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Social Aspects of Labour and Leisure

THE picture of labour displaced by machinery drawn by Sir Frank Smith in his recent Gustave Canet Memorial Lecture before the Junior Institution of Engineers was one of the most impressive features in his account of the function of the engineer in modern civilisation. The striking examples he cited of the way in which machinery is making it possible for the same output to be achieved by fewer and fewer workers could easily be multiplied, and the consequent growth in the volume of technological unemployment is one source of what has been described as the revolt against mechanism. Few, however, who are familiar with the automatic signals which have so largely replaced the traffic control policemen, or the signalmen on the Underground railways, give a thought to the unemployment aspects of such changes. Fewer still perhaps realise the effect of the growing use of mechanism in offices on the volume of clerical labour, but it is in such ways as these, as much as in the more sensational developments in agricultural or industrial machinery, that machinery, and especially power production, is affecting the whole aspect of our civilisation.

It is, of course, easy to overstress this aspect and to draw unsound deductions from such displacements of labour. Leaving out of account such questions as the liberation of human labour in this way from tasks making peculiarly severe or unpleasant demands in health and energy, the process of reducing the ratio of men employed to output has been repeatedly accompanied by an expansion in output many times greater, so that the total labour employed may be three or four times as great as before.

There are, however, signs that this position is changing and that expansion in this way in future will be limited. Moreover, here again it is not easy to obtain a true picture without considering the effect of expansion upon other industries. Development in one direction so often means restriction and diminished employment in another that the final result may be much less satisfactory than would at first appear. The ill-effects of the unbalanced development of industry have been, indeed, one weighty factor in the pleas for the national planning of industry which have been brought forward in recent years. Apart from this, it is clear that rationalisation and mechanisation alike are unable to prevent periodic unemployment or recurrent severe economic crises.

On these grounds alone, public opinion is coming to demand that the social consequences of mechanisation shall receive study as well as its narrower industrial and economic aspects. This view is powerfully reinforced by the contrast between the large volume of unemployment and its concurrent distress and impoverishment of life, and the overproduction and sabotage which have been common in many parts of the world. It is further supported by the effects of mechanisation itself on those actually engaged in production. Studies directed towards the improvement of industrial efficiency have indicated, for example, the detrimental effect on the workers of monotonous repetition in mechanical processes, but even more serious are the signs that mechanical habits are spreading from working hours to hours of leisure or amusement. Many have, indeed, largely lost the power to amuse themselves, and avoid boredom only by resorting to mechanical forms of amusement closely related to the mechanical conditions which dominate their working hours.

If we are becoming acutely aware of the dominating power which machinery has acquired in our whole lives, and of its social as well as its industrial consequences, we are becoming aware also, though more slowly, of our mechanical habits of mind. It is this, indeed, that constitutes our chief danger. It has infected our educational system, which often tends to repress rather than to encourage originality of thought or purpose. It has spread through science itself, which is a great user as well as a deviser of machinery. The very dependence of the modern scientific worker upon technique, no less than the premature and intense specialisation to which he is often condemned, encourages mechanical mindedness ; and important sections of modern science are essentially affairs of machine-minding, even if exceptional accuracy of observation and skill in experimenting or recording results are required therein.

There is in fact a general absence of creative thought ; and accordingly our mechanical mindedness has diverted energies, which are needed for the adventures of regaining control and utilising to the full the new forces at our disposal, into the pursuit of a security for life and happiness based on the assumptions of an era that has passed. In the revolt against the present dominance of mechanism, the beginnings of which may be discerned alike in science and in politics, there is at times a sense of the futility of machines, particularly when the unemployment situation is considered, which finds expression in approval of the action of the people of Erewohn. Only our mechanical mindedness can betray us into such a false position. If, as Prof. Whitehead suggests, "Life is an offensive against the repetitive mechanism of the universe", the aim of that offensive is, as Dr. L. P. Jacks points out, not the destruction of mechanism but its capture, mastery and use for the creative purposes of life.

The very magnitude of unemployment in the world to-day is bringing us to a wider vision and to more creative thought about the situation. It is more and more seen that unemployment is bound up with the general problem of leisure, and that the whole question is one of distribution—how the resources which power production have placed at our disposal can be used to raise the whole standard of living, so that, with the expenditure of effort which leaves him free to enjoy his leisure hours, man can satisfy his wants in ways that have been possible only for the few in the past, and can achieve standards of health and fitness which have hitherto been beyond his reach.

The belief that this paradox of deprivation and want in the midst of abundance is removable if we utilise our resources is steadily gaining acceptance. It is challenging the old assumptions of economic systems regarding the exchange and distribution and production of goods. Much creative thought as well as scientific study are undoubtedly essential if we are to find the solution we desire, but mere mechanical thinking is likely to perpetuate the conditions of the past until worse confusion arises.

This very attitude holds an element of hope which elsewhere is lacking. When we are prepared to adventure in life in this way, the possibility of recreation arises, and the acceptance of change, or rather the expectation of change which is an essential part of the scientific attitude to life, is one of our fundamental needs. The realisation that mechanism can be used for a larger freedom—that while it enslaves our working hours it should shorten the hours of that slavery and lengthen the hours when we are free men—confronts us with an opportunity to recover in our leisure hours all the freedom, the spontaneity and the joy which is thwarted or smothered in working hours. The estimate quoted by Sir Frank Smith that the harnessing of coal, oil and electric power in the service of man has placed at the disposal of every individual in the United States of America an average of 900 mechanical slaves, on the moderate assumption that one horse power is equivalent to the power of 10 men, gives an impressive but suggestive idea of the resources which we have at our disposal but have scarcely commenced to utilise effectively.

A vision of the resources with which science has endowed us and the realisation that now and now only, as Sir Arthur Salter points out, "our material resources, technical knowledge and industrial skill are enough to afford to every man of the world's teeming population, physical comfort, adequate leisure and access to everything in our rich heritage of civilisation that he has the personal quality to enjoy" should supply the stimulus to the creative thought and courageous and magnanimous action required. To secure such advantages revolutionary changes in our customary and accepted attitude to distribution, production, work and leisure may well be required, and the control of many sectional and selfish interests, realising that in the long run the common interest is the true interest of each individual.

The aspects of technological unemployment upon which we have touched emphasise indeed the necessity for a new outlook on this situation. Labour and leisure have been separated too rigidly both in thought and in practice, and industrial psychology has only begun to demonstrate to us some of their many important interactions. Even from the point of view of industrial efficiency, we are compelled to take account of the opportunities which leisure affords of repairing the human damage which may have resulted from the pace of mechanisation of industrial operations. The prospect of shorter hours of labour and ampler leisure for all, however, are impelling us to a wiser and surer point of view which regards work and leisure as interdependent, as complementary aspects of life as a whole, neither of which can be enjoyed to the full while the other is defective. The conception of leisure as affording opportunities for recreating life—for liberating and vitalising it—is one to which comparatively few have paid attention, but it represents one of the most important problems which mankind has to face. The readjustments in society made necessary through the increased powers with which science has endowed man can never be realised until man has learnt to utilise his leisure hours as effectively as his hours of labour. The conception of leisure implicit in the word 'vacation' must be replaced by that implicit in 'recreation'; and to achieve this, education must be directed as consciously towards the preparation for leisure as for industry. Rather it would be true to say that education must learn to combine preparation for work and preparation for leisure in a harmony which is better described as preparation for citizenship or for living.

This conception of life as a whole is one which should appeal instinctively to scientific workers, who indeed stand as much in need of its liberating and vitalising influence as any section of the community. Scientific thought must make an essential contribution to the creative thinking which is demanded if we are to gain the control of the machines and use them for our purpose without being dominated by them. The new era of orderliness will not come of itself. Our task of reconciling industrial and social practice with revised scientific thought will not be achieved without courage and vision. It may issue in a new economic structure for society which as yet we are unable to predict. No scientific worker who has glimpsed the possibilities which machine power has put within our grasp can, however, turn aside from the task of assisting society to avert the evils with which mechanisation threatens us, and to translate those possibilities into achievement, without disloyalty to that spirit of adventure and honest endeavour which is an essential part of the scientific spirit itself.

Valency Types and Problems

(1) *Some Physical Properties of the Covalent Link in Chemistry.* By N. V. Sidgwick. Pp. vii+249. 10*s*. net. (2) *Hydrides of Boron and Silicon.* By Prof. A. Stock. Pp. x+250. 9*s*. net. (The George Fisher Baker Non-resident Lectureship in Chemistry at Cornell University, Vols. 11 and 12.) (Ithaca, N.Y.: Cornell University Press; London: Oxford University Press, 1933.)

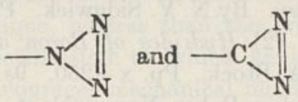
(1) DURING the past ten years, Dr. Sidgwick has built up a reputation, which is perhaps unique amongst chemists, as a reporter whose judgments are based upon an exceptionally wide knowledge of chemical facts and a keen appreciation of the significance of physical theories in their interpretation. He has, moreover, the courage of his convictions, and does not hesitate to express the results of his own independent thinking, even when they are not in agreement with the views held by his colleagues. The publication of these lectures, which he delivered at Cornell

during his tenure of the George Fisher Baker lectureship, gives to chemists in general the privilege of sharing in a type of instruction which must obviously have been very stimulating to his hearers in Cornell, as well as to his regular classes in Oxford.

It is no disparagement to the experimental work which is cited in these lectures, to say that their interest depends largely on the opportunity which they provide of hearing (or reading) the considered judgments of the author on topics which have recently been or still are in the region of controversy. One such topic is the structure of carbon monoxide. As Langmuir has pointed out, this gas resembles nitrogen very closely in its physical properties, since it can be derived from it by transferring one unit of positive charge and two units of mass from one nucleus to the other. This gives rise to the formula

$$\overset{+}{\mathrm{C}} \equiv \overset{-}{\mathrm{O}}\ ;\ \text{compare } \mathrm{N} \equiv \mathrm{N}.$$

Objections to this formula could be raised on the ground that the electric charges on carbon and oxygen would make the gas differ widely from nitrogen, where the atoms are neutral. Sidgwick points out that these charges serve to neutralise the strong dipole moment of the $>\mathrm{C}=\mathrm{O}$ group, and that the absence of any strong polarity in carbon monoxide is therefore an argument in favour of the formula. On the other hand, in the controversy as to the structure of the azides and aliphatic diazocompounds, Sidgwick records a verdict in favour of the older cyclic structures:



These are inadequate to explain the optical activity which has been recorded in certain aliphatic diazo-compounds, since this can only be explained by using a linear formula of the type

$$>\overset{-}{\mathrm{C}}-\overset{+}{\mathrm{N}}\equiv \mathrm{N}\ ;$$

but he regards the evidence for optical activity in these compounds as inconclusive.

An explanation of the cyclic structure of the azides, as contrasted with the linear structure of the azide ion $\overset{-}{\mathrm{N}}=\overset{+}{\mathrm{N}}=\overset{-}{\mathrm{N}}$, can be found in the fact that the central atom of the ion already carries 8 shared electrons and cannot therefore form covalent derivatives by electron-sharing.

More fundamental is the problem provided by the contrast between covalence and electrovalence, for example, in compounds such as

$$\mathrm{Cl{-}Cl} \text{ and } \overset{+}{\mathrm{K}}\overset{-}{\mathrm{Cl}}.$$

Is there after all any real difference between these two types of valency ? May they not be merely limiting cases, which can be bridged by a series of intermediate stages, in such a way as to make it impossible to find any sharp boundary line between them ? Fajans has adopted this view, and has cited evidence in support of a continuous transition from one type to the other. The reviewer, on the other hand, has always wanted, if only as a matter of practical convenience, to maintain a contrast which has done so much to clarify the theory of valency and to reconcile the diverse views which had previously been held by inorganic and organic chemists respectively. Many of the intermediate stages can be explained by the variable readiness with which a covalent molecule can be ionised, leading in the case of weak electrolytes to a statistical equilibrium between a covalent molecule and its ions ; but it has been left to Sidgwick to give the most complete vindication that has yet been made of this convenient hypothesis.

This vindication includes a theoretical discussion, leading to the conclusion that the formation of an intermediate type of link, which is neither a covalence nor an electrovalence, "is not likely to be of frequent occurrence" ; and this conclusion is supported by experimental evidence, under eight different headings, showing how sharp is the distinction that can be drawn between salt and non-salt. On the other hand, he rejects the symmetrical formula for benzene, with its system of three-electron bonds, and is not convinced by Sugden's arguments for widely-distributed one-electron bonds. He therefore brings very powerful support to those who hold that, apart from a few exceptional cases in odd-electron compounds and the like, there are two kinds of valency and two only, which can be invoked by chemists to explain the phenomena of chemical combination.

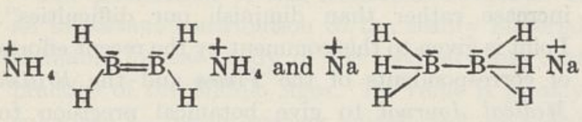
The topics cited above have been selected from an orderly review of the properties of the covalent bond, in which its length and heat of formation are discussed, as well as the directed character of the bond, which gives rise to the phenomena of stereochemistry ; and, in view of the importance of the work on dipole moments which has been done at Oxford, it is not surprising that the longest chapter of the book is given to this subject. This orderly review provides pleasant reading, and is a contribution of real value to the progress of chemistry in one of its most fascinating periods of development.

(2) Prof. Stock's Cornell lectures consist largely of a record of laborious and painstaking preparative and analytical work on the hydrides of silicon and boron. They bear tribute to the patience and skill of the author, as well as to the perversity of the materials which he had to manipulate. The anomalous behaviour of the hydrides of boron has, however, provided a series of difficult and fascinating problems and has thus placed these elusive compounds in the forefront of many discussions of the theory of valency.

The known hydrides are of two series :

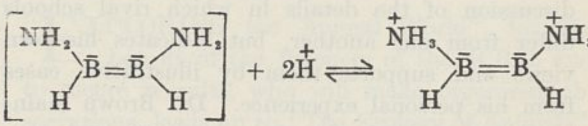
(i) B_nH_{n+4} : B_2H_6, B_5H_9, B_6H_{10}, $B_{10}H_{14}$.
(ii) B_nH_{n+6} : B_4H_{10}, B_5H_{11} and perhaps B_6H_{12}.

In each case increments of BH are recorded ; but no hydride containing *one* or *three* atoms of boron is known. In particular, there is no monomeric BH_3 to correspond with BMe_3 ; and the structure of the dimeric B_2H_6 presents a perpetual puzzle, in view of the fact that there are two electrons less than the number which just suffices to provide the single bonds between the atoms in C_2H_6. Much ingenuity has been exercised in deciding which two electrons can be kidnapped with least risk of the loss being detected ; but no final conclusion appears to have been reached. The author himself adopts a different procedure, since he assumes with Christiansen (1927) that diborane, B_2H_6, corresponds in structure and properties with ethylene, C_2H_4, rather than with ethane, C_2H_6, and accepts the formula which Wiburg in 1927 proposed on these lines. On this basis it is easy to account for the formation of a bivalent ammonium salt, B_2H_6, $2NH_3$ or $2[NH_4]^+[B_2H_4]^{--}$, and of a disodium derivative, $B_2H_6Na_2$, since these can be formulated as

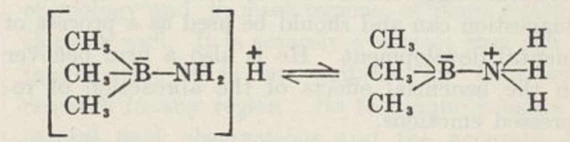


The parent compound, in which $\overset{+}{N}H_4$ is replaced by $\overset{+}{H}$, however, is more difficult to formulate, since the two acidic protons can scarcely be kept 'outside the bracket' $[B_2H_4]H_2$ and must presumably be allowed to nestle close to the negatively charged atoms of boron, even if no electrons can be spared to hold them by covalent bonds.

In any event, it seems to be clearly established that two of the hydrogens differ from the other four in being acidic, and electrolysis of solutions in liquid ammonia confirms the deductions made above, since the main effect is a replacement of two non-acidic hydrogens by NH_2 radicals, followed perhaps by the formation of an 'inner salt', thus :

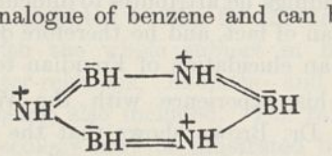


A similar 'inner salt' structure may be recognised in the compound $B(CH_3)_3$, NH_3, which is formulated as follows :



The higher homologues of this series also form analogous compounds with ammonia, such as B_4H_{10}, $4NH_3$ and $B_{10}H_{14}$, $6NH_3$, indicating the presence of four and six acidic protons.

Another interesting and remarkably stable compound has the composition $B_3N_3H_6$. This appears to be the analogue of benzene and can be formulated as



where the double and single bonds can be interchanged, exactly as in Kekulé's formula for benzene.

These problems of valency lend a peculiar interest to certain sections of the book, but its main value is to be found in the fact that it summarises the contents of 69 papers by the author, and 15 by other workers, references to which are given both in the text and in a bibliography at the end of the book. T. M. LOWRY.

Everyday Psychology

Psychology and Psychotherapy. By Dr. William Brown. Third edition. Pp. vii+252. (London : Edward Arnold and Co., 1934.) 12*s.* 6*d.* net.

THE present edition of Dr. Brown's "Psychology and Psychotherapy" has been so extensively revised and enlarged that it is virtually a new book. Dr. Brown is enthusiastic about the future of psychology ; in his opinion it is destined to become an essential part of the equipment of every educated person. Hence his endeavour to present an outline of our present knowledge in a practically useful form. The list of contents, ranging as it does from a description of simple war neuroses, through a consideration of the relation of mind to brain, up to the question of "Eternal Values", shows how wide is the scope of Dr. Brown's purview. He wisely avoids academic discussion of the details in which rival schools differ from one another, but indicates his own views and supports them by illustrative cases from his personal experience. Dr. Brown maintains his position regarding hypnosis and suggestion, and argues that the 'normal' individual can be helped by appropriate formal suggestion and autosuggestion. Indeed, in his opinion, autosuggestion can and should be used as a process of mental development. He is also a firm believer in the beneficial effects of the abreaction of repressed emotions.

Although not subscribing to the whole Freudian doctrine, Dr. Brown fully acknowledges the enormous advances which Freud's researches have brought about, and he deplores the inaccuracies and misunderstandings with which popular prejudice has confused them. Many of these misunderstandings he attributes to difficulties of terms rather than of fact, and he therefore devotes some space to an elucidation of Freudian terminology.

From his experience with the War psychoneuroses, Dr. Brown shows that the earlier such patients come under treatment the greater is the prospect of success. As this applies also to cases of "functional nervous disorders" occurring in civil life, it is important that a general practitioner should diagnose the nature of the trouble and put his patient under suitable treatment in the earliest stage.

Alcoholism and drug addiction are recognised as attempts on the part of certain neurotic personalities to escape from life's difficulties, but space does not permit the author to deal adequately with this specialised section of the wide field he seeks to cover. This inevitable limitation is noticeable in other chapters, but the purpose of the book is nevertheless well served in that it emphasises the psychological factors in many of the problems of everyday life, where until recently they had been overlooked or at any rate under-estimated.

Dr. Brown is among those who hold the ideal that the training of every doctor should be such as will enable him to treat his patients psychotherapeutically at the same time as physically. His discussion of the psychology of the adolescent will be found valuable by those who are called upon to help maladjusted or wayward individuals through this critical period of life. Here as elsewhere Dr. Brown insists upon the importance of the personal factor; the sincerity and human sympathy of the healer. In his experience everyone is at heart religious and needs a philosophy of life. It is the duty of a healer to help the patient towards the attainment of this by integrating his personality to the utmost.

Dr. Brown is to be congratulated on the clear and broadminded way in which he has, in this little book, supplied a wholesome corrective to the present-day materialistic attitude to life.

A. E. CARVER.

Fifteenth Century Physic

A Leechbook: or Collection of Medical Recipes of the Fifteenth Century. The Text of MS. No. 136 of the Medical Society of London, together with a Transcript into Modern Spelling, Transcribed and edited with an Introduction, Notes and Appendix by Warren R. Dawson. (Published for the Royal Society of Literature of the United Kingdom under the Terms of the Dr. Richards Trust.) Pp. iv+344. (London: Macmillan and Co., Ltd., 1934.) 20*s*. net.

THE Medical Society of London was founded in 1773 and has possessed since its earliest days MS. No. 136, which Mr. Warren Dawson has now transcribed and rendered into modern English, the original text and the twentieth century version being conveniently printed on opposite pages throughout the book.

The medieval compiler of this collection of recipes provides a rich supply of common names of herbs, on which the editor, very wisely, says that even in the Middle Ages the identification of plants and minerals in medical manuscripts must have been a matter of the greatest complexity, and that the glossaries and nomenclators then drawn up giving the synonomy of herbs "often increase rather than diminish our difficulties". Point is given to this comment by the recent efforts of correspondents of the *Times* and the *British Medical Journal* to give botanical precision to 'cow parsley' and to 'ground ivy' respectively.

In spite of his cautionary remarks, Mr. Dawson does provide a number of identifications. 'Cokyll' occurs as an item in these recipes and is modernised by Mr. Dawson as 'cockle (ergot)'. This raises two interesting points. 'Cockle' generally means, not ergot, but 'corncockle' (*Lychnis Githago*). Further, Flückiger and Hanbury ("Pharmacographia") and Barger ("Ergot and Ergotism") agree in giving 1582 as the date when ergot was first definitely referred to as a drug. The editor puts the date of MS. 136 about the middle of the fifteenth century, possibly 1443–44, so that if 'cokyll' is really ergot, this reference is more than a century earlier than that usually accepted. Medieval names for diseases also present difficulties. The editor explains in a footnote that "the fire of hell that burneth in a man's flesh" is "also called wildfire and St. Anthony's fire (erysipelas)". The critical summary of the literature provided by Barger (loc. cit.) seems, however, to leave little doubt that the St. Anthony's fire of the Middle Ages was not erysipelas but the gangrenous form of ergotism.

The early purveyors of medicine seem to have had an instinctive belief in the therapeutic efficacy of anything nasty. That is generally true of this collection of recipes, though a few of them might be described as "sugar and spice and all that's nice", for example, that "for the cough, a precious drink, and for the breast, and is called metheglin, and also wine of Tyre or Tiberias and this is the perfect [method of] making" (p. 89): it is a decoction of thirty-seven herbs, sweetened with honey and fermented, the fermented liquor being finally flavoured by maceration with a mixture of nine kinds of spice. Some of these spices, for example, cloves, pepper, nutmegs, mace and ginger, must have been hard to come by in fifteenth century England.

Though the familiar jibe "Any green thing that grew out of the mould was a wonderful herb to our fathers of old" can be levelled with truth at most of the items in these recipes, some of them include drugs which are still prescribed for the same purposes. Most of these, however, are materials the action of which could scarcely be overlooked even by primitive man with sufficient natural curiosity to try eating them.

The publication of this leechbook *in extenso* is an important contribution to the scanty material available for the study of the medical ideas and practice of the Middle Ages. Its value is greatly enhanced by the interesting introduction provided by the editor, which reveals among other things how leechbooks of this kind were compiled and to what extent they owe their origin and their contents to Greek and Latin writers on medicine, who in their turn drew upon the Egyptians and to a less extent the Assyrians. T. A. H.

Animals and their Environment

(1) *Exploring the Animal World.* By Charles Elton. Pp. 119. (London: George Allen and Unwin, Ltd., 1933.) 3*s*. 6*d*. net.

(2) *The Ecology of Animals.* By Charles Elton. (Methuen's Monographs on Biological Subjects.) Pp. viii+97. (London: Methuen and Co., Ltd., 1933.) 3*s*. 6*d*. net.

"EXPLORING the Animal World", for the benefit of the listeners of the B.B.C. and to secure recruits, who will make organised observations, leads up to "The Ecology of Animals". Ecology obviously sets out to define the relations between animals and their surroundings. It requires a considerable knowledge of every section of zoology and, in most regions, of plant relationships as well. It is scarcely a subject that can be taught, but it is one suitable for team-work research in any region. Its technique consists of careful field observations and the accurate determination of the organisms, coupled ultimately with thought-out experimentation in the field and in the laboratory.

The author's articles, especially on the real life of animals, the significance of migration and the regulation of numbers, are highly esteemed, and now we are indebted to him for the first attempt to deal with the whole subject in book form, animal inter-relations, habitats and economic problems being also included. The ramifications of animal ecology may be illustrated by the consideration of the fishery research of the North Sea, almost every fact in relation to which is of importance to the question of fisheries, especially the inter-relationships of the animals and plants, both to one another and to the physical and chemical conditions. Other marine areas with their various environments are also being intensively studied, and we might, as examples, refer to plankton and coral reefs. Then we think of freshwaters and finally of the land. On the latter we judge that ecological studies have not advanced far, perhaps owing to the multiplicity of environments, the vast numbers of land animals and the power of flight, coupled with rapid reproduction, which causes large numbers of wanderers to visit places to which they scarcely belong.

The subject and the book are both important, but the author, in trying to give a balanced account of animal ecology in a space about fitted to one of his chapters, is bound to lay himself open to misconceptions. In his statement that "the application of ecological ideas to these problems [of economic entomology] is as yet negligible"—two exceptions are mentioned—he is so challenging that we set out to discover what new ideas are now presented to us and what new "facts stand out clearly". Numbers are of prime importance, but here the ecologist works "within certain conventions" which are not explained, while the general omission of unicellular organisms, so essential in the food cycles of aquatic life, will assuredly invalidate many results. We learn of "the comparatively low number of species which make up any animal community of a major habitat such as a wood, a heath, a coral reef or a river", and that the most frequent values lie between 60 and 140. We turn to a table of examples "selected at random", and they do not carry conviction. Eighteen are aquatic where the omitted protistans are of major importance; of the land we have 4 arctic, 3 *Calluna* heath, bare sand and pine wood of Oxshott common, 3 very special, rotting and outgrowing fencing posts and dried fruits, and 5 animal communities in Canada and Great Britain. This seems to us scanty evidence for such a deduction and we wonder how to define "a major habitat". Surely the land plants give the essential basis for most animal communities and we would like to see how far studies of the plant and animal communities of rich areas, such as Wicken fen, bear out these numbers.

In the tropics we feel that a habitat consisting of a single species of plant would have to be chosen to give such small numbers, since the very uniform and distinctly unfavourable aspen land of Canada yields about 140 species. The reader must not be misled into thinking that much is established in animal ecology, any more than that mimicry is a "firmly established theory".

Short Reviews

La Turquie Agricole (*Partie Asiatique-Anatolie*) [in Russian, with a French summary]. Par Prof. P. Zhukovsky (P. Joukovsky). (Académie Lénine des Sciences agricoles de l'URSS: Institut de Production végétale.) Pp. xxvii + 908 + 12 plates. (Moscou et Léningrad: Les Éditions de l'Etat, Section Agricole "Selkhozghiz", 1933.) n.p.

THIS book is the outcome of three expeditions into Asiatic Turkey made by the author in 1925–27 on behalf of the Institute of Applied Botany at Leningrad. The practical aim of the expeditions was the discovery and collection of native varieties of cultivated plants suitable for introduction into Russia, and the bulk of the book is devoted to detailed monographic treatment, by some twenty authors, of the plants and their varieties cultivated in Turkey.

A large number of new varieties of wheat, rye, peas, lentils, melons, fruit-trees, etc., have been discovered and collected, and their characters studied by experimental planting in various districts of Russia. Many of them proved of exceptional value for immediate introduction, while others represent interesting material for hybridisation and selection. With regard to rye, the data obtained suggest that Anatolia was probably its original home, for it occurs there in great variety, both cultivated and wild, and its history can be followed. The cantaloupe melons, now widely cultivated under glass in Europe, were found in great variety in field culture in the Van vilayet.

Apart from the data on cultivated plants, which will be of the greatest value to plant-breeders, the book has a wider appeal, since the author treats his problem in a very broad-minded way and presents a thoroughly up-to-date survey of the geography, climatology, plant-geography and agriculture of Asiatic Turkey; no similarly comprehensive work on that country has appeared in any language since Tchihatcheff's classical monograph published seventy years ago and now completely out of print. The value of the book is enhanced by numerous illustrations (which, however, have suffered from the poor reproduction), sketch-maps of climatic and botanical regions, 27 pages of bibliography including a number of Turkish books, and statistical tables on Anatolian agriculture.

Tables of the Higher Mathematical Functions. Computed and compiled under the direction of Harold T. Davis. Vol. 1. (Published as a Contribution of the Waterman Institute for Scientific Research, Indiana University.) Pp. xiii + 377. (Bloomington, Ind.: The Principia Press, Inc.; London: Williams and Norgate, Ltd., 1933.) 25*s*. net.

THIS is the first volume of an undertaking which promises to be as imposing as it is important. The work, begun in 1927 under the direction of Mr. H. T. Davis with the assistance of twenty colleagues, aims at collecting and amplifying the tables of higher mathematical functions which are scattered through the literature of the subject, and thus rendering available a vast amount of useful material which is not always readily accessible.

The volume begins with a brief history and classification of tables and a chapter on certain mathematical processes. An account follows of methods of interpolation by differences. Here the usual formulæ are given and illustrated, but no mention is made of the remainder terms. About forty pages of interpolation coefficients with a two-figure argument are included for use with the formulæ, and a bibliography in which attention is mainly paid to functions of the kind for which the work is intended. The tables in the present volume relate to the gamma and psi functions and comprise about 140 pages, at various intervals of the argument, and to 10 or more decimal places. This forms the most complete collection at present available of values of these functions.

These tables are to be welcomed on account of their fundamental importance in the numerical applications of difference equations. The type used is the flat variety and forward differences are printed on the same line as the tabular values. These are points which may not meet with universal approval. On the other hand, the printing is clear, and one should not grumble at an author who has produced such a useful set of tables.

L. M. M.-T.

An Introduction to Biochemistry. By Dr. W. R. Fearon. Pp. x+313. (London: William Heinemann (Medical Books), Ltd., 1934.) 10*s*. 6*d*. net.

THIS book is by the professor of biochemistry of Trinity College, Dublin, and is obviously intended primarily for medical students. One may be permitted to venture a doubt whether the average medical student, at any rate in Great Britain, is likely to wish, or be able, to probe quite so deeply into the intricacies of organic chemistry as he would be encouraged to do by a thorough study of Prof. Fearon's book, in spite of the fact that the author claims to have approached "the living organism . . . along the less worn path of *inorganic biochemistry*". However much this detailed approach may unsuit the book for the British medical student, it makes it all the more useful as a general reference book for medical practitioners and scientific workers. As such, it is thoroughly up to date, and apparently free from serious typographical or other errors, though the attribution to ergosterol of two different formulæ on two consecutive pages indicates somewhat hasty revision or proof reading.

The scope of the book is evident from the fact that it includes such diverse subjects as methods for identifying the common carbohydrates, the inter-relationship between the pituitary and the reproductive systems, food and vitamins, an introduction to glutathione, cytochrome and other oxidation catalysts, a rapid account of the chemistry and constitution of the sterols and bile acids, and so on.

In spite of the existence already of a number of excellent introductions to biochemistry, we see no reason why Prof. Fearon's book, with its somewhat novel method of approach and attack, should not find a useful rôle in the training of medical and other students.

A. L. B.

Minerals and the Microscope. By H. G. Smith. Third edition. Pp. xiii+124+13 plates. (London: Thomas Murby and Co.: New York: D. Van Nostrand Co., Inc., 1933.) 5*s*. net.

THE third edition of this well-known book has been partly rewritten but, in the general method of treatment of the subject, it preserves the characters which have commended it to students throughout the last twenty years.

In the first two sections, which deal with the optical properties of minerals and descriptions of rock-forming minerals, no essential changes have been introduced. The final part, which is concerned with the study of rocks, has, however, been entirely rewritten and brought up to date. The method of treatment is genetical rather than descriptive, and aims at supplementing the knowledge gained from the study of specimens and thin sections. Difficult subjects such as gravitative differentiation, liquid immiscibility and magmatic assimilation are discussed in simple language and with a minimum of highly technical terms.

Dr. Smith provides an excellent summary of the technique of sedimentary petrography in addition to a short general description of the principal sedimentary rock-types. About seven pages are devoted to the metamorphic rocks, which are also considered from the genetical point of view.

The simple presentation of the essential facts, and the abundant photomicrographs with which the descriptive portion of the book is illustrated, provide an excellent introduction to a difficult subject.

Name this Bird. By Eric Fitch Daglish. Pp. xiii+215+64 plates. (London and Toronto: J. M. Dent and Sons, Ltd.; New York: E. P. Dutton and Co., Inc., 1934.) 7*s*. 6*d*. net.

THE avowed purpose of this book is to provide a sure guide for those who can scarcely be said to have even a nodding acquaintance with the birds of the field and garden; enabling them to name any bird that they may see, or be so fortunate as to have in the hand. For their benefit a set of 'Keys' for identification has been prepared, but these are of little practical use. The confused arrangement of the species described in these pages will be apparent when it is pointed out that the coot, the starling, and the capercaillie are all bracketed together! These 'Keys' form Section I. In Section II the species follow one another in their natural order, and are briefly described. Unfortunately, however, nothing is said about the coloration of the *immature* bird, so that those who turn to these pages to enable them to identify, say, a young starling, or robin—to take but two examples—will turn in vain.

A number of coloured plates, and of crudely drawn figures, may help in the identification when the sexes are alike. The females differing from the males are not shown. But why are the knot, rednecked phalarope, and sanderling shown only in their winter dress, and the ruff and godwits only in their breeding-plumage?

Aberdeen Meeting of the British Association

THE full programme of the Aberdeen meeting of the British Association, to be held on September 5–12, should be now or shortly in the hands of members known to be attending. The programme itself forms only part of an unusually large bulk of literature issued in advance, for the local committee has prepared a handbook containing full details of all the local arrangements, descriptions of the general excursions, and so forth. Should any members find themselves apt to lose their way through all this mass of preliminary information, there is no need for them to do so, if by using the summary time-table of the meeting they are able to decide what they wish to do with the opportunities offered ; there are cross-references in the time-table to the appropriate pages in the handbook. The Scientific Survey of the city and district, also issued in advance, has expanded somewhat beyond the lines laid down in recent years, and may be thought to deal with one or two subjects outside the scientific scope ; but its interest never fails, and these surveys, in the course of years, ought to grow into an extraordinarily valuable series. They have certainly no equivalent in other readily accessible form.

Sir James Jeans announces the subject of his presidential address as the "New World-Picture of Modern Physics". The evening discourse which, as stated in the Preliminary Programme, is intended as a memorial lecture for the late president, Sir William Hardy, is now set out as a lecture on the "Storage and Transport of Food", by Sir Frank Smith ; and no subject, nor any lecturer, could be more appropriate to the dedication of the discourse. The other evening discourse will be given by Prof. W. L. Bragg on the "Exploration of the Mineral World by X-rays".

It is common knowledge that there has arisen a widespread demand, of recent years, that the Association should secure more effective communication between science and the public, on the general subject of the relations between science and the welfare of the community. On the side of science there is some measure of feeling (whether due to modesty, concentration, or aloofness) against any overt action in this matter on the part of the Association. This view, however, does not appear to be held by many, nor does it seem justified if the Association is to carry out the objects prescribed by its founders, one of which is to obtain more general attention for the objects of science. As for the public demand, there will not be at Aberdeen any set general discussion of this topic ; on the other hand, the public is offered a fuller opportunity than ever of appreciating specific applications of science to its welfare and interest.

It is too seldom recognised that the Association, as the principal mouthpiece between science and the public, always presents in its programmes a series of subjects of public interest : if the Aberdeen programme does not make this evident, none ever will. The title of Sir Frank Smith's discourse, already quoted, is a sufficiently good starting-point. Among the sectional presidents' addresses we find those of Prof. F. G. Baily on sources of cheap electric power ; Mr. H. T. Tizard on science at the universities—problems of the present and future ; Prof. H. M. Hallsworth on the future of rail transport ; Dr. Shepherd Dawson on psychology and social problems ; Prof. J. A. S. Watson on scientific progress and economic planning in relation to agriculture and rural life. Among the subjects of discussions or papers in the sections—taken almost at random—there are economic planning, town planning, water supply (a full discussion on underground water), the reduction of noise, the preservation of food, the chemistry of milk, nutrition in relation to disease, the application of soil and ecological studies to problems of land utilisation for forestry and grazing.

These may suffice for examples ; there are many others. If subjects of this sort are judged to need further investigation by means of committees, the Association has the mechanism to set such investigation on foot. In fact, action has been taken already in relation to some of the above. The recent inquiry by the Association into the desirability of a survey of inland water resources is well known ; the outcome (if any) of the representations made last month to the Government by the Association and the Institution of Civil Engineers is awaited with interest. What may have been almost forgotten is the work of the Association's committee, which from 1875 to 1895 sedulously collected data concerning underground water supplies, and, in the manner of that time, scattered its published results through the successive annual reports, in which they are interred. The committee's recommendations in 1895 were not dissimilar, so far as they went, from those which have been made now. The discussion on noise to be held at Aberdeen follows upon the previous ventilation of this subject in the engineering section : a practical outcome is promised in a demonstration, on behalf of the Association's committee on noise, of the successful modification of a motor bicycle's din. The subject of town and country planning is occupying the attention of more than one section and also of the delegates of the Corresponding Societies, which have lately been afforded, through the Association, an opportunity of indicating to planning authorities any scientific interests which may endorse arguments for the preservation of particular sites.

Aberdeen commands so wide an area of country necessarily so seldom accessible to the Association as such, that very full opportunities are offering for excursions and work in the field. The geological, geographical, botanical, agricultural and anthropological sections will be even more active than usual outside their meeting-rooms, and the engineering section, among other visits, contemplates one after the meeting to the important hydro-electric works in the west of Scotland. It is not apparent from the programme that the zoological section is as yet concerning itself with the fauna of Loch Ness ; but it will find special interests both in land excursions and in the fisheries. The important research institutions in the vicinity of Aberdeen will receive close attention from the sections interested (see NATURE, Aug. 18, p. 258). The general (as distinct from sectional) excursions (see NATURE, July 21, p. 110) are lavishly arranged, and it is hoped that as many members as possible will help the vigorous local organisation by indicating in advance, on the form provided, the excursions in which they wish to take part. The hospitality of the city and the university has proved itself already, and members will not fail to show their appreciation of it.

It is impossible here to enter into fuller details of the programme, but one point may be added. There is a tradition in the Association that Scottish meetings are always 'good' meetings. As a matter of fact the present writer, in a number of years' experience, has never been actively conscious of a 'bad' meeting, though there may have been degrees of goodness. But there is apt to be at Scottish meetings a certain special quality of enthusiasm, both among local scientific workers who take part in the arrangements and in the programme, and about the audience recruited from interested local residents. The article in last week's issue of NATURE affords sufficient evidence that the Aberdeen meeting will not fall short of this standard.

Morphology and Biochemistry

By DR. JOSEPH NEEDHAM, Caius College, Cambridge

THOSE who are accustomed to ponder the ultimate problems of biology are aware that though the need for a comprehensive biological science is great, the difficulties in obtaining it are equally considerable. Such old antitheses as that of form and function need not, indeed, detain us, for as Woodger's analysis[1] made clear, form is simply a short temporal slice of a single spatiotemporal entity. The main difficulty which confronts the biologist concerns the fusion of the two great realms of morphology and biochemistry or biophysics. Because at the present day the biochemist has little enough to offer towards the solution of the problem of the maintenance of organic form, the morphologist is apt to suppose that no connexions exist, and to acquiesce in an acceptance of the ancient Aristotelian distinction between *materia* and *forma*. This, however, is a counsel of despair.

In much physiological thought of the past there was a tendency to forget altogether about the problem of organic form and to treat the reactions proceeding in the body as though they took place in some homogeneous medium. The rise of colloid science almost acted as a lightning conductor for these minds by allowing them to salute heterogeneity at one level while forgetting it at the higher ones. But the advance of biochemistry itself has demonstrated that organisation must be taken into account. The significant observation of Vlès and Gex[2] that the ultra-violet spectrometric curve of the intact echinoderm egg is not that characteristic of proteins though these substances make up by far the largest part of the solid present, and the equally significant finding of Pollack[3] that picric acid, a notable coagulating agent of proteins *in vitro*, produced no effect when micro-injected into the cell, pointed the way towards new conceptions. The work of Peters[4] on the effect of adsorption on the dissociation constants of fatty acids, and much other experimentation referred to in his Harben lectures[5] bore in the same direction; and recent investigations[6] of the cell-free extracts of muscle and yeast have indicated the formation of stabilisation products among the phosphoric esters which probably play little or no part in the normal processes of the living cell. Such facts as these do not throw doubt on the value of studying *in vitro* processes, they simply show the need for caution in their interpretation.

For the union of biophysics with morphology the situation is, however, not entirely hopeless. It must be always borne in mind that form persists down to the level of organic molecules, and is clearly possessed, for example, by 'crystals' of protein. The possibilities of studying the orientation of these have not so far been explored. The technique of X-ray analysis which has been so successful[7] in the case of hair and wool, and promises such interesting results with muscle, has not yet been applied to the proteins of the egg-cell. How illuminating might not such an analysis be, when applied to the cell-bridges which Moore[8] has shown to exist between the cells of the gastrulating echinoderm embryo, or to the primitive connective tissue fibres which are believed by Weiss[9] to guide the growth of cells later arising ? Again, the possibility exists that the origin of dextrality and sinistrality exhibited by certain molluscan eggs in their cleavage[10] may be found in the stereochemical properties of the protein molecules composing them. Finally, we must probably assume that some oriented space-lattice of protein molecules is involved in the polarity which, as Conklin[11] and Wintrebert[12] describe, persists and determines cleavage after the movable ballast of the egg is shifted from place to place by centrifugation ; and although as yet we know nothing of the way in which the primary organiser works in the amphibian egg, it is at least not illicit to picture the orientation of protein chains by polar groups carried on a sterol-like structure[13, 14].

It is clear that the obscure relations between morphological form and chemical change are open to experimental attack at many points. But there are two prominent misconceptions existing at the present time as to how this should be done. On one hand there is a tendency to regard the problem as impossibly difficult and to postpone the consideration of it until the Greek kalends. On the other hand, there is a desire to replace the methods of experimental morphology by those of physiology in the hope of obtaining thereby a short cut into the arcana of biological organisation.

Those who support the first of these two outlooks maintain, in their favourite phrase, that organisation in biology must be regarded as axiomatic. "The biologist," says Gray[15], "must . . . accept the living state as he finds it" . . . "It seems . . . logical to accept the existence of matter in two states (the animate and the inanimate) as an initial assumption." Such a point of view appears to overlook the fact that by making biological organisation axiomatic, we correspondingly remove it from the realm of experiment. "As I understand it," he says[16], "the age-long discussion between the mechanist and vitalist schools of thought turns on how far we believe . . . that the facts of biology can be sorted out into a harmonious and satisfying series, without invoking conceptions which are found to be unnecessary in dealing with the facts of observation within the physical world." On the contrary, the inclusion of whatever special type of organisation may be found in living systems, within the sphere of science, has nothing whatever to do with vitalism, which posits some entity in addition to organising relations. The 'irreducibility' of biological categories can receive quite another interpretation, for the laws, for example, of the nematic or smectic state in liquid crystals are similarly irreducible to those holding good for common isotropic liquids. It is for us to investigate the nature of this biological organisation, not to abandon it to the metaphysicians because the rules of physics do not seem to apply to it.

The second misconception arises from an impatience with the thinking that has still to be done on the purely biological level, that is to say, among the 'complex components' of Wilhelm Roux. To suppose that this stage of thought can be avoided is a complete illusion ; it is essential to deal first with large packets of factors in a biological organism before proceeding to the finer analysis of smaller packets. Experimental embryology, as may be seen from the admirable recent book of Huxley and de Beer[17], has up to the present been mainly concerned with the influence of part on part in embryonic development. In this way, by observing the behaviour of parts in abnormal situations, the whole array of organiser phenomena was discovered, and a great deal more knowledge based on transplantations brought into being. Empirical discoveries on the purely biological level thus serve as stimuli to the physiologist to investigate processes which his methods alone would never have revealed in the first place. To characterise experimental embryology, therefore, as "one of the backward branches of biological science" (Wells[18]), is to reveal a complete failure to understand the process of biological discovery.

This failure probably originates from a confusion of thought on the part which mathematics should play in science. "Physiological analysis," says Wells[19], "depends very greatly, for its ideas and methods, on physics and chemistry, and in these sciences the emphasis has lain on quantities rather than on shapes." Is not this a false antithesis ? Both shape and quantity must surely be regarded as ultimately definable in terms of numbers. A topological system or a figure in solid geometry is surely as numerical in its way as a finite number of quantitative weight-units. We are not indeed as yet equipped with the mathematical armamentarium which morphology requires, but this should not be allowed to obscure for us the fact that the central problem of biology is the form-problem. After all, it is essential to realise that although the quantitative in the restricted sense of chemistry has a great part to play in biology, nevertheless arithmetic does not exhaust the realm of logical order, nor is it the only form which scientific exactness may take. There are other systems of structure besides arithmetic, and the complex components may be very faithfully dealt with on their own level. An outstanding example of this is the accuracy of prediction attainable in genetics. They must, in fact, be ordered in this way before they can be linked with physico-chemical knowledge.

We may say, then, that to discuss biology with exclusive attention to matter at the expense of form is, to use the ancient phrase, "Hamlet without the Prince of Denmark". On the other hand, to discuss it with biological organisation regarded as something fundamentally inscrutable, is at least equally futile.

[1] Woodger, J. H., "Biological Principles", London, 1929, Chap. vi.
[2] Vlès, F., and Gex, M., *Comptes rend. Soc. Biol.*, **98**, 853 ; 1928.
[3] Pollack, H., *Proc. Soc. Exp. Biol. and Med.*, **25**, 145 ; 1927.
[4] Peters, R. A., Faraday Soc. Symposium, 1930.
[5] Peters, R. A., *J. State Med.*, 1932.
[6] Needham, D. M., "The Biochemistry of Muscle", London, 1932.
[7] Astbury, W. T., Street, A., and Woods, H. J., *Phil. Trans. Roy. Soc.*, **230**, 75 ; 1931 ; and **232**, 333 ; 1933.
[8] Moore, A. R., *Protoplasma*, **9**, 9, 18 and 25 ; 1930.
[9] Weiss, P., *Amer. Naturalist*, **67**, 321 ; 1933.
[10] Boycott, A. E., Garstang, S., and Diver, C., *J. Genetics*, **15**, 113 ; 1925.
[11] Conklin, E. G., Contrib. to Cowdry's "General Cytology", 1932.
[12] Wintrebert, P., *Comptes rend. Soc. Biol.*, **106**, 439 ; 1931.
[13] Waddington, C. H., Needham, J., and Needham, D. M., NATURE, **132**, 239, Aug. 12, 1933.
[14] Waddington, C. H., Needham, J., Nowinsky, W. W., Needham, D. M., and Lemberg, R., NATURE, **134**, 103, July 21, 1934.
[15] Gray, J., NATURE, **132**, 661, Oct. 28, 1933.
[16] loc. cit.
[17] Huxley, J. S., and de Beer, G. R., "Elements of Experimental Embryology", Cambridge, 1934.
[18] Wells, G. P., NATURE, **133**, 890, June 16, 1934.
[19] loc. cit.

Ancient Indian Iron*

By S. C. Britton, Salters Fellow, University Metallurgical Laboratories, Cambridge

Method of Production

The careful investigation of I. E. Lester[16] and of A. K. Coomaraswamy[17] indicate that iron was produced in ancient India by direct reduction from the ore, and that the process was precisely similar to that employed by primitive Indian craftsmen down to comparatively recent times. The description given by Prof. Henry Louis[18] of the process which he witnessed at Jubbulpoor may be quoted to give an idea of the method of working :

"The furnace was built of dried clay along the edge of a trench some 3 feet high above the trench ; the bottom of the hearth was about a foot above the bottom of the trench so that the furnace was about 5 feet high inside ; it was about 10 inches square at the mouth, but widened out to about double that size at the hearth. The back and side walls were about 2 feet thick, but the front wall, facing the trench, was only a couple of inches in thickness. Through that passed a couple of tuyères, made of dried clay, about 2 feet long, pierced with a 2 inch hole. The blast was supplied by means of a pair of circular goat-skin bellows worked by hand ; a roof of branches and leaves was built over the bellows to screen them (and the man blowing them) from sparks. The furnace was filled with charcoal, and, after that had been ignited, small baskets of ore and charcoal were thrown on alternately at intervals of about half an hour. After some ten or twelve hours' work, the thin wall was broken down, and a bloom of some 70 lbs. weight was got out. That rough bloom was cut into pieces, heated up in a primitive forge and hammered into flat cakes, in which form it was sold."

Lester[16] is strongly of the opinion that the quality of Indian iron is due to the cunning of the smith in making a selection from the metal produced from the ore and to his operative skill.

There seems little doubt that the ore used was generally the nodular hæmatite which is fairly widely distributed in India. A typical analysis given by Hadfield[19] is SiO_2, 9·14 ; Al_2O_3, 9·85 ; Fe_2O_3, 72·39 ; FeO, 0·22 ; moisture, 8·40 ; S, nil ; P_2O_5, 0·05.

The extremely low sulphur content of all the ancient specimens analysed shows that a pure charcoal was generally used for smelting and treating the metal.

Resistance to Corrosion of Ancient Indian Iron

Pliny, the Roman historian[20], stated that there was in existence at the city of Zengma, upon the Euphrates, an iron chain by means of which Alexander the Great constructed a bridge across the river ; the links of the chain which had been replaced had been attacked by rust, while the original links were quite exempt from it. This belief that the iron of to-day is inferior to that of yesterday has echoed down the ages, and most observers have been content to repeat it to explain the state of preservation of ancient Indian iron. Several suggestions have been made as to the direction in which the alleged superiority lies. Hadfield, dealing with the Delhi pillar, regards the purity of the metal and absence of inclusions as responsible for its preservation. Protagonists of copper steels have alleged that a small percentage of copper might be responsible. A. S. Cushman, discussing Hadfield's work on Sinhalese iron[21], reported that old wrought iron nails which had shown almost perfect resistance to corrosion for a hundred years in Virginia, had a very similar composition to the Sinhalese specimen, having an analysis C, 0·03 ; Mn, 0·06 ; P, 0·205 ; Si, 0·121 ; Cu, 0·027. He doubted whether the resistance of ancient steels was due to the presence of copper in them ; the three Sinhalese specimens examined by Hadfield showed percentages 0·012, 0·090 and 0·119, but all were corroded in similar fashion. Perhaps the combination of low sulphur and low manganese with high phosphorus produced corrosion resistance.

Wallace reported[22] the general freedom of Indian iron from rust and mentions that he has noticed that modern native-made iron forged on a stone anvil does not rust like English iron. "The iron-work of the car on which the Gods of the Kulu valley take the air has a fine brown patina and no rust flakes. It is all charcoal iron." Discussing this communication, Carulla suggested that forging on a stone anvil might "Siliconide the skin of the iron" and thereby make it resistant.

Rosenhain[23] suggested that much ancient iron contained a large amount of cinders in layers so that corrosion proceeded until a cinder layer was reached and then ceased. Also Desch[24] noted that many specimens looked as if coated with a fine adherent layer of slag. However, Hadfield has been unable to find any evidence of such coatings on the materials which he has examined.

Several observers have been inclined to believe that there is not inherent superiority in the metal over modern products. Graves, discussing the paper of Friend and Thornycroft[25], commented that, of the many specimens of ancient iron which he had seen in India, some were rusted and some were not, the difference apparently depending on the situation. In the same discussion Prof. Louis suggested that the preservative factor was essentially climatic.

Friend[26], discussing the Delhi pillar, states that the composition of the metal "tends toward the reduction of corrodibility but does not suffice to explain the general immunity of the pillar from corrosion. This suggests that the resistance to

*(Continued from p. 240.)

corrosion is due to the surface condition of the metal, which in other similar cases is usually known to be highly polished". He goes on to mention "the ancient custom of anointing the pillar with butter at certain religious festivals" as a contributory cause of a resistant surface.

There appears to be some confusion amongst the various views expressed as to whether the various well-preserved specimens have suffered corrosion at a remarkably slow rate or have suffered no corrosion at all, and it seems worth while to consider what could be the reason of either alternative. If there has been no corrosion, three possible explanations arise : that the metal is by reason of its composition not susceptible to attack, that it is covered by an oxide scale, formed in manufacture and never broken, or that the rain falling or moisture condensing on the metal is alkaline.

It seems unlikely that the original scale should never have been broken, especially, for example, on the fractured surfaces of the Dhar pillar.

R. B. Mears has recently, at Cambridge, used the method[27] developed by himself and Dr. U. R. Evans to compare the susceptibility to attack of modern iron and steels with that of a specimen of the Dhar pillar, the gift of Sir Edwin Lutyens to Prof. A. Smithells, who kindly allowed its use for the experiment. The specimens used were all ground, the final grinding being carried out in identical fashion for all materials. The method of the experiment consists essentially in the determination of the proportion of drops of distilled water (condensed in quartz) which cause rusting of the material in 24 hours under an atmosphere having pure oxygen and pure nitrogen in equal parts. The figures obtained were :

Pure Carbonyl Iron	0 per cent
Electrolytic Iron	8·3 ,, ,,
Modern Wrought Iron	82·8 ,, ,,
Modern Mild Steel	87·9 ,, ,,
Dhar Pillar Iron	100·0 ,, ,,

Although the various materials used may not be typical of their classes, and the Indian specimen may not be from the best part of the pillar, the numbers do show that the ancient iron cannot well be less susceptible to the commencement of corrosion than the modern products. The fact that corrosion began so readily under 'pure' conditions suggests that the Indian pillars have been corroded to some extent, unless the rain which falls on them is alkaline.

The results obtained in recent work show fairly definitely that the idea that special resistance to atmospheric corrosion can be conferred on iron or steel by eliminating minor constituents (particularly carbon and manganese) is wrong, though there is considerable evidence to show that physical unsoundness or the presence of sulphide inclusions causes premature failure.

In American tests[28] forms of iron low in carbon and manganese faired somewhat badly as compared with the steels. U. R. Evans and the author[29] compared the resistance of a pure electrolytic iron having C, 0·03 ; S, 0·005 ; Mn 0·04 ; P, 0·02 ; with that of a steel having C, 0·026 ; Si, 0·14 ; Mn, 0·57 ; P, 0·018 ; to corrosion in the atmosphere of Cambridge. Purity (that is, the absence of a second phase) and surface 'smoothness' undoubtedly retarded the early development of rust, but after six months, any difference which existed between pure iron and good mild steel in the unpainted condition was in favour of the steel.

It has to be remembered that the Indian irons are really wrought irons, and there is some evidence to show that under modern English conditions, wrought irons can give superior service to steel. For example, many structures, such as the High Level Bridge at Newcastle, erected in 1845, the Conway Tubular Bridge, erected in 1846, and the Menai Tubular Bridge, erected in 1852, are still in service, though it is possible that their preservation is the result of effective painting.

The exposure tests of Evans and the author[30] at Cambridge "point to the good behaviour of wrought iron. This is apparently due to the infrequency of specially susceptible points, the greater tendency to passivity and the convenient character of the scale". However, it remains true that in the English or American climates the rates of corrosion of wrought iron, good steel and 'pure iron' are substantially of the same order of magnitude, and it is safe to conclude that a slow rate of attack of such objects as the Delhi pillar is not due to their composition alone. It seems probable that climatic conditions have been the preservative factor.

For centuries after the erection of the Delhi pillar, the atmosphere of its neighbourhood must have been substantially free from pollution by any products of combustion, and its distance from the sea rendered the presence of much salt in the air unlikely. The dryness of the climate was sufficient to ensure that the pillar was only wet during the fall of rain, which must have been effectively distilled water. In these circumstances the initial rate of corrosion of the pillar would be extremely slow. W. H. J. Vernon[31] showed that an initial period of exposure of iron to a relatively non-corrosive atmosphere greatly reduced the rate at which it was corroded when the conditions were made more severe ; the Indian columns may have benefited by this effect in being erected initially during the 'dry' season.

The extremely slow attack may well have built up a very closely adherent and complete layer of rust which, being free from hygroscopic salts and in a hot climate did not, as rust often does, promote attack by keeping the metal moist, but actually served to shield the metal and reduced still further the rate of attack. It may be supposed that the rust layer became in the course of centuries sufficiently protective to withstand the arrival of a more polluted atmosphere. The bronze-like patina described so often may well be due to this compact layer of ferric hydroxide.

It is worth noting that in parts of India to-day, modern steels are giving excellent service. Indian railway authorities state, for example[32], "The conditions on the Railway are tropical and there is very little corrosion. Steel trough sleepers removed from the main line after 35 years service still retain a great deal of the original mill-scale" and "Iron covered goods wagons built in 1883 are still free from corrosion" but "Plates which give over thirty years of life in this part of India do not last more than a few years in Burma or on the Bombay Coast".

Thus, the most probable explanation of the preservation of the Delhi pillar seems to be the combination of 'purity' of atmosphere and the climate. The other specimens of Indian iron have not all had the same favourable conditions although the metal is similar and so a good deal of rust is found on some of them. The specimens of ancient iron found in countries other than India may be said in general to be in a state of preservation varying with their climatic environment. Thus many specimens, preserved excellently, have been excavated in Egypt[33]; here conditions have been dry, stretches of the desert are alkaline, and the atmosphere is unpolluted, though it has also been suggested[34] that the iron is of meteoric origin and owes something of its preservation to a high nickel content. On the other hand, specimens of Roman iron found in Britain are found to be extremely rusty, although Friend and Thornycroft[35] comparing the still metallic part of a corroded nail with a modern mild steel found that the ancient iron was the more resistant to corrosion of the two.

On the whole, it must be concluded that, although we should regard the operative skill and capacity for hard work of the ancient smiths with admiration, we cannot really expect to solve our corrosion problems by contemplation of their products.

[16] Presidential Address to the Staffs. Iron and Steel Inst., Sept. 30, 1911.
[17] "Medieval Sinhalese Art".
[18] *J. Iron and Steel Inst.*, No. 1, 129; 1912.
[19] *J.I.S.I.*, No. 1, 152; 1912.
[20] Pliny, Book XXXIV. Chap. 43.
[21] *J.I.S.I.*, No. 1, 179; 1912.
[22] *J.I.S.I.*, No. 1, 84; 1908.
[23] *Trans. Far. Soc.*, **11**, 236; 1916.
[24] *J. West of Scotland I.S.I.*, 1913–14.
[25] *J.I.S.I.*, **122**, 237; 1925.
[26] "Iron in Antiquity", p. 147.
[27] *Proc. Roy. Soc.*, 1934.
[28] Report of Com. A 5, *Proc. Am. Soc. Test. Mat.*, **27**, Part 1; 1928.
[29] *J. Soc. Chem. Ind.*, **49**, 173, T; 1930.
[30] *Trans. Electrochem. Soc.*, **64**, 48; 1933.
[31] *T.F.S.*, **23**, 164; 1927.
[32] "Corrosion Committee of Iron and Steel Inst. First Report (1931)", p. 18.
[33] Hadfield, *T.F.S.*, **11**, 183; 1916.
[34] T. A. Rickards, *J.I.S.I.*, No. II, 333; 1929.
[35] *J.I.S.I.*, **11**, 225; 1925.

Obituary

M. B. Baillaud

BENJAMIN BAILLAUD was born in 1848, a year of revolutions, and his peaceful life, which came to an end on July 8 last, was crossed by two wars which shook France to her foundations. Passing through the École Normale, he became an assistant to Leverrier at the Observatory of Paris, and also his substitute at the Sorbonne. After the defeat of France in 1870, Baillaud, then at the meridian of his energy and clearness, shared in the immense revival of France which had its place in the sciences, as well as in other directions. Sent to Toulouse, to reform the Observatory in succession to Tisserand, and afterwards as dean of the Faculty of Sciences, he performed these duties with singular zeal and effectiveness. He modernised the Observatory and brought many men, since famous, to the University; in the former respect we may mention only, as an instance of his foresight, that he developed as a pioneer, celestial photography. He also established at the greatest height then known, more than 9,500 ft., an observatory, chiefly, of course, meteorological, on the Pic du Midi de Bigorre, in the Pyrenees.

Chosen director of the Observatory of Paris in 1907, and so titular head of French astronomers, Baillaud added to his previous work on celestial photography an interest especially in time determination and distribution, a matter in which his friendship with Ferrié, then in charge of the station at the Eiffel Tower, assisted. The Observatory of Paris has a long and notable history, and is housed in Paris in a celebrated building, which is scheduled among the historic monuments of France. It was in Baillaud's time, however, somewhat out of date in equipment. He had, fully formed, complete plans for the renovation of the observatory, but circumstances prevented a repetition of his work in re-equipment, as at Toulouse, as it also prevented his repeatedly expressed desire for retirement.

The latter was not the desire of the astronomers however. When the sixth Congress met in 1909 to regulate celestial photography and produce the astrographic catalogue and the Carte du Ciel, Baillaud was chosen president. Later, with Ferrié, two successive congresses were summoned at the instance of the Bureau des Longitudes, in 1912 and 1913, to deal with time distribution, which was initiated, so far as Europe was concerned, and has since been maintained, from the Eiffel Tower, and afterwards from other more powerful stations; the first of these congresses chose Baillaud as its president, and he kept the organisation in being right through the War, though none of the countries which had initialled the document creating the Bureau de l'Heure ratified it. He only resigned this charge, as he resigned that of the Carte du Ciel—without ceasing an interest in them—in 1919, when he was chosen as the first president of the International Astronomical Union;

which with his invariable sense of duty he demitted in 1922; but he did not cease to attend the meetings. He was present at Cambridge in 1925, when the University conferred an honorary degree upon him.

Baillaud's work was for the most part administrative and official, so there is comparatively little to signalise personally, and that is technical; but he was a good mathematician, and contributed many discussions upon the usual subjects. He retired in 1926, and lived until the present year in the south of France, chiefly about Toulouse, or the Pyrenees, to which he was much attached.

He was a man of many friends, and incapable of rancour. In his long retirement he became, as a relative writes, *toute bonté*. R. A. S.

WE regret to announce the following deaths:

Prof. B. J. Collingwood, O.B.E., professor of physiology in the University of London, on August 9.

Prof. G. Dreyer, C.B.E., F.R.S., professor of pathology in the University of Oxford, on August 17, aged sixty-one years.

Prof. W. M. Hicks, F.R.S., formerly professor of physics and also first Vice-Chancellor of the University of Sheffield, on August 17, aged eighty-three years.

Prof. W. McF. Orr, F.R.S., lately professor of pure and applied mathematics at University College, Dublin, on August 14.

News and Views

Sir Peter Chalmers Mitchell, C.B.E., F.R.S.

AT the August general meeting of the Zoological Society of London, it was announced that Sir Peter Chalmers Mitchell would retire from the secretaryship at the annual meeting next April, and the Council would nominate Prof. Julian S. Huxley for election as his successor. For the past thirty years, Sir Peter has done so much towards making the Zoological Gardens more attractive to the public, while adding to the opportunities which they afford for scientific research, that his retirement marks the end of a brilliant epoch in the history of the Society. Only those who have been closely associated with him can realise the indebtedness of the Council to his ever-ready initiative and inspiration in the undertakings which they have entrusted to his tactful direction. One of his earliest tasks was the removal of the offices, library, and meeting room from Hanover Square to a new building in the Gardens, where there was more ample and convenient accommodation. A small extension to the Gardens was then arranged, in return for the provision of some paddocks open to public view in Regent's Park. The Mappin Terraces soon followed as a generous gift, and eventually the Society was induced to risk great expenditure in placing under the Terraces the Aquarium, which was so well planned and arranged that public appreciation returned the outlay almost at once. The new buildings for apes and monkeys, reptiles, and insects, besides rearrangements for the parrots and smaller birds, and the provision of an adequate sanatorium, should also be mentioned; nor must the new and comparatively luxurious refreshment houses be forgotten. Sir Peter Chalmers Mitchell, however, will always be best remembered by the great share he took in the acquisition, planning, and organising of the Zoological Society's country park at Whipsnade, where wild animals live under almost natural conditions, and can be studied in ways for which there is no provision in an ordinary menagerie.

THROUGHOUT his administration, Sir Peter Chalmers Mitchell has always encouraged the use of the Society's collection for scientific research. His own work on the anatomy of vertebrates came nearly to an end with his great memoir on the intestinal tract in mammals in the Society's *Transactions* in 1905, but he continued to stimulate others in the prosectorium, and he organised new lines of investigation. He induced a succession of pathologists to join the staff, and they have now for many years published valuable results, besides helping to improve the health of the animals. Parasites have been systematically collected and studied; and for some time after its foundation the scientific problems of the Aquarium were examined by a special assistant. The scientific meetings of the Society have been arranged to make a wider appeal to the fellows, and most of the technical papers are now taken as read for publication in the *Proceedings*. Sir Peter, indeed, will hand on to his successor an admirable organisation for making the best use of the scientific resources of the Society. He retires with the best wishes of zoologists for the enjoyment of his well-earned leisure, which will enable him to return to the quiet contemplation of the subjects which he has made his own.

Centenary of Sprengel, 1834–1906

AMONG the many men of science of German birth who during last century made England their home was Herman Johann Philipp Sprengel, F.R.S., the centenary of whose birth occurs on August 29. Born at Schillerslage near Hanover, he studied physics and chemistry at Göttingen and Heidelberg, taking the degree of Ph.D. in 1858. In January 1859 he came to England and for three years was associated with Brodie at Oxford. He then settled in London and engaged in research work at the Royal College of Chemistry and in the laboratories at Guy's and St. Bartholomew's Hospitals. From 1865 until 1870 he was chemist at Farmer's chemical works in Kennington, after which he devoted himself mainly to his own inventions. He was elected F.R.S. in 1878 and in 1903 the title of professor was bestowed upon him by the German Emperor. He died suddenly on January 14, 1906. Sprengel will always be remembered for his invention in 1865 of the dynamic mercury pump which made possible the evacuation of Swan's and Edison's electric glow lamps, Crookes's radiometer and Röntgen's apparatus, and for his improvements in explosives. In 1871 he took out patents for a class of explosives which were non-explosive during manufacture, storage and transport, but for want of encouragement he allowed the patents to lapse. His explosive 'rack-a-rock' was used in 1885 for removing the Flood Rock Reef which obstructed the entrance to New York Harbour at Hell Gate, some 300,000 lb. of the explosive being used. He also devised a U-tube for the determination of the density of liquids, introduced the use of a finely divided spray of water in the place of steam in sulphuric acid chambers and was the first to direct attention to the value of picric acid as an explosive.

New Belgian Ascent into the Stratosphere

DR. MAX COSYNS is to be warmly congratulated on his successful ascent into the stratosphere on August 18. The disaster of the two previous ascents had not deterred the chief actors in this from going forward with their preparations, for it will be remembered that the American ascent came to grief only so recently as July 28. Dr. Cosyns was accompanied on this ascent by M. van der Elst, and the project was under the auspices of the Belgian Fonds National de la Recherche Scientifique which gave the balloon its name *F.N.R.S.* It had a capacity of about 14,000 cu. metres and was provided with an aluminium gondola with special means of rapid exit. The motive of the flight was the investigation of the directive tendency of the cosmic radiation, and as a good landing has been made it is to be hoped that the records are safe. The ascent was made from Hour-Havenne in the valley of the Lesse in Belgian Luxembourg at 6.10 a.m. on Saturday in perfect weather conditions, and the descent at Zenavlje in Yugoslavia at 9.30 p.m. on the same day. The height reached, as reported in the daily newspapers, was about 10 miles. Though this does not constitute a record for height, the recent aeroplane work of Blackett and Gilbert in Great Britain at comparatively low altitudes shows the value of such data as may be obtained in this manner in resolving the problem of the directive tendency of the cosmic radiation. A further point of interest is the fact that the balloon covered a distance of about 1,000 miles in a general south-easterly direction during a period of 15 hours. This would indicate a very high wind velocity at high altitudes.

Cambridge Lake Rudolf Rift Valley Expedition

THIS expedition has now been in the field some eight months, and we regret to report that on August 14 two members—Dr. W. S. Dyson, naturalist, and Mr. W. H. D. Martin, surveyor—are reported missing on South Island. There are three uninhabited volcanic islands in the lake: Central Island, studied by the Cambridge Expedition of 1930–31, North Island, visited in 1932 and South (Höhnel) Island, which has remained unknown since it was roughly mapped from the mainland during the original exploratory journey by Teleki and von Höhnel in 1885. Its study was a particular object of this year's expedition, which has a folding boat and outboard motor for the purpose. The two men crossed the five miles of open water to the island about August 1, and after a fortnight in which prearranged signals were not received on the mainland, Mr. V. E. Fuchs, leader of the expedition, asked for Government assistance, if possible by aeroplane, to aid in the search. If the missing men are on the island they should have little difficulty in obtaining subsistence on fish; the water is potable though unpleasantly alkaline. Earlier in the year the expedition, which is mainly geological, proceeded up the west side of the lake with the view of going to the Omo River and excavating important bone beds *en route*. The Malembe triangle, where Kenya borders on the Sudan and Abyssinia, is somewhat unsettled and an armed guard had to be taken north from Lokitaung; this impeded the work, but valuable collections and surveys have been made. After returning south, the expedition moved to the south-east corner of the lake to study the eastern scarp of the rift valley, where high-level beaches were reported by the 1931 expedition. It was here that the unfortunate incident occurred.

Gift to the University of Birmingham

AT the meeting of the Court of Governors of the University of Birmingham in February, reference was made to the urgent need of further accommodation for the Department of Chemistry, but it was pointed out that the financial commitments incurred in the building of the new Medical School were such as to make the desired addition to the chemistry building impossible for the present. The difficulty has now been solved by the generous gift of £45,000 by Mr. A. E. Hills, a Birmingham tube manufacturer, for the specific purpose of erecting an additional block of buildings for the Department of Chemistry. In his letter to the Pro-Chancellor, Mr. Hills says: "For some time past I have had in my mind the desire to assist the higher education of those likely to be engaged in industry in Birmingham and the Midlands, with which I have been closely connected in my business life. I have come to the conclusion that I can best do so by helping the University in one of its scientific departments which is in need of extension. . . . It seems to me that the department most overcrowded and badly housed is that of Chemistry. Much of its work is being carried on in wooden huts which are inadequate and are becoming dangerous. The present Chemistry block is insufficient for the increasing number of students who come to it for the training in chemistry which forms a necessary part in practically all scientific careers, and also for those engaged in post-graduate research." It is understood that the new block will fill the gap between the existing chemistry and geological blocks, thus completing the western part of the architect's original scheme for the group of buildings.

Edinburgh Geological Society

BY the end of this year, the Edinburgh Geological Society will have been in existence for one hundred years. In order to take advantage of the presence in Scotland of many foreign and overseas geologists who will be attending the Aberdeen meeting of the British Association, it has been decided to hold the centenary celebrations early in September. Invitations have been sent to learned societies at home and abroad, and a large number of delegates will take part with the fellows of the Society in various functions. On Monday, September 3, the delegates from kindred societies will be received in the buildings of the University of Edinburgh, where they will be welcomed by the president, Sir John Flett, in the name of the Society, and by Sir Thomas Holland, in the name of the University. During the afternoon, visits will be paid to the Royal Scottish Museum and the offices of the Scottish branch of H.M. Geological Survey. In the evening, the Society and its visitors will be the guests of the Lord Provost and Town Council of Edinburgh at a reception in the College of Art. Tuesday morning will be devoted to hearing short addresses by eminent geologists in the new Geological Department of the University. The party after lunch will make a tour of various places of geological interest in and around Edinburgh. A dinner on Tuesday evening given by the Society to the visiting representatives will bring the functions to a close.

Earthquake in Scotland

AN earthquake of unusual strength occurred in Ross-shire and the surrounding counties on August 16 at about 2.15 a.m. (G.M.T.). The early accounts are insufficient to determine its intensity and disturbed area, but it seems to have reached the degree 7 (Rossi-Forel scale) and to have been felt over at least 10,000 sq. miles, for it was observed at such places as Glenshiel in west Ross-shire and Pitlochry in Perthshire. Its strength is also evident from the fact that it was recorded at West Bromwich, where, at about 2.25 a.m., it caused the pointer of the seismograph to move an eighth of an inch. The principal earthquake zone in the north of Scotland is the portion of the Great Glen fault that lies between Inverness and Loch Ness. As most of the places from which reports come cluster in the neighbourhood of Dingwall, it is possible that the origin may lie in that district.

Element 93: A Correction

X-RAY spectroscopic analysis has failed to confirm the presence of any new element in pitchblende from Joachimsthal. Dr. O. Koblic has consequently withdrawn his claim to the discovery of an element of atomic number 93 in this uranium ore, concerning which an announcement was made in NATURE of July 14, p. 55. He now states that the substances he supposed to be the silver and thallium salts of an acid, $H(93)O_4$, were sent to Prof. V. Dolejšek (Prague) and to Drs. I. and W. Noddack (Berlin) for X-ray spectrum examination. No lines corresponding to an element of atomic number were obtained but the presence of tungsten was unmistakable. Tungsten was also detected afterwards by chemical means in Dr. Koblic's preparations. The erroneous atomic weight determination arose from the assumption that his silver salt was $Ag(93)O_4$ whereas it was actually silver tungstate. The unusual behaviour of tungstates in acid media is suggested as an explanation of the reactions described by Dr. Koblic (*Chemický Obzor*, 9, 129; 1934) which he attributed to the presence of a new element. This withdrawal has, of course, no reference to the earlier work of Prof. E. Fermi dealing with the 'synthesis' of an element of higher atomic number than uranium (NATURE, June 16, p. 898).

An International Air Police Force

LORD DAVIES continues his vigorous campaign for an international police force in a new booklet entitled "Force and the Future" which deserves notice as a shorter and more incisive statement of the argument of his larger work, which we have already noticed in review. He also brings it up to date by arraigning the Government on several counts for holding up the League of Nations and failing to provide it with the means of enforcing its will. The discussion of these is clearly out of place in these columns, but it is germane to science to point out that, as time goes on, opinion seems definitely to be settling on the air as the sphere of action in which international co-operation is most appropriate, feasible and urgent. A well-thought-out plan for a European air police has lately been submitted to the League of Nations Union by Rear-Adm. R. N. Lawson and should be carefully considered by the government experts and everyone who is anxious to move in the direction of greater security and union among the nations. If not immediately practicable in the form of police, it clearly is so in the form of greater facility and safety in transport and communication. Started in this way, as the International Postal Union was in the middle of last century, a union or bureau associated with the League of Nations would secure a much more efficient and economical way of utilising the air for peaceful purposes, and indirectly sidetrack the horrors of bombing from the air which Lord Davies and many others have held up to us as the inevitable result of man's latest conquest. Were the air used habitually for its obvious purpose of bringing the nations easily together, it would soon seem as mad and monstrous to use it for destruction as for the barber to cut your throat when you sit down to be shaved. While man has free will, one cannot absolutely rule out the possibility of the wildest actions, but one can make them, by controlling habits, improbable to the highest degree.

Community Education and Training

IN a paper on "The United States United Communities Bill from the Point of View of India's Educational Problems" read before the ninth All India Educational Conference in December, 1933, Capt. J. W. Petavel, formerly lecturer on the poverty problem in the University of Calcutta, explains that the United Communities Bill aims at providing for the financing by the State of a system of modernised mutually co-operating co-operative colonies. In other words, it plans to bring into existence an organisation of people who would be customers to one another, and thereby independent of fluctuations in general trade prosperity. Capt. Petavel claims that co-operative colonies for education would be the easiest type to establish, and that in India they would enable an ideal educational programme to be planned. They would revive in a modern form the old Indian *Gurukul* education system as was strenuously advocated by the late Sir Asutosh Mookerjee. In the educational colonies, three hours per day might be devoted to productive work of a suitable kind, which it is claimed is the first item in any ideal educational programme. Another three hours devoted to organised games would serve to develop muscle, alertness and disciplined co-operation. In the ideal programme there would be time also for instruction conveyed by drama, song and similar methods. Class-work need then occupy not more than four hours, leaving fourteen hours for rest and recreation. The colonies would be practically self-supporting, since the pupils would cultivate the land that would give them and those who taught them their food. In the Indian rural districts, the educational 'united communities' would be centres also of technical training of all kinds. They would be the seed farms, stock farms, demonstration farms and centres of rural reconstruction generally.

The Ministry of Health in 1933-34

THE fifteenth Annual Report of the Ministry of Health was issued on August 11 (Cmd. 4664. London: H.M. Stationery Office. 6*s*. net). The Report, which relates to the year ended March 31, 1934, is divided into six parts—public health, housing and town planning, local government and local finance, administration of the poor law, national health insurance and contributory pensions, and the Welsh Board of Health. As in previous years, the Annual Report of the Chief Medical Officer of the Ministry is published separately. During the twelve months, private enterprise built without subsidy 207,869 houses, which constitutes a record. The opportunity has been taken to include in the Report a full review of the public health services under the conditions created by the Local Government Act, 1929. The number of samples of food analysed by public analysts during the year 1933 was 138,171, of which 7,601 samples were reported as adulterated or not up to standard, a percentage of 5·5, being a slight increase over the two previous years. As regards infectious diseases, the notable features of the year were an increase in the prevalence of scarlet fever, concurrently with an increase in the prevalence in diphtheria, an increase in the prevalence of and mortality from cerebro-spinal fever, and a decline in the incidence of smallpox.

The Giorgi System of Units

AN interesting note on the metre, kilogram, second and 'another unit' system of units by Prof. G. Giorgi has been published by the International Electrotechnical Commission (I.E.C.) the central office of which is at 28, Victoria Street, S.W.1. This system of units has already been described in NATURE of April 21, p. 597. The committee for electric and magnetic units voted last year unanimously in favour of a proposal to arrange the system of practical electrotechnic units into a complete absolute system usually called the M.K.S. system. In this paper, Giorgi describes the three well-known groups of units, the C.G.S. electrostatic, the C.G.S. electromagnetic and the group of practical units. He commends the national system of units devised by Heaviside, in which the 4π is displaced and a perfect duality between electric and magnetic formulæ is secured. The theory of physical dimensions is better understood than it was fifty years ago. No one now believes that everything in the physical world depends necessarily on three fundamental quantities, length, mass and time. Giorgi shows that by taking the ampere, or the volt, or the coulomb as the fourth unit, he can build up a complete absolute system from four fundamental units. This set of units is neither electrostatic nor electromagnetic; it is in agreement with the principle of duality and can be used with either rational or non-rational derived units. All units of the system lie between the smallest and largest magnitudes that present science has to measure. It will simplify the learning of the theory of electricity by students of electrical engineering. No proposal is made to discard the existing systems of units. Each one will be employed according to the requirements of the subject and the preference of the user. Future practice will show which is the most convenient.

Before Papyrus: Beyond Rayon

AN interesting and brightly written paper by Dr. G. J. Esselen, the president of Inc. Chemical and Research Development of Boston, is published in the *Journal of the Franklin Institute* of March. It is entitled "Before Papyrus . . . Beyond Rayon". Rayon a few years ago was universally known as artificial silk. The basic chemical substance to which the writer refers is cellulose. It forms the structural framework of all vegetable life and is the raw material of great industries. The reason why the derivatives of cellulose were so slow in developing is that it is only a few years ago since its empirical composition was discovered. Transparent sheets of cellulose plastic are used in the manufacture of the laminated 'glass' used in automobiles. A recent discovery has so lowered the cost of the manufacture of cellulose acetate plastic that at the present time more than 70 per cent of all the laminated 'glass' manufactured in the United States is made from it. They also make bullet-proof 'glass' composed of five laminations, the centre one being a piece of plate glass about $\frac{3}{4}$ in. in thickness. It is being used for the windows of armoured cars and cashiers' cages in banks. In 1910, no rayon was being made in the United States. In 1931, 144 million pounds were produced. Methods of manufacturing rayon are continually improving, greatly increasing its strength and its resistance to water. A new use of cellulose is the manufacture of shoes. With this material all sewing and nailing of the soles to the uppers are eliminated. The cement used to stick them together is a cellulose nitrate cement. It is now only necessary to hold them together for fifty seconds. A single operator in 8 hours 15 minutes applied soles to 1,580 pairs of shoes. The value of cellulose as a raw material is continually increasing as our knowledge increases.

Fenland Archæology

AMONG the objects which the recently founded Fenland Research Committee, of which Prof. A. C. Seward is chairman, has in view is the preparation and publication of a map, or series of maps, showing the extent of Roman or British occupation of the Fens and of the watercourses as they existed at that period. As was pointed out when the Committee was formed, the scientific investigation of the Fenland to a great extent has been neglected, and if it should be possible to complete the survey for the purpose of this map on the scale contemplated, it will prove of very considerable importance for the study of the physical and human geography of the period. It is estimated that something like a million acres will be added to the map of Roman Britain. In the meantime, an appeal has been issued by the Committee for assistance towards the cost of printing a map of the Fens on the scale of two inches to the mile in a series of twenty sheets, of which four have already been prepared. The maps are to be reproduced by photography from the six-inch Ordnance map and will show all that is shown on that map. It has been found by experience that the two-inch scale is more convenient for survey work than the six-inch, hence the necessity for the reproduction. The maps are intended for use as a basis for the research work of the Committee, especially in connexion with the work of plotting from air-photographs showing abandoned drainage channels, the Celtic, or Romano-British, system of fields and drainage and the like. A sum of £500 is required. Contributions may be sent to the Hon. Secretary, Dr. Grahame Clark, Peterhouse, Cambridge.

Afforestation in Great Britain

IN view of the conditions of drought experienced in 1933, the fourteenth Annual Report of the Forestry Commissioners for the year ending September 30, 1933 (H.M. Stationery Office, 1934) may be read with satisfaction. Since the Commissioners commenced their afforestation work, the only comparable drought in Great Britain was that of 1921 ; the losses in the nurseries and new plantations were far less in 1933 than in 1921. Equally satisfactory is the comparison of fire losses with those of the bad fire year 1928–29, even though the drought in 1933 was more prolonged. This is attributed to the fact that the whole system of fire prevention and fire protection was overhauled after 1928–29, and with success; since the acreage burnt in 1932–33 was 1,313 compared with 4,574 acres in 1928–29. It is of interest to note that 50 per cent of the fires in plantations during 1932–33 originated from sparks from railway engines, whilst 19 per cent were caused by the general public. With the growing area of coniferous woods in the country, as a public property, it would appear that railway managements should take steps to minimise this wasteful destruction. The Commissioners continued their planting work, the total area dealt with (planted or sown) during the year amounting to 21,037 acres, of which 19,160 acres were conifers and 1,877 acres broad-leaved species. The total area planted by the Commissioners during the fourteen years amounts to 232,711 acres, of which 217,919 acres are under conifers and 14,792 under broad-leaved species. During the same period, 95,228 acres have been planted by local authorities and private owners with the help of State assistance ; the area during 1932–33 amounting to 4,580 acres. Land acquisitions during the year amounted to 17,591 acres, 15,335 acres being classified as plantable land. The Commissioner's policy of establishing training camps for the unemployed resulted in five new camps being formed, the total number being thus augmented to twelve.

Agricultural Industries Congress

THE fourth International Congress of Agricultural Industries will be held in July 1935 in Brussels. The third congress was held last Easter in Paris. Many aspects of agricultural research and technology were considered, including the importance of *p*H (intensity of alkalinity-acidity) in agricultural practice ; improvement of wheat and sugar beet by genetical methods ; fermentation studies, and various other subjects connected with the food industry. The April number of the *Bulletin de l'Association des Chimistes de Sucrerie, de Distillerie et des Industries Agricoles* contains an account of the Congress, the final report and the resolutions passed. The scientific proceedings have been published in a separate volume. As a result of the last Congress, a permanent International Commission of Agricultural Industries has been established in Paris (156 boulevard de Magenta). Its purpose is to organise international congresses and exhibitions and to notify the various States and organisations concerned of the results of such activities. Among the resolutions passed by the last Congress was a recommendation that some suitable international organisation be requested to correlate the present knowledge concerning water pollution by industrial wastes, and to facilitate further study of the conditions that must be fulfilled by water from industrial wastes in order that it shall not be harmful.

Fauna of Caves

A BIBLIOGRAPHY of cave faunas is now being published ("Animalium Cavernarum Catalogus", auctore B. Wolff, Pars 1 : Vorwort ; Einleitung, Band 1, S. 1–16 ; Band II, S. 1–32 ; Band III, S. 1–64. 18 M. Pars 2 : Band I, S. 17–32 ; Band II, S. 33–64 ; Band III, S. 65–144. 18 M. Berlin, W. Junk, 1934). This work is to be completed in three volumes which will form respectively a bibliography, a list of the caves and of the animals recorded from each, and a list of the animals found living in caves arranged in systematic order, and will be provided with an index in two parts—an alphabetical list of the caves and another of the animals recorded. The first and second parts now issued contain the first section of the bibliography (32 pp.), of the list of caves arranged according to the countries in which they occur (64 pp.) and of the catalogue of animals recorded—Protozoa, Coelenterata, Vermes, Crustacea and Insecta as far as the end of the Apterygota (144 pp.). The author is rendering useful service in bringing together the widely scattered references on cave faunas in the literature, and in carefully analysing the papers on the subject for the data recorded in the second and third sections of the work.

Romanes Lecture at the University of Edinburgh

MISS ISABELLA DAVIDSON ROMANES, of Edinburgh, who died in 1932, bequeathed to the University Court a sum of £2,000 in memory of her brothers Robert and James, chemists, who graduated B.Sc. in the University of Edinburgh, in 1874 and 1880 respectively. The elder brother, moreover, obtained the degree of D.Sc. in 1876 ; he was later scientific chemist in the Government School, Rangoon. The University Court has *inter alia* instituted a biennial Romanes lectureship. The first lecture was given on May 24 by Prof. H. Wieland, of Munich, on "Some Enzymic Reactions of Yeast".

Population of Arctic Russia

THE Soviet Government has published a map on a scale of 1 to 5,000,000, in two sheets, showing the distribution of people in the northern parts of Russian territory in Europe and Asia, from the Finnish frontier to the Pacific. On a groundwork showing only water features in blue, the various races are shown by twenty-three colours and tints. Squares of colour indicate settlements of different sizes while circles of colour show the density of nomadic peoples. The map is very clear, although the different colours and symbols have to overlap in many places. The data were collected during the census of 1926 and the map has been prepared by P. E. Terlezki for the Northern Tribes Assistance Committee. The legend is in English as well as Russian. The two sheets present a most graphic picture of the distribution of peoples, their relation to river valleys and sea coasts and the meeting and intermingling of various tribes.

Physical and Chemical Apparatus

WE have received from Messrs. Griffin and Tatlock, Ltd., Kemble Street, Kingsway, W.C.2, a copy of their illustrated catalogue, No. 50 L, of scientific apparatus. This describes, in 900 pages or more, instruments and apparatus for the physical sciences, including mechanics, sound, heat, light and electricity, with the addition of laboratory fittings and a list of chemicals. The catalogue also contains a very useful classified list of standard textbooks and recent publications on all branches of physics, chemistry and general science. Of special interest to the teacher of physics is the "Microid Physical Series" comprising apparatus and instruments of new and improved design for demonstrating physical principles. This series contains more than one hundred items and we may instance as articles possessing novel features of interest the circular trolley and centrifugal force apparatus, an apparatus for finding "g", a rotating platform for illustrating angular momentum (Pohl), the universal projector, spectrometer, and optical bench, the potentiometer and the earth inductor. A section on microscopy includes an inexpensive micro-projector and drawing apparatus for biological and other subjects. Among technical testing apparatus we find the Griffin–Sutton bomb calorimeter, the Boys' gas calorimeter, and also microid pyrometers. It is gratifying to find that British firms are now active in the design and construction of scientific apparatus.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A temporary surveyor in the Engineer's Department, River Medway Catchment Board—Engineer, 71A Bank Street, Maidstone (Aug. 31). A principal of the Widnes Municipal Technical School—Secretary, Education Office, Town Hall, Widnes (Aug. 31). A technical assistant with training in electro-acoustics at the Air Defence Experimental Establishment, Biggin Hill, Kent—Superintendent (Aug. 31). A deputy station superintendent at the Pigeon House Steam Power Station, I.F.S.—Secretary, Electricity Supply Board, 60 Upper Mount Street, Dublin (Aug. 31). A lecturer in electrical engineering at the College of Technology and Art, Rotherham—Director of Education, Education Offices, Rotherham (Sept. 1). A lecturer in chemistry at the Portsmouth Municipal College—Registrar (Sept. 1). A director of research of the Research and Standardisation Committee of the Institution of Automobile Engineers—Secretary, I.A.E., marked 'Personal' (Sept. 1). An assistant lecturer in the Department of Physiology, qualified in medicine and preferably with a science degree, at University College, Cardiff—Registrar (Sept. 1). A professor of animal husbandry and lecturers in histology and embryology, in chemistry and physics and in biology at the Royal Veterinary College, London, N.W.1—Secretary (Sept. 3). An assistant in the Botany Department of the University of Aberdeen—Secretary (Sept. 8). A demonstrator in civil engineering, City and Guilds (Engineering) College, chiefly for work in connexion with the theory of structures—Secretary, Imperial College of Science and Technology, South Kensington, S.W.7 (Sept. 8). A county librarian to the Northamptonshire Education Committee—Secretary for Education, County Education Offices, Northampton (Sept. 8). A chief advisory economist for the Midland Province at the Midland Agricultural College—Principal of the College, Sutton Bonington, Loughborough. A sanitary engineer for the Department of Health, Palestine—Crown Agents for the Colonies, 4 Millbank, London, S.W.1, quoting M/3449.

Letters to the Editor

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

Radioactivity Induced by Neutron Bombardment

USING neutron sources containing up to 250 millicuries of radon mixed with beryllium, we have been able to confirm many of the results reported by Fermi and his collaborators[1]. We have also obtained the following additional results :

Fluorine appears to give an effect of about 40 sec. period, which has an initial intensity of about 5 per cent of that of the shorter period already reported by Fermi.

Zinc. The longer period exhibited by this element appears to be about six hours, and chemical separation shows that the active body is an isotope of copper.

Copper also gives an effect of about six hours period, of the same order of intensity as the effect from zinc : the active body is probably identical.

Sodium. Besides the short period, we have found a very weak effect from sodium the period of which (*c.* 10 hr.) is within the errors of measurement the same as that of the long periods given by magnesium and aluminium, which are known to be due to an isotope of sodium[1]. The active body in each case is probably ${}_{11}Na^{24}$. We are indebted to Dr. Segrè for suggesting that we should look for this period, as it is apparently a definite case of capture of a neutron without expulsion of a material particle, since ${}_{11}Na^{22}$ is known to have a very short period (and to emit positrons)[2].

Search for a period of 13 days from phosphorus, which would be a similar case, was without result.

T. BJERGE.
C. H. WESTCOTT.
Cavendish Laboratory,
Cambridge.
Aug. 14.

[1] Fermi and others, *La Ricerca Scientifica*, 5, 1, 283, 330, 452, and 652 ; 1934. 2, 21 ; 1934. NATURE, 133, 757, May 19, 1934.
[2] L. Meitner, *Naturwiss*, 22, 420 ; 1934.

Dependence of Magnetic Induction on the Magnetic Field in Supraconducting Lead

SUPRACONDUCTIVITY is destroyed by a magnetic field, the critical field H_k depending on temperature. Until recently it was held that the magnetic state of a supraconductor could be computed from electrodynamics with the aid of a single assumption that the conductivity is infinitely great right up to H_k. The dependence of the magnetic induction B on the field strength H for this case is shown on Fig. 1 by the thick line.

Starting from Bridgman's hypothesis[1] that the supraconductive and non-supraconductive states could be considered as two phases, to which the laws of thermodynamics might be applied, Rutgers[2] and Gorter[3] derived a relation between dH_k/dT and the jump in the specific heat at the transition point, assuming that in the supraconducting phase the permeability $\mu = 0$, and that in the ordinary phase $\mu = 1$. The relation obtained was in good agreement with the values found for tin at Leyden.

In order to decide the question whether, indeed, two phases exist, it appeared to us important to measure μ as a function of H up to values greater than H_k. In order to gain a general survey, some measurements were made and the results published[4]. We now possess more accurate data, which we should like to report briefly in NATURE.

The experiments were carried out on a polycrystalline rod of lead, 5 mm. in diameter and 50 mm. long, at a constant temperature of 4·24° K. The axis of the specimen was parallel to that of a long solenoid, which produced a homogeneous field. We made use of two different methods, namely :

(1) $\Delta B / \Delta H$ as measured by suddenly changing H in small stages. For these measurements, a spool was tightly wound around the middle of the rod and connected over an amplifier with a ballistic galvanometer.

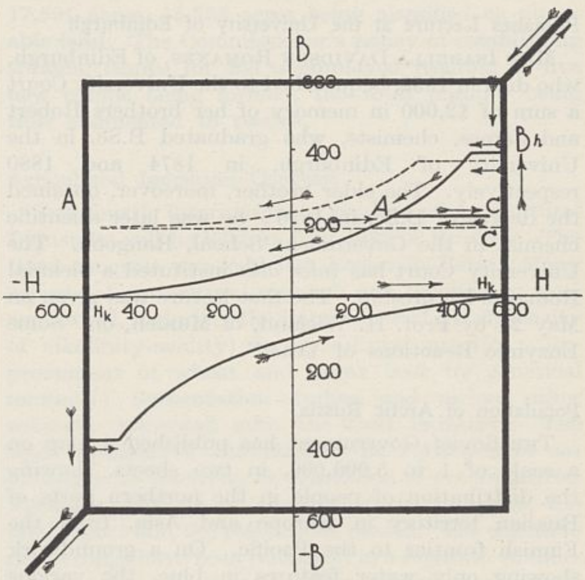


FIG. 1.

(2) The magnetic moment of the supraconductor was measured in a constant field by quickly removing the specimen itself far from the sphere of action of the spool surrounding it. The experiment consisted in observing the throw of the ballistic galvanometer, connected to the spool, when the specimen was suddenly removed or suddenly introduced. In the course of its motion the specimen always remained in a field of constant intensity. Fig. 1 shows the relation which we found between the induction B and the field strength H, represented by a thin line and by the thick line above H_k. The dotted curve was obtained with the first method ; the full curve shows the results obtained with the second method, part of which coincided with those gained with the first.

The following conclusions may be drawn from these experiments :

(1) When the specimen is first magnetised, B and also μ are equal to zero with an accuracy of 0·2 per cent, when the field varies from 0 to H_k. This result was found to be independent of time.

(2) In fields near to H_k the induction B increases very rapidly in a very narrow interval of field strength

up to a magnitude corresponding to that of the ordinary metal.

(3) In fields above H_k, B and μ agree with the known data on ordinary metals with an accuracy of 0·2 per cent. $\mu = 1$.

(4) When the field strength is decreased again to values near H_k, the phenomenon is completely reversible. A further decrease of H causes a very rapid fall in B, which, however, suddenly ceases when B reaches a certain value B_h. However, in different experiments carried out with the same specimen, this value was completely non-reproducible. The remaining induction B_h varies from 60 to 80 per cent of the maximum value of B. In some cases B was found to decrease slightly with time. Violent shaking of the specimen caused no noticeable change in B.

(5) When H is further reduced, B also decreases. In this part of the curve a considerable discrepancy is discernible between the results obtained with the first and the second method. It may be that the conditions under which the first method may be applied are not fulfilled in this part of the curve. For small values of H the curve obtained by the second method is completely reproducible and does not depend on how far B jumps in the H_k region.

(6) At $H = 0$, the specimen always retained a residuary induction, which was fairly well reproducible and equal to 18 per cent of the maximum value of B at the moment of transition, as measured with the second method.

(7) When H is increased in the negative sense, the residuary magnetisation decreases. Along the entire falling portion of the curve a return to a former value of the field strength causes no change in the induction. (Compare line AC on Fig. 1.) When the field strength equals $-H_k$, the residuary induction vanishes, and a further change in the field-strength leads to a completely symmetrical cycle.

Our experiments show that in the vicinity of H_k a sudden change occurs in B with increasing as well as decreasing field strength. These results do not agree with the former concept of a supraconductor, in which, when the field-strength is decreased, the induction should be maintained constant by means of induced persistent currents (Fig. 1). The actual fact that a jump takes place in the induction in falling field strengths we are inclined to ascribe to the formation of a new phase with $B = 0$.

We hope to obtain a more simple relation between B and H for single crystals, with which we have begun experiments.

At $H = 0$, the persistent currents give rise to a residuary magnetic moment in a supraconductor. Mendelssohn and Babbitt[5], apart from ourselves, observed this phenomenon in a sphere of tin and found the residuary moment to be 1/6 of the maximum moment at the point at which supraconductivity is destroyed.

G. N. RJABININ.
L. W. SHUBNIKOW.

Ukrainian Physico-Technical Institute,
Kharkov.
July 3.

[1] P. W. Bridgman, 4-ième Conseil Solvay, 286; 1924.
[2] P. Ehrenfest, *Leiden Comm.*, Suppl. 75b.
[3] C. I. Gorter, *Arch. Mus. Teyler*, 7, 378; 1933.
[4] Rjabinin and Schubnikow, *Sov. Phys.*, 5, 641; 1934.
[5] Mendelssohn and Babbitt, NATURE, 133, 459, March 24, 1934.

Spectrum of Nickel Hydride

RECENTLY we have observed the spectrum obtained by introducing nickel carbonyl vapour into the flame of a Meker burner. Just above the blue-green cones, in the hottest part of the flame, we find a very wide-spaced band structure which can only be attributed to a hydride.

Examination of this wide-spaced structure under high dispersion shows that it consists of two well-defined bands, degraded towards the red, with heads at λ5712·6 and λ6245·9. These show well developed P branches, slightly weaker R branches, and Q branches which start with high intensity and quickly fade out. The general intensity distribution, taken in conjunction with the fact that the continuity of the R and P branches through the origin is broken by six missing lines, indicates that the bands arise from transitions of the type $^2\Delta \rightarrow {}^2\Delta$. The term differences show that the bands have a common final level. The initial level of the λ5712·6 band shows marked perturbation. Preliminary estimates of the rotational constants are:

	λ5712·6	λ6245·9
B'	5·6 cm.$^{-1}$	5·5 cm.$^{-1}$
B''	7·6 ,,	7·6 ,,
I'	4·9 × 10^{-40} gm.cm.^{2}	5·0 × 10^{-40} gm.cm.^{2}
I''	3·6 ,, ,,	3·6 ,, ,,

We conclude that the spectrum is to be attributed to the molecule NiH. This is supported by the observation that the same structure is obtained when a discharge from a 10,000 volts transformer is passed between nickel electrodes in a flame of hydrogen burning in air.

The hydride bands fade out towards the top of the flame, where they are replaced by a second, much more closely spaced, system of bands believed to be due to the oxide NiO. In addition, the flame shows two groups of nickel lines; the first between λ2300 and λ2480 is restricted to the base of the flame; the second between λ3000 and λ3900 extends through the whole of the flame. The bands of C_2, CH and OH, which are also observed, occur in the spectrum of the flame alone.

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Conductivity of Tellurium

THE influence of relatively few foreign atoms on the electron properties of tellurium supports A. H. Wilson's theory[1,2] of semi-conductivity. The accompanying curves (Fig. 1) illustrate the decrease in the electrical resistance of tellurium by the addition of copper and antimony.

This high sensitiveness to impurities explains the lack of agreement among various investigators as to the specific resistance of tellurium. The conductivity of the tellurium we studied could be entirely attributed to an impurity of about 0·01 per cent antimony or bismuth, so that it seems possible that ideally pure tellurium would have a much higher resistance than has been observed. This assumption is strengthened too by its abnormal thermoelectric power[2].

The addition of 0·2 per cent antimony or bismuth to our tellurium caused the electrical conductivity to increase about a hundred times and the temperature resistance coefficient to change from negative to positive. These facts can be explained by assuming that the foreign atoms play a double rôle: (1) furnish free electrons (or holes) by Wilson's mechanism (increases conductivity); and (2) scatter electron waves in the manner accepted for ordinary metals (decreases conductivity)[3]. Is the first process also present in ordinary metals? Calculation shows that

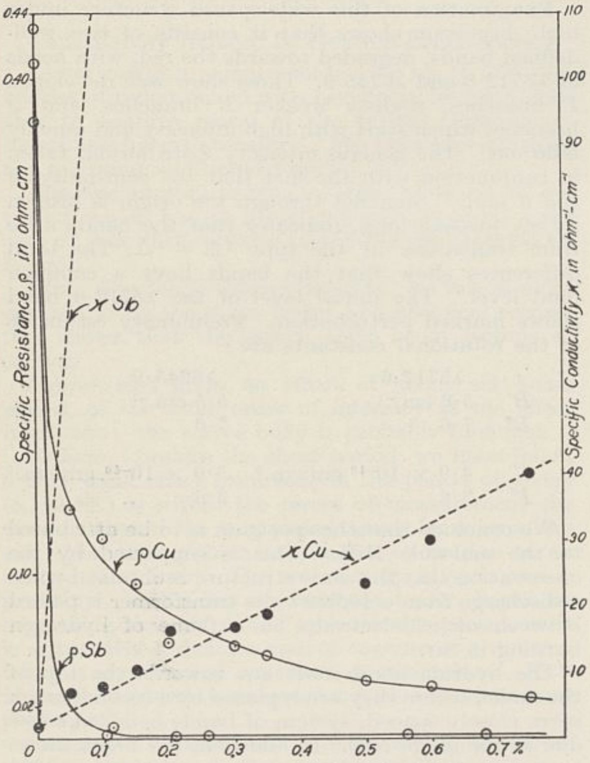

FIG. 1.

when few free electrons are present (semi-conductors) the first mechanism predominates; when many free electrons are present (conductors), the second. Wilson's mechanism, if present in ordinary metals, is masked and can be assumed without contradicting experience (for example, the Matthiessen rule for conductors).

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M. HABERFELD.

Laboratory of Physical Chemistry,
Technical Faculty of the University, Brussels.
June 26.

[1] A. H. Wilson, *Proc. Roy. Soc.*, A, **133**, 458; 1932. **134**, 277; 1932.
[2] R. H. Fowler, *Proc. Roy. Soc.*, A, **140**, 505; 1933.
[3] W. V. Houston, *Z. Phys.*, **48**, 449; 1928.

Magnetism of Tin

IT is well known that the diamagnetic susceptibility of colloids of graphite and bismuth depends on the size of the colloidal powders[1]. The specific intensity of magnetisation of a ferromagnetic metal like nickel also shows a similar dependence on particle size[2]. An investigation was therefore carried out with tin to study the effect of colloidalisation on its magnetic properties.

White tin has a small paramagnetic susceptibility[3] of $0 \cdot 025 \times 10^{-6}$, while grey tin is strongly diamagnetic, its susceptibility[3] being $0 \cdot 35 \times 10^{-6}$. A sample of pure white tin powder was carefully sorted out by settling in propyl alcohol and centrifuging. It was found, on testing the colloidal powders magnetically, that as the particle size decreases, the susceptibility becomes diamagnetic, this diamagnetism attaining larger values for smaller particle sizes. On melting and recrystallising, the substance becomes once again paramagnetic. Careful experiments showed that these results were not due to chemical or ferromagnetic impurities. It seems, therefore, most likely that the paramagnetic susceptibility of white tin is not an atomic property, but is dependent on the crystal structure of the metal in some manner which at present is uncertain. Full details will be published elsewhere.

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Annamalai University,
Annamalainagar, S. India.
June 30.

[1] See, for example, *Ind. J. Phys.*, **6**, 241; 1931. **7**, 35; 1932.
[2] *Phys. Rev.*, **44**, 850; 1933.
[3] "International Critical Tables", vol. 6, p. 355.

Induced Positron Radioactivity

RADIOACTIVITY induced by proton, diplon, neutron and α-particle bombardment can be explained on the hypothesis that the nuclear structure of stable isotopes consists of α-particles, neutrons and diplon. Missing isotopes of mass number less than twice the atomic number contain, on this theory, a free proton in addition to the other nuclear components[1]. Such nuclei are unstable and radioactive, emitting positrons. They may be produced artificially by bombarding appropriate stable isotopes with protons, diplons or α-particles but, being short-lived, have not at present been detected. These positron radioactive isotopes will only be found among elements below scandium in the periodic table, and are of the structural type, for example, ${}_7N^{13}$ $(3\alpha + p)$, ${}_6C^{11}$ $(2\alpha + D + p)$, ${}_{15}P^{30}$ $(7\alpha + p + n)$.

Accordingly, the following radioactive isotopes are possible:—

Type 1. ${}_3Li^5$, ${}_7N^{13}$, ${}_9F^{17}$, ${}_{11}Na^{21}$, ${}_{13}Al^{25}$, ${}_{15}P^{29}$, ${}_{17}Cl^{33}$, ${}_{19}K^{37}$, ${}_{21}Sc^{41}$.

They are produced by bombarding the corresponding stable isotopes, ${}_2He^4$, ${}_6C^{12}$, ${}_8O^{16}$, ${}_{10}Ne^{20}$, ${}_{12}Mg^{24}$, ${}_{14}Si^{28}$, ${}_{16}S^{32}$, ${}_{18}Ar^{36}$, ${}_{20}Ca^{40}$ with protons or diplons. If the bombarding particles are diplons, neutrons will be emitted during the formation of the radioactive isotopes, for example:

$${}_{14}Si^{28}\,(7\alpha) + p \rightarrow {}_{15}P^{29}\,(7\alpha + p) \rightarrow {}_{14}Si^{29}\,(7\alpha + n) + \overset{+}{e}\nearrow$$

$${}_{14}Si^{28}\,(7\alpha) + D \rightarrow {}_{15}P^{29}\,(7\alpha + p) + \overset{\nearrow}{n} \text{ and}$$

$${}_{15}P^{29} \rightarrow {}_{14}Si^{29} + \overset{+}{e}\nearrow.$$

Type 2. ${}_2He^3$, ${}_6C^{11}$, ${}_8O^{15}$, produced by bombarding ${}_1H^2$, ${}_5B^{10}$, ${}_7N^{14}$, respectively, with diplons. Neutrons will be emitted during the formation of the radioactive isotopes.

Type 3. ${}_{11}Na^{22}$, ${}_{13}Al^{26}$, ${}_{15}P^{30}$, ${}_{17}Cl^{34}$, ${}_{19}K^{38}$, ${}_{21}Sc^{42}$, produced by bombarding ${}_9F^{19}$, ${}_{11}Na^{23}$, ${}_{13}Al^{27}$, ${}_{15}P^{31}$, ${}_{17}Cl^{35}$, ${}_{19}K^{39}$ with α-particles. Neutrons are emitted during the bombardment, followed by positrons from the radioactive isotope.

The following isotopes of type 2 are also radioactive:—$_{10}Ne^{19}$, $_{12}Mg^{23}$, $_{14}Si^{27}$, $_{16}S^{31}$, $_{18}Ar^{35}$, $_{20}Ca^{39}$. They are formed when an α-particle in the normally stable isotopes, $_{10}Ne^{20}$, $_{12}Mg^{24}$, $_{14}Si^{28}$, $_{16}S^{32}$, $_{18}Ar^{36}$, $_{20}Ca^{40}$, possess excess energy such as suggested by Oliphant, Harteck and Rutherford[2]. These 'excess-energy' isotopes lose energy emitting a proton or a neutron. The emission of a neutron results in the formation of the radioactive isotope.

In these radioactive transformations the free proton within the nucleus emits a positron and is transformed into a neutron.

F. H. NEWMAN.
H. J. WALKE.
Washington Singer Laboratories,
Exeter.
July 24.

[1] See Walke, *Phil. Mag.*, **18**, 156; 1934.
[2] *Proc. Roy. Soc.*, A, **144**, 692; 1934.

Galvanometer Amplification by Photo-Cell

I REFERRED recently[1] to the use of a Weston 'photronic' cell arranged differentially for amplifying galvanometer deflections. It has been found since, (*a*) that a Bernheim cell is several times as sensitive, and (*b*) that there is considerable advantage in cutting the cell into two halves, and opposing the two halves *in parallel*. In the previous arrangement the conducting surface only was divided, and contacts made to its two halves: the two half-cells were thus opposed *in series*. With the new arrangement (i) there is at least twice the current in an ordinary low resistance galvanometer for a given difference of illumination, and (ii) for equal illuminations of the two halves there is no current.

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July 27.

[1] NATURE, **133**, 685, May 5, 1934.

Direct Proof of the Existence of Metastable Molecules in Active Nitrogen

THE two bands λ2760·6 and λ2603·8, which are the (0,6) and the (0,5) bands respectively of the new band system discovered by me recently in gaseous nitrogen[1], have now been observed in the nitrogen afterglow. These bands originate on the $A^3\Sigma$ state, and their appearance in the afterglow provides direct proof of the existence in it of metastable molecules. The tube, in which the afterglow was photographed, was running in the so-called green stage[2], corresponding to the lowest current at which it will show an appreciably strong afterglow. In this afterglow are also present both second-positive and first-positive bands, which originate on vibrational levels higher than those that normally occur in electrical discharges in nitrogen. In fact, it is the presence of these first-positive bands that gives both the afterglow and the discharge their characteristic green-white colour.

In a symposium on spectroscopy in astrophysics, which was held at the joint meeting of the Astronomical Society of the Pacific and the American Physical Society in Berkeley on June 19, I directed attention to the fact that the light of the night sky consists of radiations which can best be explained as bands belonging to the first-positive, the second-positive and the new $A^3\Sigma \rightarrow X^1\Sigma$ systems. In particular, bands originating on high vibrational states seemed to be involved in the explanation of the light of the night sky. The presence in the afterglow of all three of these systems definitely establishes the plausibility of my hypothesis. It is proposed to take photographs of even weaker afterglows in order to test further my view that the light of the night sky is a very weak afterglow of nitrogen.

JOSEPH KAPLAN.
University of California at Los Angeles.
July 20.

[1] Kaplan, *Phys. Rev.*, **45**, 675; 1934.
[2] Kaplan, *Phys. Rev.*, **45**, 671; 1934.

Kinetics of Photosynthesis

BALY and Morgan[1] have proposed kinetic equations which account for observations of Warburg[2] and Emerson[3] on the rate of photosynthesis. We wish to direct attention to one of Warburg's observations which is not in accordance with their equations. At low light intensities, the temperature coefficient of photosynthesis approaches unity, while at low carbon dioxide concentrations it remains high. We have confirmed this for five different species of algæ. This leads us to suppose that carbon dioxide is a reactant in the temperature-sensitive reaction, rather than in the photochemical reaction, where Baly and Morgan placed it. Their assumption seems to us untenable because it leads to equations in which light intensity and carbon dioxide concentration are interchangeable, and because according to photochemical principles a photochemical primary process is unimolecular, taking place immediately on the absorption of light.

Emerson and Arnold's[4] observation that the maximum yield in flashing light is reduced by lowering the carbon dioxide concentration indicates that carbon dioxide enters the process prior to the light reaction. If we assume that carbon dioxide, P, and chlorophyll, a, combine in the Blackman reaction to form the intermediate substance x, and that the absorption of light by x leads to the formation of products of photosynthesis and uncombined a, then under stationary conditions, when both reactions proceed at equal rates

$$y = k_1 I x = k_2 (a - x) P e^{-Q/RT} \qquad (1)$$

where y is the rate of photosynthesis, a represents the total chlorophyll in the system, and I the light intensity. Following Baly and Morgan, we divide by $k_1 I(a - x)$ and let $K - y = k_1 I(a - x)$, and (1) leads to

$$\log \frac{y}{K - y} = \log \frac{k_2 P}{k_1 I} - \frac{Q^1}{T} \qquad (2)$$

where $Q^1 = \dfrac{Q}{2{\cdot}303R}$. (2) is in agreement with Emerson's[3] observations on *C. vulgaris* photosynthesis at different temperatures, just as is Baly and Morgan's equation (2), because these equations are identical except for the constant term.

The elimination of x from (1) gives

$$y = \frac{k_1 k_2 I P a e^{-Q/RT}}{k_1 I + k_2 P e^{-Q/RT}}. \qquad (3)$$

This corresponds to Baly and Morgan's equation (3), and is in qualitative agreement with the observations discussed in the first paragraph. If I is small, y becomes independent of temperature, while if P is small y remains a function of temperature. The stoichiometric equations from which we have derived (2) and (3) are in agreement with the majority of observations on rates of photosynthesis. A bimolecular Blackman reaction is involved, instead of the monomolecular one proposed by Baly and Morgan, but their statement that the Blackman reaction is monomolecular appears to be without substantial support.

ROBERT EMERSON.
LOWELL GREEN.
California Institute of Technology,
Pasadena, California.
June 7.

[1] NATURE, 133, 414, March 17, 1934.
[2] *Biochem. Z.*, 100, 230; 1919.
[3] *J. Gen. Physiol.*, 12, 623; 1929.
[4] *J. Gen. Physiol.*, 15, 391; 1932.

Action of Phenyl *Iso*cyanate on Insulin

DURING the past three years, we have been investigating the properties of proteins which have been treated with phenyl *iso*cyanates[1]. This reaction is of special value for the introduction of new groups into proteins, since it is rapid and can be carried out in neutral or faintly alkaline solution (*p*H 7–8) and at relatively low temperatures (5°–8° C.).

The new protein compounds produced by this reaction have been studied by chemical and immunological methods, and these investigations show that phenyl *iso*cyanate appears to react only with the free amino-groups of the protein. These free groups, from the chemical evidence of other authors and from the immunological evidence which we have presented, appear to be the ε-amino-groups of the lysine molecules.

In addition to the application of this reaction to some problems of immunological chemistry, it was thought desirable to make use of it for other purposes, and with this object in view we have studied the action of phenyl and *p*-bromophenyl *iso*cyanates on insulin. (For a generous supply of insulin for this work we are indebted to Messrs. Boots Pure Drug Co., Ltd., Nottingham.) In particular, it was hoped that this investigation might yield useful information about the active groups of insulin, a problem which has received much attention during the past few years. In a very recent review of the chemistry of insulin by Jensen and Evans[2], mention is made of some unpublished investigations by Jensen, Evans and Schock on the treatment of insulin with phenyl *iso*cyanate. In view of this, it is of interest to record our own observations and to give a brief outline of the conclusions which we can draw from our previous chemical and immunological studies.

Treatment with phenyl or *p*-bromophenyl *iso*cyanate rapidly causes complete or almost complete destruction of the activity of insulin. This inactivation is very rapid and is practically complete in 10 minutes at 5°–8° C. From our previous work on similar compounds, we can conclude that the *iso*cyanate reacts with the free amino-groups of the insulin, and not to any significant extent, under the conditions of our experiments, with the hydroxyl groups of the tyrosine. Insulin appears to contain free amino-groups in addition to those of the lysine molecules, since a value of 1·00 per cent[3] has been given for the amino-N of an insulin of potency 25 units per mgm., but insulin contains only 2 per cent of lysine[4].

Preparations of *p*-bromophenylureido-insulin which we have made have been found to contain 4·8, 5·5 and 5·0 per cent of bromine, and the theoretical value for complete reaction with all the free amino-groups is 5·0 per cent. Thus phenyl and *p*-bromophenyl *iso*cyanates probably react with all the free amino-groups, including the ε-amino-groups of the lysine molecules. The basic groups of insulin appear, therefore, to be important for the physiological activity of insulin, a view which was tentatively suggested by Jensen[5] in 1932.

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July 11.

[1] Hopkins, S. J., and Wormall, A., *Biochem. J.*, 27, 740 and 1706; 1933. 28, 228; 1934.
[2] Jensen, H., and Evans, E. A., *Physiol. Rev.*, 14, 188; 1934.
[3] Freudenberg, K., Dirscherl, W., and Eyer, H., *Z. physiol. Chem.*, 202, 128; 1931.
[4] Jensen, H., and Wintersteiner, O., *J. Biol. Chem.*, 98, 281; 1932.
[5] Jensen, H., *Science*, 75, 614; 1932.

Hive-Bees do not necessarily Sacrifice their Lives when they Sting

MY scepticism regarding the frequent statement, for example, Bischoff[1], that worker bees (*Apis mellifica*) cannot withdraw their barbed sting, and thus invariably die when they have stung, was first aroused by observing a raid by wasps (*Vespa germanica*) on a hive in Essex, in September 1926.

In one case a wasp made a bold entrance by the doorway, was met by a bee and vigorously repulsed. It entered again, and emerged at once, struggling with a bee, which eventually succeeded in throwing it to the ground. The bee seemed somewhat exhausted; but it recovered completely. The wasp fell helpless, and died a few minutes later.

Experiments with bees showed that, when induced to sting a handkerchief, some of them, perhaps a third, finally get the sting into a position from which they cannot extricate it, the whole gland and vesicle tearing out in their struggles. But many penetrating stabs are followed by successful withdrawal.

Eight insects were killed by making hive-bees sting them. These were muscid maggots and flies, chiefly *Calliphora*, a small acridiid grasshopper, and an *Eristalis*. Some died in a few minutes. All were dead within twenty-two hours. A frog was stung several times, the frog hopping away on one occasion with the bee hanging by its sting. The bee succeeded in withdrawing and re-stowing it, and appeared none the worse. I was stung on the thumb, and perhaps because it was unexpected and I acted more violently than our other subjects, the sting was left in the wound. In all the other cases, however, even when the same bee stung several times, the bee recovered and re-stowed its sting none the worse. There thus seems little ground for the belief that worker bees sacrifice themselves when stinging other insects, or that they are any more handicapped than wasps in defending their nests from such enemies, or that they can sting only once.

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[1] Bischoff, H., "Biologie der Hymenopteren", Berlin, p. 548.

Partnership between Fish and Anemone

THE association between large anemones and brightly coloured fish is so common in all the Indo-Pacific area that it has been noted many times, though strangely Rüppell, who described both the fish and the anemone of the Red Sea in 1828, does not note their association. The latest mention by Yonge in "A Year on the Great Barrier Reef" describes and illustrates the association between the fish *Actinicola percula* and the anemone *Stoichactis*, but here, in the vicinity of the Biological Station of the University of Egypt in the Red Sea, both species are different, the fish being *Amphiprion bicinctus* (Rüppell) and the anemone *Actinia quadricolor* (Rüppell).

The fish are apparently allied species, but the anemones are very different, *Actinia* having large tentacles which can attain a length of 6–8 cm. with a thickness of 1 cm., the body being 20 cm. or so in diameter. Rüppell's drawing was made from a much-contracted specimen. The anemone is found in any part of the harbour reefs where coral is growing from just under L.W.S. to 2 fathoms, and wherever either partner is seen the other will be found within a yard or so, often two fish to each anemone. Occasionally the same fish is partner to a much smaller, grey coloured anemone.

As both fish and anemone will live for weeks in the laboratory, I am able to add to the known habits of the commensals. The fish spends most of its time among the tentacles of the anemone, but should any object be put into its tank it immediately attacks it. If the object is a small fish, such as a 'sardine' (*Atherina*), the *Amphiprion* attempts to seize it by the tail. As the *Atherina* is half again as long as the *Amphiprion* this attempt is fruitless until the prey has come into contact with the anemone's tentacles, which cause instant paralysis, the *Atherina* taking a vertical position, motionless but for a greatly accelerated breathing, at about 240 gasps per minute. The *Amphiprion* attacks again, and after several contacts with the anemone even so comparatively large a fish as *Atherina förskali* is overcome, and is dragged back to the anemone and engulfed.

Amphiprion is thus an active hunter for its host, but its share of the prey seems to be small. The bones of the fish are ejected by the anemone after some hours, and are then picked by the *Amphiprion*, which also nibbles at the anemone's mouth, apparently obtaining some of the half-digested food. It has been stated that *Amphiprion* actually enters the cœlenteron of the anemone, but this has not been observed here, though it can become quite invisible among the tentacles. It has been seen to bite off and eat the end of a tentacle.

The anemone is also more active than expected, the long tentacles are often in motion and changes of shape are frequent. The most interesting observation is that the animal alters its position in the aquarium in order to come beneath the inflowing water jet, and if this is moved the anemone moves correspondingly.

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Infant Self-Help

BRAVO, Infant! Miss Chick and others, through Austrian sufferings, have taught us that, "crying for the light" you make use of it to do your own D-ing. Now comes the welcome news[1], that you are not to be outdone even by the rat: that "mewling and pewking in [your] nurse's arms", you can yet C—alone; in fact, make your own *Antiscorbutic Acid*, from birth up to about five months old—a time at which the doctrine "them 'aves what we 'aves" more or less naturally comes to your aid. Nature, it seems, still favours the now unpopular practice once so powerfully advocated by my old neighbour, the late Samuel Smiles. At the moment, however, the newspapers are full of prayers offered up by headmasters, even in Royal Presence, on prize day, that your dear brothers shall be kept on at school—I suppose to continue learning to be led and that they may develop a full measure of swollen head: they will not even have had enough 'science' put into them to understand the wonderful example you are setting of self-helpfulness. Of course, I assume that the report is no mere report.

I have long been wondering whether milk, at its best, may not be an incomplete food for the mammalian infant: whether Nature may not have arranged to supplement the mother's care. I have sought to learn how early the young of herbivorous animals begin to nibble grass: probably they do so very early in life; the young guinea pig, I believe, at once. I can obtain very little trustworthy information upon this subject.

HENRY E. ARMSTRONG.

[1] NATURE, **134**, 142, July 28, 1934.

Physiological Studies of Fungi

IN his review of my "Researches on Fungi", vol. 5[1], Mr. J. Ramsbottom, referring to the well-known Smut fungus, *Tilletia tritici*, by an unfortunate slip states that I have interpreted "the secondary conidium of Brefeld as a special type of primary sterigma borne by the basidium-body (promycelium)".

As a matter of fact, I have interpreted Brefeld's secondary conidium as a true basidiospore. The secondary conidium of *T. tritici*, in its asymmetrical form and drop-excretion mode of discharge, exactly resembles the basidiospore of every mushroom and toadstool and of every Rust fungus.

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The Herbarium,
Royal Botanic Gardens,
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July 30.

[1] NATURE, **134**, 80, July 21, 1934.

I MUST apologise to Prof. Buller and to your readers for the *lapsus calami* which will be obvious to anyone referring to the preliminary account in NATURE mentioned in the review.

In my opinion Prof. Buller is probably right in regarding the secondary conidium as a basidiospore. What I intended to question was his use of the term primary sterigma for the structure which Brefeld called a primary conidium or basidiospore.

J. RAMSBOTTOM.

Research Items

Tuamotuan Stone Structures. Plans and notes of Tuamotuan stone structures made on the Tuamotu Survey of the Bernice P. Bishop Museum in 1929 and 1930 by Mr. Kenneth P. Emory are published in *Bulletin* 118 of the Museum. The only stone remains of any consequence in the archipelago are the maraes. In pre-European times houses were not built on platforms nor were stone walls erected around dwellings or villages. Many of the maraes were roughly built without the use of any squared stone, but many are carefully built and faced with neatly fitted slabs. Megalithic slab uprights trimmed to a conventional shape stand on the platforms in front of them and out on the court. Some of the courts are enclosed by low stone walls. The maraes in the western part of the archipelago have suffered much. Except in the extreme eastern part of the archipelago the maraes of one island differ little from those of another. Throughout they have an unpaved court, quadrangular with a platform at one end ranging from 10 to 80 ft. in length, 2 to 10 ft. in width, and 1 to 5 ft. in height. Along the rear edge of the marae are planted three or more upright slabs, and there is a tiny platform out on the court, placed midway between its sides. The *ahu* uprights range from 2 to 9 ft. in height. The tiny court platform may bear an upright and other smaller uprights may stand on the court. The only stone suitable for building is supplied by outcropping or uncovered limestone ledges. Rectangular slabs of limestone completely dominate the stonework of Tuamotuan maraes. When set on end these slabs serve as uprights. Orientation to the cardinal points was not practised.

Biology of *Calanus Finmarchicus*. The continuation of the important researches of Dr. A. G. Nicholls and Miss S. M. Marshall (*J. Marine Biol. Assoc.*, 19, No. 1; 1933) adds much to our knowledge of this copepod ("On the Biology of *Calanus finmarchicus*". (1) "Reproduction and Seasonal Distribution in the Clyde Sea-Area during 1932" by A. G. Nicholls. (2) "Seasonal Variations in the Size of *Calanus finmarchicus* in the Clyde Sea-Area" by S. M. Marshall. (3) "Vertical Distribution and Diurnal Migration in the Clyde Sea-Area" by A. G. Nicholls). It is found that *Calanus* passes the autumn and early winter mainly in Stage V. The minimum number occurred in April in Loch Fyne, in general the total numbers being high in September in 1931 and falling steadily to a minimum in March. A sudden increase occurred in May and numbers rose to maximal values, with a sudden decline. Three plainly marked breeding seasons were observed between February and July. The egg developed into an adult in four weeks, the total life of a *Calanus* during summer being about two and a half months, in winter five to six months. The size was greatest when the temperature was low, least when high, but there were also increases and decreases of size apparently connected with the breeding periods, those at the beginning of the breeding season being large and those at the end small. The greatest number of eggs usually occurred when the females were small. The late stages taken in the top 30 m. were almost invariably smaller than those from deeper water. Ova and nauplii were observed to be most abundant in the top 30 m. Copepodite states I, II and III most abundant above 30 m. and only Stage III in the deeper layers; Stage IV migrated to the surface at night; Stage V was always in the deeper water with slight diurnal changes. Females showed definite diurnal migrations both in January and July. Males migrated in small numbers towards the surface at night and away from it in the day. Stage V and females both lived nearer the surface in January than in July, correlated with seasonal changes in intensity of sunlight. Food must play an important part in controlling these migrations, also light intensity; spawning is probably a third factor which will affect adults only.

'Blackhead' in Turkeys. Blackhead disease in turkeys in the United States is due to the invasion of the tissues of the cæca by the flagellate protozoon, *Histomonas meleagridis*, first recognised by Theobald Smith in 1895. In young turkeys, the disease, which is not uncommon also in Britain, is progressive and almost always fatal; if the bird recovers, the protozoon is eliminated from the tissues but may establish itself in the cæcal contents, in which it continues to multiply for a long period. Such a bird becomes a 'carrier' and its discharges, which often contain great numbers of *Histomonas*, are infective for normal birds. Since *Histomonas* survives for only a brief period in the cæcal discharge, cases of blackhead appearing in young birds that have never been associated with older stock could not be accounted for by direct transmission. H. W. Graybill and Theobald Smith (1920) discovered that blackhead may be produced by feeding large numbers of the embryonated eggs of *Heterakis gallinæ*, the common cæcal worm of poultry, and they offered the tentative hypothesis that the cæcal worms lowered the resistance of the bird to the *Histomonas*, supposed to be already present, and hence the protozoon was able to multiply. E. E. Tyzzer (*Proc. Amer. Acad. Arts and Sci.*, 69, No. 5; 1934) produces experimental evidence to show that *Histomonas* is carried in the embryonated egg of this worm, though it has not yet been possible actually to demonstrate the protozoon in the egg. The hatching of the egg is necessary for the release of the *Histomonas* in the bird's intestine. No other example is known of an intestinal worm serving as the vector of an infectious disease. The author gives details of the morphology of *Histomonas* in the tissues and in culture, records the finding of the protozoon in the epithelium of the intestine of *Heterakis*, and adds observations on the loss of virulence in *Histomonas* in culture and on the immunising properties of an attenuated strain.

Culture of Barley for Brewing. The second Horace Brown Memorial lecture of the Institute of Brewing, delivered by Dr. E. S. Beaven on "The Culture of Barley for Brewing", has now been published in the Institute's journal (*J. Inst. Brewing*, 40, 188–203; 1934). The lecture covers a wide field, but the greater part of it consists of an account of the methods so successfully used by Dr. Beaven in breeding and testing new barley varieties. The environmental factors which affect yield and malting quality in barley are described, and the heritable characters of the crop—productivity, tillering, the "coefficient of migration" and the nitrogen content of the grain—

which provide a basis for selection, are discussed. The successful new varieties bred by Dr. Beaven arose from the crossing of not widely dissimilar races of proved economic worth, which were themselves obtained by selection from the produce of single plants of old established races. Little or no success was obtained by hybridisation of plants of widely differing characteristics. When the selections were made and multiplied, the next stage was to test their value in field conditions. Dr. Beaven, in association with "Student", was a pioneer in the development of modern methods of field experimentation. Though the 'chequer-board' and 'half-drill strip' methods which he describes no longer fulfil the requirements of statistical theory, they have proved of great value in variety testing. The paper concludes with references to recent work on differential response of varieties to environment, and on brewing quality in barley.

Frost Injury to Trees. In *Oxford Forestry Memoirs* No. 16, 1934 (Clarendon Press), W. R. Day and T. R. Peace of the Imperial Forestry Institute discuss the "Experimented Production and the Diagnosis of Frost Injury on Forest Trees". One of the objects of the research is to ascertain the possible relation of frost damage to the occurrence of fungus pests such as *Dasyscypha calycina*, *Phomopsis pseudotsugæ* and others. The experiments were confined to the periods September–November and January–June. It is held that the time thus covered was sufficient to make it evident that, in general, susceptibility increases during the spring, is at a maximum during the summer, and decreases again in the autumn to a winter minimum. The experiments showed that Douglas fir and Sitka spruce are most susceptible to autumn damage. To winter frost Douglas and Scots pine are the most susceptible. Early spring frosts affect European and Japanese larch, Douglas fir and *Thuja plicata*, followed by Scots Pine; oak, which at the beginning of the period is one of the hardiest species, is by the end of it one of the more susceptible. Work of this type is of value, but many foresters would probably agree that it is a slant of frost-laden biting wind which does the greatest harm to young tree growth and often even to old. Refrigerator experiments do not produce this condition. The monograph is illustrated by a series of excellent plates.

The Chad Basin. Perhaps the most interesting—and astonishing—fact about Lake Chad, which is discussed in considerable detail in "The Chad Basin: Geology and Water Supply" by Dr. Raeburn, assistant director of the Geological Survey of Nigeria and Mr. Brynmor Jones (Crown Agents for the Colonies, 4, Millbank, S.W.1) is that this vast sheet of water, covering, according to secular variation, anything from 5,000 to 8,000 square miles, is liable "at a relatively early date" to disappear almost completely from the map of Central Africa, of which at present it forms so notable a feature. There is a danger that the important system of drainage into the lake through the Shari–Logone Rivers, which contribute 76 per cent of the lake's water supply, may be captured by the River Benue, in which case it would be diverted entirely from the Chad Basin. The lake is aptly described as unique among inland seas: notwithstanding its enormous extent, it is shallow, with a mean depth not exceeding 13 ft. and sometimes as little as 3–4½ ft.; its salinity is insignificant; it has no apparent outlet; it lies on the edge of one of the world's greatest deserts, and there are only one or two vantage points from which its waters, concealed behind thick reed banks, can be observed. Much other interesting scientific information is contained in the publication relative to the Chad Basin, which is the largest basin of inland drainage in Africa, occupying an area of roughly 650,000 square miles of tropical grasslands and desert in British and French territory, including an account of the geology of the district, climate and rainfall, the latter being monsoonal in character with fluctuations in irregular cycles, topography and scenery, vegetation, soil and water supply, which is mainly obtained from wells, ranging in the British area down to 300 ft. in depth. A number of the wells are sub-artesian and there are at present no flowing wells in the Basin. The question of water supply is naturally of importance in relation to the development of Nigeria.

Atmospheric Ozone. The results of nearly four years of regular measurements of the amount of ozone in the atmosphere on all sunny days at the Commonwealth Solar Observatory, Mount Stromlo, Canberra, are given in a recent memoir of the Observatory (No. 3) by Mr. A. J. Higgs. The observations are made by the normal photographic method in which spectra of the ultra-violet region of sunlight are measured, and the absorption caused by ozone in the atmosphere is calculated. The work generally confirms the results previously found at other places: there is an annual variation with a maximum in September or October and a minimum in April, while the average value of the ozone content for the year is about 0·27 cm. The Australian observations have also confirmed the connexion found between the meteorological conditions and the amount of ozone, and the usual relation of high ozone in low pressure areas and low ozone in high pressure areas obtains, though the connexion with the absolute value of the surface pressure is small. Estimates of the average height of the ozone in the atmosphere have been made by observations on direct sunlight when the sun is low. The average value of 56 km. is in reasonable agreement with the value found by this method in Europe, but it is now known that this method is unreliable and gives results which are much too high. The work is a valuable contribution to our knowledge of atmospheric ozone.

Generalised Function Theory. In the ordinary theory of functions of a complex variable, a great part is played by monogenic functions, which are closely associated with certain partial differential equations, in particular Laplace's equation. Interesting generalisations of these ideas are contained in V. Volterra's "Équations aux dérivées partielles et théorie des fonctions" (*Ann. l'Institut Henri Poincaré*, 4, fas. 3). Instead of the ordinary functions, which depend upon the co-ordinates of a point in a plane or on a surface, he considers functions of lines, which depend upon the co-ordinates of every point upon a straight or curved line. The field due to an electric circuit is an example of such a function. The term isogenic is then given to a relation between two functions of lines, corresponding to monogenic for ordinary functions. Theorems are found analogous to Green's theorem and Cauchy's theorem, with a partial differential equation corresponding to Laplace's. The work can be extended to any number of dimensions.

Radiolympia 1934

If the charge be true that the annual Radio Exhibition is increasingly a cabinet-makers' show, yet there is comfort in the disappearance of the worst excesses of the cabinet-maker. The standard of taste in the casing of sets has improved greatly; there are very pleasing models—even a wireless set with a divan built into it is inoffensive. It is certainly not a philologist's show; impressions from different stands may unite into a nightmare which asks whether an all-electric superhet with high note uplift should embody not only a tweeter but also a boffle for the energised dynamic speaker, to eliminate woofiness! The physicist may let himself be soothed by an unqualified assurance that "If Blank is your aerial, even in the most exposed position, there is nothing to fear. Blank is so well insulated, so thoroughly protected that it is impossible for your set to receive a 'direct hit'—the lightning simply cannot get as far as the set—you and your home are perfectly safe from harm". He will certainly be depressed by an offer to measure—for sixpence—an undefined physical quantity (physical since it is read on a dial) called "It".

Turning to the more cheerful aspects of the show, the visitor will find a notable rise in musical quality, no longer wholly obscured by the distressing proportion of loud-speakers retaining an individuality of their own. He will be interested in the pioneer examples of variable selectivity, allowing the user to accept the widest band of frequencies that the disturbance conditions of the moment permit. He will rejoice that the amount of available quantitative data is slowly increasing. He will welcome the emergence of piezo-electric devices from a long sojourn in the laboratory into general use in loud-speakers, microphones, pick-ups (or picks-up). He will note that the extension of the range of acoustic fidelity permitted by the 'tweeter'—the high frequency auxiliary speaker—is a boon, but a boon admixed with accentuated troubles from microphone and transmitter hiss, receiver noise, surface-noise from records, and naturally and artificially generated noise in the medium. All these were benevolently reduced by the loud-speaker's neglect of the high audible frequencies; all come into prominence along with the welcome overtones of the desired sound. He will see another stage in the progress of magnetic materials, marked by the public 'release', in time for the show, of magnets in the nickel-aluminium-iron alloys.

In vacuum tubes, the new 'universal' valves for A.C./D.C. use, and the wide range of multiple valves for automatic volume control of varying complexity, are the special features of 1934. The 'octode' brings within sight the day when a decision on the appropriate lubricating consonant for a 'dodecahode' and an 'icosahode' will be required. Cathode ray tubes of increased size and of reduced size, with and without gas-filling, are among the rare harbingers of the television show which must be expected about 1936. A very neat and versatile cathode ray oscillograph equipment for direct connexion to mains is a specially attractive exhibit.

The Post Office repeats and extends its valuable demonstration of the interference due to electrical plant, and of its reduction. The somewhat curiously entitled "Physical Exhibit" is supplemented by a cinematograph film which the physicist would not willingly exclude from the category of "physical exhibits".

The Department of Scientific and Industrial Research is a newcomer to the Exhibition, with a special exhibit called "The Radio Weather House". Here the work of the Radio Department of the National Physical Laboratory, for the Radio Research Board, is illustrated by a talking film and by experimental demonstrations. The film, made by G.B. Instructional Ltd. in co-operation with the Laboratory, is an interesting and markedly successful experiment in instructional films; it is a well-planned and well-photographed exposition of the principles of the cathode ray oscillograph and its application in radio research. The only obvious break in an exceptionally clear and logical pictorial argument is the evasion of explanation of how the resultant of two equifrequent but not cophasal simple harmonic motions becomes an ellipse. It is understood that the two reels of this film on "The Cathode Ray Oscillograph" are intended as the introduction to a projected series of films on radio research; the further films of the series will be awaited with interest.

The "physical exhibits" of the collision preventer, the course-deviation indicator, the cathode ray compass, and the acoustic analogy of echo-sounding of the ionosphere have been noticed in our columns when they were shown to more specifically technical audiences. They have been ingeniously adapted, and supplemented by animated diagrams, for the present occasion. The Department of Scientific and Industrial Research and the Radio Manufacturers' Association are to be congratulated on the co-operation which has enabled the methods and products of radio research to be illustrated to a considerable proportion of the quarter million visitors to this exhibition.

Epidemiology of the Nosu, Western Szechwan, China*

The independent Nosu tribes of Western Szechwan, known to the Chinese by the derogatory title of the Lolo, occupy a territory of about 11,000 square miles in the bend of the Yangtse River and according to one estimate number so many as 1,500,000. Politically their country is within the Chinese Empire; but it forms a part of the foothills of Tibet. Information about these isolated inbreeding tribes is meagre and vague.

In 1932, an expedition to study the Nosu tribes, and more particularly their epidemiology, was organised by Dr. W. R. Morse, professor of anatomy and anthropology at the West China Union University, on a commission from Harvard University. The report on the work of the expedition, in addition to descriptive notes and a record of the journey, deals with blood pressure, surveys general diseases, and sets out observations on the eyes and teeth. Physical anthropology will be treated separately.

* The Nosu Tribes of Western Szechwan: Notes on the Country and its Peoples and on the Diseases of the Region. By Drs. E. R. Cunningham, Leslie G. Kilborn, James L. Maxwell, W. R. Morse and Harrison J. Mullett and F. Dickinson, with a Foreword by Dr. Maxwell. The Department of Field Research, Henry Lister Institute, Shanghai. Supplement to the *Chinese Medical Journal*, March 1933. Pp. 56.

The social organisation of the Nosu tribes is of great interest. Each tribe is divided into two groups or castes, the Black Bones and the White Bones. Each marries only within the group, but the latter are a little the more civilised, as they have adopted Chinese customs to a limited extent. The Black Bones are the influential ruling and leading class, hereditary aristocrats. They do not work and do not wash themselves. They have unlimited power of life and death over the White Bones and slaves. The White Bones are the servile and inferior class. They live under the protection of Black Bones, are comparatively clean, industrious, and carry on trade with the Chinese. They always walk instead of riding horses as do the Black Bones. A Black Bone may be degraded to the status of a White Bone for various reasons, among these being defeat and capture by Chinese. Apparently both Black and White Bones belong to the same stock.

They have a written language of which knowledge is confined to the shamans.

Dr. Kilborn, reporting on blood pressure, compares the results with those found in Western, Chinese and African determinations. The most striking fact revealed is that the blood pressure of the Nosu, besides being low, tends to fall to still lower levels as age advances, agreeing in this with results obtained among African natives, but contrary to the tendency in Western civilised peoples. The average systolic pressure is 104·5 mm., the average diastolic, 72·8 mm., and the average pulse pressure 31·7 mm.

Dr. Maxwell's report on disease directs attention to the surprising fact that there is a marked difference in incidence in some of the commonest diseases of the country as between the Chinese and the Nosu. Smallpox, for example, is rare, contrasting strikingly with conditions among the Chinese. This in part, perhaps, but not entirely, is due to the practice of vaccination carried out in certain localities by a modified arm to arm method. A form of typhus and relapsing fever is considered very fatal. Tuberculosis is strikingly absent in all its forms, again contrasting with Chinese conditions. Leprosy showed a surprising frequency. It is probably the most serious disease of the locality, affecting both Chinese and the Nosu. In the more primitive parts the leper is either burnt or buried alive. Syphilis is less common than among the Chinese, but is not rare. Malaria, absent at the higher levels, is fully in evidence in the lower valleys; but it does not seem to be severe. Infestation with round worm is the most common affection among children; but of all the fatal diseases, infantile diarrhœa is the worst. The dysenteries scarcely seem to be common. Chronic indigestion, owing to the diet, is common in adults. Some cases of gastric ulcer and pyloric obstruction were seen. Of skin diseases, few suffer from the almost universal Chinese complaint of scabies. Few external tumours were noted, but information was received of an area of goitre towards the Yunnan border.

Dr. Cunningham reports on the eyes. He notes that the Mongolian fold appears in less than half of the Nosu examined. The position and constancy of the superior lid fold corresponds closely to that of the Occidental. Another fold in the lower lid is practically always present and is particularly well-marked in the child and young adult. The irises were homogeneous, and in colour the highest percentage was found to belong to group number 14 of the Martin-Schultz scale. A number of pathological conditions were noted.

The general impressions gathered from Dr. Mullett's observation of the teeth were of well-developed, well-functioning dental organs in well-formed jaws, the third molars being well developed as contrasted with the Chinese, where impaction or crowding is very prevalent. The teeth were from medium to large, usually presenting a combination of the tapering and ovoid. There is much abrasion owing to the character of the food. 'Mottled enamel' was observed in many cases. Notwithstanding the absence of oral hygiene, caries was practically absent; but disease of the gums was almost universal.

Polyploidy in *Chrysanthemum*

PAPERS continue to appear showing the importance of polyploidy in flowering plants. A recent paper by Shimotomai (*J. Sci., Hiroshima Univ.*, Series B, Botany, Vol. 2, Article 1) summarises a considerable amount of work on the wild Japanese species of *Chrysanthemum* and the cultivated forms.

The fundamental chromosome number is 9. Two of the Japanese species are decaploid, two octoploid, three hexaploid, one tetraploid and four diploid. In geographical distribution, the high polyploids ($6n$, $8n$ and $10n$) occur only on the sea coast, the tetraploid species (*C. indicum*) is both coastal and montane, while only one of the diploid species (*C. nipponicum*) is coastal. Most of the species overlap very little in distribution. It is concluded that the higher polyploid species have been derived from the lower ones through maritime conditions acting as a stimulus. Thus *C. Shimotomaii* ($6n$), found on a short stretch of coast, is derived from the more inland *C. indicum* ($4n$). The still higher polyploids have perhaps been derived from crossings between lower polyploid species.

Chromosome counts in garden forms throw light on their origin. A group of twenty nearly related varieties have 53, 54 or 55 chromosomes and are regarded as derived from the hexaploid wild species. In another group of forty more distinct varieties with large heads and long rays, the chromosome number ranged from 52 to 67. These are much more specialised but are regarded as derived ultimately mainly from the same wild species, *C. japonense* and *C. Shimotomaii.*

Various crosses were made between wild species of chrysanthemum with different chromosome multiples, and these gave mostly true-breeding hybrids. Thus *C. japonense* ($n = 27$) $\times$ *C. pacificum* ($n = 45$) gave a constant hybrid with $n = 36$, except that the length of the ray florets varied from plant to plant. But in certain hybrids higher multiples appeared. For example, *C. Makinoi* ($n = 9$) $\times$ *C. Decaisneanum* ($n = 36$) gave an F_1 with $2n = 72$; and *C. Makinoi* $\times$ *C. japonense* ($n = 27$) produced an F_1 with $2n = 63$. The characters of *C. Makinoi* were more strongly marked in the hybrid, and in meiosis tetravalent and trivalent chromosomes appeared. The $3n$ additional chromosomes appear therefore to have come from *C. Makinoi*. But exactly how a diploid species produced $4n$ germ cells is not yet clear.

Preservation of Inshore Fisheries*

FOR a number of years past, British inshore fishermen have experienced difficult times due mainly to scarcity of fish on the grounds which they work. The problem of how best to bring about an improvement in these fisheries is a very difficult one which, for some considerable time, has occupied the attention of local fishery committees and other interested bodies. It is generally agreed that the capture and destruction of young fishes, too small to be landed and exposed for sale as a food commodity, are against the best interests of any fishery. With only one exception, the fishing methods at present in general use do not cause wasteful destruction of young stages. There cannot be the least doubt, however, that trawling works great havoc amongst fish stocks by indiscriminately capturing and killing not only marketable but also the small unmarketable members. The most obvious and satisfactory way, therefore, of preserving fish populations and maintaining successful fisheries, would be to prohibit trawling altogether. For many reasons such drastic action cannot be taken. What then are the other possibilities, if any ?

An effort to obtain accurate and adequate data upon which to base a satisfactory answer to this question has been made by Mr. H. J. Buchanan-Wollaston, of the Ministry of Fisheries Laboratory, Lowestoft. For the locus of his researches, extending from 1924 until 1929, Mr. Wollaston chose the English Channel coast and worked mainly from Poole (Dorset) and Beer (Devon). At both of these small ports a very active inshore fishery is carried on.

A comprehensive report on these researches, together with recommendations bearing upon protective legislation, has now been published. This report, states the author, is specially addressed to inshore fishery committees and to the fishermen themselves. To the former it is intended to serve as a guide in dealing with the fisheries over which they have legislative control, and to the latter as a help in deciding whether or not protective legislation is desirable.

Concerning the problem with which he deals, the author is able to state definitely that any attempt to increase the stock of fish on a restricted inshore ground by transplantation seems not to be practicable, at any rate so long as the present methods of wasteful fishing are allowed to continue unregulated. In March 1926 and in May 1927, small plaice were transported from certain Dutch nursery grounds to Poole Harbour with absolutely negative results, so far as any benefit to the local fishery was concerned.

Numerous other experiments and observations carried out by Mr. Wollaston support the view that the enforcement of a minimum size of trawl mesh—the actual measurements to differ slightly in different localities according to the various conditions peculiar to them—would be beneficial. The entire closure of certain bays and similar areas which act as nurseries and/or sanctuaries for the young stages is also discussed in the report. For various reasons, the author hesitates unreservedly to recommend this procedure, at any rate within the area with which he is dealing.

Mr. Wollaston is to be congratulated on having demonstrated very successfully how productive of useful data can be the intensive study of a local fishery in a restricted area, carried out from very minor fishing ports.

* Ministry of Agriculture and Fisheries. Fishery Investigations, Series II, Vol. 13, No. 1, 1933: Inshore Trawl Fisheries of Dorset and Devon. By H. J. Buchanan-Wollaston. Pp. 69. (London: H.M. Stationery Office, 1933.) 3*s*. 6*d*. net.

Structure of Proteins

IN the April issue of the *Berichte der Deutschen Chemischen Gesellschaft*, Prof. Abderhalden and Herr Heyns describe the synthesis and characterisation of three amino-hydroxy-fatty acids, which are of considerable interest to biochemists, since they have for some time been regarded as structural units in the building up of proteins, although the constitution of the actual products of hydrolysis of these proteins has never been completely established. The three acids studied are the α-amino-β-hydroxy derivatives of *n*-butyric, *n*-valeric and iso-valeric acids, of which the last two are called β-hydroxy*nor*valine and β-hydroxyvaline respectively.

The synthesis of such compounds is by no means easy, and many different methods were attempted before success was attained. β-Hydroxyvaline had already been synthesised in 1922, although not under that name, by Schrauth and Geller, and their results have now been substantially confirmed. By using ethyl crotonate instead of ethyl ββ dimethyl acrylate as starting-point, the present authors have been able to synthesise α-amino-β-hydroxy-*n*-butyric acid. The addition-compound which the unsaturated ester makes with mercuric acetate and methyl alcohol is decomposed first with potassium bromide, then with bromine. After hydrolysis of the ester, the bromine is replaced by the amino-group and the methoxyl by hydroxyl, when the amino-hydroxy-butyric acid is liberated.

The synthesis of β-hydroxynorvaline was effected by an adaptation of a method devised by Sörensen. α-Chloropropyl ethyl ether was condensed with the sodium derivative of phthalimido-malonic ester and the product hydrolysed.

These methods of synthesis leave no doubt about the structure of the resulting acids, and the latter have been further characterised by means of their phenyl carbimide, benzoyl and phenyl hydantoïn derivatives. Direct comparison with the products derived from proteins by Schryver, Rimington and others was not possible, but it seems certain that they are not identical. Stress is laid on the fact that whereas Schryver's compounds readily yielded dibenzoyl derivatives, two of these compounds benzoylate only at the amino-group, and the melting-point of the dibenzoyl derivative of α-amino-β-hydroxy-*n*-butyric acid is 60° higher than that of the compound previously described under that name. Further investigation of the natural products will be necessary before the discrepancies can be explained.

University and Educational Intelligence

LONDON.—The following degrees have recently been awarded: D.Sc. degree in astrophysics to C. S. Beals (Imperial College—Royal College of Science) for works entitled "The Wolf Rayet Stars" (*Pub. D.A.O.*, 1930), and "Spectrophotometric Studies of Wolf Rayet Stars and Novæ" (*Pub. D.A.O.*, 1934); D.Sc. degree in biochemistry to G. M. Richardson (University College and Imperial College—Royal College of Science) for six works on biochemistry (*Proc. Roy. Soc.*, B, 1934, and *Biochem. J.*, 1931–33); D.Sc. degree in chemistry to T. Malkin (private study) for five published papers dealing with the application of X-rays to structural problems of organic chemistry, together with ten conjoint subsidiary contributions.

SIR WALTER HAMILTON MOBERLY, Vice-Chancellor of the University of Manchester, has been appointed chairman of the University Grants Committee in succession to the late Sir Walter Buchanan Riddell.

THE Carnegie Trust for the Universities of Scotland in its thirty-second annual report directs special attention to the operation during the last five years of its schemes for the endowment of post-graduate research. The principal scheme, under which fellowships, scholarships and grants are awarded, has now been operating for thirty years, during which period scientific investigation in the universities by 1,162 persons has been subsidised by this means to the extent of more than a quarter of a million sterling, the expenditure for the six quinquennia beginning 1903–8 having been: £27,754, £35,698, £27,540, £39,465, £51,047 and £69,268. "What this has meant to the enrichment of the intellectual life of the Scottish universities may in part be inferred," says the report, "from the fact that the total publications received have numbered 227 volumes and 2,002 other original contributions." The problem has been, not to find suitable and well-qualified applicants, but to find sufficient means to finance them, and in order that the amount available should meet the requirements of the situation so far as possible, the value of the individual awards for 1932–33 was reduced, fellows' stipends being lowered from £300 to £250, senior scholarships from £200 to £175 and other scholarships from £175 to £150; and it has now been found necessary to place all scholarships on the uniform level of £150. A welcome indication of better times is afforded by the fact that resignations on account of appointment to salaried posts have again become numerous. Other financial aids to research are provided by the Trust in the shape of grants towards the maintenance of the laboratory of the Royal College of Physicians of Edinburgh, amounting during the last quinquennium to £9,369, and awards to university assistants and lecturers devoting not less than half their time to research, amounting during the same period to £18,329.

EDUCATION in India in 1927–32 is reviewed by Sir G. Anderson, Educational Commissioner with the Government of India in a volume of 274 pages obtainable from the Manager of Publications, Delhi (price 5*s*.). The situation and tendencies disclosed by the review afford but scanty ground for satisfaction with the past or confidence in the future: some are characterised as alarming and there is no support for the theory that the progress of education is qualifying the people of India to rule themselves. Economic distress has been made an excuse for indiscriminate retrenchment instead of being used as an occasion for restraining wasteful and ineffective expenditure, the prevalence of which was demonstrated by the Hartog Committee of 1928. Among instances cited are: the continuance unchecked in Bengal of a reckless and impetuous multiplication of primary schools regardless of quality; the retention of numerous primary schools with only three classes although well known to be almost wholly useless; filling of a large percentage of primary school places with pupils much too old to benefit by the instruction; a growing tendency towards communal separation, involving scandalous waste and inefficiency; the rapid increase in the number of students who throng the colleges and high schools without the qualifications requisite for deriving benefit from the instruction. Since the transfer of educational control in 1921 from the central to the local government, there has been a rapid growth of provincial particularism which may have fostered local initiative but has involved overlapping and extravagance particularly in regard to university education. A strong central educational intelligence service is badly needed. One of the most disastrous faults found throughout the secondary school systems is the preoccupation with the goal of university entrance qualification to the exclusion of all other aims. Ample evidence is to be found in the report that "the educational systems of India need to be recast and adjusted to the requirements of new conditions".

Science News a Century Ago

Death of Sir John Barton

On August 25, 1834, Sir John Barton died at Windsor Castle. He was buried in the cloisters of St. George's Chapel and a memorial tablet was erected to him by command of William IV. For forty-six years he had served as secretary and treasurer first to William IV when he was Duke of Clarence and then to Queen Adelaide. He was born at Plymouth in 1771. At one time Barton was comptroller of the Mint and he made several improvements in coining machinery. One obituary notice of him said that he was the inventor of a floating compass, a hydrostatic balance, a hydrostatic floating lamp, a draw-bench for use at the Mint and an "atometer" with which a millionth of an inch was rendered a sensible measure to the eye. He originated the ornamental effect produced by the decomposition of the rays of light reflected from polished metallic surfaces covered with a series of very minute lines or grooves, ruled upon them by a diamond point, and also a method of producing a cube in a lathe, which he applied to a scheme for the prevention of the forgery of Bank of England notes, by engraving upon these cubes and printing from them an interpolated coloured line.

Whewell on Tides

IN his researches on the tides, Whewell asked for observations made in various parts of the world, and in the *Journal of the Franklin Institute* a letter was published from Prof. A. D. Bache addressed to the Committee of Publications. Writing on August 26, 1834, Prof. Bache said: "It is no doubt well known to you, and to those of your readers who follow the progress of general science that the Rev. Mr. Whewell, of Trinity College, Cambridge, is engaged in endeavouring to advance the important, and hitherto comparatively neglected, science of the tides, the first results of these investigations being the memoirs on, and map of cotidal lines, contained in the *Transactions of the Royal Society of London*, for 1833. Through the kindness of a mutual friend, I have received the articles, also from the pen of Mr. Whewell, on the subject just referred to, which accompany this note, and which I should feel obliged by your inserting in that part of the *Journal* of the Institute where they will be most likely to meet the eye of anyone who may be disposed to contribute good tide observations to the stocks which Mr. Whewell is now accumulating for the further elucidation of the subject."

Paris Geographical Society and Sir John Ross

On September 1, 1834, Sir John Ross on receiving the Gold Medal of the Paris Geographical Society (*Bull. Soc. de Géog. Paris*, ser. 2, 1), wrote :

"Gentlemen—M. de Bacourt, Chargé d'Affaires de France, has remitted your letter of April 13, accompanied by the gold medal of your Society. I beg to assure the learned and distinguished members of the gratification which I feel, following my return to Europe after a voyage of unusual length and difficulty. Nothing could have afforded me greater pleasure than the honourable and enviable dignity that the Society has conferred. Inspired by these sentiments, the gold medal, awarded in a manner so flattering, will be transmitted to my descendants as a precious witness of the esteem entertained by the Society for my efforts for the advancement of geographical knowledge. I beg you to believe that I am not less sensible of the flattering expressions which marked the occasion of the gift.

Your most obedient and most humble Servant,

John Ross."

Draper on Capillary Attraction

John William Draper (1811–1882), the father of Henry Draper (1837–1882), was born in England but at the age of twenty-one years emigrated to the United States. While a student in the University of Pennsylvania he made experiments on capillary attraction, an account of which was published in the September number of the *Journal of the Franklin Institute* for 1834. After reviewing what was then known of the subject, he said : "This was the state in which I found capillary attraction ; my attention was first drawn to it during those tiresome moments of returning health which follow an autumnal fever. Perhaps, if there be any merit in these experiments, it may hereafter be of service to someone to know that they were begun in sickness and in a land of strangers; they were pursued in all the calamity of family bereavement and in the depths of forests, alike unused to music, to poetry or to philosophy. Solitude if it be conducive to the development of intellect, and favourable to the exercise of thought, is likewise attended with many evils. Though no disturbance arises from the intrusion of the frivolous, yet the counsel and assistance of the wise are wanting, and, indeed, those advantages which are supposed to result from such tranquillity are, for the most part, only fictitious appearances, which like certain other apparitions, everyone can discourse of, but no one can say he has seen."

Societies and Academies

Paris

Academy of Sciences, July 2 (*C.R.*, 199, 1–104). A. Lacroix : New observations on the distribution of tectites in Indo-China and in the neighbouring countries. Giuseppe Sanarelli was elected *Correspondant* for the Section of Medicine and Surgery in succession to the late J. Cantacuzène. Bertrand Gambier : Tetrahedra inscribed in a Σ quadric and with edges tangent to a quadric S. Pototzki : The determination of complexes all the congruences of which are W. A. Rosenblatt : The application of Picard's method of successive approximations to the study of certain partial differential equations of the parabolic type with two independent variables. Léon Motchane : The distribution of the points of continuity of a function of n variables continuous with respect to each of them. V. Niemytski : Unstable dynamical systems. Heinrich Hilmy : Movements stable in the Poisson sense and the recurrent movements of a dynamical system. Bernard Kwal : The tensorial fields which accompany Dirac's electron : the theory of the neutrino and the antineutrino. Jean Pontremoli and Max Serruys : The influence of anti-detonants on the velocity of combustion and the temperature of exhaust in internal combustion motors. André Couder : The compensation of double refraction in astronomical objectives. Discussion of the effects produced in telescope objectives by double refraction due to insufficient annealing. The use of a compensator consisting of a plate of Iceland spar is suggested. Results of experiments made with the large equatorial at the Strasbourg Observatory are given, showing the value of the compensator. J. Gauzit : The ultra-violet extremity of the spectrum of the night sky. One interesting result obtained was the presence of emission lines in the region of the large absorption band of atmospheric ozone : work in confirmation of this is in hand. Fernand Baldet : The continuous spectrum of comets. A. Portevin and D. Séférian : Experimental study of the thermal state during autogenous welding. Mlle. N. Choucroun : The superficial electric moments in the interior of a liquid. James Basset : The influence of pressure on the electrical resistance of a rod of impure zirconium oxide in air. At constant temperature, the resistance of the zirconia rod increases with the pressure. In air at 900° C. a rod having a resistance of 4,500 ohms under atmospheric pressure alters to more than a million ohms under 4,000 kgm./cm.^{2}. Léon Bloch, Eugène Bloch and Pierre Lacroute : The analysis of the first spark spectrum of bromine. Jean Bouchard : The influence of viscosity on the decrease of the fluorescent power of solutions of certain colouring materials as a function of the concentration. G. Monod-Herzen : The energy of linkage, the mass of the neutron and the grouping of atomic nuclei. Walter M. Elsasser : The linkage energies in the radioactive families of uranium-radium and thorium. Jean Perreu : The heat of crystallisation of hydrated salts in slightly supersaturated solution. Jean Amiel : The preparation and explosion temperature of some complex compounds of copper chlorates with the primary amines. Pierre Jolibois : The chemical reactions in different parts of a tube containing rarefied gas. Marcel Mathieu : The study by Röntgen rays of the fixation of acetone by nitrocellulose. In the experimental arrangement, the effect of the absorption of acetone on the nitrocellulose could be studied continuously. At no stage was there any indication of the formation of a definite compound. The sudden disappearance of the crystalline structure defined the formation of a gel. MAURICE BILLY and MARC ANTOINE FOEX: Mineral precipitations in glasses. Investigations with alkaline glasses (silicate, borate, phosphate) with copper, gold, silver and other metals. MARCEL BALLAY: The preparation of brilliant electrolytic deposits of nickel in the presence of colloids. WENLI YEH: The frequency of the number of isotopes of the chemical elements. The author shows that elements of odd atomic number should have a smaller number of isotopes than either of the neighbouring elements, and deduces that argon should have three isotopes instead of two, chlorine should have only two isotopes and palladium should have three isotopes instead of one. T. KARANTASSIS and L. CAPATOS: Some complex compounds of germanous bromide with cæsium bromide and with the bromides of organic bases. LÉON PIAUX: The influence of various radicals on the characteristic frequency of the ethylene linkage in cyclopentene derivatives. C. V. GHEORGHIU: The mechanism of the ionic dissociation of 2–thio–4–oxytetrahydroquinazoline derivatives and the corresponding oxygen derivatives. GEORGES RICHARD: The action of potassium cyanide on an α-chlorketone. By an abnormal reaction an ethylene oxide derivative is produced. ANDRÉ A. POLICARD: The constitution and absorption in the ultra-violet of the ethyl diphenylmuconates. CHARLES DUFRAISSE and JEAN LE BRAZ: Applications of the antioxygen effect to the problem of fire fighting. The extinction of flames. L. DONCIEUX, R. PAVANS DE CECCATTY and M. SOLIGNAC: The presence of fragments of nummulitic limestone in certain Quaternary pebbles of the region of Médenine. G. SCHNEIDER: Conclusions drawn from some exact measurements of the yield of the thermal springs of Aix-les-Bains: H. VAUTRIN: The orogenesis of the Hermon (Syria) massif. H. S. REED and T. FRÉMONT: The reactions of the root cells of *Citrus* to infection by the mycorrhiza. ANTOINE DE CUGNAC and FERNAND OBATON: Some peculiarities of the floral biology of the Gramineæ. R. FAILLIÉ, R. JONNARD and H. VIAL DE SACHY: The variation of the constriction of the pupil with illumination. PIERRE MOLLARET: Modifications of the chronaxies of antagonistic stimuli under the influence of local and contralateral posture in the dog. H. BORDIER: Some experimental results furnished by the heliochromometer. Applications to meteorology and to climatology. JEAN COURTOIS: The influence of the reaction of the medium on the hydrolysis of α– and β–glycerophosphoric acids by taka diastase. MME. ANDRÉE ROCHE and JOSEPH BRACCO: Contribution to the study of the molecular weight of the globulins of blood serum. RADU CODREANU: The relations between the development of *Symbiocladius rithrogenae* and the growth of its ephemeral host. FRÉDÉRIC DIÉNERT, PIERRE ETRILLARD and MME. MADELEINE LAMBERT: Research on bacteriophage in waters.

CRACOW

Polish Academy of Science and Letters, May 7. T. HUBER: The analogy of a certain problem of the equilibrium of slightly curved thin elastic bars with a simple case of forced oscillations. I. ADAMCZEWSKI: The mobility of the ions in dielectric liquids. In the method used by the author the ions are produced by X-rays. The measurements prove the existence of three kinds of ions in pentane, hexane and heptane. There is a close relation between the mobilities and the viscosity coefficients of the liquids studied. MLLE. A. FATERSON: Re-emission in the fluorescence of the bands of mercury vapour. The experiments confirm the hypothesis of the molecular, and not atomic, origin of the phenomenon of re-emission. L. MARCHLEWSKI and J. ZGLECZEWSKI: The absorption of ultra-violet rays by certain organic substances (37). A. SWARYCZEWSKI: The mono-, bi- and trichromates of guanidine. W. SZYMONOWICZ: Langerhans cells in the tactile hairs. J. ZACWILICHOWSKI: The innervation and sensorial organs of the wings of *Stauroderus biguttulus*.

ROME

Royal National Academy of the Lincei, March 4. T. LEVI-CIVITA: Stationary solutions of Pfaffian systems. G. ARMELLINI: Horizontal diameter of the sun in 1931, 1932 and 1933. The mean of the values obtained in 1931 at four observatories for the solar radius was 961·65″. For 1932, three observers (one ceased measuring) found a diminution, the mean value being 961·56″. In each case a higher result was obtained in 1933, the mean being 961·71″. These variations may possibly be related to the sunspot frequency and to the general activity of the sun. U. BROGGI: Generalised method of Euler's summation. B. SEGRE: Integrals of binomial differentials. G. LAMPARIELLO: A noteworthy class of non-linear differential equations of the second order. (1) Preliminaries and reduction to the first order. F. CONFORTO: Construction of automorphous functions by means of infinite products (1). L. GEYMONAT and M. ZEULI: Generalisation of certain concepts and formulæ of differential geometry of the Riemannian varieties. M. MANARINI: Considerations on the absolute vectorial calculus in a V_3 and on double tensors with a single divergence. A. ROSENBLATT: Non-linear m-harmonic equations with two independent variables (2). R. EINAUDI: Cauchy's problem relating to superficial elastic waves. A. DE MIRA FERNANDES: The unitary theory of physical space and the relativistic equations of atomic mechanics. G. C. WICK: The radioactive elements of F. Joliot and I. Curie. The theory of β-disintegration, recently proposed by Fermi, is applied to the radioactive phenomena lately observed by Joliot and Curie. R. L. GOMES: Dirac's matrices in a Riemannian space. R. ZAÏCOFF: Generalised wave mechanics. (3) Wave equations for positive and negative electrons. Introduction of a Hamiltonian function. General form of the electric quadri-current. S. BERLINGOZZI: Method of preparing aromatic nitro-ketones. Treatment of an aromatic nitroaldehyde with a magnesium aryl halide yields a nitro-carbinol, which gives the corresponding nitroketone on oxidation with chromic anhydride. A. BELLUIGI: Individualisation and determination of buried basaltic dykes and infiltrations by the Wenner geo-electric method. S. SORRENTINO: The presence of an Oligocene soil in the neighbourhood of Buonalbergo (Benevento). L. TREVISAN: Preliminary observations on the fauna of the Cretaceous in Sicily. G. BRUNELLI and G. CANNICCI: Preliminary notes on the chemical and biological characteristics of Lake Sabaudia (Paola). MARIA VENTURA: Embryological observations on *Manihot palmata*, Muell. *M. palmata* follows the ordinary type of formation of the macrospores. The female adult gametophyte is octonucleate. O. VERONA: Microbiological study of a peaty soil. A. DE AGAZIO: Action of ephedrine and adrenaline on the isolated heart of *Bufo-vulgaris*.

VIENNA

Academy of Sciences, May 11. WILHELM FIGDOR: Generatively increased descendants of *Bryophyllum calycinum*, Salisb. BERTA KARLIK and ELISABETH RONA: Investigations on the dependence of the range of polonium α-rays on the intensity of the radiation, the age of the preparation, and the nature of the foundation. FRANZ HERITSCH: The age of the Trogkofel chalk. RUDOLF WAGNER: The existence of Γ-helical sympodes. FRITZ FRÜCHTL: Adriatic plankton copepods.

May 17. HILMAR SCHUMANN: Petrographic phenomena in the Seckauer Tauern. FRANZ RÜCKER: Reflective power of animal surfaces in the ultra-red region of the spectrum. Even with insects, for which numerous and comprehensive measurements have been made, no general relation between their reflective power and the radiation-climate prevailing in the regions where they occur, appears to exist. KARL MORSCH: β-Ureidocarboxylic acids and dihydrouracils: (1) β-Phenylureidocarboxylic esters and 3-phenyldihydrouracils. GUNTER LOCK: Cannizzaro's reaction (3). The experiments have been extended to halogen derivatives of dihydroxybenzaldehydes and their methyl esters. GEORG WALTER: Action of chlorosulphonic acid on naphthalene. Under certain conditions, the sulphochlorinating reaction is replaced by chlorinating and oxidising reactions. A. LUSZCZAK and L. GRÜN: The colour of mercapto and methylmercapto dyes of α- and β-naphthols. Spectro-analytical investigation of these dyes reveals certain regularities. GUSTAV ORTNER and JOSEF SCHINTLMEISTER: Radioactivity of samarium. FRIEDRICH LAUSCHER and WILHELM SCHWABL: Investigations on the brightness in woods and at their edges. FRITZ KERNER-MARILAUN: Evidence of the climate of the Gosau formation. KARL STRUBECKER: Constructions in Laguerre geometry. HARALD EGBERT HOCHSTETTER: The fauna of the Walbersdorf 'tegel'. ALFRED FRÖHLICH and EMIL ZAK: (1) The ability of lung-tissue to regulate the water-content of the blood of the lungs. The water-content of rabbit's blood is the same in the right and left ventricles. If, however, the blood is thickened by the introduction of glycerin or 20 per cent sodium sulphate solution into the abdominal cavity, the thickened blood is detectable in the right ventricle, but after the blood has passed through the lungs, its water-content rises. (2) Influence of purine derivatives on the permeability of the heart. By these derivatives the penetration of foreign substances, not only into the central nervous system, but also into the heart, is facilitated. HANS MAUTNER and ALFRED EBEL: Influence of soporifics on the course of infections. GABRIELE FEHÉR and LEO POLLAK: Distribution and degradation of injected galactose in the organs of the animal body. W. ANTOPOL and R. RÖSSLER: The heart-action in the dog of vasopressin extracts.

Official Publications Received

GREAT BRITAIN AND IRELAND

Medical Research Council. Fourteenth Annual Report of the Industrial Health Research Board to 30th June 1934. Pp. ii+34. (London: H.M. Stationery Office.) 9*d.* net.

The Scientific Proceedings of the Royal Dublin Society. Vol. 21 (N.S.), No. 8: The Chemical Constituents of Lichens found in Ireland. *Buellia canescens*, Part 1. By Dr. T. J. Nolan. Pp. 67–71+plate 2. 1*s.* Vol. 21 (N.S.), No. 9: Derangement of the Digestive Processes in the Milk-fed Calf due to Abnormal Curd Formation in the Fourth Stomach. By E. J. Sheehy. Pp. 73–85. 1*s.* Vol. 21 (N.S.), No. 11: Investigations on the Cryoscopy of Milk. By J. J. Ryan and G. T. Pyne. Pp. 113–122. 6*d.* (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.)

Technical College, Bradford. Diploma and Special Day Courses, Session 1934–1935. Pp. 246+20 plates. (Bradford.)

Further Experiments on Cylinder Wear. By C. G. Williams. (No. 7500, B, Class 42, 251.) Pp. 21. (London: Institution of Automobile Engineers.)

Board of Education. Report of the Advisory Council of the Science Museum for the Year 1933. Pp. 47. (London: H.M. Stationery Office.) 9*d.* net.

Birkbeck College (University of London). Philosophy and Politics: being the Sixth Annual Haldane Memorial Lecture, delivered by Prof. Ernest Barker, June 5, 1934. Pp. 18. (London.)

OTHER COUNTRIES

Ministry of Public Works, Egypt: Physical Department. The Nile Basin. By Dr. H. E. Hurst and Dr. P. Phillips. Supplement to Vol. 4: Ten-Day Mean and Monthly Mean Discharges of the Nile for the Years 1928–1932 and Normals for the Period 1912–1932. (Physical Department Paper No. 31.) Pp. vi+259. (Cairo: Government Press.) 50 P.T.; 10*s.*

Government of India: Department of Industries and Labour (Public Works Branch). Irrigation in India: Review for 1931–32. Pp. 51. (Delhi: Manager of Publications.)

The Indian Lac Research Institute. Bulletin No. 18: Modifications of Shellac. Part 1: The Effect of Sulphur. By M. Venugopalan. Pp. 12. (Nankum.) 1 rupee.

Publications of the Kapteyn Astronomical Laboratory at Groningen. No. 46: The Coefficient of Differential Galactic Absorption. By J. J. Raimond, Jr. Pp. ii+46. (Groningen: Hoitsema Bros.)

Field Museum of Natural History. Anthropological Series, Vol. 21, No. 2: The Ovimbundu of Angola. By Wilfrid D. Hambly. (Frederick H. Rawson—Field Museum Ethnological Expedition to West Africa, 1929–30.) (Publication 329.) Pp. ii+89–362+plates 9–92. (Chicago.) 2.75 dollars.

Statens Meteorologisk-Hydrografiska Anstalt. Årsbok, 13, 1931. iv. Meteorologiska iakttagelser i Sverige, Band 73. Pp. x+107. (Stockholm.) 7.00 kr.

Report of His Majesty's Astronomer at the Cape of Good Hope to the Secretary of the Admiralty for the Year 1933. Pp. 12. (Cape of Good Hope: Royal Observatory.)

Comité International des Poids et Mesures. Procès-verbaux des séances. Série 2, Tome 15: Session de 1933. Pp. vii+215. Série 2, Tome 16: Annexes du Comité consultatif d'Électricité et de Photométrie, Mémoires présentés à la session de 1933. Pp. viii+342. (Paris: Gauthier-Villars.)

Annales de l'Institut de Physique du Globe de l'Université de Paris et du Bureau central de Magnétisme terrestre. Publiées par les soins de Prof. Ch. Maurain. Tome 12. Pp. iii+92. (Paris: Les Presses universitaires de France.)

Travaux et mémoires du Bureau International des Poids et Mesures. Publiés sous les auspices du Comité International par le Directeur du Bureau. Tome 19. Pp. vi+74+127+54+97+48+7. (Paris: Gauthier-Villars.)

U.S. Department of Agriculture. Technical Bulletin No. 418: Transmission of Anaplasmosis by various Species of Ticks. By Charles W. Rees. Pp. 18. (Washington, D.C.: Government Printing Office.) 5 cents.

U.S. Department of the Interior: Geological Survey. Water-Supply Paper 728: Surface Water Supply of the United States, 1932. Part 3: Ohio River Basin. Pp. x+370. (Washington, D.C.: Government Printing Office.) 20 cents.

Smithsonian Miscellaneous Collections. Vol. 91, No. 15: Reports on the Collections obtained by the First Johnson-Smithsonian Deep-Sea Expedition to the Puerto Rican Deep. Two New Congrid Eels and a New Flatfish. By Earl D. Reid. (Publications 3251.) Pp. 11+1 plate. (Washington, D.C.: Smithsonian Institution.)

Zoologica: Scientific Contributions to the New York Zoological Society. Vol. 17, No. 1: A Review of the Box Turtles. By Raymond L. Ditmars. Pp. 44. Vol. 18, No. 1: An Experimental Study of the Reproductive Habits and Life History of the Cichlid Fish, *Aequidens latifrons* (Steindachner.) By C. M. Breder, Jr. Pp. 42. (New York City.)

Cornell University: Agricultural Experiment Station. Bulletin 587: The Rural Churches of Allegany County. By William G. Mather, Jr. Pp. 32. Bulletin 588: History, Culture and Varieties of Summer-Flowering Phloxes. By A. M. S. Pridham. Pp. 32. Bulletin 591: Movement of Population to and from New York State. By W. A. Anderson. Pp. 36. Bulletin 595: The Rural Homes of City Workers and the Urban-Rural Migration. By Leland B. Tate. Pp. 54. Bulletin 599: Studies of the Effects of Handling Methods on the Quality of Market Peas. By F. S. Jamison. Pp. 28. Bulletin 603: An Investigation of the Cause of the Stiff-Lamb Disease. By John P. Willman, S. A. Asdell and Peter Olafson. Pp. 20. Memoir 153: Brand Canker of Rose, caused by *Coniothyrium wernsdorffiae* Laubert. By Cynthia Westcott. Pp. 39. (Ithaca, N.Y.)

Museums of the Brooklyn Institute of Arts and Sciences. Report upon the Condition and Progress of the Museums for the Year ending December 31, 1933. By William Henry Fox. Pp. 64+6 plates. (Brooklyn, N.Y.)