the 'fast boat' behaved as if it was going right down: it remained in about the same place.

(4) After an interval, the whale reappeared near where it went down, and was easily harpooned a second time by one of the other boats. Even a whale that had exhausted all the line in the 'fast boat' and was 'loose' or free to escape, came up near where it went down.

(5) In deep water, unless I am mistaken, a whale cannot be captured by means of floats or 'drouges'.

A whale was certainly in an exhausted condition when it first came up after a long and deep dive, but if given time and not quickly attacked a second time, it soon recovered and broke loose, to be caught perhaps at some later date with the old harpoon still buried in its blubber. At the Greenland Sea and Davis Strait fisheries, many whales were lost through negligence on the part of the nearest assisting boat quickly to 'strike' a whale a second time.

In reply to the practical part of Dr. Ommanney's letter, I would say that a long submergence is not necessary to permit a whale even when embarrassed by the harpoon and the whale-line to descend to and return from a depth of a mile. In the case of whales that did not try to escape by 'sounding', the line taken out was not limited or definite in amount. Among ice it was always much more. In 1895 in the Greenland Sea, the *Polar Star* of Dundee lost a whale with 3,000 fathoms of line—all attached to a 'first harpoon'.

R. W. GRAY.

8 Hartley Road,  
Exmouth.  
March 24.

THERE is, I think, no reason why whales should suffer from the troubles which affect divers and caisson workers<sup>1</sup>. There is not enough air in the whale's lungs to produce bubbles of nitrogen in the blood, even if this were mostly absorbed on going down to deep water, and the whale then came to the surface. To produce bubbles on decompression, the whale would have to come up, fill its lungs and then go down until the nitrogen in the lungs was absorbed and repeat this operation, so charging itself with dissolved nitrogen. It is most unlikely to do any such thing.

It has been suggested that the lungs fill with water in the depths, and are emptied of water when the whale spouts. But I have come across observations which showed that the spouting took place in a very few seconds, and therefore emptied only the entry of the breathing passages. It is most unlikely that the whale would have to spend time on the

surface emptying its lungs of water. How far the air in the lungs can be compressed depends on the anatomical arrangements, and it is this which must control the depth to which the whale goes.

LEONARD HILL.

Nicholls Wood,  
Chalfont St. Peter,  
Bucks.

<sup>1</sup> NATURE, 135, 429, March 16, 1934.

#### Diet of Seals

IN a letter in NATURE of March 23 (p. 473), Mr. R. W. Gray says that there seems to be very little scientific evidence beyond that given by Mr. G. A. Steven on this subject, and he objects to the validity of a generalisation on a basis of a study of only three specimens.

In the past five years, I have examined four seals caught in the River Tay and have found the stomachs and intestines to contain the remains of fish. These included immense numbers of flatfish, sprats and some salmon smolts. In addition, there were great numbers of small crustacea, but most of them were forms well known as gill parasites of fish.

Incidentally, tolerance and preservation of seals on the southern coasts of England may have had not a little to do with the disappearance of salmon from rivers in that area.

FRANK GREENSHIELDS.

Natural History Department,  
University College,  
Dundee.  
March 25.

#### Nova Herculis, 1934

THE light curve of this nova continues to be abnormal: after oscillating between 2<sup>m</sup> and 5<sup>m</sup> during the months January to March, the star has faded rapidly during the first half of April to 10<sup>m</sup> on April 14. At the same time, the spectrum has altered, the chief new lines being due to [Fe II], represented by emission maxima displaced to the violet. The two maxima previously present in H, [O I] and Fe II can now be seen only in the hydrogen bands. These have faded along with the continuous spectrum, and on April 15 much the strongest line in the spectrum was [O I] 6300; the spectrum now consists predominantly of the forbidden lines of [Fe II], [N II] and [O I], resembling in many respects that of  $\eta$  Carinae.

F. J. M. STRATTON.  
E. G. WILLIAMS.

Solar Physics Observatory,  
Cambridge University.  
April 16.

#### Word-Association Tests of Trance Personalities

THIS method of investigation<sup>1</sup> has recently been continued and extended with the following results:

1. In a special experiment by Besterman and Gatty, the latter, acting as subject, was tested alternately in two 'poses' or 'orientations of mind' based on different aspects of his own life. No attempt was made to give different reactions to particular pre-selected words; but, in spite of this, *significant differences* were found between the two states, as regards both reaction time and reproduction test.

It follows that such differences are not, as I had



at first supposed, evidence *per se* of the autonomy of the personalities compared.

2. Using the term 'controls' to denote trance personalities specifically associated with the medium, as opposed to 'communicators' which are specifically associated with the individual 'sitter', I find that there is a significant tendency for controls to show, in respect of reaction time, the equivalent of a negative correlation—which I am terming 'countersimilarity'—when compared with other personalities. Thus, of 10 comparisons involving 'Fedá' (Mrs. Leonard's control), 8 give a negative and 2 a positive result; while of 12 comparisons not involving Fedá only 1 is negative and 11 are positive. The chance of this disparity being fortuitous is less than 1 in 2,000.

The same tendency is observable with 'Uvani' (Mrs. Garrett's control) though to a lesser extent corresponding to the smaller quantity and inferior quality of the material available.

This curious phenomenon seems explicable only on the assumption that 'Fedá' and 'Uvani' are true secondary personalities formed round nuclei of repressed material. The fact of repression seems calculated to produce in respect of certain words a longer reaction time for the normal than for the secondary personality, and probably vice versa, thus affording a basis for the inverse relationship observed.

Since the effect is not found in the case of communicators, it would appear that these, if they are to be regarded as modifications of the medium, are of a different type from controls and formed in a different manner. On the assumption that their claim to autonomy is ill-founded, they would seem to be more in the nature of histrionic poses than secondary personalities in the pathological sense.

3. Normal persons, controls, the Gatty poses, and the one 'automatic' state hitherto examined—a total of 10 personalities—agree in showing, subject to very minor qualifications, a significant association of prolongation in reaction time with disturbance in reproduction. This indicates that these diverse kinds of state—whether normal, secondary, 'posed', or of a presumably dissociated character—are at least 'undivided' in the sense that a single source is responsible for both times and reproductions.

This is not true in the case of two out of the three communicators studied. In each of these, one set of reactions is indistinguishable from those of the normal medium—the other, equally well defined, is significantly different. There is accordingly a strong suggestion to the effect that two factors are here at work, of which one, if not extraneous altogether, is derived from some state or level of the medium's mind other than the normal, despite the fact that it is contemporaneously operative with it.

The third communicator shows the association between reaction time and reproduction which indicates an undivided personality; but in this case there is no significant similarity to the normal medium in respect of either component, though only one (reproduction) is significantly different. Probably the minimum straining of the evidence is required by supposing that this personality has achieved in both respects a separateness from the normal medium—of whatever kind this may be—which the other two have achieved in one respect only.

WHATELY CARINGTON.

Rotterdam.

Feb. 23.

<sup>1</sup> NATURE, 134, 187; 1934. *Proc. S.P.R.*, Part 136.

### Alleged Anæsthesia Produced Electrically

MR. F. DE LA C. CHARD, in defending the electric 'stunning' of animals<sup>1</sup>, states that it is "only a matter of time before . . . research confirms the opinions expressed by eminent physiologists in favour of electric anæsthesia for animals". By thus prejudging the issue, Mr. Chard illustrates the very attitude against which my letter was a protest.

Mr. Chard adds some sweeping generalisations. One is that "Animals are very much more susceptible to electric shock than humans". In the systematic researches of such workers as Kouyvenhoven I can find no evidence to justify this statement. He also claims that unhealthy subjects are less susceptible to electric effects than are healthy ones; but Jellinek, a leading authority on electrical accidents, holds the contrary view<sup>2</sup>. He claims also that "In electrical accidents, severe burning has been felt only as a 'stinging sensation'". But in other accidents severe pain has been felt. The results of accidents vary so widely, according to the many variable factors concerned in them, that no such generalisation is worth consideration.

Mr. Chard's reasoning leads him to one conclusion that can be definitely tested by experience and proved to be wrong. He concludes on theoretical grounds that the "A.C. is . . . twice as effective as the intermittent D.C. used by Regensburger". But Regensburger produced exactly the same effects that are got in the slaughterhouse with A.C.; that is to say, when his current was too weak the pigs recovered too quickly and when it was too strong the reactions were too great for commercial requirements. The point that Mr. Chard has overlooked is that the rate of change of the current is an important factor as well as the amplitude.

The real point at issue is that electric 'anæsthesia' has been pronounced genuine on the strength of two tests: (i) absence of response to pain stimuli, and (ii) absence of pupil reflex. Hertz's experiments have proved that these tests are not valid in the case of electric immobilisation, and we are therefore without any means of knowing whether, or at what stage, insensibility supervenes. My letter was a protest against attempts to short-circuit the need for knowledge.

C. W. HUME.

14 The Hawthorns,

London, N.3.

March 17.

<sup>1</sup> NATURE, 135, 343, March 2, 1935.

<sup>2</sup> Quoted in Taylor's "Principles and Practice of Medical Jurisprudence", vol. 1, p. 528; 1934.

### Newton and Spinoza

WITH regard to the new biography of Isaac Newton by Prof. More and to the review in NATURE of January 5 (p. 3), the following considerations may be of interest. Brought up in a family devoted to the Royalist cause, Newton became a staunch Whig. As a fellow of Trinity College he is said to have been influenced by the Platonists, but in spite of this, Newton became a man of science who is far from Henry More's mystical Paracelsic ideas. We must ask how this astonishing development took place, even if we suppose that Newton's genius was essentially responsible for it. I believe that no biographer has yet pointed out the possibility of Spinoza's views having influenced Newton, for this



great Dutch-Jewish philosopher was the only one among the philosophers of the seventeenth century who may be ranked with Newton. Oldenburg, secretary to the Royal Society, visited Spinoza at his residence at Rhynsburg in 1661 and was in correspondence with him from 1661 until 1665 and afterwards, 1675-76, concerning scientific, philosophical and theological problems. It is known that Boyle was interested in Spinoza's view, and it is most probable that Newton too had some knowledge of Spinoza and his works. The "Theological-Political Treatise" (1670) greatly influenced English metaphysicians, for example, Locke. It might have influenced Newton's political and theological views as well.

Of still greater importance is the question of the sources of Newton's scientific work. If his thoughts about space and time were influenced by More, there is already a contact with Spinoza, because Spinoza may also have been influenced by More (see Prof. L. Roth's "Spinoza", p. 70, Ernest Benn, Ltd., 1929). But there is a great difference between the mysticism of the Platonists and the definiteness of Spinoza and Newton. In their conception God is not hidden in Nature, for they sought to find Him there; the universe is for them rational. We find in Newton's

thoughts the same monistic and deterministic characteristic traits as in Spinoza's. For both, philosophy and science are impersonal statements of impersonal truth. The geometrical demonstration of Spinoza's "Ethics" (1677) is an expression of this impersonality, and I suspect that the deductive form of the "Principia" (1687) is derived rather from the "Ethics" than from Euclid. In the "Principia", and also in the "Queries" of the "Optics", there are passages which seem to express pantheistic ideas. Certainly there are other passages which may express an opposite point of view, but it is well known how great the prejudices of the time were and that Spinozism was regarded like atheism, and was therefore persecuted.

Prof. More has studied all the documents regarding to Newton, and as he does not say anything about Newton's connexion with Spinoza, there seems to exist no written proof. We may suppose that Newton himself would have destroyed all documents or that his first editors tried to efface all evidence of a damaging relationship.

OTTO BLÜH.

German University,  
Prague.  
Feb. 24.

### Points from Foregoing Letters

PROF. W. ROWAN and Mr. J. Gregson report that the disease-carrying tick, *Dermacentor andersoni*, which hitherto refused to feed upon rabbits during winter, was induced to do so when the host was 'modified' by previous gradually increased illumination.

Chicks fed upon a special diet developed a deficiency disease leading to changes in the gizzard, and to anaemia and hæmorrhage. The disease was cured by foodstuffs like hog liver fat, hemp seed and certain vegetables. Mr. H. Dam considers that these contain an essential new vitamin K. This cannot be identical with the already known vitamins A and B, since fish-oils, which contain both these vitamins, do not cure the disease. Mr. F. Schönheyder describes the tests used in determining the change in the clotting time of the blood of plasma of diseased chicks. These tests serve to estimate the quantity of vitamin K present.

The ability of neutrons to render silver radioactive has been shown by Messrs. Herszfinkiel, Rotblat and Żyw to be increased by passing them through heavy water, though to a less extent than by passage through ordinary water (Fermi effect). A small increase in the thickness of the heavy water layer leads proportionately to a greater activity than in the case of ordinary water, and this is attributed to the fact that neutron-scattering takes place backwards in heavy water and forward in ordinary water.

Although the anti-beriberi vitamin B<sub>1</sub> was the first vitamin to be discovered, its chemical composition and structure are still uncertain. Drs. T. W. Birch and Leslie J. Harris, from the change in the intensity of acidity-alkalinity (pH) upon addition of alkali to a solution of the purified vitamin, calculate its molecular weight to be about 330. This agrees fairly well with the formula C<sub>12</sub>H<sub>18</sub>O<sub>2</sub>N<sub>4</sub>S.2HCl. They also find evidence for the presence of an atomic arrangement that changes under the influence of alkali, and may be responsible for the variations in biological activity observed by different investigators.

The velocity of oxidation and self-inflammation of hydrocarbons is of great importance in connexion with the combustion engine. Prof. M. Neumann and Mr. B. Aivazov have determined the velocity of oxidation of mixtures of pentane and oxygen in order to test the hypothesis that the sudden increase in this constant, which occurs at a certain temperature and pressure, is due to an intermediary catalytical reaction. They find, in accordance with expectations, a maximum velocity at 340° C.

Sir James Henderson, replying to Prof. Wilberforce's criticism of his treatment of the dimensions of  $\mu_0$  and  $K_0$  in electromagnetic theory, contends that these dimensions are not arbitrary, and that this follows from Stroud's system wherein every symbol occurring in a physical equation contains its own units.

In answer to Dr. Ommanney's objection, Mr. R. W. Gray recapitulates Scoresby's observations which have led him to infer that whales can descend to great depths, 700-800 fathoms (not 2,500 fathoms as stated in NATURE of March 16, p. 429). Sir Leonard Hill expresses the opinion that whales need not suffer from caisson disease after deep diving as there is not enough air in their lungs to produce bubbles of nitrogen in the blood when the animals come back to the surface.

Mr. Whately Carington, having carried out, with normal and 'psychic' persons, further word-association tests (time taken to respond to a list of words and type of response) finds that the 'significant differences' which he had previously found between medium and control, are also shown by other people in different 'orientations of mind'. He finds now a negative correlation between the time-reaction to certain words which the medium gives in normal and in the 'trance' state. From this he deduces that 'controls' which speak through the mediums are secondary personalities formed round nuclei of repressed material.



## Research Items

**Stone Structures in the Western Transvaal.** A number of stone structures ascribed to "the ancients" have been investigated by Dr. Ir. E. C. N. van Hoepen and Dr. A. C. Hoffman (*Archeologische Navorsing van die Nasionale Museum*, Bloemfontein, Dl. 2, St. 1). These structures are situated at Buispoort, 24 miles north-west of Zeerust, and consist of stone walls which have served for huts, enclosures around huts and for cattle. There are also walls which served as storage platforms for grain-bins, semi-circular to nearly completely circular stone-rings surrounding threshing-floors, small structures for storing grinding stones, furnaces for smelting iron ore, heaps of slag, ash-heaps and remarkable graves. On the evidence of both Campbell and Moffat, and taking into account the reputation of the Bahurutsi for iron-working, it is concluded that these structures are the work of the ancient Bahurutsi, especially as skulls found here are similar to recent Bahurutsi skulls from Braklaagte. These structures corroborate and substantiate for the first time the fact that the Bantu did build with stone. This has an important bearing on the problem of the Zimbabwe culture. The graves found were all covered-in fissures between rocks. Many bones show signs of burning, which may be due to their burial after a Matabili raid in which the houses with their occupants were burned. A number of furnaces, without doubt for the production of iron, have been found. Potsherds and two or three broken pots were found. The material is coarse; and it contains foreign matter which does not improve the clay. It was probably introduced without clear understanding of its operation in firing. Three or four definitely globular pots were found. These are rare among the modern Bahurutsi. Pots with three legs had reached a culminating point, the legs being of enormous size. A pot with a gradually thinning lip may have been introduced by strangers.

**The Manatees.** Not since Hartlaub's paper of 1886 has an attempt been made to monograph the manatees (genus *Trichechus*), and Robert T. Hatt's contribution on the group in the "Scientific Results of the Congo Expedition" establishes a few hitherto unrecognised characters for the distinction of the crania of the different forms, corrects certain erroneous conclusions come to by Hartlaub, and records for the first time specific features of the post-cranial skeleton (*Bull. Amer. Mus. Nat. Hist.*, 66, 533; 1934). While admitting only three living species of manatees, one African and two American, the author considers it probable that geographic extremes of these species are racially distinct. But the Congo specimens showed no character that could distinguish them from the better known forms from Senegal. The African species (*T. senegalensis*) is more closely related to the West Indian species (*T. manatus*) than to the South American *T. inunguis*, so that there seems to be a stronger linkage in this case between the distant African and West Indian species than between the neighbouring American species.

**Bacterial Decomposition and Synthesis of Cellulose.** Mme. Y. Khouvine, who has been responsible for much work on the decomposition of cellulose, has recently reviewed briefly the present position in this field (*Actualités scientifiques et industrielles*, 164.

"Exposés de chimie biologique." (2) "Cellulose et Bactéries." Paris: Hermann et Cie). In it she deals in turn with the chief aerobic, anaerobic and thermophilic bacteria that have been described as cellulose decomposers. As in many other publications, the organism *Spirochaeta cytophaga*, first isolated by Hutchinson and Clayton in 1918, and known now as *Cytophaga Hutchinsoni*, is named as being the most numerous and active cellulose-decomposing organism in the soil, though, in point of fact, it has never been conclusively shown to be active in attacking the cellulose of plant residues. It is a little unfortunate too that fungi are not dealt with as well as bacteria when considering cellulose-decomposition, for there is no doubt that under aerobic conditions the former group is of great importance. The last part of the present useful little work is devoted to the consideration of the synthetic activities of *Acetobacter xylinum*, which when growing on sugar alcohols such as mannitol or sorbitol, produces acid, and on the surface a membrane now shown by Hibbert to be true cellulose. The crystallites are not oriented as in a fibre, but by tension may be partially aligned so that an X-ray diagram is obtainable not very dissimilar from that of cotton. Details of the culture of this organism are given, and its fermentative reactions considered.

**Chromosome Homologies in *Drosophila*.** *Drosophila melanogaster* has four pairs of chromosomes while *D. pseudo-obscura* has five pairs. In the latter species, five linkage groups of genes have been found, and a further study of this species (Crew and Lamy, *J. Genet.*, 30, No. 1) indicates that snapt and tilt (wing characters) and sepia (eye colour) are located in the left arm of the X-chromosome, which corresponds in part with the right arm of chromosome III in *D. melanogaster*. On the right arm of the X are located eosin and cuprous. The rod-shaped chromosome III of *D. pseudo-obscura*, which contains the dominant stubble and the recessive glass (eye), is found to be homologous with a considerable portion of the left arm of chromosome III in *D. melanogaster*. The mutations short and jaunty in the fourth linkage group of *pseudo-obscura* (a small rod-shaped autosome) may be homologous with part of the right arm of chromosome II in *melanogaster*. Thus it appears that there has been a considerable rearrangement of the chromatin material since these species diverged from a common ancestor. The authors also discuss the nature of the action of the genes for eye colour, based on observations of colour changes during ontogeny and on the colour effects produced on eye and testis sheath by various gene combinations. They conclude that these genes are not directly concerned in pigment production, but act on the mechanism which is responsible for production and deposition of pigment, the colour of the pigment being determined by the chemical conditions at the stage of development when the pigment is formed.

**Malayan Orchids.** A paper on "Some Malayan Orchids" appears in the *Gardens' Bulletin* of the Straits Settlements (8, Part 2, Jan. 26, 1935). It is by Mr. C. E. Carr, and describes the orchids collected by the Oxford University Expedition to Sarawak in 1932. The plants were obtained from



the neighbourhood of Mount Dulit, at altitudes varying from near sea-level to 1,400 metres. 132 species were collected, and 32 are now described for the first time. Descriptions of the species are very complete, and lengthy diagnoses of new species appear in Latin and English. A perusal of the descriptions suggests that many kinds will, in the future, add even greater beauty to our already beautiful English orchid houses. An attempt is made to describe the perfume of several species, and both the systematic botanist and the gardener will find a great deal of interest in the paper. Members of the genera *Bulbophyllum*, *Coelogyne*, *Dendrobium*, *Dendrochilum* and *Eria* predominate in the list.

**Entomogenous Fungi.** Mr. T. Petch has recently published further "Notes on Entomogenous Fungi" (*Trans. Brit. Mycol. Soc.*, 19, Part 3, 161-194, Feb. 1935). Having already described seventy-five species of fungi which attack insects, Mr. Petch continues with No. 76, and his present paper finishes with No. 100, but a very useful review of the entomogenous species of the genus *Cladosporium*, and the description of eight new species of fungi relieve its abruptness and make it complete in itself. Eight species of *Cordyceps* are described critically, whilst fungi of this genus which attack orthopterous insects receive special mention. The new species are *Blastotrichum aranearum*, on spiders, *Hirsutella radiata*, *H. formicarum*, on ants, *Verticillium fuliginosum*, *Sporotrichum columnare*, *Metarrhizum brunneum*, *Patellina epimyces* and *Stereocrea coccophila*. Most of the fungi are foreign to Great Britain, and many have been collected from Crete.

**Baluchistan Earthquakes of 1931.** The recently issued part of the Memoirs of the Geological Survey of India (67, 1-82; 1934) contains an interesting study by Mr. W. D. West on the destructive Baluchistan earthquakes of August 25 and 27, 1931. The district is one that is frequently visited by earthquakes, the most important predecessors being those of December 20, 1892, and October 31, 1909. Of the two recent earthquakes, the earlier and less intense, known as the Sharigh earthquake, occurred at about 3.5 a.m., I.S.T. (August 24, 9.35 p.m., G.M.T.). The epicentre was close to Sharigh and its focus was clearly shallow, for, though the intensity was 8 (Rossi-Forel scale) in the epicentral area, it faded away rapidly, so that the total area disturbed was only about 31,000 sq. miles. The second, or Mach, earthquake occurred on August 27 at about 8.57½ p.m., I.S.T. The epicentral tract was a long, narrow, curved band, following closely the strike of the rocks for about 100 miles in a general southerly direction from Mach. Within this band, the shock reached the intensity 10, and caused much destruction to buildings. The disturbed area covered a large part of Baluchistan and Sind and contained about 370,000 sq. miles, or about the same as that of the Californian earthquake of 1906. The epicentres of both earthquakes were closely related to the re-entrant angle in the eastern boundary of the Baluchistan Hills, that of the Sharigh earthquake being on the northern side, and that of the Mach earthquake running parallel to the south-western side, of this angle.

**Use of Drilling Mud in Burma Oilfield.** The search for new and deeper sources of oil in the fields of India and Burma has during recent years been complicated by heaving or caving shales and high-pressure water

issues. Laboratory experiments and field experience have shown that the former difficulty can be surmounted by selection of a drilling fluid from which there settles out, when mixed, a minimum of free water. Also, to discourage penetration of formation water into the hole, the fluid must either be sufficiently heavy in itself to overbalance formation water pressure, or, failing this, it must be loaded with barytes, iron oxide, etc. High-pressure water issues, whether associated with heaving and caving or not, can be combatted only by application of sufficient pressure to counteract formation water pressure; this is done by the use of a loaded drilling fluid and back pressure supplied by the drilling equipment. Mr. A. W. G. Bleek, in his paper "Some Experiences in the use of Drilling-Fluids in the Yenangyaung Oilfield, Upper Burma" (*Trans. Min. Geol. Inst. India*, 39, 3, December 1934), after an exposition of these difficulties, proceeds to record personal observations made during the deepening of a well in the southern extremity of the Yenangyaung Field, Burma. All previous attempts at deep drilling in the neighbourhood had failed, and records showed that, in the case of the present well, heaving and caving must be anticipated; also water lying between 4,800 ft. and 4,900 ft. was believed to be high-pressure water. Actually no high-pressure water issues were encountered and the problem was, therefore, confined to prevention of heaving and caving and exclusion of formation water. Back-pressure drilling equipment was not called into operation though it was ready on site, and the successful deepening of this well is attributed to the use of a mud fluid which, while preventing heaving and caving, was possibly also responsible for the absence of high-pressure water issues, which are frequently attributed to poor quality fluid and consequent encouragement of flowing shales.

**Ozone in the Atmosphere.** A. R. Meetham and G. M. B. Dobson (*Proc. Roy. Soc.*, A, March 15) have investigated the vertical distribution of atmospheric ozone in a high latitude (Tromsø, lat. 69° 40' N.). The method used involves the measurement of zenith sky light at two wave-lengths for various zenith distances of the sun, and it has already been applied in Switzerland, yielding results which were confirmed by Regener's sounding balloon measurements. The height of the centre of gravity of the ozone is nearly the same at Tromsø and at Arosa, but the distribution is rather markedly different. At Tromsø the ozone is more concentrated in a region about 21 km. high, while in Switzerland it is more uniformly distributed through the lower 30 km.

**A New Form of Cloud Chamber.** C. T. R. Wilson and J. G. Wilson (*Proc. Roy. Soc.*, A, Feb. 15) describe a new type of cloud chamber which possesses very interesting features and may be further developed. In this chamber the flow of air when the expansion takes place is radial, the air leaving the chamber by slits left between flat rings of slate which are piled to form the walls of the chamber. The corresponding distortion of the tracks is a uniform two-dimensional magnification. Both back and front of the vertical chamber are of glass, and the illumination is supplied through the back, the light being stopped out of the camera as in microscope dark-ground illumination. Since the tracks scatter much light through small angles, the illuminating arrangement is very efficient. Another important innovation consists in allowing



the chamber and its auxiliary gear to fall freely under gravity, it being released as the expansion takes place. It is claimed that the chamber may thus be removed from a confined space, for example, the pole-gap of a magnet, before the photograph is taken. Since gravitational forces do not affect the contents of the chamber, convection currents are prevented and the tracks retain their form for a long time. This may prove an important advantage for some types of work.

**Isotopic Water in the Sea.** The densities of samples of water from different oceans have been found by H. E. Wirth, T. G. Thompson and C. L. Utterback (*J. Amer. Chem. Soc.*, 57, 400; 1935) to be very uniform for the Mediterranean, Red Sea and Indian Ocean, with one exception of water obtained at 4,000 metres in the Indian Ocean, which gave the highest values ever found. No surface specimen from this locality was available. Low values were found for samples from the Antarctic, North Pacific and Bering Sea. One result of the investigations was that regions of high dissolved oxygen content are those of low density, and conversely. Waters from the Baltic showed low density differences from ordinary distilled water, which are attributed to dilution by land drainage, and a region of the San Juan Archipelago noted for its abundant fauna and flora yielded waters of low density differences. The paper describes an apparatus for measuring small differences of density of the order of  $10^{-8}$ , depending on the communicating tube method; the liquid heights were altered by means of metal plungers and an oscillation circuit was used.

**Element 93.** The experiments on the bombardment of uranium with neutrons led Fermi to conclude that elements with an atomic number above 92 are formed (*NATURE*, 133, 898; 1934). It was assumed that the product, with a period of 13 minutes, which is precipitated from a highly oxidising and acid solution along with manganese, is the highest homologue of the latter, or element 93. A. V. Grosse and M. S. Agruss, however, had expected other properties for this element, and they now describe (*J. Amer. Chem. Soc.*, 57, 438; 1935. See also *NATURE*, 134, 773; 1934) some experiments in which protactinium, the longest-lived isotope of element 91, was used as an indicator in experiments similar to Fermi's. Manganese dioxide and rhenium sulphide were precipitated from uranyl nitrate and protactinium solutions. The behaviour of element 91 and the reported behaviour of element 93 were found to be identical within the limits of experimental error. The authors, however, report that Fermi has tested whether the artificial radioelement is precipitated with zirconium phosphate, the coprecipitation being a very clear and definite reaction for element 91, and has found that the active products are not precipitated, which speaks against identity with element 91.

**Properties of the Telephone Transmitter.** The design of early types of telephone transmitter was almost entirely empirical. In the commercial form, the electrical resistance of a small column of specially prepared carbon granules is made to vary by the sound waves which it is desired to transmit. In appearance the carbon granules are like granite chips, and the column consists of a series of sharp corners and edges in contact with more or less plane surfaces.

In the Engineering Supplement to the *Siemens Magazine* of March, it is stated that the Company, seeing that the limit of progress on purely empirical lines was practically reached, decided to attack the problem experimentally and theoretically, and appointed Mr. G. W. Sutton to analyse the working of the 'Neophone transmitter' and to measure its mechanical and electrical properties if possible. He describes in this supplement a new method of measuring these properties, and attempts to make a complete analysis of the 'Neophone' transmitter, which incorporates some of the latest developments. The influx into the industry all over the world of a younger generation of engineers trained in the modern technique of acoustics and of audio-frequency engineering has enabled research work on a larger and more effective scale to be done. The introduction of new raw materials and of improved factory processes has also helped. The author has collected many experimental data which will be found useful. Considering that the time permitted for the research was somewhat limited, the agreement between the calculated curve and the observed frequency characteristic is very good. The demand for an improved quality of speech in telephone transmission probably arises from the education of the faculty of discrimination of the public by the gramophone and by broadcasting.

**Current Measurement at Radio Frequencies.** At a meeting of the Meter and Instrument Section of the Institution of Electrical Engineers on April 5, Dr. H. E. M. Barlow read a paper entitled "A Valve Ammeter for the Measurement of small alternating Currents of Radio Frequency". This paper comprised a description of an alternating current milliammeter having four ranges, 5, 10, 20 and 30 milliamperes, and suitable for measurements at frequencies from 25 cycles to  $5 \times 10^6$  cycles per second. The instrument makes use of a two-electrode thermionic valve, with its direct-current supplies arranged to give the saturation current in the anode circuit. Under these conditions, if the temperature of the filament is raised by a small amount, a rapid increase takes place in the saturation current. Thus if an alternating current is superimposed on the direct current through the filament, the increase in the anode current provides a measure of the alternating current. In the first arrangement of the instrument described in the paper, suitable filter circuits are included to restrict the alternating and direct currents to their appropriate paths. A simple resistance-bridge arrangement is connected in the anode circuit, by means of which the steady current through the galvanometer is balanced out. On the application of alternating current the balance of the bridge is upset, and the deflection of the galvanometer indicates the value of the current to be measured. An alternative arrangement of the instrument employs a second valve so connected in the circuit that any drift of the galvanometer zero, due to variation of filament battery voltage, is avoided. Among the advantages claimed for the instrument are that it is sensitive and quick in response, that several ranges can easily be incorporated in one instrument, and that it has a high overload capacity. A typical calibration curve for an instrument having a range of 5 milliamperes is included in the paper, and shows that the accuracy of indication is within 0.5 per cent from 25 cycles per second up to nearly 5 megacycles per second.



## Fruit Soil Survey

THE county of Kent, along with its neighbours Surrey and Sussex, became classical ground for the scientific survey of soils after the publication of "A Report on the Agriculture and Soils of Kent, Surrey and Sussex" by Sir Daniel Hall and Sir John Russell. Now, more than thirty years after that auspicious pioneer work, a "Survey of the Fruit-growing Areas on the Lower Greensand in Kent" has been published by the Ministry of Agriculture and Fisheries (Bulletin No. 80. Pp. 81. H.M. Stationery Office, 1934. 3s. net). The Survey reports extensive work by Messrs. W. A. Bane, of East Malling Research Station, and G. H. Gethin Jones, of the South Eastern Agricultural College, Wye, and collects the results of a large number of observations.

It is only by the application of intensive methods of soil survey to small areas that they can be made of use to the practical grower. This has been done in the survey under review, and as a result, twenty-six types of soil have been recognised. Of these, only about six are regarded as naturally good for the growth of fruit, though others are classified as average or fairly good. Good soils cover extensive areas. Estimation of the suitability of particular soils for the needs of a particular crop is not easy; but the survey under review takes into account such factors as soil water, drainage and the less tangible effects of such features as management.

The solid geology of the district is illustrated by a coloured map inserted in the Bulletin, and by a very useful diagrammatic section, in addition to descriptions in the text. Methods of soil classification are based upon the American method of field examination. Soils which have the same geological origin, similar water relations and profile, and analogous topographical position are placed in the same series. Each series is subdivided into types according to the texture of the surface soil, and each type may have

one or more 'phases', according to variation in such features as depth or drainage.

Several valuable conclusions emerge from the report. The area of Kent covered by the Lower Greensand is undoubtedly very suitable for the growth of tree and bush fruit. Water conditions of soils in this area seem to determine their suitability for fruit growing, rather than physical nature of the particles. The question of draining is dealt with in an interesting manner, and it is shown that two soil series known as the Malherbe and Cox Heath are both troubled by excess of water in winter. The Malherbe series can be improved, by draining, for a certain type of fruit growing, whilst it is "doubtful whether the cost of such work would be repaid on the Cox Heath series". Heavier soils derived from the Folkestone sand strata can be used for fruit growing, if careful manuring, particularly with potash, is performed. Lighter soils from the same strata cannot be improved profitably.

Soil survey has been correlated carefully with the use of such special practices as ringing, and studies of varying root systems in different soils and on different rootstocks open up interesting possibilities for future work. The survey of existing fruit plantations reveals the fact that a large proportion contain apple trees which are unsuited to modern needs, are grafted upon rootstocks unsuited to the type of crop desired, and are not spaced to the best advantage.

There can be no better advocate of improved cultivation than the presence of East Malling Research Station in the area under survey. Results from this Station are of the highest practical value, and indicate, among other things, that fruit of dessert quality might be grown more extensively in the area, rather than that of culinary grade as at present. The Survey is already welcomed by the more progressive trade organisations as a valuable contribution to the age-old industry of fruit-growing.

## Pygmies of Central Africa

THE difficulty of placing the pygmies of Central Africa in such a position in a scheme of ethnological classification as will be generally accepted as convincing is well known. To a certain extent this is due to the lack of adequate detailed information bearing on their physical characters; but in part it also arises from the fact that such material as has been available did not readily admit of comparative study of variation among the pygmies themselves. This applied especially to the question of the degree to which they were related to, or showed evidence of admixture with, the peoples of greater stature, the negroes, among whom they had their habitat.

It was, therefore, welcome news to anthropologists that Paul Schebesta, who had made a study of the pygmies of the East, and more especially of the Semang of the Malay Peninsula, was undertaking an expedition to the Congo for the purpose of studying and measuring the African pygmies.

P. Schebesta's expedition was in the field in 1929-30. It was made possible by the generous assistance of the Charles University, Prague, the Comenius University, Bratislava, and a contribution was

received from the Dr. Aleš and Mrs. Marie Hrdlička Fund. The material collected has been analysed by Prof. Victor Lebzelter, who had dealt similarly with the Semang material collected by P. Schebesta, and the combined report has been published by the Czech Academy of Sciences and Arts\*, the tables of original measurements being included and an English translation appended.

In the first section of the report, P. Schebesta deals with the demography and morphology of the pygmies, the anthropological analysis by Prof. Lebzelter forming the second part. The peoples or groups who came under observation fall into two categories—the pure pygmies of the Ituri Forest region, who are distinguished by special somatic features, and the pygmiforms—a term here preferred by the authors to 'pygmoid', as this latter term is generally used to include peoples who approach the

\*Česká Akademie Věd a Umění (Académie Tchèque des Sciences et des Arts). Třída (Class) 2: Anthropologica. Anthropologie Středo afrických Pygmejů v. Belgickém Kongu (Anthropology of the Central African Pygmies in the Belgian Congo). Napsali P. Šebesta a V. Lebzelter. Pp. 143+66 plates. (Prague: Česka Akademie Věd a Umění, 1933.)



pygmies in their small growth only. The pygmiforms, while presenting racial features of the pygmies which are absent in the pygmoids, differ from the standard pygmaean type without being negroes. Some of the pygmiforms approach the standard pygmy closely, others differ widely. The pygmiforms, or mixed types, are already to be discerned on the periphery of the Ituri region, especially on its northern border. The pygmiforms who came under the observation of the expedition were Batwa in Ruanda, the Baéwa, or Batebo, of the Province de l'Équateur north of Lake Leopold II, and sedentary or village Basúa, so-called, who live in four villages within the Ituri limits.

The Bambuti, the pygmies proper, of the Ituri are not divided into tribes; but for linguistic reasons, they fall into three groups on the basis of the negro languages they have adopted. These groups are the Aká, the Basúa and the Efé. The Bambuti number in all about 25,000, distributed over an area of 123,000 sq. km. They are by no means on the decrease, though owing to the strenuous condition of nomadic life, infant mortality is high. It would seem that the conditions of life are such that an approximate stability of population has prevailed for some considerable time. The state of health of adults is excellent; and grey-headed men and women are not rare.

Though there is no race which at first inspection presents so many strange features as the Bambuti, there is no sign that they are a product of degeneration. Though the body is remarkably short and clumsy, it is not stunted. The average height for men is 146 cm. and for women 133.5 cm. The shortest woman measured was 118 cm. She was the mother of six children. Pygmy men of more than 150 cm. are very rare.

The heavy and clumsy appearance in build of the pygmy is due to the relative proportions of the body. The head is disproportionately large, the neck short and the trunk disproportionately long. Steatopygia is not marked. The legs are short and thin and to a superficial observer suggest rachitis. The gait is heavy and clumsy, but in running swift and light-footed. The knee shows marked projection of the patella. The complexion in the more pure Bambuti is a greyish yellow. The darker complexion, which is sometimes found, is probably due to negro admixture.

The conformation of the face is unique and in itself is sufficient to distinguish the pygmy from all other races. Two types are recognised. Of these one is long with a sudden narrowing of the lower part below the zygomatic arches, so that it ends in a pointed chin; the other is a round-faced type, in which the cheek bones are less prominent and, probably, there is less prognathism. The round projecting conformation of the forehead is striking. It is especially noticeable, because there is almost no root to the nose. The nose itself is very characteristic. It is button shaped, and always broader than it is long. It is a highly specialised form, for the study of which it was found necessary to devise a new technique. The mouth is large and the lips thin. Owing to the weakly developed receding character of the chin, the mouth has a markedly snoutlike appearance.

The hair is either frizzled or spiral. The latter is only half as frequent as the frizzled; but reliable data cannot be given as the Bambuti are mostly shorn. There is a strong growth of face and body hair; but the growth of lanugo was observed rarely only, and then in women and only on arms and legs.

There is very great variation in the details of the ear, and five types are distinguished. It presents a general resemblance to negro or even European ears; but it differs fundamentally from the Bushman ear notwithstanding resemblance in certain features.

There is evidence throughout the analysis of the anatomical data that in certain characters the pygmy is a highly specialised type. Prof. Lebzelter, in summing up his conclusions on the ethnological characters of the pygmies, distinguishes six types: Pygmy Types I, II, and III; the Europoid Types; and Negro Types I and II. Of the pygmy types, I and II are dolichocephalic and sub-dolichocephalic respectively, while III is brachycephalic with thinner lips and low face. The Europoid Type is taller, with narrower face, narrow nose and thin lips; while Negro I is taller, with long skull, broad nose and thick lips and Negro II is brachycephalic, but otherwise has similar features.

The distribution of these types shows that there are considerable differences within each tribe. In the main, the Bambuti are of one race, with the addition of a small percentage of negroid and European elements.

## Research and the Library

By DR. J. L. BERRY, Lecturer in Physiology, and DR. WILFRID BONSER, Librarian,  
University of Birmingham

THE enormous output of research to-day which finds its way into scientific and medical periodicals has produced a problem both for the research worker and the librarian. The former finds it impossible to read everything now being published, and the latter finds the cost growing more and more prohibitive quite apart from the amount of shelf room required each year for housing.

The recent campaign conducted in the United States and England against the exorbitant cost of German scientific and medical periodicals has resulted not only in a reduction in prices, but also in a reduction in bulk of the publications themselves. There has long been a well-founded complaint against the unnecessary amount of matter published, for the usual practice was to include in each article not only the original contribution to research but also a

lengthy résumé of the whole subject, which was, or at least should have been, already known to readers. The price reduction has been secured by the beneficial excision of this superfluous matter.

From our point of view, further reforms are necessary, and we put forward the following as conducive to clarity, economy of cost, bulk, and library storage room.

1. It has long been the practice of chemical journals to accept only new matter, and this cut down to the briefest account. This principle can be adopted with advantage in other scientific subjects. The modern tendency of the young research worker to be judged upon the number of his papers rather than their quality swells the amount of printed matter. Ruthless editing of immature work and refusal of partial results of a research would lead to



the increased reputation of the worker which would be acquired by one complete and authoritative paper. Most journals do not make full use of their competent editorial boards, who must co-operate with the contributor and the publisher to attain this desirable objective.

2. Much space is occupied by a long list of references to previous authors, and many of these can be eliminated by a single reference to what we term a 'key paper'. Where a good paper on the subject with a full historical bibliography has already been published (for example, in *Physiological Reviews*, or a monograph) this could be quoted in lieu of repetition, papers subsequent to this only being cited. Such 'key references', in these days of specialisation within subjects, inflict no hardship upon the interested reader and would avoid the full list of references being given every time.

The 'key reference' would reduce the long preamble setting forth the reasons for undertaking the particular line of research, and would yield a concise statement of method and results.

Failing a ready-made 'key paper', the complete and authoritative paper previously mentioned would thereupon automatically become the 'key paper' on that particular subject.

3. Abstracting journals are published mainly in English and in German, and it cannot be claimed that both are essential. Where a full abstracting service is available in one language (for example, in the *Ber. ges. Physiol.*) this should adequately cover the field and absorb or replace all others. It is no longer a valid excuse that German is not known by English-speaking workers, as a working knowledge of both languages is part of a scientist's equipment.

If a full abstracting service does not exist for a subject, we recommend the excellent system adopted by the Royal Microscopical Society, which publishes, as an appendix to each part of its journal, abstracts from articles appearing in other journals on cognate subjects. If this practice were made a general one, a saving in bulk and binding would accrue. For example, the Physiological Society by printing its abstracts in the *Journal of Physiology* might (although slightly enlarging the size of the journal) eliminate its second periodical, *Physiological Abstracts*. If the Society did not adopt this procedure, which we term 'telescoping', it might save space by excluding all abstracts from articles in its own *Journal of Physiology*.

4. 'Telescoping' could usefully be employed in removing redundant publications. The *American Journal of Physiology* could coalesce with the *Journal of General Physiology*, the gain being the heightened standard of the articles.

Some societies, including the Royal Society of Arts and the Royal Society of Medicine, print papers *in extenso* in their journals when a résumé would usually be preferable: they also print *verbatim* the vote of thanks proposed by the chairman (the inclusion of which is tedious and unnecessary), as well as the ensuing debate. Excision of these would reduce the journals in question from unwieldy tomes to volumes of handy size.

The instructions for the reduction of bulk which were issued by the firm of Springer for their periodicals have already been abstracted in NATURE<sup>1</sup>: these might serve as a model in Great Britain and the United States.

## University and Educational Intelligence

COLLEGE HALL, London, founded in 1882 to provide residential accommodation for university women students, has been greatly enlarged in the past four years. Its recently issued annual report includes a detailed account of the opening of the "Mary Brodriek" wing by H.R.H. Princess Alice on November 15. With this addition, the Hall is able to house 172 students. It fulfils an important imperial and international function in facilitating social intercourse between students from different parts of the Empire and from foreign countries. Its financial stability is, for the present, assured, but there is still a substantial debt to be cleared off, and the Council is especially anxious to do this at the earliest possible date so that it may increase the number of rooms let at reduced rates to impecunious students and build up a reserve fund for the purchase of the freehold of the site.

SECONDARY school problems in the United States are discussed in an article by Prof. D. Snedden, of Teachers College, Columbia University, in *School and Society* of February 16. The four-year high school, he says, tends rapidly to become a school for the whole of the population (9 millions) between 14 and 18 years of age. Already in 1934 two thirds of this population was in full-time attendance. Except as regards what he calls their pseudo-vocational courses, the high schools are still excessively under the spell of college entrance requirements. Changing family and economic conditions render increasingly profitless any serious vocational training begun before the age of eighteen or twenty years, and such vocational education as the high schools can offer is practically valueless. Hence an urgent necessity for devising high school curricula that shall enable these vast armies of pupils to be adequately prepared for finding themselves amid the modern world's welter of products of printing press, camera, phonograph, laboratory and shop. A few suggestions are offered, starting from the assumption that there must be at least three parallel sets of courses for the exceptionally gifted, the average, and the sub-average pupil.

THE Carnegie Trust for the Universities of Scotland held its thirty-third annual meeting on February 6. Among the outstanding events of the past year the report records the death of Lord Sands, its chairman since 1922, when he succeeded Lord Balfour of Burleigh. His place has been taken, since last July, by Sir H. Arthur Rose. Grants to universities and extra-mural institutions are distributed by the Trust quinquennially, the last distribution, for 1930-35, having allocated £259,025, to be spent on libraries (£29,725), buildings and equipment (£184,600), and endowment of teaching and other general purposes (£44,700). Of the Trust's activities under its scheme of post-graduate study and research for 1933-38, the report observes that since awards were intimated last July, there have been many resignations on account of acceptance of salaried posts—a sign, it is hoped, of improved economic conditions in the country. Assistance in payment of class fees for 1933-34 absorbed £56,348, the number of beneficiaries being 4,017. Forty former beneficiaries voluntarily repaid to the Trust during the year sums amounting in the aggregate to £1,658, including a remittance of £300 from one whom the Trust had assisted to the extent of £100 only while he was a student in 1902-6.

<sup>1</sup> NATURE, 132, 34, July 1, 1933.



## Science News a Century Ago

## Societies and Academies

## Sir Charles Bell on the Brain

On April 30, 1835, Sir Charles Bell continued the reading to the Royal Society of his paper on the relation between the nerves of motion and of sensation and the brain. The report of his paper said: "The author enters into a minute anatomical investigation of the structure of the spinal cord, and of its relations with the encephalon, and with the origin of the nerves. He finds that the spinal cord is constituted in its whole length, by six pairs of columns, namely, two posterior, two lateral and two anterior; each column being composed of concentric layers, and invested with an external coating of cineritious substance, and all the columns being divided from each other by deep sulci, which penetrate nearly to the centre of the cord. On tracing the posterior columns in their ascent towards the encephalon, they are seen to diverge laterally at the *calamus scriptorius*, or bottom of the fourth ventricle, and to proceed into the substance of the cerebellum. . . ."

## Quetelet's Natural Philosophy

Among the "Analyses of Books" contained in the *Records of General Science* of May 1835 is a notice of the "Facts, Laws and Phenomena of Natural Philosophy etc. Translated from the French of Professor Quetelet of Brussels, with notes by Robert Wallace".

"For this translation," the notice ran, "we are indebted to the industry of some young ladies in the vicinity of Glasgow. Mr. Wallace, the editor, states that having been called to give some lessons to some young ladies who were desirous of acquiring a knowledge of Natural Philosophy, he proposed that he should employ M. Quetelet's work as a text book. This proposal was adopted, the work translated, and the result of their labours is now presented to the public. It is extremely gratifying to see the tender sex not only enriching our books of science with their pencils, but actually studying something more than mere superficialities. M. Quetelet is concise in his statements of facts, of which the work forms a good digest. . . . The recent important discoveries in electricity of Dr. Faraday have entirely escaped the notice of the author, but should have been introduced by the editor, as they include some very curious phenomena and constitute a very essential part of the science".

## Gurney's Oxy-Hydrogen Light

"The Bude Light," said the *Mechanics' Magazine* of May 2, 1835, "is a name given by Mr. Gurney (of steam-carriage abortion celebrity) to a new light which he has discovered, and so named after his new place of residence in Cornwall. It is obtained by directing a stream of oxy-hydrogen gas on a quantity of powdered egg shells. The light is represented to be 140 times greater than any of those now employed in lighthouses—so intense, indeed, that Mr. G. lately stated to the House of Commons Committee on Lighthouses 'his belief that it would be possible to make his light, by certain management, point out the precise situation of a coast beacon to a ship three or four miles at sea, under circumstances of a fog so dense that no other light—not even the sun—could penetrate it to any distance'!"

## PARIS

Academy of Sciences, March 11 (*C.R.*, 200, 869–992).  
 LUCIEN CAYEUX: The conglomerate structure in lacustral medium in the old sedimentary series of France. RICHARD FOSSE, PAUL DE GRAEVE and PAUL EMILE THOMAS: The identification of small quantities of amino acids by elementary analysis. The method is based on the conversion of the amino-acid into a hydantoic acid with potassium cyanate and condensation of this with xanthydroxol. CHARLES NICOLLE and MME HÉLÈNE SPARROW: The weak pathogenic power, for small apes, of the murin virus I from rats at the port of Tunis. J. CABANNES and J. DUFAY: The annual variation of the intensity of the bright lines of the night sky. The results suggest that the polar aurora and the emission of the nocturnal sky may have a common cause. HENRI LAGATU and LOUIS MAUME: The kinematics of lime and magnesia and their physiological relation in the tobacco leaf. Method of leaf relays. SYLVAIN WACHS: The reduced form of a quaternion unilateral linear substitution. N. AKHYESER and M. KREIN: A quadrature formula of Tchebicheff. ROBERT MEYNEUX: The functional equations expressing the theorems of addition and of others more general. ALEXANDRE DUFOUR: The possibility of deciding experimentally the difference between classical kinematics and relativist kinematics. Z. HORAK: The effect of the friction of pivoting on the shock of elastic bodies. SIMON DE BACKER: Viscous fluids and waves capable of propagation. ANTOINE BRUN: The variable stars of the great nebula of Orion. A list of ten new variable stars. VICTOR NAGGIAR: The production of threads and vortices in nematic liquids. JACQUES SOLOMON: The applicability of the principle of conservation of the moment of quantity of motion to nuclear processes. N. THON: The constitution of the double layer and the trend of the curve of potential in the electrolytic neutralisation of metallic ions. G. WATAGHIN: The thermal equilibrium of elementary corpuscles. LÉON ENDERLIN: Study of the magnetic susceptibility of tetraphenylrubene and its dissociable oxide. The magnetic measurements agree with thermochemical data and tend to establish that the oxygen of the dissociable rubene oxide is connected with the organic substratum by normal valencies. This is a new argument in favour of the formula adopted for oxyrubene. C. H. CARTWRIGHT and J. ERRERA: The intramolecular isomerism of  $\alpha$ -picoline studied in the extreme infra-red. The hypothesis of the existence of the second tautomeric form of  $\alpha$ -picoline is not confirmed by these researches. ANDRÉ CHARRIOU and MME. SUZANNE VALETTE: The influence of alkaline iodides on the properties of photographic emulsions. RENÉ AUDUBERT: The sensibility of photon counters. JEAN ROULLEAU: The mechanisms of the photopotential of sheets of oxidised copper. LÉONARD SOSNOWSKI: The artificial radioactivity of iridium. The iridium was produced by the action of neutrons from beryllium irradiated with radium. The artificial radioactivity thus induced is fairly intense. The results are not in agreement with those of Fermi. HENRI MURAUOUR and ANDRÉ MICHEL-LÉVY: The origin of the luminosities which accompany the detonation of explosives. E. DUCHEMIN: The influence of light on periodic precipitations in gelatinous media. The precipitation of silver chromate, phosphate and



arsenate. CHARLES DUFRAISSE and MARIUS BADOCHÉ : The relations between the optical properties of the medium and the photochemical constants of tetraphenylrubene. Study of the absorption spectrum. The positions of the absorption bands vary with the nature of the solvent, but there is no evidence of the formation of any definite compound of the rubene with the solvent. ANDRÉ MEYER and Mlle. MADELEINE MAURIN : Some reactional properties of 4-hydroxyquinoline. CLÉMENT DUVAL : The coloration of cobalt salts. HENRI WAHL : The chlorine derivatives of *p*-xylene. Along with the 2,5 dichloroxylylene already known, the 2,3 isomer is formed in the proportion of about 5 per cent. The constitution of the latter has been established by synthesis. JOSEPH HOCH : A general method of synthesis of the nitrogen substituted ethylenic amines,  $R : C : CR'.NR''(Ar)$ . ROBERT LEVAILLANT : The symmetrical sulphates of amyl, hexyl, heptyl and butyl. The reaction used was that between a chlorosulphonate,  $ClSO_2R$ , and a sulphite,  $R_2SO_3$ , in the presence of a trace of zinc chloride as catalyst. CHARLES PRÉVOST : The iodoargentobenzoic complex as agent of iodation; probable structure of the complex. PIERRE BEDOS and ADREIN RUYER : The constitution of  $\Delta$  3,4-cyclohexene-1,2 diol. Some  $\alpha\beta$ -derivatives of adipic acid. GEORGES MIGEON : The variation of the volume and the modifications of the network of the sepiolites as a function of the temperature. HENRI LONGCHAMON : The sepiolite of Ampandrandava (Madagascar). ANDRÉ RIVIÈRE : New observations on the secondary of the Anti-Elbourz (Persia). GEORGES DEFLANDRE : The presence of microdiaclasses in fragments of flint. Their importance in the artificial coloration of microfossils, and in particular, Foraminifera. ALBERT ROBAUX : Extension of the formations of the upper Cretaceous, the Eocene and the Oligocene of the Fylsch series in the south of the Province of Cadiz. LOUIS EBLÉ and GASTON GIBAUT : The values of the magnetic elements at the station of VAL-JOYEUX (Seine-et-Oise) on January 1, 1935. CONSTANTIN T. POPESCO : The undulatory movements in the leaves of *Dracena indivisa* and *Alocasia macrorhiza*. RAYMOND POISSON and RENÉ PATAY : *Beauveria doryphore*, a Muscardine parasite of *Leptinotarsa decemlineata*. A. PAILLOT : Leucocytic nodules and various reactional processes in silk worms experimentally infected with *Streptococcus bombycis*. EMILE HAAS : The measurement of accommodative amplitude. EMILE BRUMPT : Paludism in birds. *Plasmodium padde* of *Padda oryzivora*. The utilisation of this parasite for chemiotherapeutic researches on paludism. Mlle. GERMAINE COUSIN : The phenomena of neoteny in *Acheta campestris* and its hybrids. HENRI NOUVEL : The glycogen reserves in the Orthonectides. Study of their evolution. W. KOPACZEWSKI : Serum gelification by cancer-producing agents. MME. MARIE PHISALIX, AUGUSTIN BOUTARIC and JEAN BOUCHARD : The action of some snake poisons on the fluorescence of solutions of uranine. MLADEN PAIĆ and Mlle. VALERIE DEUTSCH : The specific rotatory power, the rotatory dispersion and the polarimetric determination of the seric proteins. GEORGES ANTOINE : The presence of siliceous particles in animal tissues. After destruction of the organic matter in various organs of man and animals, siliceous particles remain which the author regards as silica of interposition, of outside origin. MME. YVONNE KHOUVINE : Study of some plant membranes. RENÉ DUJARRIC DE LA RIVIÈRE and ETIENNE

ROUX : Has heavy water any action upon bacteria ? The bactericidal action is very small, if any. LOUIS BESSON : The influence of temperature and season on mortality. ARISTIDE MALHERBE, RAYMOND VILENSKI and NOËL HERMAN : Researches on the remnants of audition in deaf mutes. Bone perception and its utilisation in teaching. Mlle. DINAH ABRAGAM : The action of titanium on rats, carriers of Jensen sarcomas. Injections of titanium compounds reduced the mortality due to the tumours.

## LENINGRAD

Academy of Sciences (*C.R.*, 4, No. 8-9; 1934). L. KANTOROVITCH : A generalisation of the integral of Stieltjes. K. EVSTROPJEV and N. SUJKOVSKAJA : Influence of the composition of glass on the value of the phase potential. V. JUZHAKOV : Migration of electrons from sodium into rock salt. V. CHLOPIN and A. SAMARCEVA : Researches in the chemistry of polonium. (1) Some compounds of bivalent polonium. V. LUKASHEVITCH : Sodium amalgam with traces of iron. K. GORBUNOVA and A. VAGRAMIAN : The passive state of the cathode. M. POLIAKOV : Heterogeneous and homogeneous catalysis,  $H_2 + O_2$ . V. SADIKOV, R. KRISTALLINSKAJA, H. LINDQUIST-RYSAKOVA and V. MENSHIKOVA : Effect of the temperature regime during the splitting of protein in an acetoclave upon the composition of the auto-clavolysate. R. BELKIN : Interaction of the external and internal factors during ontogenesis in Amphibia. (1) Influence of temperature on the metamorphosis of tadpoles of *Rana temporaria* produced by thyroxin. The influence of temperature is more important than that of thyroxin. L. POLEZHAJEV : Determination of a regeneration. K. V. KOSIKOV : The attached X-chromosomes in *Drosophila simulans*. E. HASRATIAN : The problem of the relation between the duration of the conditioned stimulus and the magnitude of the conditioned reflex. V. NOVIKOV : The problem of hardness in seedlings of alfalfa varieties. B. RUBIN and L. NAUMOVA : Activity of enzymes as a varietal character. V. TRUPP : The problem of chemical processes in vegetables during storage. A. VOLOGDIN : *Archeocyathi* from the basin of the River Laba in the northern Caucasus. Fresh finds of *Archeocyathus* sp. in the Caucasus confirm the existence of the Cambrian system in the lower sections of the Caucasian palaeozoic strata. N. SOUSTOV : New data on the geology of the Khibiny district.

## VIENNA

Academy of Sciences, January 31. GEORG KOLLER and HERMANN HAMBURG : (1) Constitution of *Diploschistes* acid. This acid, which occurs in *Diploschistes scruposus* and *D. bryophilus*, and gives a deep blue colour with baryta solution, consists of lecanoric acid and a second depside,  $C_{16}H_{14}O_8$ , built up of orsellinic acid and *s*-methylpyrogallolcarboxylic acid. (2) A component of *Pertusaria dealbata*. This component, a lichen acid of the formula  $C_{15}H_{16}O_{11}$ , proves to be thamnolic acid. ERICH MOLL : Aerological investigation of periodic mountain winds in V-shaped Alpine valleys. OTTO BANKOWSKI : Reciprocal replaceability of the hydrogen atoms of the co-ordination space of a complex salt and of water. RICHARD WEISS and LUDWIG CHLEDOWSKI : Formation of cyclic compounds from aromatic diamines by means of chloral. EMIL ABEL, OTTO REDLICH and WALTER STRICKS : Iodion catalysis of deuterium peroxide. The velocity



constant of this catalysis at 25° is 1.13, those for HDO<sub>2</sub> and H<sub>2</sub>O<sub>2</sub> being 1.19 and 1.57 respectively. FRANZ KNOLL: The Bruns-Hermite series in statistics.

February 7. LEOPOLD SCHMID and SIEGMUND MARGULIES: Gossypol. RUDOLF TOTH: Stratigraphical observations on the trias chalk of the Hohen Wand region in Lower Austria. VICTOR F. HESS: Criticism of Arthur Wagner's paper entitled "Critical Remarks on the Daily Course of Cosmic Ultra-radiation". HANS PRZIBRAM: Lower males of the stag-beetle, *Lucanus cervus*, L. as heat-forms. LEONORE BRECHER: Chrysalis coloration of the cabbage butterfly, *Pieris brassicae*, L. and of *Vanessa Jo* and *V urticae*. H. BOERSCH: Determination of the structure of simple molecules by electron interference. E. BARONI and A. FINK: Investigations on the concentration of D<sub>2</sub>O in natural ice. F. WERNER: Reptiles of the [islands of the] Ægean Sea.

February 14. H. MANN: A law of normal divisors. KARL MAYRHOFER: Partial fraction series. FRITZ PRENN: Dragon-fly fauna of the Tyrol (biology of *Somatochlora arctica*, Zett. and *S. alpestris*, Selys). RICHARD WEISS and JOSEF EBERT: Conversion of dialkylidene-cyclohexanes into the isomeric dialkylphenols. (1) Dibenzylidene-cyclohexanone to 2:5-dibenzylphenol.

February 21. HERBERT HABERLANDT, BERTA KARLIK and KARL PRZIBRAM: Fluorescence of fluorite. (3) Line fluorescence spectrum. The spectra for different yttrifluorites and fluorites exhibit general agreement but individual divergences. One yttrifluorite showed the blue europium bands, and with a fluorite from Weardale the Eu lines were strong in comparison with those of Tb. With fluorites from Eastern Turkestan and Cornwall, the lines were intensified by radium radiation, the presence of very short-lived centres being indicated. WOLFGANG HOFF and FRANZ URBACH: Attainment of a photochemical equilibrium with silver bromide. ALFONS KLEMENC, RAOUL WECHSBERG and GEORG WAGNER: Gas-analysis methods for determining carbon suboxide in presence of carbon dioxide, carbon monoxide and oxygen. Various methods, especially the use of fractional crystallisation at temperatures of about -100° C., were employed for separating these gases. F. ANGEL and OTTO FRIEDRICH: Form of magnetite. OTMAR ECKEL: Radiation research in certain Austrian lakes. FRITZ LIEBEN and STEPHAN MOLNAR: Behaviour of the combination glycocoll-alcohol towards yeast which has been shaken with oxygen. The amount of glycocoll taken up by the yeast is increased by the presence of alcohol, while the uptake of alcohol is checked when glycocoll is present.

### Forthcoming Events

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

Saturday, April 27

ROTHAMSTED EXPERIMENTAL STATION.—Conference on the "Swarming of Bees and the Practical Means of Controlling it".

Sunday, April 28

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

Monday, April 29

BRITISH MUSEUM (NATURAL HISTORY), at 11.30.—G. J. Arrow: "Horned Beetles".\*

VICTORIA INSTITUTE, at 4.30.—George H. Kimble: "The Expansion of the Habitable Earth in Old Testament Times".

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Prof. G. Barbour: "Floods and Flood-Control in China and America".

Tuesday, April 30

ROYAL PHOTOGRAPHIC SOCIETY (SCIENTIFIC AND TECHNICAL GROUP), at 7.—Dr. Oliver C. de C. Ellis: "The Afterglow in Gaseous Explosions".

Thursday, May 2

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Sir William Bragg: "The Molecular Structure of Dielectrics" (Kelvin Lecture).

Friday, May 3

ROYAL INSTITUTION, at 9.—Sir William Larke: "Iron and Steel".

IRON AND STEEL INSTITUTE, May 2-3. Symposium on the "Welding of Iron and Steel" to be held at the Institution of Civil Engineers, Great George Street, Westminster, S.W.1.

### Official Publications Received

#### GREAT BRITAIN AND IRELAND

World Power Conference. Annual Report, 1934. Pp. 18. (London: World Power Conference.)

Forestry Commission. Utilization Series, No. 2: Report on the Demand for Timber in Coal-Mining in England and Wales. Pp. vi+77. (London: H.M. Stationery Office.) 1s. 3d. net.

Report of the United Kingdom Sugar Industry Inquiry Committee. (Cmd. 4871.) Pp. iv+123. (London: H.M. Stationery Office.) 2s. net. The Archaeology of Rochford Hundred and South-East Essex. By William Pollitt. (Museum Handbooks, No. 7.) Pp. 59+22 plates. (Southend-on-Sea: Public Library and Museum Committee.) 6d.

University of Oxford: Committee for Advanced Studies. Abstracts of Dissertations for the Degree of Doctor of Philosophy. Vol. 7 (Dissertations accepted during 1934). Pp. iv+129. (Oxford: Clarendon Press; London: Oxford University Press.) 3s. net.

#### OTHER COUNTRIES

Ingeniørvidenskabelige Skrifter. A. Nr. 38: Radiation from a Vertical Antenna over Flat Perfectly Conducting Earth. By Dr. P. O. Pedersen. Pp. 50. 6.00 kr. B. Nr. 12: Miscellaneous Papers. By Dr. P. O. Pedersen. Pp. 105. 6.00 kr. (Copenhagen: G. E. C. Gad.)

Department of Agriculture: Straits Settlements and Federated Malay States. Scientific Series, No. 16: The Toxic Value of *Derris* Spp. By N. C. E. Miller. Pp. ii+44+2 plates. (Kuala Lumpur: Department of Agriculture.) 50 cents.

Commonwealth of Australia: Council for Scientific and Industrial Research. Pamphlet No. 52: Systematic Entomology—Contribution 1: i. Notes on the Genus *Hexamera* B. and F. (Dipt. Tachin.), by A. L. Tonnoir; ii. Australian *Hemitermes* (Isoptera), with Descriptions of New Species and hitherto Undescribed Castes, by G. F. Hill. Pp. 31+3 plates. (Melbourne: Government Printer.)

Indian Forest Records. Vol. 20, Part 13: Results of Experiments on the Kiln Drying of Wood with Ozonized Air. By Dr. S. N. Kapur. Pp. ii+20. (Delhi: Manager of Publications.) 8 annas; 10d.

British Guiana: Second Legislative Council, Fourth Session, 1933: Geological Survey Department. The Kaburi District: 1933 Progress Report. By Dr. D. R. Grantham, S. Bracewell and Dr. G. J. Williams. Pp. 22+2 plates. (Georgetown: Government Printers.)

Mémoires de la Société de Physique et d'Histoire Naturelle de Genève. Vol. 41, Fasc. 3: Études sur la partie occidentale du Lac de Genève, 2: Histoire malacologique du Lac de Genève. Par Jules Favre. Pp. 295-414+plate 13. (Genève et Bâle: Georg et Cie.) 10 francs.

Ochrona Przyrody: Organ Państwowej Rady Ochrony Przyrody. Rocznik 14. Pp. iv+235+4 plates. (Kraków: Państwowej Rady Ochrony Przyrody.)

Proceedings of the American Academy of Arts and Sciences. Vol. 70, No. 1: The Melting Curves and Compressibilities of Nitrogen and Argon. By P. W. Bridgman. Pp. 32. 65 cents. Vol. 70, No. 2: Observations on the Behavior of Animals during the Total Solar Eclipse of August 31, 1932. By William Morton Wheeler, Clinton V. McCoy, Ludlow Griscom, Glover M. Allen and Harold J. Coolidge, Jr. Pp. 33-70. 75 cents. (Boston, Mass.: American Academy of Arts and Sciences.)

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 117: On the Motion of High-pressure Powder Gases and Compression Waves in the neighbourhood of the Muzzle of a Rifle. By Kwan-ichi Terazawa, Mitsuo Tamano and Sin-iti Hattori. Pp. 439-492+9 plates. (Tôkyô: Koseikai Publishing Office.) 75 sen.