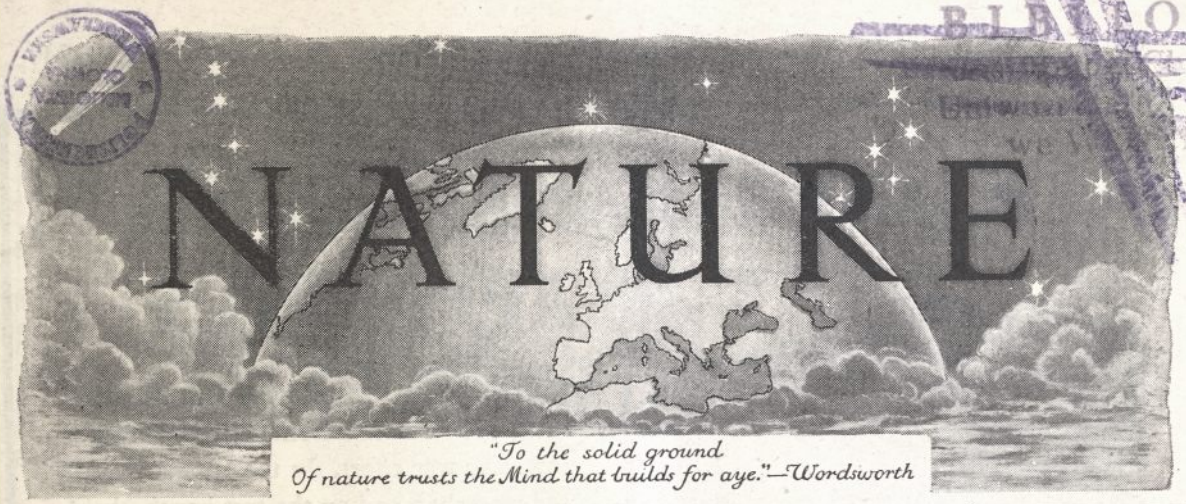


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# NATURE

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# FUNDAMENTALS IN POST-WAR RECONSTRUCTION

HOWEVER great the horror and detestation with which the aims and methods of Nazi Germany may be viewed, it must not be forgotten that they have sufficed to raise a crushed and despondent people to take a place once more among the Great Powers, even though it has ceased to play any part in affairs beyond that of a powerful and firmly welded instrument designed for and directed solely to domination. Whereas Great Britain and her allies hold fast to a faith rooted in belief in the essential dignity of mankind, a dignity which can attain full stature only in a world in which freedom and justice are the guiding principles, it must constantly be kept in mind that, over against that ideal there stands another, an ideal of service and self-sacrifice in the interests of the group or State, which is, if anything, even more compelling and no less inspiring of devotion in its votaries than that to which we give allegiance. If we believe that the ideals of democracy and the cause of humanity will prevail in the long run over the narrower and cruder aims of a restrictive nationalism, and the totalitarian State which is bent on aggression and domination by force, it is incumbent upon us to justify that faith by showing that it has a more certain foundation than wishful thinking. On this the verdict of science claims to be heard.

*Magna est veritas et praevalebit.* But if truth, that is the reality of things, is to prevail in post-War reconstruction, where does it reside ? Faith in the ultimate triumph of truth exacts that the settlement and adjustments that are to come should be in harmony with it ; and the lasting character of the peace which will be made and the opportunities peace will afford for the advancement of mankind will stand in direct relation to the clarity we attain in our vision of its principles and essential nature. In Germany, in the last seven years, by the aid of the crudities and unwarranted interpretations of racial theory and the suppression of freedom of thought and research, the resources of science and its methods have been harnessed to the production of a certain type of mentality and a society wholly subservient and adapted to the creed of an aggressive, violently national, totalitarian State. Is it in this direction that truth lies ?

Granting the difference in aim of a society that desires peace and the advancement of mankind, is the regimentation of the individual inseparable from the application of scientific truths to the problems of the well-being of the peoples of the future ? In other words, is the democratic ideal of the freedom of the individual in thought and action compatible with the scientifically planned economy which, so far as can be seen at present, post-War conditions will demand as an essential condition of the survival of civilization and the rescue of large masses of the world's population from the effects of abject destitution ? Democracy is notoriously slow to act, and in its anxiety to compromise in the interests of individual rights, not infrequently muddled in its decisions. Guidance of such a society along the paths to its welfare indicated by the results of scientific research is apt to enlarge the powers of the bureaucrat. It must seem, therefore, that one of the first problems to be resolved in post-War society, assuming the survival of the democratic ideal, will be to reconcile the freedom of choice of the individual with the application of scientific principles which, it can be shown, are essential to the well-being of some or all the members of a

given community. Obviously one solution lies in education, and the more widely it is spread, and the greater its continuity, the more readily will the conflict be resolved.

Such questions, however, are a matter of machinery and leave the main principle untouched. In the interval between the two world wars of 1914–18 and of 1939, the course of events in world politics and economics was such as to lead many to think that the rapid expansion in the material development of the twentieth century, in which science has played a preponderant part, has masked a very real check in the intellectual and moral development of mankind. The optimism as to the capability of mankind for continuous development, which was characteristic of the nineteenth century, gave way to a pessimism which regarded civilization, at least in its Western form, as on the verge of dissolution. Such a pessimistic view, however, is unscientific and lacking in perspective. The more intensive the study of man and of human society, and the more precise the methods applied to these studies, the more clearly does it become apparent that, on a long view, the story of man physically, mentally, morally and socially has been on the whole one of continuous advance. To say this is to ignore neither the fact that advance in certain characters is now less readily discernible than in others, or that in specific instances great civilizations have risen and after a period of dominance have fallen into decay.

If it be accepted as demonstrable truth that, just as man, like other members of the animal kingdom, is the product of an evolutionary process, so also the social and cultural structure, which he has devised as the setting and means for the existence of the individual and the perpetuation of the race, the joint product of his brain and the necessities, physical and other, of his organism, is also the outcome of a development which may be regarded as closely analogous to the evolutionary process of the organic world. Without entering into details of the argument, it may be taken that recent application of the methods of research in social anthropology to problems of administration among backward peoples, more especially in Africa, has shown that if acute unrest and dislocation in the social organism is to be avoided, any attempt to promote the well-being of the people, whether by the introduction of a more advanced and efficient system of government or by raising the general standards in mode of life, must be adapted to the cultural stage of the community and must be in harmony with what, it might be anticipated, would be the natural trend of social and cultural development.

In the history of human society, progress in civilization would appear on broad lines to be largely dependent on two factors. It is rooted in the institution of the family, the most stable and, on the whole, the most effective agent for the early training of individual character; and secondly, it depends upon the degree to which the community, the greater unit within which the family exists, reproduces the conditions of the lesser unit in a consciousness of unity and the peaceful harmony with which its members are prepared to co-operate with one another. Further, it is a matter of observation as well as of historical record that the more extended the social unit in which conditions comparable to the family prevail—clan, tribe, people or nation—the greater the opportunities for the growth and development of the individual in conditions of social, political and economic tranquillity. That there have been exceptions by no means invalidates an argument which can be illustrated by reference to a line of development which has culminated in the British Empire, the movement towards unity of the two Americas, and would now seem to be at the point of being carried further in the approach to one another under stress of the two greatest English-speaking peoples of the world, the United States and Great Britain, with its American possessions and Canada.

In so far as these principles or rather trends in social and political development throw any light on the fundamentals of post-War settlement, they would appear to point to the necessity for continuous endeavour to create larger and even larger unities, which both internally and externally would work for the preservation of peace by eliminating inter-group political, social, and economic competition and rivalry. The League of Nations was an attempt to create such a unity, but it failed. The post-War settlement which followed the War of 1914–18, in the attempt to restore the *status quo ante bellum*, erred in stressing the small group, and by fostering rights of self-determination opened the way to racial and national self-assertion and rivalry. Contrast its political failure with its success in the fields of scientific research, social reform and intellectual co-operation, in which national and racial barriers were ignored.

The League might have been saved from a

second mistake had greater heed been given to the cultural traditions of the peoples whom it was sought to include in a close bond of union. It brought within its fold not only nations of very varied cultural history in northern, western, eastern and southern Europe, as well as South Americans long removed from European tradition, but also peoples at varying stages of cultural development. As a result, when Abyssinia was attacked, a State that many regarded as semi-barbarous, the League showed itself impotent. Unity of action was unattainable. The failure up to the present to secure co-operative effort in India is held by many to be due to a failure to appreciate the difficulty of applying advanced political ideas to a situation conditioned by the varied stages of social development of the population, which have not in any instance yet attained a point at which the democratic ideal can be fully grasped.

So far as a post-War world is concerned, the first lesson of the past history of social development appears to be that we must not look for any return to the *status quo*. The future line of development lies in the direction of the formation of larger and larger political and social entities, among whom peace will be secured by co-operation, good will and a common interest in the advancement of humanity, as well as the elimination of political and economic rivalries. At the same time, regard must be paid not only to differences of cultural tradition, for these indeed will make a useful contribution to the common stock of ideas, but also to differences in the stage of cultural advancement, lest incompatibles be held in too close a bond of union which friction and lack of understanding will disrupt. Too frequently the impact of two widely diverse cultures has brought about friction, disintegration and retarded development. Hence the difficulty which confronts any attempt to form a federated Europe which necessarily must include States of backward peoples, as well as the more advanced. A system of zoning or grouping of compatibles must be devised.

It is evident that, if the trend of development in the future of human society can be determined thus with reasonable probability, the Nazi aim of a dominant Aryan people ruling the subject and inferior races of a united but conquered Europe is retrograde and contrary to the trend of social 'evolution'—a reversion to the medieval conditions of the period of migrations.

On the other hand the democratic ideal does at least allow for that free play of ideas essential to a progress which in the long run will conform to the truth as we see it—a harmony with the evolutionary process.

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# THE PLAIN MAN AND GOD

## God in a World at War

By John Hadham. Pp. 96. (Penguin Special S.73.) (Harmondsworth and New York : Penguin Books, Ltd., 1940.) 6*d*. net.

THE object of this little book is not to argue, "but only to state a belief in God in terms which any man can understand". In this it has certainly succeeded, though a belief in God which is understandable is not necessarily credible. Still, unless a belief in God is put in intelligible terms, it is not likely to be effective, even if true. As Mr. Hadham says, "God cannot be made real by the irrelevant accuracies of metaphysics" ; and this is all the more the case when these irrelevancies are inaccurate. One of the things from which we are suffering to-day is "that all the conventional descriptions of God were written by men who held totally different views of the world, of human society. and of the nature of the individual, from that which we now hold." These descriptions were valid enough at the time they were written, but the permanence of such validity was dependent on the permanence of the views in terms of which they were made ; and the terms are now quite obsolete and not so much incredible as meaningless.

Of course the trouble is that when you make a profound idea understandable you may sacrifice its profundity. For example, in his desire to make it clear that God is personal, Mr. Hadham may seem to many to present us with a deity with strong resemblances to Mr. Henry Ford, or perhaps to Mr. Gladstone. It may be true that "God is a person, and is best described and thought of by the ordinary person in purely personal terms" ; but it will not do to regard God as a magnified and non-natural man. That is almost worse than theological mumbo-jumbo. Even the ordinary man cannot be relieved of the painful necessity of asking himself, when he is told that God is a person, what

do I mean by a person ? Mr. Hadham is not helpful here because he rather condones the popular view that metaphysics is a mystery, and not just the pursuing of ordinary questions to their ultimate limits. If a man asks himself what a person is, he may end by regarding personality (as the Oriental religions do) as a limitation rather than as a goal. Religion may even consist in trying to transcend or pass beyond personal existence with its desires and fears. Is not the *ego* a limitation, a prison, a barrier dividing us from God ? Even Christian mystics seem to have suggested this. If this is so, is Mr. Hadham really on right lines with his activist, common-sense religion ? It is of course far better than the "churchianity" he treats with such vitriolic contempt, but that, surely, is not to say much.

But the virtue of this book consists in the fact that it does supply the plain man with a version of Christianity which he can at any rate understand and endeavour to practise. Most people who lapse for good causes or bad from organized religion become for practical purposes secularists. But there is no reason why they should, if they read this able, sincere, and highly readable book.

J. C. H.

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# THE PHYSIOLOGY OF REPRODUCTION

## Recent Advances in Sex and Reproductive Physiology

By Dr. J. M. Robson. Second edition. Pp. xiii + 329. (London : J. and A. Churchill, Ltd., 1940.) 15*s*.

IT is six years since the first edition of Dr. Robson's "Recent Advances" was published, and in the interval great progress has been made in sexual physiology and in particular in the study of the sex hormones. The principal results of the newer work have been successfully incorporated in the second edition, and the author is to be congratulated on having achieved a not very easy task. In reviewing the first edition it was pointed out that the title was somewhat misleading since the work dealt almost exclusively with the sexual and reproductive phenomena of the female organism, omitting the work done upon the male. This criticism has now been met, for not only has a new chapter been added on the male hormone and other androgens, but also such subjects as "cycle changes in the male", the "assay of androgens", and other contributions to the physiology of the male sex have been incorporated in the appropriate parts of the book. Moreover, there are additional chapters on the chemistry of the hormones and on the methods used in their standardization and the determination of their activity.

The least satisfactory chapter in the book is probably that on the maintenance of pregnancy and the initiation of parturition, but this is not due so much to the author's treatment as to the inherent difficulties of the subject, resulting from the apparently contradictory evidence and the great amount of species variation. Nevertheless, although recognizing the antagonistic action of oxytocin and progesterone as shown by the fact that uterine response to the former is decreased by the presence of the latter, the author fails to give full weight to the evidence on the point as presented by Dr. Knaus in his work on "Periodic Fertility and Sterility", a book which is referred to in another chapter.

In a chapter on the function of the pituitary and its relation to the gonads, the neural factors regulating the cycle are dealt with rather inadequately. The work on the "Hypothalamus and Central Levels of Autonomic Function", recently issued by the Association for Research in Nervous and Mental Diseases, no doubt appeared too late for consultation, but only a very few of the papers quoted in the articles by Drs. Brooks, Bard, and Uotila, are referred to by Dr. Robson. This is unfortunate, as the recognition of the important part played by exteroceptive factors in sexual periodicity is among the recent advances of generative physiology. It is true that some of the most beautiful examples of such phenomena are to be found among birds and lower vertebrates and that Dr. Robson's work confines itself to mammals. Nevertheless, with mammals of certain species the evidence of neural control is very evident, but only a few examples of this are cited. Dr. Harris's work on the production of pseudo-pregnancy in the rat (an animal which ovulates spontaneously) as a result of electrical stimuli is omitted, and there is no account of the numerous experiments by different investigators on ovulation in the rabbit as a result of stimulating substances acting on the pituitary or on the hypothalamus. The statement that electrical stimulation of the cervical sympathetic ganglia produced ovulation is now known to be erroneous, as has already been pointed out in several papers. It is to be hoped that greater prominence will be given to the subject of neural control in the third edition, which will be doubtless called for in a few years.

F. H. A. MARSHALL.

# ASIATIC YAMS

## An Account of the Genus Dioscorea in the East

(Annals of the Royal Botanic Garden, Calcutta, Vol. 14.) Part 2: The Species which Twine to the Right; with Addenda to Part 1, and a Summary. By D. Prain and I. H. Burkill. Pp. viii + 211–528 + xx + plates 86–150. (Alipore: Bengal Government Press, 1939.) 67 rupees; £5.

YAMS must have been one of the foods of primitive man, and in their wild state they still form one of the chief components in the diet of jungle tribes; indeed, in times of failing rainfall and consequent scarcity, they rise to a prime importance for the survival of individuals in remote tracts. These tubers are commonly found at a considerable depth underground, sometimes as much as five feet, and are often protected against the depredations of wild animals, principally pigs, by thorny growth above the tubers themselves. Considerable labour is demanded for their extraction, especially in times of duress when drought has hardened the soil. The wild man's tools are of poor quality, and it is at such times that the curse of Adam lies heavy on the untutored savage.

At what stage in this evolution, and by what chain of circumstances early man began to realize that he could make his life easier and more secure by growing his food artificially, and by what slow degrees he achieved this purpose, is a fascinating, if not very fruitful, subject for speculation. But achieve it he did, and in so doing he improved the quality and quantity of the yield by bettering the conditions under which it was grown, and by conscious or unconscious selection. Was the first step the result of a flash of genius in one man or a slow process growing up by accident? Presumably we shall never know. Under cultivation the size and shape vary very greatly in the same species, as can be seen from plate 125 of this work, where no fewer than 72 different forms of the tubers of *Dioscorea alata* L. are figured.

As is the case with many cultivated plants, it is not possible to state definitely where certain yams, now well known, are truly indigenous, even though it is known in what localities they are growing spontaneously. Some yams have poisonous properties when raw and have to be prepared accordingly before they are fit for human consumption.

The first part of this monograph, dealing with the species which twine to the left, was reviewed in Nature of January 29, 1938, and a portion of the present part in that of November 25, 1939. In the latter survey it was pointed out that the systematic matter was not yet published. The full part has now been issued, and the whole of this noble contribution to botanical science is available to those interested.

The systematical portion of this part deals entirely with the section Enantiophyllum—the species which twine to the right. It comprises seventy-six species, that is to say, a few more than the sum of all the other sections. In it is included the most important species from the point of view of food material—*Dioscorea alata*, Linn. This yam has been very widely cultivated, not only in the East, but also in Madagascar, many parts of Africa and in the West Indies.

A simple and easily applied key to the species is provided and also keys to the varieties where subdivision calls for them. A full description of every aspect is given for each species, together with complete synonymy and references to literature. The herbarium specimens examined are listed under the subregional scheme adopted by the authors. All this, however, is not the sum total; a comprehensive history of each species is recorded with a discussion of the significance of the vernacular names applied to it; the uses are detailed, with information on cultivation and the preparation of the yams and bulbils for consumption. One feels that the authors have followed up every clue with the pertinacity and acumen of a criminal investigator, bringing to light every fact possible for the compilation of a complete 'dossier' for each species. The resulting production, moreover, is as entertaining to the discerning reader as the pages of a 'thriller'. In short, this monumental achievement can claim to be an exhaustive account of the Dioscoreas of the East, and it seems difficult to believe that anything is left for further investigation.

In the course of their researches the authors have found it necessary to make no fewer than seventy-four new species, one more than had been hitherto published. These have all been described previously in the pages of various journals; the great majority in the *Journal of the Royal Asiatic Society* or in the *Kew Bulletin*.

The sixty excellent drawings (besides three photographic reproductions and three plates of locality maps), are the work of several artists, but nearly one half are from the pencil of the junior author.

C. E. C. Fischer.

# A GERMAN ZOOLOGY

**Handbuch der Zoologie**
Eine Naturgeschichte der Stamme des Tierreiches. Gegründet von Prof. Dr. Willy Kükenthal. Herausgegeben von Dr. Thilo Krumbach. Band 3 : Hälfte 2 : Chelicerata, Pantopoda, Onychophora, Vermes Oligomera. Lieferung 12. Pp. 160. 22 gold marks. Band 3, Hälfte 2 : Chelicerata, Pantopoda, Onychophora, Vermes Oligomera. Lieferung 13. Pp. 128. 18 gold marks. (Berlin : Walter de Gruyter und Co., 1939.)

THESE are the last two parts of this now well-known "Handbuch" to be received in Great Britain and it seems likely that no more will be received for some time.

The first is illustrated with 288 figures, only three of which are original, but they are well chosen and well reproduced so that they form a useful collection. The text continues the account of the Araneæ by Prof. U. Gerhardt and Dr. A. Kästner, and concludes the description of the embryology already commenced in the preceding part. It passes on to deal with the ecology, web spinning, reproductive phenomena, stridulation and moulting. Two pages are devoted to a discussion of the phylogeny before passing on to the classification and systematic review which occupies 78½ pages. The last 8½ pages are devoted to the bibliography, and so this part terminates the account of the Araneæ. The Liphistiidæ are regarded as the oldest of the spiders.

In the second part, 29 of the 120 illustrations are original, and the idea of illustrating individual species by a series of photographs of good specimens rather than by drawings has proved a most successful one. The first 3½ pages finish the bibliography of Prof. C. J. Cori's account of the Phoronidea, and the remainder of the part, with the exception of 4 pages of index at the end, is devoted to Dr. J. Gerhard Helmcke's treatment of the Brachiopoda. It includes a description of the shell and skeleton and of the anatomy, histology and development of the group. Short accounts of the physiology and ecology precede a somewhat longer one of the geographical distribution, particularly in relation to the ocean currents. As in other groups, the account ends with the systematics and a list of the literature. For conciseness and compactness of treatment this part on the Brachiopoda might well have served as a model for the accounts of some of the previous groups, which tended to be prolix and discursive.

It is no small praise to the authors, editors and publishers of these two parts to say that they worthily maintain the standard of the "Handbuch".

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# AGRICULTURAL INDUSTRIES

**The Agricultural Industries**
By Prof. Deane W. Malott and Boyce F. Martin. Pp. viii+483. (New York and London : McGraw-Hill Book Co., Inc., 1939.) 26*s*.

IN the early agricultural systems the production and processing of food, drink and clothing was carried out within the farmer's family. It is a feature of a developed agriculture that the cultivator finds full-time occupation on the land, handing over his product to form the starting point of associated industries of ever-increasing extent and complexity. The United States offers an extensive field for the study of the economic and technical problems which these agricultural industries present ; for in that country the manufacturing and processing industries based on agricultural raw materials account for no less than 15 per cent of the total industrial output and employ nearly a million people.

The basis of the book is a course of instruction in the agricultural industries given by the authors at the Harvard Business School, and a great deal of supplementary information has been supplied from the many trade experts whom the authors have consulted.

A systematic treatment is adopted. Each of the main industries forms the subject of a lengthy chapter. The types of raw material and methods of production are first dealt with. Then assembly, transport and marketing organization are described and discussed. The authors pass on to the financing and business organization of the industry, and set out the aims and results of the legislation that has been imposed on almost all branches of agricultural production and marketing to meet the economic changes of the past few years. A critical appraisal of the problems of the industry concludes each chapter.

The first section deals with the dairy industry, for the cash receipts from milk by United States farmers are greater than from any other agricultural

commodity, and more than three times as large as from wheat. The struggle between producers and distributors around the question of the milk price, with the ultimate adoption of control, has followed the course familiar to English readers. Next comes an account of the livestock industry; the historical sections dealing with the development of livestock farming and the meat packing industry being particularly interesting. Chapter iv is devoted to cotton, and the efforts made by the Government to control surpluses and institute orderly marketing are set out in tabular form covering the period from 1929, when the price decline of American cotton became really serious, until 1939. Occasionally, as in 1937, the bounty of Nature outweighed all restrictive schemes and threatened to bring confusion to the industry.

The extent of the sugar industry in the United States is sometimes overlooked in Europe. The fact is that the output of beet sugar alone is more than twice that of Great Britain, to say nothing of a considerable production of cane sugar. The organization of this industry is discussed in Chapter vi.

Other chapters deal with tobacco and wool. In their concluding section, discussing the relationship of the problems of the farm to those of the agricultural industries, the authors stress the need for grappling with the problems of surpluses, and look to the development of new industries based on new crops to take the place of redundant acres of the older ones. At the same time the processing trades should search for new outlets for the standard crops.

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# ARCHÆOLOGY IN THE EASTERN MEDITERRANEAN

**The Annual of the British School at Athens** No. 37, Session 1936–37, Papers presented to Prof. J. L. Myres in honour of his 70th Birthday. Pp. x+286+31 plates. (London: Macmillan and Co., Ltd., 1940.) 42*s*. net.

IT is a striking tribute to the work and personality of John Linton Myres that the contents of the thirty-seventh issue of the Annual of the British School of Archæology at Athens consists, not as is usual, of records of research work of members of the School in the year under review, but of a number of papers presented to him in honour of his seventieth birthday by fellow workers in the field of the archæology and early history of the Eastern Mediterranean. A larger number of friends and colleagues, of whom a list is given, have contributed towards the cost of publication. It is appropriate that the British School should delight to honour one who is chairman of its Committee of Management, has been a staunch supporter of its work throughout the greater part of its existence, and is one of its students of longest standing. There will be many who will regret that the circumstances have precluded the inclusion of a like tribute from those whose province lies in other fields of learning and inquiry in which Prof. Myres has achieved an eminence no less worthy of commemoration than his archæological studies in the Eastern Mediterranean.

The list of contributors, needless to say, includes many distinguished names, of whom a few only can be mentioned here. Dr. C. W. Blegen reviews the evidence of the excavations of the expedition of the University of Cincinnati, 1932–38, on the site of Troy in its bearing upon the dating of the various settlements and their contacts with the Early, Middle and Late Bronze Age in the Ægean. An impromptu lecture by Prof. A. W. Brøgger, delivered while on a tour in the *Cairo City* in 1939, on "The Vikings of the Mediterranean and the Vikings of the North", dealing with the cultural influence of sea-power, so impressed its audience as to achieve here a well-deserved permanent record. Prof. V. Gordon Childe also deals with a field which he has made peculiarly his own in "Neolithic Blackware in Greece and on the Danube". An interesting and pertinent topic is examined by Prof. R. M. Dawkins, who traces the process of tradition in Greece in so far as it affects legends dealing with such supernatural happenings as no one is likely to regard as true. An interesting communication by Dr. P. Diaios, which is of added importance for its bearing upon ritualistic and cultural relations, describes an iron age painted vase in the Cyprus Museum, the product of illicit excavation but saved for archæological science, the decoration of which, a ritual of drinking through a siphon, points to a connexion with Syria.

The wide range of interest covered by other papers to which detailed reference cannot be made in a brief review may be suggested by the fact that they extend from western Europe (Prof. H. J. Fleure on the rough stone monument) to Palestine (Prof. D. A. E. Garrod on decorated mesolithic skeletons), and the Anatolian Plateau (Dr. H. Z. Koşay on excavations of the Turkish Historical Society in the copper age levels of Alaca-Höyük).

# ALLOYS OF IRON AND CHROMIUM

**The Alloys of Iron and Chromium**

Vol. 2 : High-Chromium Alloys. By A. B. Kinzel and Russell Franks. (Alloys of Iron Research : Monograph Series.) Pp. xv+559. (New York and London : McGraw-Hill Book Co., Inc., 1940.) 40*s*.

THE Alloys of Iron Monographs, arranged by the Engineering Foundation of the United States, constitute a valuable series. The alloys of iron and chromium have taken up two volumes ; volume 1, by Kinzel and Crafts, dealt with those alloys containing less than 10 per cent of chromium, and now volume 2, by Kinzel and Franks, deals with those alloys containing more than 10 per cent of chromium. The volumes are claimed to be a review and summary of published information and available unpublished data. A careful study of both volumes shows that the work has been well done, and a service of the first order rendered to ferrous metallurgy. The scientific and technical literature covering this field is so extensive now that for those who have not grown up with the subject the systematic study and analysis of available data which the authors have achieved is most valuable.

The investigation and technical exploitation of the iron-chromium series has led to the availability of a very valuable series of rust-, acid- and heat-resisting steels, which have greatly assisted modern engineering developments in many widely dissimilar fields. The explanation of this great achievement is that the addition of a sufficient amount of chromium to iron confers upon the iron the property of producing spontaneously upon its surface a passive and resistant film as a result of contact with the atmosphere or with certain aqueous environments. Such passive films, if mechanically damaged, are self-repairing. The quality of resistance of the film is advantageously affected by increasing the chromium content, and as regards quite a wide range of corroding media, by the addition of other elements, such as nickel, molybdenum, tungsten, copper, titanium, etc. It has also been shown, but is not mentioned by the authors, that the corroding medium also, in a very interesting manner, takes a definite part in producing the particular type of film by which it is resisted ; as regards the type of film necessary in the case of some corroding media, the formation, whilst taking place with sufficient rapidity for successful technical employment, cannot be regarded as being spontaneously produced. Turning to steels which operate at high temperatures, the oxide film is progressively thickened for a time, and then appears to become stabilized as regards resistance to further thickening. It will be seen that the whole field has presented, and indeed still presents, a great experimental ground for the investigator and also for the practical technologist as regards extended applications.

The authors, in endeavouring to present to the student some account of all published and available work, whilst being largely successful in that object, have almost necessarily given space to both technically interesting and technically uninteresting alloys, and it would have been an added value to the volume if indication had been given in a more definite manner of the extent two hich different alloys had found their particular niche in wide industrial application.

For certain data, fundamental to all ranges of the iron-chromium alloys, it will be necessary to refer to volume 1 (Kinzel and Crafts) which, although directed particularly to a study of the low-chromium alloys, deals with such aspects as the history of the chromium steels, the preparation and properties of chromium metal and ferrochromium, the constitution of the iron-chromium alloys and the general effects of chromium in iron and steel. In the present volume, after referring briefly to the metallurgical fundamentals of stainless steels, the authors describe the melting of the high-chromium steels and discuss the methods which have been developed to overcome the particular problems which arise in the process, owing to the high affinity of molten chromium for carbon. In the subsequent chapters, the fabrication and properties of the various types of high chromium steel and cast iron, and the effect of alloying additions are dealt with systematically, including the extremely important rich chromium-nickel-iron alloys, and the less important chromium-manganese-iron and chromium-aluminium-iron alloys. The work is principally a correlated summary of published data, rather than an expression of the authors' personal and critical findings.

On page 86, under the heading "Effect of Tungsten", we find the statement : "Steel containing 0·12 per cent maximum carbon, 12 to 14 per cent chromium, and 2·5 to 3·5 per cent tungsten, has been proposed for oil cracking service. This material is said to have higher useful strength at elevated temperatures than similar material containing no tungsten, but no data are available". It seems somewhat strange that the

authors should have overlooked the following data given in Thum's "Book of Stainless Steels" (second edition), pp. 264–265: "the American Iron and Steel Institute has issued a standard type No. 418 for the nominal composition 12 to 15 per cent chromium 0·12 per cent max carbon and 2·5 to 3·5 per cent tungsten. W. J. Teemer, of Allegheny Steel Company, kindly forwards the following physical properties of metal conforming to the above type number (manganese and silicon both under 0·50 per cent)". Thereafter follow data derived from a series of creep and short-time high-temperature tests carried out at temperatures varying between room temperature and 1400° F. On page 90, for Chapter xvi read xv. On page 292 it is interesting to note that an 18/12 steel is recommended for severe deep drawing. One would have expected the 12/12 steel to be recommended.

It is in regard to low-temperature tests that the most serious inaccuracies have been noted; for example, on page 341 reference is made to Izod impact tests carried out at low temperatures by Colbeck and his associates, on a steel containing 0·13 per cent carbon, 17·80 per cent chromium and 7·97 per cent nickel, but no reference to a steel of this analysis can be found in the original paper. Again, on page 342, data are quoted from a paper given by De Haas and Hadfield (*Phil. Trans. Roy. Soc.*, A, **232**, 297–332; 1932). The figures quoted are inaccurate, the correct values being as follows:

| | Testing temperatures | |
|---|---|---|
| | 20° C. (70° F.) | −252·8° C. (−423° F.) |
| M.S. tons/sq. in. | 52·4 (117,400 lb.) | 119·8 (268,400 lb.) |
| Y.P. tons/sq. in. | 25·9 ( 58,000 lb.) | 55·8 (125,000 lb.) |

On page 368, table 113, first line of the third group, for 79·92 read 74·92.

To one deeply interested in the subject it was natural to look to the index to see what the book contained concerning passivity, the passive film, the sigma phase and contact corrosion. It is always a great advantage in a book of reference of this character to have a complete index, and it is therefore surprising that help is not given to locate the relevant information. The passive film theory is dealt with to some extent, but there appears to be no reference to the very curious phenomenon of intermittent passivity.

There is no doubt that this volume will prove a very useful addition to the technical library, and as regards the text, there appears to be very little to which exception can be taken. It is a very big undertaking to handle critically the large number of papers now extant in this field, but, nevertheless, the authors are to be congratulated upon the extent of the success which they have achieved.

There is an excellent bibliography of the subject consisting of more than five hundred references.

W. H. Hatfield.

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# HYDROCARBONS

## (1) Physical Constants of Hydrocarbons

Vol. 2: Cyclanes, Cyclenes, Cyclynes and other Alicyclic Hydrocarbons. By Gustav Egloff. (American Chemical Society, Monograph Series No. 78.) Pp. 605. (New York: Reinhold Publishing Corporation; London: Chapman and Hall, Ltd., 1940.) 72*s*. net.

## (2) Conversion of Petroleum

Production of Motor Fuels by Thermal and Catalytic Processes. By Dr. A. N. Sachanen. Pp. 413. (New York: Reinhold Publishing Corporation; London: Chapman and Hall, Ltd., 1940.) 36*s*. net.

TO the chemist the word hydrocarbon defines a particular group of substances, to the public the equivalent word petroleum signifies motor fuel and motive power. To-day, when the destruction of the oil supplies and reserves of the enemy is the primary object of our bombing raids, it is interesting to reflect on the enormous technical advances in the petroleum industry largely due to the application of scientific research and the extension of scientific knowledge. Probably no industry has done more to encourage research and development than that of petroleum, and it has been richly rewarded. In particular the speed of the development has been amazing.

Whereas in early days straight-run products, that is, selected fractions of a simple distillation, were the rule, at a later stage these were augmented by cracking the higher boiling residues, and to-day thermal and catalytic processes have been brought in both to augment the yield of motor spirit and to give to it a quality which enables the modern engines which use it to produce such amazing speeds in aeroplanes and elsewhere.

(1) Egloff's book is the second volume to appear of a four-volume series in which the physical constants of hydrocarbons are collected. The first was reviewed in Nature of March 23, 1940, and covered the open straight- or branched-chain hydrocarbons; the second deals with the cyclanes or closed-chain compounds, which the author tells

us amount to about one quarter of the total world production of oil. A brief and well-written introduction deals with the nomenclature of alicyclic hydrocarbons, which is in a confused state. The author has set out rules based on the Geneva Nomenclature Conference of Organic Chemistry with his comments, and uses the terms cyclanes, cyclenes and cyclynes for cycloparaffins, olefines and acetylenes respectively.

The tabular text is broken up into sections listed in the table of contents; each substance has its formula clearly set out and references are given to the original literature for each physical constant.

(2) Sachanen's monograph, which is likewise of trans-Atlantic origin, is a timely exposition of the principles and methods of the production of high-octane fuels. The subject is so extensive that the scope of the book has had to be limited, and consideration of the vast patent literature has been omitted as well as any account of the historical development.

Whilst thermal cracking remains the most important process in the conversion of crude oil into motor spirit, the newer processes are coming more and more to the front, including those dealing with refinery gases.

This is a book essentially for the petroleum technologist, and criticism in detail of the author's method of treatment of the problem is best left to a more technical journal. The chemist at large will gather from it the enormous amount of scientific work which lies behind the practical effort that enables us to buy a gallon of reliable petrol for our car. E. F. ARMSTRONG.

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# SCIENCE AND PSEUDO-SCIENCE IN POLITICS

## Marxism

A Post-Mortem. By Henry Bamford Parkes. Pp. vii+246. (London: George Allen and Unwin, Ltd., 1940.) 7*s*. 6*d*. net.

THIS is a straightforward and readable criticism, written primarily from an American angle. The author describes how history has deviated from the path which Marx marked out for it; he shows up the dreary unrealities and illogicalities of the Marxian theory of value: he shares, in the main, with the orthodox economists and the neo-socialists, the conviction that extensive economic planning is incompatible with personal freedom, and that only under a free market system, where the consumer is king, can the public be well served with the goods and services of its choice; and finally he delivers a relatively mild attack upon the metaphysical foundations of Marxism.

Most of this has been said before. The author is perhaps most effective in his historical section, where he is also most concrete. He produces here some facts that are very awkward to assimilate in the orthodox doctrinaire Marxist analysis of contemporary society. Revolutions, for example, have proved themselves to be more at home among peasant than among industrial communities; and the industrial proletariat and its trade unions have shown markedly conservative tendencies, while the rise of a new middle class has thrown the Marxian class war right out of gear. Further, whatever else may have been accomplished by the professedly Marxist revolution in the Soviet Union, the level of prosperity and the range of personal freedom to be enjoyed there still remain behind that of States like Sweden.

The depressing thing is that there is so little reason to believe that this book will shake the faith of a single Marxist. For Marxism is a faith, and not a hypothesis based upon considered and precise observation of facts; and the root of the trouble is that social matters are still considered even by eminent men of science (many of them calling themselves Marxists) to be an appropriate sphere for faiths. What is wanted, in fact, is not just a post-mortem on Marxism, but a post-mortem on the whole apparatus of systems and 'isms' with which the study of social problems is cluttered up, and the substitution of an empirical, concrete approach. The job of the social organization is to see that people are properly fed, clothed and housed, and that they have opportunity to form mutually satisfying relationships with one another. Generalities about socialism, communism, fascism, Marxism and what-not now contribute very little towards the solution of these problems. These generalities are, in fact, mostly quite meaningless.

The whole approach to social and political questions is still pre-scientific. Until we have renounced tribal magic in favour of the detached and relentless accuracy characteristic of science, the unconquered social environment will continue to make useless and dangerous our astonishing conquest of the material environment. The weakness of Dr. Parkes's book, and of its many predecessors, is not that it does not say things that are sensible and true, but that the debate is conducted on the wrong plane. The abracadabra of Marxism will only be finally disposed of as an incident in a much more comprehensive mental revolution.

BARBARA WOOTTON.

# THE EXTRA SPOTS OF THE LAUE PHOTOGRAPH

By Sir William Bragg, O.M., K.B.E., Pres.R.S.

Several workers have recently discussed the diffuse spots which often appear in Laue X-ray crystal photographs and do not belong to the Laue pattern proper. Thus Preston has given[1] illustrations of the spots in a number of cases and concludes that "the diffuse spots can be explained by the thermal vibrations of the lattice which break the crystal up into groups, consisting probably of an atom and its twelve neighbours. The thermal vibrations cause the interatomic distances to vary slightly from one group to another so that new diffraction maxima, characteristic of the group of atoms, are produced".

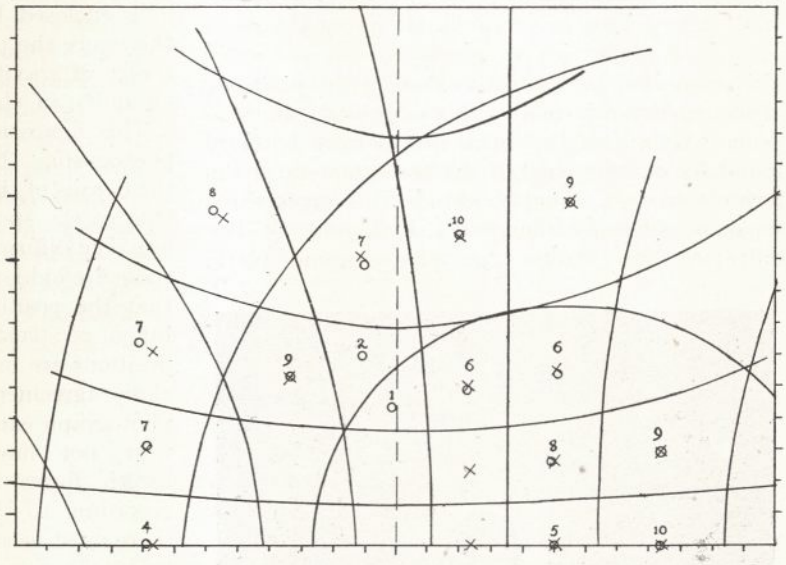

Fig. 1.

This diagram shows one half of the diffraction pattern referred to in the text. Observed diffuse spots transferred from the photograph are shown by crosses. Calculated positions are shown by small circles, and calculated intensities of maxima are indicated roughly by single figures. In the calculation of intensities no allowance is made for the effects of obliquity or of the dispersed arrangement of the scattering centres in the atoms.

If a pencil of monochromatic rays falls upon a group of scattering points in regular array in space, the diffracted rays take the form of a series of pencils which will produce a pattern on a photographic plate similar to the observed pattern of diffuse spots. The pattern so produced may be too weak to be observed; this will certainly be the case when the group is large enough. In the latter case, the crystalline arrangement of points must, as we know, be correctly oriented with respect to the incident ray. But when the group is small and there are sufficient groups which act more or less independently of one another and give a sufficient intensity in combination, there must be a diffraction pattern for all positions of the crystal containing the groups. The positions of the spots in the pattern are independent of the size of the group: and they change very slowly as the orientation of the crystal is changed.

Whether or no the spots of this diffraction pattern are actually the diffuse spots that are observed is a matter requiring proof. But at least it is worth observing how very accurately a calculation of the pattern predicts the positions of the spots and even to some extent their relative intensities.

It is, of course, true of a plane optical grating also that the positions of the diffraction maxima do not depend on the number of lines in the grating provided the spacing and wave-length remain unchanged. Nor do the directions of the diffracted pencils change much with the orientation of the grating. But there is no parallelism here to the characteristic crystal effect in which, when the number of atoms is large, observable reflection only occurs at definite orientations. This is a result of the three-dimensional arrangement. When the number in the group of atoms is small, the parallelism between the two cases is more complete.

A single illustration will illustrate the relation between calculation and observation. Suppose that a pencil of X-rays of wave-length $\lambda$, parallel to the $z$-axis, strikes a group of eight diffracting centres disposed at the corners of a cube of edge $a$. Let the cube be so arranged that one edge is parallel to the $y$-axis and two others are inclined at an angle $\theta$ to the axes of $x$ and $z$ respectively. In other words, the cube is tilted about the $y$-axis through an angle $\theta$ from a position symmetrical with respect to the axes. The tilt adds a complication to the problem which the hypothesis meets satisfactorily. The postulates of monochromatic rays and a simple cube can easily make way for more general cases later on.

The amplitude of the ray diffracted by the group of atoms in the direction $hkl$ is then proportional to

$$\cos\frac{\pi a}{\lambda}\left\{h\cos\theta+(1-l)\sin\theta\right\}\cos\frac{\pi ak}{\lambda}\times$$

$$\cos\frac{\pi a}{\lambda}\left\{h\sin\theta-(1-l)\cos\theta\right\}.$$

It is somewhat laborious to calculate the positions of the various maxima of this expression, but the general lay-out of the diffraction pattern is easily found by putting each of the three factors of the formula in turn equal to zero. This gives three separate relations connecting $h$, $k$ and $l$. The diffracted ray strikes the photographic plate,

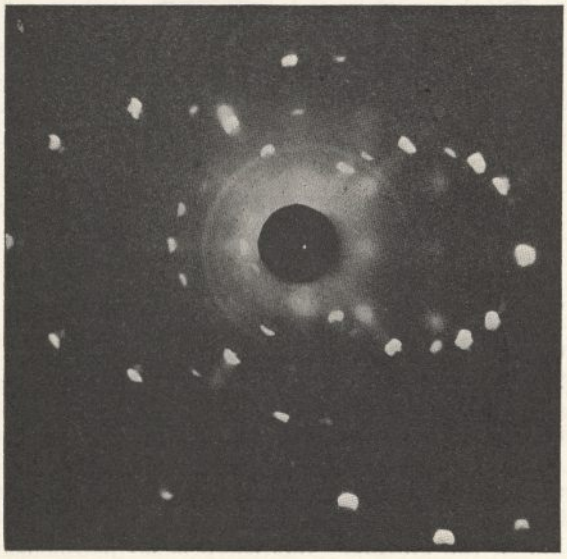

Fig. 2.

X-RAY PHOTOGRAPH OF POTASSIUM CHLORIDE; MOLYBDENUM $\alpha$-RAYS; CRYSTAL TILTED 20°.

which is normal to the direction of the incident, at a point defined by co-ordinates $x$ and $y$, where $x = hD/l$, $y = kD/l$, $D$ being the distance from crystal to plate. Expressing the three $h$, $k$, $l$ relations in terms of $x$ and $y$, we have three families of lines on the plate at every point of which the intensity of the diffracted ray is zero.

The accompanying figure shows these lines in the case when $\lambda = 0{\cdot}71$ A., being the wave-length of the $\alpha$-ray of molybdenum, and $a = 3{\cdot}14$, being the length of the edge of a cube of potassium chloride atoms, four potassium atoms and four chlorine atoms lying at alternate corners. As potassium and chlorine atoms are very nearly equal in weight, the group of eight atoms corresponds well to the hypothetical group of eight diffracting centres, except that they are not point sources. The angle of tilt $\theta$ is 20°.

The zero lines are ellipses and hyperbolas. As the angle of tilt is not large, two of the sets of curves are roughly parallel to the axes of $x$ and $y$. The third, corresponding to the third factor of the formula, is a set of ellipses. A point of maximum intensity lies at the approximate centre of each area enclosed by zero lines; at the outskirts of the figure the point lies nearer the origin than the centre of gravity of the area, an effect due to the obliquity of the rays.

This figure is to be compared with the actual photograph. It is not possible to bring out all the details of the photograph, and this is especially true of the spots on the left of the figure, which are very diffuse and relatively weak. Some of the spots are hidden by Laue spots. I fear, therefore, that the positions of some of the spots must be taken on trust. Their calculated and observed positions are marked in the figure. The generally close agreement is obvious. The rays of the photograph came from a molybdenum target, and were not monochromatic. Thus every wave-length forms its own diffraction pattern, and according to the hypothesis under consideration there must be streaks radiating outwards, the spots being the more intense portions due to the characteristic rays.

The spots in the photograph are not so diffuse as the formula would lead us to expect. But the formula is based on the assumption of a group of eight atoms only; if more atoms are included in a group, the spots become sharper. If larger and larger groups are taken into consideration, the total effect becomes less and less until at last the diffraction effect now considered disappears, the crystal becomes perfect, and observable reflection is only possible when the Bragg law is fulfilled. As already stated, the positions of the principal maxima do not depend on the number of atoms in the group; but as the number increases the lines of minimum intensity multiply in number and change their positions while retaining their general form.

The formula is derived on the assumption that the eight diffracting centres are points. Actually, the chlorine and potassium atoms are extended in space, and in consequence the intensity of the diffracted ray falls away as the inclination of the ray to the original pencil increases. The spots must therefore be weaker at the edge of the photograph than at the centre. The spread due to obliquity has an additional effect of the same kind.

That such groups of atoms can exist and have independent action does not seem unlikely. Similar associations in a liquid must produce rings and not a pattern of spots, because in a liquid all orientations are possible. In a solid, the orientations of groups are more restricted. The smaller

and the more numerous and the more independent are the groups, the more diffuse and also intense should be the spots. Perhaps in this way the effects of temperature can be explained.

The phenomenon of the diffuse spots has been discussed at length by a number of writers, but I venture to add this simple description of an effect which must exist whether it is observed or not. Faxen, in 1923, gave an explanation which relied on the existence of reflecting crystal planes in any zone, planes which could be correctly oriented for reflection even though one of the plane indices was incommensurable. He supposed that such extra planes could be produced by the passage of heat waves along the principal planes of the zone. In effect this gives the same result as a plane crossed grating, at least when there is no angle of tilt. That is because the unlimited choice of planes in a zone has removed the restriction of the three-dimensional arrangement. Zachariasen and Slater have examined the question more elaborately[2], and are conducting a series of experiments on the subject. So are Mrs. K. Lonsdale, Miss I. E. Knaggs and Mr. H. Smith, who have described their observations up to the present in Nature[3]. To these last-named workers I am indebted for the photograph reproduced above. A discussion on lines which vary considerably from those taken by other workers has been given by Raman[4].

The positions of the extra spots in Raman's photograph of diamond can also be determined with accuracy by the method described above.

[1] *Proc. Roy. Soc.*, July 1939.
[2] *Phys. Rev.*, **57**, 597 and 795 (1940).
[3] Nature, **146**, 332 (1940).
[4] *Current Science*, April 1940.

# CHRISTIAN HUYGENS, 1629-1695

By A. E. Bell,

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THE central interest of Huygens' life and work may be said to be his relations with Galilei and Descartes on one hand, and with Newton and the English men of science on the other. Descartes and Galilei were the brightest stars in the scientific firmament at Huygens' birth, and they influenced him in one way or another all his life. When he died in 1695 his own star, though still bright, too quickly paled beside the brilliance of the ascendant Newton. A study of Huygens' collected works leads to the view that claims may well be made for wider recognition of the importance of his work.

Huygens' life came at a time just succeeding the long-prepared attack on Aristotle's science. His education was modern and included a study of the works of Archimedes, Galilei and Descartes, and the ardent Cartesianism of his famous father and his teachers profoundly affected his outlook. In fact Huygens was probably first stimulated in his scientific work by those writings of Descartes which Leibniz dismissed as "un beau roman de Physique". But without Huygens' researches Leibniz might well never have coined that phrase. Without Huygens, in fact, an important stream of scientific thought, instead of reverting to the methods of Galilei, might have followed Descartes to disaster. Nevertheless Huygens never completely forsook Cartesianism, no doubt owing to all the influences of his early years and partly perhaps because of his profound opposition to the law of universal gravitation and to the absolute space of Newton's "Principia". His scientific and philosophical position, indeed, cannot be indicated in a word, and a detailed consideration lies beyond the scope of this article.

Huygens is remembered for his discovery of Saturn's ring, his invention of the first practicable pendulum clock, his telescopic eyepiece and micrometer and his formulation of the wave theory of light. To these the historian would add his important researches on percussion and centrifugal force and his magnificent theoretical work concerning the pendulum clock (on the centre of oscillation of the compound pendulum and the proof of the tautochronism of the cycloidal pendulum). Then also there is his work on refraction at curved surfaces leading to general formulæ for lenses and lens combinations, the quantitative estimation of the effect of spherical aberration, the introduction of the concept of the optical centre of a thick lens and an important theorem containing the germ of the least action principle in optics. This leaves on one side his important work in pure mathematics, his lesser contributions to astronomy and his influence in the secure foundation of the Royal Academy of Sciences in Paris. Here we may concentrate on the main scientific conceptions he helped to establish in science in the course of these researches, and try to indicate why he became the "incomparable Huygens" to both Leibniz and

John Bernoulli, and "one of the chief Mathematick Luminaries of the present Age" to his English admirers.

The history of mechanics up to Huygens is really the history of statics. This is not surprising in a sense, for the first tendency, following the Neoplatonic revival of the sixteenth century which coincided with the decline of Aristotelianism, was to reduce most physical problems to geometry. Perhaps because of the absence of accurate time measurement, the time dimension scarcely entered into science. Even in Huygens' work, the geometrical method of presentation is dominant. In dynamics, however, the geometrical method was inadequate and Huygens had to invent his own procedure. He had, to start with, the law of constant acceleration of Galilei and its simpler deductions, the presumption of the law of inertia, the recognition of the vector nature of force (da Vinci and Stevin both obtained a proof of the parallelogram of forces) and certain ideas found in Stevin's work which may be said to have been the seed of a theory of virtual velocities. Galilei failed to relate force with motion and did not perceive the need of a distinction between mass and weight. The contributions of Descartes' brilliant but wrong-headed world-mechanism can only have served to confuse these questions.

Huygens' early studies were on the central problem of how motion is transmitted by impact. For this he introduced a famous device. He imagined a man standing in a boat which moves steadily with the stream. From his hands, spherical bodies of perfect elasticity are suspended by strings of equal length. In this way the bodies may be given any velocity in the direction of motion of the boat. With respect to a stationary observer on the bank and to the 'navigator' there are then two sets of co-ordinates on which to represent the motions of the bodies. Both representations are equally 'true'. Starting with certain self-evident axioms, Huygens was able, through this simple principle of relativity, to solve all the problems concerning impact between the masses whether equal or unequal. The correct formulation of the laws of conservation of momentum and of kinetic energy (*vis viva*) resulted from this work: $mv$ and $mv^2$ (later modified to $\frac{1}{2}mv^2$) then entered physics with their modern significance. This involved a contradiction of all Descartes' work on the same subject and a revelation of his errors in the treatment of motion. Huygens treated mass as distinct from weight and implied an alternative method for comparing masses.

In his work on impact and still more on the centre of oscillation Huygens made great use of a fundamental principle (which he supposed to be self-evident) that the centre of gravity of a number of masses cannot ascend of itself through any motion of the masses under gravity. It followed that separate masses might have their centres of gravity brought to the height of the common centre of gravity "without the expenditure of any other force besides that which resides in the system"[1]. The principle also gave him a direct proof of Jordanus's theorem on the inclined plane. In his derivation of the formula for the distance of the centre of oscillation of a compound pendulum from the axis of rotation, Huygens combined this principle with Galilei's relation that the velocity acquired in descent under gravity varies as the square root of the height. The speeds of suspended particles at any point in the path were then deduced from the corresponding heights of descent, a procedure which really amounts, in combination with the conservation of *vis viva*, to the application of the law of conservation of energy in mechanics. Huygens had the formulæ but not the term. (Indeed if he had developed his ideas more fully the energy concept would have played an important part in physics much earlier than it did.) As for the rest of his work on suspended bodies of all forms, the derivation of the general formula is a masterly example of the inductive method and one which it is difficult to parallel. Parts of the problem could not be unravelled with the resources of classical geometry alone, and an astounding method of summation of elements had to be employed in obtaining the moments of inertia of certain solids of revolution.

Later in life, Huygens corresponded with Liebniz on the subject of the differential calculus and he collaborated with Fatio de Duillier on the new method. It came too late, however, to be of great help to him. His work illustrates almost tragically the need of the new weapon and the new notation. It is the same when we read his great work on the tautochrone, a curve which he discovered partly through practical experiments to correct the error of the clock pendulum and partly through an interest in the cycloid aroused by Pascal's 'Dettonville' problems.

Curiously enough, Huygens' study of centrifugal force also originated from his attempts to solve the practical problems of time measurement. The conical pendulum appeared to him at one time to offer certain advantages over the simple pendulum, and his first conical pendulum clock was probably constructed empirically. Huygens, of course, could not resist the temptation to investigate the laws of the new pendulum, and the theorems of the (posthumous) "De Vi Centrifuga" were the result. The statement of the theorems without proof was given at the end of the "Horologium Oscillatorium" of 1673. The importance of these for Newton's work is well known. After

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reading the book, Newton spoke of his "great satisfaction" with it, "finding it full of very subtile and usefull speculations very worthy of ye Author". It is interesting to note that Newton admired Huygens' classical mathematical style and considered him "the most elegant writer of modern times".

Huygens followed the traditional view, due first to Aristotle and found in Galilei, that rectilinear and circular motions were the fundamental forms of motion. Huygens was clear that uniform rectilinear motion had no effect on events which normally occur in an apparently stationary environment. This was the foundation of his 'relativity' principle mentioned above. Circular motion, however, was not of this kind but introduced new effects. It was only after the appearance of Newton's "Principia" that Huygens retracted this statement of the absolute nature of circular motion. He then (more consistently) took a firm stand on the relative nature of all motion and against the idea of any 'absolute' space. As for the conception of a gravitational force, innate and inherent in matter, this, he wrote, "appears to me absurd" and a conception which "takes us very far from the principles of Mathematics or Mechanics".

We have here Huygens' last dependence on the mind of Descartes. Whilst he rejected the latter's dictum that the essence of matter is extension—pointing out that hardness, for example, could not be deduced from extension—he remained a Cartesian in his belief in a pervading subtle matter. This subtle matter served as a medium for the propagation of light, and its rotation in vortices around each of the planets produced the effect of gravitation. Huygens considered he had experimental evidence both of the existence of the subtle matter and of the way in which its circular motion could produce a centripetal force. He found that mercury, in certain circumstances, would not descend from an inverted tube mounted in the manner of a barometer and placed in the receiver of an air pump. He failed to note the need of a film of moisture for this phenomenon, which is now ascribed to the tensile strength of the liquid, and instead supposed that a medium other than air supported the mercury column. Huygens did not proceed from this subtle matter to embrace the entire vortex theory of Descartes. On the contrary, he saw that these vortices "are superfluous [in astronomy] if one admits the system of Mr. Newton where the movement of the planets is explained by the gravity towards the Sun and the *vis centrifuga* which balances it. . . ." Nevertheless, he himself rather illogically retained a limited vortex theory because he considered it essential to explain gravitation and because he needed the pervading medium in his wave theory of light. It may be mentioned that, for him as for Descartes, light was more than a mere phenomenon for laboratory study ; it was something cosmic, something belonging to the stars. One of Descartes' treatises was in fact called "Le Monde ou Traité de la Lumière". But when all is said, it is remarkable if Huygens did not perceive how completely Newton's "Principia" had shattered the Cartesian vortices.

There is little space in which to refer to Huygens' voluminous work in optics. In his laboured geometrical notation he introduced several important formulæ into optics, notably for refraction at convex and concave spherical surfaces, the position of the image formed by a thin lens and the magnification produced both by a single lens and by a telescope. He did much to improve the telescope by estimating the amount of spherical aberration of objectives and the optimum conditions for reducing this effect, and also by constant experiment on methods of grinding and polishing lenses. Through his labours astronomers gave up the quest for lenses of other than spherical form which had been started by Descartes. In his scornful way, Leibniz once remarked : "The best *apologia* that could be made for M. Descartes would be to complete his hyperbolic spectacles, which are the only useful things he discovered—if it were practicable to do so . . ." Huygens in fact showed that even this game was not worth the candle.

The main ideas of Huygens' "Traité de la Lumière" in which he expounded his wave theory of light are sufficiently well known. The most important points of superiority over other wave theories of the time were the idea of secondary wavelets generating a wave front, and the exact geometrical construction for the reflected and refracted rays. Huygens' attempt to explain double refraction by utilizing spheroidal wavelets as well as spherical ones and his relating of the spheroidal surface with the fine structure of the crystal are also brilliant exploits. The curious question of why back-waves are not observed was not overlooked by Huygens. But as the longitudinal vibrations were supposed to be transmitted through hard particles in contact and in accordance with his laws of percussion, Huygens considered a back-wave could only be set up if some particles smaller than the rest were present, for then only would there be a rebound of a particle after impact. When the particles are all equal the compressional pulse was transmitted without displacements occurring.

Huygens was inclined to be dogmatic and intolerant of ideas which were repugnant to him. Both over Fermat's least time principle—"this pitiable axiom"—and over Newton's work on the composition of white light, he had to alter his

opinions. He was convinced that colour was a matter which was beyond mathematical treatment and his reception of Newton's early paper was very disappointing. Until the essential explanation of colour was reached, he wrote, "he [Newton] will not have taught us what the nature and difference of colours consists of, but only this accident (which assuredly is very considerable) of their different refrangibility". Huygens' attitude here recalls his criticism that Newton should have explained the cause of gravitation. These were the evil influences of the Cartesianism which he never wholly eradicated. For even whilst he perceived Descartes' faults more clearly than any of his critics, the outlook and the vision of the great philosopher had been too great a part of his early training to be utterly rejected. Huygens was in these respects a Cartesian in spite of himself. Mouy[2] has gone further than this and has contended that Huygens' work in effect instituted a mathematical Cartesianism, and that through Huygens Cartesianism did really enter modern science. Against this we have Huygens' own words, written late in life, that he could find "hardly anything" he could accept "in all the physics, metaphysics or meteors" of Descartes.

Huygens was in fact a modern. He showed scant respect for systems whether philosophical or religious, and accordingly had several clashes with the Jesuits and the doctrinaire Cartesians. Kircher, who adopted the cosmology of Tycho Brahe, he openly criticized for his timidity. We others, he asserted, are "without fear". It is thus not surprising that Huygens saw that Descartes, for all his brilliance, had really repeated the errors of scholasticism, for he had hoped to found a demonstrative and deductive science. More than any other man of science, certainly more than Leibniz, Huygens uncovered the errors of the great Cartesian mechanism. To him is due the fact that Cartesianism never became more than a provocative and stimulating vision of the realm of Nature.

[1] "Horologium Oscillatorium", Part 4, Hypothesis 1.
[2] Mouy, P., "Le Développement de la Physique Cartésienne 1646–1712" (1934).

# OBITUARIES

## Prof. C. G. Seligman, F.R.S.

BY the death of Prof. C. G. Seligman, emeritus professor of ethnology in the University of London, which took place at Oxford on September 19, anthropological studies in Great Britain have lost the support and inspiration of one who had been an outstanding personality as investigator in the field and as teacher for the greater part of the present century. As is shown by the record of his earlier years, he might well have attained eminence in more than one of the medical and kindred branches of scientific study ; but his association with the late Dr. A. C. Haddon on the Cambridge Anthropological Expedition to the Torres Straits in 1897 inspired him with an interest in ethnology which ultimately led him to make the study of early man and the life of primitive peoples from every side and in the broadest sense the major object of his life work. Yet final judgment upon his standing in the world of science cannot fail to take into account that his acute and versatile mind was quick to seize upon the essentials of any new or suggestive lines of investigation in other branches of study, which might bear upon his own subject, such as, for example, recent developments in psychology and the interpretation of dreams, not only turning it to his own purpose, but more often than not also making some original constructive contribution of his own to its advancement.

Charles Gabriel Seligman was born in 1872 and educated at St. Paul's School, and St. Thomas's Hospital, London, where he became house-physician, studied pathology with a Salter research fellowship, and held the appointment of director of the Clinical Research Laboratory. In the meantime, as already mentioned, he visited Queensland, New Guinea and Borneo as a member of the Cambridge Expedition to the Torres Straits, studying native diseases, childbirth customs and other native practices, ceremonies and beliefs. On his return to England in 1899, while still holding his appointment in the Clinical Laboratory, he was preparing himself for further work in the anthropological field. This took shape in the Cooke-Daniels expedition to New Guinea in 1904, of which he was joint leader with Major Cooke-Daniels. Seligman's scientific observations on this expedition were embodied in "The Melanesians of British New Guinea" (1910), a work which set a new standard in detailed observation of a primitive people as well as in the analytical study of ethnological problems on a first-hand knowledge acquired in the field. On his return from this expedition, Seligman once more took up medical studies for a time. In 1906 he was awarded the gold medal in pathology at the London M.D. examination and delivered the Hunterian and the Arris and Gale Lectures.

Hence onward Seligman's interests centred in anthropology. To this his marriage to Brenda Z. Salaman contributed in no small degree. It in no way detracts from Seligman's qualities or achievements to say that his outstanding position as an anthropologist was in no small measure due to Mrs. Seligman's devotion, encouragement and collaboration. Their first joint enterprise was an expedition in 1908, under

Government auspices, to the Veddas of Ceylon, where much valuable work of observation was done. Their material was embodied in "The Veddas" (1911), a standard work of which they were jointly the authors. Mrs. Seligman's work on this expedition was complementary to that of her husband, for in their association Seligman was giving practical effect for the first time to a plea which Dr. Haddon had long urged for the inclusion of women observers for obvious reasons in ethnographical expeditions among primitive peoples.

This association was continued when from 1909 onward Seligman became interested in Africa, and was engaged for some years under Government auspices in the study of the peoples of the Sudan, not only collecting the information which was embodied in "The Pagan Tribes of the Nilotic Sudan" (1932), but also laying the foundations of what is now the most efficient native survey service under British administration. Of the scientific importance of Seligman's discoveries among the Nilotic tribes in relation to the history of the kingship all readers of later editions of Frazer's "Golden Bough", as well as of his own Frazer Lecture, "Egypt and Negro Africa, a study in the Divine Kingship" (1934), are well aware. Another outcome of Seligman's African studies was an excellent little volume "The Races of Africa" in the "Home University Library".

Seligman was possessed of a highly developed artistic sense, which his scientific interests had fostered rather than blunted. It led him to the study of Chinese art and antiquities. He formed a small but choice collection, for which he built a museum at his home at Toot Baldon, and made his last journey of any considerable extent when in his later years he visited China to obtain a first-hand view of Chinese culture.

In 1910 Seligman was appointed lecturer in ethnology in the University of London and in 1918 he became professor in that subject, being attached to the London School of Economics, where he was associated with Prof. B. Malinowski. He retired in 1933, being granted the title of professor emeritus. The value of his work was widely recognized. In 1915, he was president of Section H (Anthropology) of the British Association; in 1918 he was admitted to fellowship of the Royal Society; and he was president of the Royal Anthropological Institute during 1923–25. He was awarded both the Rivers Memorial Medal for work in the field (1925) and the Huxley Memorial Medal (1932) of the Royal Anthropological Institute, as well as the Annandale Memorial Medal of the Royal Asiatic Society of Bengal (1931).

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The late C. G. Seligman and I were very old friends. We were born in the same year and met first at about the age of sixteen at the house of the late F. M. Halford, the greatest authority of his day on dry-fly fishing. We were both beginning to be interested in biology, and Halford was an enthusiast in microscopy, possessing a powerful binocular instrument with the then new oil-immersion lenses. We used to visit him on most Sunday afternoons; another of his young visitors being the late Edwin Montagu, afterwards Secretary of State for India and a successful promoter of sanctuaries for rare birds.

Seligman proceeded from school to St. Thomas's Hospital, I to Cambridge. But we spent two summer holidays during these undergraduate years together, one on a walking tour in the New Forest, the other on a visit to Norway. Even in these early days his outstanding characteristics were his absorbing love for biological research, his power of concentration and his independence. His possession of independence was scarcely surprising, as he had lost both parents at an early age and was brought up in the homes of strangers.

Thus it was that in 1897, when the late A. C. Haddon was considering the personnel of his memorable expedition from Cambridge to the islands of the Torres Straits, New Guinea and Borneo, I (his old pupil) brought the two together, and Seligman accepted his offer to join it. Under the guidance of Haddon and Rivers, Seligman learnt his anthropology. At first he made a speciality of investigating native diseases and native treatment, collecting medicinal and other plants and information about the customs and rites of women during parturition and at puberty. But later his work during the expedition covered almost the whole field of anthropology.

While Rivers, McDougall and I were carrying out mainly psychological investigations in Murray Island, Seligman was for most of the time in New Guinea. While there, so keen became his interest in ethnology that he seriously considered the offer which he received of medical practice at Port Moresby.

The expedition decided Seligman's career in ethnology as it did mine in psychology. I have already mentioned his whole-hearted devotion to science, his perseverance and his thoroughness. His bravery in the face of continuous ill-health during later life is also noteworthy. To these qualities he added the wider social ones of blunt honesty and of unfailing loyalty to his friends. C. S. Myers.

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In a message received from Sir James Frazer, he asks us to say he esteemed very highly Dr. Seligman's contribution to the science of man; he regrets that the state of his eyesight prevents him from making a fuller acknowledgment of the debt which he owed.

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## Prof. L. O. M. von Rohr

The announcement of the death of Prof. Louis Otto Moritz von Rohr will be greatly regretted by his many scientific friends in Great Britain.

Prof. von Rohr was born at Lazyn, Kreis Hohensalza, Germany, on April 4, 1868, and had therefore reached the age of seventy-two.

At the University of Halle he was a student under the late Prof. G. Contor and obtained there the degree of Ph.D. in 1892. A few years thereafter at the age of twenty-seven he commenced his life-long association with the firm of Carl Zeiss as technical collaborator under the arrangement introduced by the late Prof.

Abbe whereby young men of ability, while holding academic appointments, were engaged by Messrs. Zeiss, to the advantage of the collaborator and of the firm. They were afforded the opportunity, so often lacking elsewhere, of communicating direct to the firm the results of special research and of participating in the work of development, and in so doing of acquiring technical experience of the most advanced nature. Dr. Moritz von Rohr undoubtedly appreciated the importance of such a connexion and made the fullest use of his opportunities.

In 1913 von Rohr received the additional appointment of assistant professor in the Department of Medical Optics at the University of Jena. His interests were soon diverted to the field of optics and particularly ophthalmics; but although he might have made a name for himself in the more creative field of research, he became at an early stage of his career greatly interested in the history of the science to which he had become devoted. Even in his earliest contributions the historical aspects of the subject tend to predominate over the more technical details.

Von Rohr soon became by far the most important writer in every branch of historical optics. Although his knowledge of previous writings was profound, much of his material was the result of personal research. To ensure the accuracy of the information, he travelled widely and was unsparing of his strength. Few writers on any one subject can ever have been the author of so many contributions. The list is of extraordinary length. Dr. von Rohr will be remembered not so much because of any outstanding original creative work, but rather as a historian who discovered and recorded much valuable material that otherwise would have been lost to the scientific world.

JAMES WEIR FRENCH.

## Prof. Hans Zinsser

THE recent death in New York of Prof. Hans Zinsser, when he had nearly completed his sixty-second year, has removed an outstanding personality from the ranks of American bacteriologists. His work in the field of immunology and his researches during the past ten years into the prevention of typhus fever by means of a vaccine prepared from the causal organism had secured for him a world-wide reputation. Moreover, numerous interests, which extended far beyond the sphere of his scientific work, engaged his leisure hours, and thus he gave the impression of having lived intensely, even during the prolonged illness of which he clearly foresaw the inexorable end.

Zinsser was professor of bacteriology at Stanford University, California, from 1911 until 1913; at Columbia University, New York, from 1913 until 1923; and afterwards at Harvard Medical School, Boston. He was a member of the American Red Cross Sanitary Commission to Serbia in 1915; and in 1917 he served in the Medical Corps of the U.S. Army in France, where he acted as assistant director of the laboratories. In the summer of 1923 he visited Russia as sanitary commissioner for the Health Section of the League of Nations.

Problems investigated by Zinsser and his co-workers include: the mechanism of bacterial allergy; the immunological significance of certain non-protein substances extracted from the tubercle bacillus and other bacterial species, a series of observations which were later illuminated by Avery and Heidelberger as a result of their pioneer work on the type-specific polysaccharides of the pneumococci; the essential identity of the various manifestations of the antibody reaction; a comparison of the precipitation and agglutination reactions as influenced by the surface, in the aggregate, of the antigenic particles exposed to the action of the antibody component; and—in a different category—studies on the causative virus of Brill's disease, of herpes and of typhus fever.

Zinsser was the author of a lucid, exceptionally well-written and deservedly popular text-book of immunology under the title "Resistance to Infectious Diseases"; he prepared the latest edition with the aid of his colleagues Enders and Fothergill. His book "Rats, Lice and History", a popular account of the history and mode of transmission of typhus fever, won the good opinion of readers on both sides of the Atlantic not only by its solid background of knowledge but also by the numerous divagations from the main theme into the by-ways of literature and philosophy with which the reader is beguiled. He has also written an objective account of his life and experiences, which was recently published in the United States and has been acclaimed to be of unusual merit. We understand that the book will appear shortly in Great Britain, and we cannot doubt but that the self-portrait it contains will reveal the character of one whose interests ranged widely throughout the domains of thought and action and who, when his health finally broke down, met his fate with calm and even light-hearted courage. Perhaps, after all, it was for the best that a man of his intellectual energy should have been spared the "cruel disintegration of slow years", the tragedy of old age to which he thus alludes in the last sonnet he wrote.

G. F. PETRIE.

WE regret to announce the following deaths:

Dr. William Bowie, president during 1933–36 of the International Union of Geodesy and Geophysics, on August 28, aged sixty-eight.

Prof. R. S. Dugan, professor of astronomy in Princeton University, on August 31, aged sixty-two.

Sir Henry Head, F.R.S., the eminent neurologist, former editor of *Brain*, on October 8, aged seventy-nine.

Prof. E. H. Lindley, professor of psychology in the University of Kansas during 1898–1917, on August 21, aged seventy-one.

Prof. H. H. Nicholson, professor of chemistry in the University of Nebraska during 1882–1905, on August 17, aged ninety-five.

Prof. Vito Volterra, For. Mem. R. S., formerly president of the International Committee of Weights and Measures, aged eighty.

# NEWS AND VIEWS

## The War and the British Fauna

It is probably still too early to judge the effects of the War upon British wild life, for it was not until the second or third years of the War of 1914–18, when the calling-up of older men had more extensively depleted the gamekeeping profession, that the great increase in so-called 'vermin', including rarer species like the wild cat and polecat, became of national concern; nevertheless, the present War has speeded up a great deal of this disturbance of wild life by the greater activity at home. The most noticeable effects have been an extension of the range of normally persecuted species like the carrion-crow, fox, otter, kestrel, little owl and sparrowhawk, and this may be followed by a slower extension of species like the badger and raven. The use of sand-dunes and lonely islands in the coastal defences and of rural parks for training the army has considerably disturbed the nesting haunts or 'sanctuaries' of uncommon species, particularly birds, more so than the building of factories in rural areas, and this may have a permanent effect in further reducing the nesting population of terns, waterfowl and waders.

On the other hand, the breaking up of estates and game preservation is furthering the extension of the little owl and the grey squirrel in the north of England. As in 1914–18, the rumour has gained popularity that warfare on the Continent has sent rarer Continental birds to nest in England, notably the avocet in Essex, but it is unlikely that the campaign abroad had any effect upon the British avi-fauna. Pollution of rivers has again arisen, notably on the Severn, Bristol Avon, and the Derbyshire Derwent, with considerable loss of fish life. It yet remains to be seen if the rosebay willow-herb will emulate the story of the London rocket in spreading over ruined buildings in London and other cities; that the poppy will recolonize the Flanders area in its former abundance is very likely, for the destruction of buildings has again made the soil highly calcareous.

## Civic Development under War Conditions

A leading article in *Engineering* of September 27 shows that if no effective means be found to ensure the abolition of warfare the motives which have influenced the location of communities in certain districts of the earth's surface will be much the same in the future as in past history. Food and water, a dwelling-place of some kind and a reasonable measure of security against weather and the assault of enemies, these things are desired by the human race and by beasts and birds and even insects. Applied science has facilitated the establishment of communities in places where otherwise life could be maintained—if at all—with the greatest difficulty. On September 13 was celebrated the fiftieth anniversary of the foundation of Southern Rhodesia by the pioneer column which had trekked from Kimberley to take over and develop the territory for which mining concessions had been granted to Cecil Rhodes by Lobengula, the Matabele chieftain. On September 29, as related by Mr. W. J. Jarvis, city engineer of Salisbury, in a paper published in this number of *Engineering*, a beginning was made in the construction of the waterworks. The intervening fortnight had been occupied with the building of a fort which the pioneers had completed on the previous day. It is significant of the unchanging essentials of colonization that the assurance of a proper water supply was regarded as a necessary preliminary to all other activities, even though the fort was erected in close proximity to a river. It was only on the following day, September 30, 1890, that mining law was provisionally proclaimed, and prospective licences were issued to enable the provisional members of the column to proceed about the business which had brought them into what is now Southern Rhodesia.

This is a good example of the processes which have led to the establishment in their present situations of so many capital cities, the origins of which go far back into the history of mankind. It was not chance that located London and Paris and Rome and the many industrial cities like Newcastle and Sheffield in their present situations. In many cases the main considerations were the military ones which governed communal life until the general spread of a more ordered existence. Prior to 1914 this state had remained for so long in Great Britain that people had begun to regard it as settled and immutable, in spite of the wars that had periodically afflicted other European nations. The four years of war from 1914 to 1918, while they may have shaken this belief to some extent at the time, did not eradicate it. In fact the conviction that a war of such a prolonged and costly character could not be quickly followed by another seems to have encouraged both civil and industrial expansion in directions which it could scarcely have taken if the lessons of history had been properly assimilated. The experiences that Europe in general has undergone in the last twelve months suggest that the military considerations which have gradually lapsed into the background should once again be given due weight in planning for future mass movements of populations.

## Heating Private Air Raid Shelters

The efficient heating and lighting of air raid shelters is a problem of interest to many at the present time. A solution suggested by Mr. D. Bellamy, the general manager of the Hull Electricity Undertaking, has much to recommend it. He has prepared a scheme extending the existing assisted wiring scheme so as to include lighting and power plug points in domestic shelters free to the consumer. The offer is to install one lighting and one five-ampere plug socket for a charge of 1*s*. per week for 18 months;

alternatively the provision of a 'warden' fire in addition to one lighting point and one 5-amp. plug socket for 1*s.* 3*d.* per week for 18 months. These proposals have been unanimously approved by the Electricity Committee, and will be put into operation as soon as the necessary approval has been obtained to the financing of the scheme. After the scheme has been approved by the Electricity Commissioners it is hoped that it will be put into operation. It is to be hoped that similar facilities will be made widespread by other undertakings throughout the country. Winter is immediately ahead, with much illness to come if the shelter-comfort problem is not dealt with promptly.

### Air Raid Precautions for Users of Ammonia

THE Ministry of Home Security has recently issued a pamphlet on "Air-Raid Precautions to be taken by Users of Ammonia" (London: H.M. Stationery Office. 1*d.*). The extensive use which is now being made of anhydrous ammonia refrigerating plants makes the question an urgent one. The main precaution recommended is to keep stocks of anhydrous ammonia down to the absolute minimum. If the capacity of a given plant is sufficient to provide a reservoir, no reserve stocks at all should be kept. Where it is essential to keep additional supplies in cylinders, these should preferably be dispersed to protected positions in the open away from risk of fire and stored horizontally. If such a dispersal is impracticable, the cylinders should be placed in an angle of the walls of the building and suitably protected on the exposed sides. Precautions against the escape of ammonia from the refrigerating plant include the provision of sills around the area over which liquid ammonia may flow from a broken condenser coil; and it is suggested that the condenser water should be kept running, as ammonia is readily soluble in water and the aqueous solution is less dangerous than the anhydrous liquid. In an emergency, the charge in the machine should be isolated by closing all possible stop valves. To facilitate this operation by possibly inexperienced personnel, the engine-room master-valves may be painted in striking colours. It is pointed out that cylinders to be emptied should be laid horizontally, so as to discharge the ammonia in liquid form, due care being taken to avoid burns by the splashing of the liquid.

### Electric Power Stations Underground

As we see things at present, unless war can be banished from the earth we may have to revise our ideas completely as to underground power plant and underground shelters. The only really safe refuge in a great city assaulted from the air is a chamber far below the surface such as we find along some of the lowest tunnelling of the electric tubes, a level well below the maximum depth excavated by the comparatively feeble bomb of 1940. In the *Electrical Times* of September 26 it is stated that soon after the War of 1914–18 a few eminent consultants and power plant engineers sent the editor outline ideas of generating stations placed underground at low level. One of the difficulties which appeared insurmountable at that time was the supply of cooling water in large bulk at these depths. The inlet of water is easy enough, but what of the outlet? The case is a little less puzzling in that of oil-driven prime movers, but even these would strain the engineer's resources and ingenuity.

When the struggle at present raging reaches a settlement, inquiry may well be reopened. Excavations to a considerable depth and on a large scale may become essential, if only for providing an absolutely safe refuge for distracted people and hospital patients and staffs. Underground stations, too, are being used as air raid shelters. This is one stage of a difficulty which in time might become formidable; it will have to be considered along with the other problem of finding a safe lodging for the much-discussed electric power house.

### British Rheologists' Club

SINCE the outbreak of War, new and urgent problems concerning the flow and deformation properties of materials (rheology) have arisen in many industries and in research, and a group of British rheologists have therefore formed a club for mutual help and discussion. Prof. G. I. Taylor, Yarrow research professor of the Royal Society, has accepted the presidency. The objects of the new Club are "to co-ordinate the activities of Rheologists in Britain during the War, to further the appreciation of the importance of rheology in industry and to facilitate the pooling of information (where it is desirable) with respect to problems and new methods of research". Membership of the Club is open to any individual working or interested in rheology who is resident anywhere in the British Empire, and there is a nominal subscription of five shillings per annum. Arrangements are in preparation for an inaugural meeting of the Club to be held at the National Institute for Research in Dairying, University of Reading, on November 16, when it is proposed to hold an informal discussion on a topic to be selected, followed by an inspection of rheological apparatus including some recent developments. Fuller details of the Club may be obtained from the honorary secretary, Dr. G. W. Scott Blair, c/o Institute of Physics, at the University, Reading, Berks.

### Primitive Art: Past and Future

THE anthropologist, when confronted with some of the more extreme pronouncements of æsthetic judgment on the primitive artist, was at one time perhaps a little too apt to regard them as unwarranted apotheoses of what was after all a phase and no more in a process of æsthetic development or 'evolution', differing in this relation in no essential from any other cultural element depending upon technical achievement. He was, however, so far justified in that each example of the artist's skill and taste was to be regarded with reference to its social and religious background; and while it might, and very often did, afford satisfaction to a judgment habituated to European canons, to award it the highest mark as

an expression of æsthetic principles, as, for example, in the better-known specimens of West African sculpture, seemed to attach a false value to characters which were, in historical perspective, faults of technique rather than an outcome, conscious or unconscious, of any theory of artistic balance, selection or composition. A saner method of approach to the products of primitive art was illustrated by Dr. Leonard Adam in a recent lecture delivered before the Royal Society of Arts (*J. Roy. Soc. Arts*, June 28, 1940) in which he briefly directed attention to certain of the main principles of primitive art which emerge from its study in accordance with the evolutionary or cultural methods elaborated by the late Dr. A. C. Haddon, Prof. Franz Boas and others. Incidentally Dr. Adam stressed the interest and importance of the art of the American Indians of the north-west coast of America, which has suffered neglect in favour of the culturally less illuminating art of Africa.

The future of primitive art is, when properly understood, no less interesting than its past. It is true that in many parts of the world European impact has brought about degeneration; but experience in West Africa has shown that this is not inevitable. It was pointed out by Dr. Adam that modern ethnographical studies have demonstrated that early observers tended to overstress the static element in primitive culture. Art, however, like other cultural factors, has been subjected to a continuous process of change. Much of the so-called primitive art is in fact both highly sophisticated and 'evolved'. The result of such European guidance in West African education as has been formulated with understanding of native modes of thought has been to produce a native school of art, which not only in the traditional art of wood-carving, but also in other branches of artistic activity such as painting, is thoroughly African in conception, feeling, and atmosphere. It has survived or overcome the break with the social and religious factors upon which African art depended, but which vanished, or are vanishing, before European contacts. Hence, as Dr. Hanns Vischer pointed out from the chair on this occasion, this development indicates a line of advance in the present deplorable state of education in Africa—a beginning "to make grow . . . to liberate something which has been stifled under the thick crust of foreign knowledge acquired without real understanding".

## Rufford Village Museum

Rufford Village Museum, which was opened at Rufford Old Hall, a National Trust property in West Lancashire in July of last year as: "A Museum of Folk Culture and Industry: To illustrate and capture the spirit of the countryside" (to quote its constitution) is being developed by the honorary curator, Mr. Philip Ashcroft, jun., to be "an example for other districts to follow, so that in the future, each village or group of villages will have a museum to represent their life, history and culture". In addition to Baron Hesketh's extensive collection of old armoury and other relics of medieval life, Mr. Eric Hardy has drawn up lists of the local fauna and flora which will be exhibited above photographs, drawings, diagrams, etc., of wild life to encourage people to preserve as well as observe the wild life of the parish. This happens to be unusually rich, for the flora includes flowering rush, flowering fern, arrowhead, yellow waterlily, water soldier, bladderwort and nearly a thousand other plants; there is a list of twenty-two mammals for the parish and F. A. H. Hall and E. Hardy have drawn up a list of 101 bird records, including sixty nesting species—a third of the British records. The Museum itself is a historic old timbered hall, the restored part of which dates from the seventeenth century.

## Research in Social Relations in Industry

Mr. H. Valder, of Hamilton, New Zealand, has endowed for five years a research fellowship in social relations in industry at Victoria University College, Wellington, N.Z. Mr. Valder has himself done original work in investigating problems of industry, more especially those concerning the relation of capital and labour, and he believes that the work can be carried further by a man with scientific knowledge. To ensure that the investigator may be independent, the work is to be done under the ægis of the Victoria University College Council, and the appointment will carry with it the privileges of a professorial chair in the College. The salary offered is £1,000 a year (N.Z. currency) for five years. Applications from candidates should be sent to the Registrar of the College.

## Forestry Investigations in India

The activities of the Forest Research Institute at Dehra Dun, India, are summarized in a report entitled "Forest Research in India and Burma, Part 1, 1938–39". The work of the various branches of the Institute is described and the report forms a record of a large amount of useful work carried out in the interests of the State. Apart from research work, an enormous number of queries relating to the utilization of various forest products has kept the staff extremely busy during the year. It is noteworthy that all the provinces of India now employ an officer solely dealing with sylvicultural problems. The co-ordination of this work and advising on statistical requirements, in order to make the best use of the researches going on, have taxed the Sylvicultural Branch of the Institute severely.

It is not possible to make more than passing reference to a few of the programmes of work that are being carried out. The destruction of timbers by termites and by fungi is one of great importance, and this work is closely linked with problems of the seasoning and preservation of woods of many kinds. The paper-pulp section is another activity of great importance and promise, and questions connected with the manufacture of paper and plywood were probably the most numerous of all. The report itself, it may be added, is printed on paper made at the Institute from *Saccharum arundinaceum*. The cultivation of drugs is another aspect of work that

presents many problems of interest. The exploration of the potentialities of Derris as an insecticide is very encouraging, while proof that the alkaloid ephedrine, present in Indian species of Ephedra, is in no way inferior to the Chinese product as a potent remedy for asthma, opens up possibilities for India in this connexion. It is hoped that failure in the past to attend to certain essentials regarding the collection of the plants will be remedied and full advantage taken of the present opportunity for developing trade in Indian Ephedra. Among other subjects spike disease of sandalwood is still under investigation, but proof is needed that Jassidæ (leaf-hoppers) are the vectors concerned with the transmission of this baffling kind of disease.

### Scottish Society for Research in Plant Breeding

THE report for 1940 of the director of the Plant Breeding Station at Craig's House, Edinburgh, includes several important practical results of scientific research. It is shown that the renovation of semi-derelict pastures is best performed by ploughing up and re-sowing. A nurse crop of Sandy oats to be grazed in July, and a mixture of varieties of one grass species, together with wild white clover, are found to be preferable to sowing a mixture of grass species under rape or a seeding nurse crop of oats.

The Ainville sub-station, used for trials, has been transferred to six acres of land, six hundred feet above sea-level, at Boghall. The breeding of potatoes resistant to blight and to virus disease is meeting with considerable success, and several selections are being further tested. It is now possible to investigate the genetical background of resistance to pure strains of the *B*, *C* and *X* viruses. The available evidence indicates an autotetraploid segregation with dominance for susceptibility. Resistance to finger and toe disease in swedes is being tested both among new seedlings and in the field. Beans, wheat, barley and kale are among the other crops which are being bred for practical purposes under the guidance of scientific principles.

### Institute of Organic Chemistry in Moscow

IT is announced by "Russia Today" Press Service that work has been commenced in Moscow on the new building for the Institute of Organic Chemistry of the Academy of Sciences of the U.S.S.R. The building will consist of three blocks, the main one of which (the laboratory block) will house the seven departments engaged in the study of the different branches of organic chemistry. This block will have a volume of 1,907,000 cubic feet. In addition, there will be an autoclave building and a block for big installations and workshops, with an aggregate volume of 388,500 cubic feet. Spacious accommodation has been set aside for a library of 70,000 volumes, as well as a big reading-room and an auditorium for 250 persons. The cost of the new building, not counting special equipment, is estimated to be 12½ million roubles. It is hoped to complete it in 1942.

### Military Training for University Students

SINCE it is recognized that young men of eighteen and onwards at universities cannot undertake home defence duties without undue interference with their studies, it has been decided to expand the contingents of Training Corps at universities so that every student may enrol to obtain basic military training. Those who wish to serve in the Royal Air Force will have an opportunity of joining a university air squadron. By these means university education will be maintained, and undergraduates will be enabled to acquire useful experience.

### Postponement of Nobel Awards

ON October 11 the Board of the Nobel Foundation asked the Swedish Government to allow a postponement in conferring the Nobel Prizes of 1940 for literature, physics, and chemistry until the 1941 prizes are conferred. The Medicine Prize was yesterday reserved until 1941 by the Faculty of the Carolean Medico-Surgical Institute in Stockholm.

### Announcements

THE seventeenth award of the Duddell Medal of the Physical Society to Prof. E. O. Lawrence, of the University of California, which was announced in NATURE of June 1, p. 852, has a significance deeper than the honouring of a great American physicist's achievements in the invention and development of the cyclotron. Circumstances permitting, Lord Lothian, the British Ambassador to Washington, will present the Medal to Prof. Lawrence at Philadelphia on the evening of December 27, 1940, the occasion being that of a dinner in connexion with a three-day meeting of the American Physical Society. It is a particularly appropriate occasion, for on the same day there is to be also a meeting of the American Association for the Advancement of Science, at which Prof. Lawrence, as a retiring vice-president, will address one of the sections.

THE following appointments in the Colonial Service have recently been made: P. Adames, agricultural officer, Sierra Leone; E. S. Capstick, agricultural officer, Sierra Leone; J. H. Hinds, Agricultural officer, Gold Coast; J. A. N. Burra, assistant conservator of forests, Gold Coast; J. P. W. Logie, assistant conservator of forests, Kenya.

MORE than 100,000 books were destroyed or severely damaged in a fire following the bombing of the University College library during a recent air raid on London. Two members of the staff were killed and eight were wounded, and the memorial hall was almost demolished.

*Chronica Botanica*, the international plant science journal, established in Holland in 1935, is being published fortnightly in the United States (annual subscription, about the same as formerly when the journal was published as a bi-monthly, 7.50 dollars, foreign and domestic, post paid). Communications should be sent to Dr. F. Verdoorn, P.O. Box 151, Waltham, Massachusetts.

# LETTERS TO THE EDITORS

*The Editors do not hold themselves responsible for opinions expressed by their correspondents. They cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*

IN THE PRESENT CIRCUMSTANCES, PROOFS OF "LETTERS" WILL NOT BE SUBMITTED TO CORRESPONDENTS OUTSIDE GREAT BRITAIN.

## Non-Lethality of the Mid Factor in *Lythrum Salicaria*

IN 1927 East[1] proposed a theory of the inheritance of style-length in tristylic *Lythrum Salicaria* which involved three factors. One of these, *S*, was epistatic to the others, and determined Short style as opposed to Mid and Long. The other two, each of which was supposed to give Mid style as opposed to Long, were lethal when homozygous and were linked. In 1932 East[2] seemed to abandon this theory in favour of a single non-lethal factor, having found for the first time a plant which, crossed with Long style, gave a large progeny nearly all Mid. In 1936, however, he explained[3] that the 1927 theory was not abandoned, but applicable in his opinion only to the special type of plant with which first Barlow and later he himself had worked.

As Barlow[4] was the pioneer in the genetics of Lythrum, it would be very strange if she had encountered a strain of plants in which the mechanism of the inheritance of style length not only presented unusual features, but also had been totally transformed by the substitution of two linked lethals for a single non-lethal factor in the determination of the Mid style-length, especially as all three factors have *ex hypothesi* no recognizable effects except on the form of flower. At the time of East's second paper[2], therefore, one of us planned a series of tests, involving no illegitimate matings, and using an open pollination technique. It was hoped in this way to avoid disturbances to the phenotype ratios, due possibly to illegitimate pollination, and it was soon found that large progenies with entirely reliable ratios could be obtained in this way.

The first step, aimed at settling the question of lethality, has now been completed. Four Short plants from seed of an open pollinated plot, grown at the Chelsea Physic Garden in 1936, were tested by open crossing with Long at Harpenden in the following year, and sufficiently large progenies were grown at Merton in 1938. The following classification was obtained :

| Family | Long | Mid | Short | Total |
|---|---|---|---|---|
| *A* | 123 | 0 | 135 | 258 |
| *B* | 130 | 0 | 130 | 260 |
| *C* | 141 | 0 | 127 | 268 |
| *D* | 63 | 64 | 139 | 266 |

The absence of Mid progeny out of 786 in the first three families is good evidence that stray pollen was effectively absent. The Short parent of family *D* evidently contained a single gene for Mid style-length. Two other such Short plants have since been found among eight more from open-pollinated seed tested in 1940.

The Short parent *D* was grown with a Mid daughter from the family set out above, in isolation in Dr. F. Yates's garden at Harpenden, and two progenies from the reciprocally crossed seed were grown this year at Merton. Since both parents contain the same gene for Mid style-length, the test is critical for the lethality of this gene. If it were lethal we should expect 2 Mid : 1 Long, otherwise 3 Mid : 1 Long.

The two progenies obtained have now been scored as follows :

| | Long | Mid | Short | Total |
|---|---|---|---|---|
| Mid X Short .. | 28 | 103 | 117 | 248 |
| Short X Mid .. | 25 | 78 | 94 | 197 |
| Total .. | 53 | 181 | 211 | 445 |
| Expected (non-lethal) | 55·62 | 166·88 | 222·50 | |

The parallelism and homogeneity of the reciprocal progenies afford further confirmation of the absence of stray pollen. As regards the segregation for Mid and Long, the frequencies accord well with the expectations for 3 : 1 ($\chi^2$ less than 0·7, from one degree of freedom); but are incompatible with a 2 : 1 ratio ($\chi^2$ greater than 12·0). It is virtually certain, therefore, that the gene tested is not lethal.

The material from these progenies will be available for testing other possibilities not considered by East. Of these perhaps the most important is that of autopolyploid inheritance of the chromosome carrying the Mid gene. If adequate numbers can be tested, we may anticipate finding, both among the Mids and the Shorts, plants which have certainly received the same gene from both parents, and may in this case parallel the behaviour of those which East regarded as containing linked duplicate lethals.

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[1] East, E. M., *Genetics*, **12**, 393–414 (1927).
[2] East, E. M., *Genetics*, **17**, 327–334 (1932).
[3] East, E. M., *Amer. Nat.*, **70**, 5–12 (1936).
[4] Barlow, N., *J. Genet.*, **3**, 53–65 (1913); **13**, 133–146 (1923).

## Cardiac Metabolism and Rigor in Thyroidectomized Rats

IN order to elucidate the possible influence of the thyroid on heart metabolism, the effect of thyroidectomy on the course of cardiac rigor in rats has been studied.

Rigor was followed graphically according to the method of Chang, Patras and Templeton[1]. The results obtained are summarized below and will be

published in full detail elsewhere. For the present purpose, two time units of measurement will be distinguished: (*B*) the time in minutes from the removal of the heart to the onset of rigor, and (*S*) the time in minutes from the removal of the heart until rigor is maximal.

Rats which are rendered unconscious by a blow on the head or neck yield a shock rigor curve which is far shorter than normal. It may be seen from Table 1 that treatments 3, 4, 6, 8, 9 and 10 enhance the shock effect and lead to an onset of rigor immediately after the heart beat ceases. The onset of the effect and its disappearance on recovery are reflected in the shape of the rigor curve. Digitalis or cardiazol (Table 1, treatments 5 and 7) almost completely nullify the influence of brain shock, asphyxia, or exhaustion on the rigor, but do not nullify the influence of thyreotoxic principle. Chronic asphyxia (45–120 min. exposure to an atmosphere of approximately 5·8 per cent oxygen) does not influence the rigor curve.

TABLE 1

| No. | Normal | | Thyroidectomized | | Treatment |
|---|---|---|---|---|---|
| | *B* | *S* | *B* | *S* | |
| 1 | 25·0 | 44·2 | 44·4 | 67·8 | Amytal narcosis |
| 2 | 10·0 | 22·1 | 42·6 | 59·9 | Shock by blow on neck |
| 3 | 4·2 | 14·2 | 47·0 | 62·3 | 0·5 mgm. strychnine + blow on neck |
| 4 | 6·0 | 17·3 | 39·5 | 61·5 | 0·008–0·02 gm. caffein sodium benzoate + blow on neck |
| 5 | 26·0 | 40·3 | | | 5–6 mgm. cardiazol + blow on neck |
| 6 | 9·0 | 23·0 | 37·9 | 55·2 | 20 minutes swimming, death under amytal narcosis |
| 7 | 15·4 | 36·4 | | | Same treatment + previous digitalis treatment |
| 8 | 5·0 | 13·3 | 17·4 | 35·7 | KCN (6 mgm. subcutan.), death under amytal narcosis |
| 9 | 1·5 | 5·0 | 2·0 | 8·5 | 0·15 mgm. mono-iodoacetate, death under amytal narcosis |
| 10 | 3·8 | 9·0 | | | Iodothyrine + blow on neck |

The cardiac rigor curve of thyroidectomized rats is essentially different from that of normal rats (Table 1). The former is of markedly greater duration and is not influenced by brain shock, caffeine or strychnine administration. Exhaustion does not affect this curve. Digitalis is without influence upon it. Acute asphyxia causes a marked but relatively smaller curtailment of the rigor curve when thyroidectomized rats are used. Chemical rigor produced by mono-iodoacetate poisoning is, on the other hand, essentially the same in thyroidectomized as in normal rats.

The beating time of thyroidectomized rat heart immersed in Ringer solution at 36° C. is twice that of normal rat heart.

TABLE 2

| Animals | No. of exp. | Heart glycogen gm. % | Loss of heart glyc. through chronic oxygen lack gm. % | Loss of heart glyc. through chron. oxygen lack in % of initial value | Muscle glycogen gm. % | Liver glycogen gm. % |
|---|---|---|---|---|---|---|
| Thyroidect. | 15 | 0·250 | 0·113 | 31 | 0·27 | 1·92 |
| Control | 15 | 0·068 | 0·142 | 68 | 0·26 | 1·84 |

The markedly greater glycogen content of the heart of thyroidectomized rats is only slightly reduced by killing without narcosis through a blow on the neck (Stein, Tuerkischer, Wertheimer[2]). Chronic oxygen-lack affects the cardiac glycogen content of thyroidectomized rats to a lesser extent than it does the cardiac content of normal rats. Both treatments reduce the cardiac glycogen content of normal rat to a minimum. KCN and also caffeine have an identical effect on the heart glycogen of both thyroidectomized and normal rats. Thyroidectomy does not produce any of the above-mentioned deviations from normal in skeletal muscle.

The total creatinine content of the heart of thyroidectomized rats averages 23 per cent more than normal. Skeletal muscle of thyroidectomized rats gives normal creatinine values. Cardiac phosphagen and lactic acid content are not changed by thyroidectomy.

The specific nature of the changes produced by thyroidectomy in cardiac rigor, glycogen storage, and total creatinine content leads to the conclusion that removal of the thyroids affects the special metabolism of heart muscle in a manner which is not dependent on the depression of general metabolism by thyroidectomy.

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[1] Chang, St., Patras, M. C., and Templeton, R. D., *Amer. J. Physiol.*, **118**, 423 (1937).
[2] Stein, L., Tuerkischer, E., and Wertheimer, E., *J. Physiol.*, **95**, 356 (1939).

## Drinking Habits of Animals

IN a recent publication[1], I made reference to a paper by Gregersen[2] in which he recorded that dogs, confined in cages and fed once a day, drank water from time to time during 2–5 hours after the meal and scarcely at all at other times of the day. I interpreted this to mean that the dogs did not drink water until an interval of two hours had elapsed after the time of feeding, whereas the charts shown in Gregersen's paper indicate clearly that the dogs drank water from time to time during the 2–5 hours *immediately* following the time of feeding. I wish to record my apology for my error.

Also, mention is made, in my paper already referred to, of the drinking habits of leopards kept in confinement and fed once a day on flesh. Further observations made on one such leopard showed that, although on several occasions it did not drink water after feeding until an interval of about 2 hours had passed, this was not a constant habit. The observed intervals, expressed in minutes, between the time of completion of a meal and the time of first drinking water thereafter were: 2, 6, 15, 50, 56, 115, 120, 121, 148.

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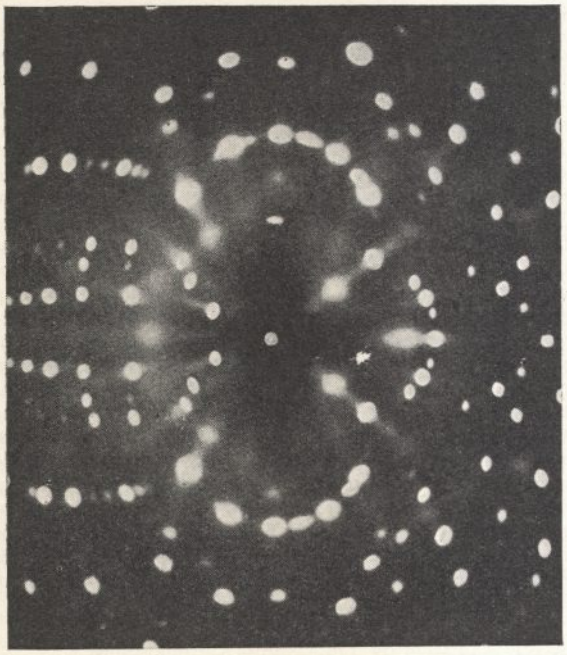
[1] Brownlee, A., *J. Comp. Path. and Ther.*, **53**, 55 (1940).
[2] Gregersen, M. I., *Amer. J. Physiol.*, **102**, 344 (1932).

## Modified Reflection of X-Rays

As stated in an earlier communication[1], quantum theory leads to the remarkable conclusion that the reflection of X-rays in crystals is of two types ; first, the classical or unmodified reflections associated with the normal structure amplitudes of the crystal ; and secondly, the quantum or modified reflections which arise when the vibrations of the crystal lattice are quantum-mechanically excited by the incident X-radiation. The direction and intensity of the reflections of the second kind have been considered theoretically in a recent paper[2]. It is shown that when the energy taken up by the crystal lattice is in the form of *acoustic waves*, the recoil of the photon is observable as *a diffuse scattering* of the incident X-radiation, while on the other hand, when the *optical vibrations of the crystal lattice* are excited, the resulting effect is *a regular reflection* of the incident radiation.



Modified reflections with calcite.

The geometric law of quantum or modified reflection, shown to be experimentally valid by an extended series of measurements[3] with sodium nitrate and with rock-salt crystals, takes the very simple symmetric form $2d \sin \frac{1}{2}(\theta + \varphi) = n\lambda$, where $d$ is a crystal spacing, and $\theta$, $\varphi$ are the glancing angles of incidence and reflection with respect to such spacing. The formula leads to the interesting conclusion that the angle between the incident and reflected rays is independent of the setting of the crystal though, as shown both by theory and experiment, the intensity of the reflection does depend on such setting.

Table I. 400 Modified Reflections observed with a Rock-Salt Crystal. $\lambda = 0{\cdot}708$ A., $d = 2{\cdot}814$ A.

| $\theta$ | $\varphi$ | $\theta + \varphi$ | $d$ (calculated) Symmetric formula | $d$ (calculated) Asymmetric formula |
|---|---|---|---|---|
| 9° 40′ | 19° 18′ | 28° 58′ | 2·83 A. | 2·76 A. |
| 11° 36′ | 17° 26′ | 29° 2′ | 2·82 ,, | 2·78 ,, |
| 17° 46′ | 11° 22′ | 29° 8′ | 2·82 ,, | 2·85 ,, |
| 19° 21′ | 9° 57′ | 29° 18′ | 2·80 ,, | 2·85 ,, |
| 25° 21′ | 3° 57′ | 29° 18′ | 2·80 ,, | 2·89 ,, |

Table 1 (fourth column) gives the spacings calculated by the stated formula from observations on the second-order modified reflections from the cleavage planes of a rock-salt crystal, and shows fair agreement with the known crystal spacing. It is given here especially to exhibit the fact that there is no such agreement between the actual crystal spacing and the values entered in the fifth column, which have been calculated from the formula :

$$d(\sin \theta + \cos \theta \tan \varphi) = n\lambda.$$

In the latter formula, $\varphi$ indicates, according to Faxen[4] and to Zachariasen[5], the direction of maximum intensity in the diffuse thermal scattering of X-rays by a cubic crystal.

The well-defined character of the quantum reflections given by an ideal crystal is illustrated in the accompanying reproduction, which is a strongly exposed Laue pattern of calcite. It exhibits the modified reflections by numerous planes in the crystal including, especially, the first, second and third order reflections from the cleavage planes, the $K_\alpha$ and $K_\beta$ spots being clearly separated.

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August 18.

[1] Nature, **145**, 860 (1940).
[2] Raman and Nath, *Proc. Ind. Acad.*, **12**, 83 (1940).
[3] Raman and Nilakantan, *Proc. Ind. Acad.*, **11**, 398, and **12**, 141 (1940).
[4] Faxen, *Z. Phys.*, **17**, 277 (1923).
[5] Zachariasen, *Phys. Rev.*, **57**, 597 (1940).

## Atomic Energy Values of Ionized Tellurium (Te II)

The identification of the structure of the spectrum of singly ionized tellurium, briefly reported by one of us previously[1], has led to the following absolute values of the characteristic terms :

| | | | |
|---|---|---|---|
| $5p\ {}^4S_{1\frac{1}{2}}$ | = 173801 | $6s\ {}^2P_{1\frac{1}{2}}$ | = 85375·8 |
| ${}^2D_{1\frac{1}{2}}$ | = 163580 | $6p\ {}^4D_{\frac{1}{2}}$ | = 74458·6 |
| ${}^2D_{2\frac{1}{2}}$ | = 160847 | ${}^4D_{1\frac{1}{2}}$ | = 72811·2 |
| ${}^2P_{\frac{1}{2}}$ | = 152281 | ${}^4D_{2\frac{1}{2}}$ | = 66515·4 |
| ${}^2P_{1\frac{1}{2}}$ | = 148101 | ${}^4P_{\frac{1}{2}}$ | = 77008·9 |
| $6s\ {}^4P_{\frac{1}{2}}$ | = 95352·6 | ${}^4P_{1\frac{1}{2}}$ | = 74376·0 |
| ${}^4P_{1\frac{1}{2}}$ | = 91057·5 | ${}^4P_{2\frac{1}{2}}$ | = 70364·6 |
| ${}^4P_{2\frac{1}{2}}$ | = 87704·4 | ${}^4S_{1\frac{1}{2}}$ | = 65461·6 |
| ${}^2D_{1\frac{1}{2}}$ | = 78944 | ${}^2P_{\frac{1}{2}}$ | = 73362·4 |
| $a$ | = 71559 | ${}^2P_{1\frac{1}{2}}$ | = 68150·4 |
| $\beta$ | = 83810 | ${}^2D_{1\frac{1}{2}}$ | = 71733·8 |
| $6s\ {}^2P_{\frac{1}{2}}$ | = 89246·1 | | |

The ionization potential of Te II, as determined from the largest term $5p\ {}^4S_{1\frac{1}{2}} = 173801$ cm.$^{-1}$, is 21·5 volts approximately. The detailed results will be published elsewhere.

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[1] Nature, **143**, 376 (1939).

# RESEARCH ITEMS

## Bony Growths in the Human Jaw

CERTAIN secondary formations on the human jaw were first reported in 1884 by Danielli. Though noted repeatedly since by various scientific workers, they are still far from being generally known and understood. Aleš Hrdlička, in a recent discussion of the condition (*Amer. J. Phys. Anthrop.*, **27**, 1 ; 1940), has reviewed and analysed recorded observations and has added to them new data based upon an examination of 5,632 lower jaws—cases which offered no possible doubt as to the nature of the formation. These hyperostoses consist of various grades and forms of supplementary hard bony tissue above the mylo-hyoid line on the lingual surface of the mandible. They have no connexion with anything pathological, though they may, when over-developed, cause trouble mechanically. They do not as a rule develop in the higher apes. In man they occur sporadically from palæolithic times—they are reported in Sinanthropus—are more frequent in the neolithic period, and later grow more or less common in various human groups. They do not show any clear racial selectiveness, but are more common in the Yellow-Browns than in White or Black. This preponderance, however, appears more regional than racial. It is most marked in the northernmost or cold, least marked in the southern or warm, regions. A remarkable and instructive difference is seen to exist between the North American and the Old Peruvian Indians ; in the latter the hyperostoses are almost wanting, while in the North Americans they are four times in number and even more in weight. The evidence furnishes a strong indication that the mandibular hyperostoses are neither of phylogenetic transmission nor show any plain racial heredity. Apparently they are brought about by environmental conditions, which can only mean food, and hence mastication. They tend to be both more frequent, and on the whole more strongly developed in the males. It is impossible to reach any conclusion other than that they are caused by stresses of mastication in excess of the capacity of the individual bones, and that they are the efforts of the organism to provide additional strengthening to the parts affected.

## The English Sparrow in the United States

THE common house-sparrow, introduced from England to Brooklyn (N.Y.) in 1850 and 1852, has long been established in the United States beyond the possibility of eradication. And the introduction and establishment are regretted, for the evidence gathered by a new investigation of the activities of the bird show that its harmfulness to agriculture outbalances whatever good it does. E. R. Kalmbach in his inquiry into the economic status of the sparrow examined the food content of 8,004 stomachs, a larger number than ever before employed in the study of the food habits of a single species of bird (U.S. Dept. Agric., Tech. Bull., No. 711 ; June 1940). Since the publication fifty years ago of Barrows' classic account of the sparrow in the United States, the range of the species there has more than doubled and the bird has come to be of economic importance in every State. It is admitted that in special localities and on special occasions sparrows have done notable service, for example, in destroying the alfalfa weevil in Utah in 1911 and 1912 or in destroying bark-beetles in a lumber-yard in Alabama in 1913–1915, but such beneficial activities are almost confined to the short period when the nestlings are fed on insects. They do not appear to counterbalance the real and potential harm with which the adults must be charged on account of their feeding activities. In addition, it is known that the sparrow is an agent in the transmission of certain poultry parasites and diseases. The author, however, does not advise ruthless slaughter ; control measures should always be limited to the needs of the occasion, and it should be remembered that in cases of unforeseen insect plagues the sparrow may turn out to be a valuable helper in checking and suppressing the enemy.

## Variation in the Bull- or Gopher-snakes (*Pituophis*)

IN the first thorough attempt which has been made to analyse the variations in the snakes of the genus Pituophis, Olive Griffith Stull recognizes six species and thirteen "forms" (*U.S. Nat. Mus. Bull.*, **175** ; 1940). This genus of conspicuous and well-known snakes ranges from Guatemala to Canada, including most of Mexico, all the United States west of the Mississippi, several to the east, and all Atlantic States from Alabama to New York, and everywhere it seems to be little restricted as to habitat. Comparison of the different forms in their geographical relationship shows that from the probable centre of dispersal outwards a general decrease in scale characters accompanied by an increase in proportionate length of tail occurs in all forms. Also in every form which is represented by a sufficient number of specimens there is a similar variational tendency in scale rows, ventrals, and caudals. As a rule decrease in scale characters within any form is correlated with general dwarfing, but this is not necessarily true for comparisons between different forms. Sexual variation is indicated by higher numbers of scale rows and ventrals in the females, and higher caudals, proportionate tail length and number of tail spots in the males.

## X-Ray Radiation on Tradescantia Chromosomes

A. C. FABERGÉ (*J. Genetics*, **40**, 379–384 ; 1940) describes an experiment involving the radiation of chromosomes of *Tradescantia bracteata* by X-rays of differing wave-lengths. He shows that several checks on the accuracy of such an experiment may be made by statistical treatment ; it is shown that in this experiment it is uneconomical to examine more than 18 cells per slide. The estimation of chromosome breaks was made by counting the number of bodies in the cell after radiation. No difference between the results of hard and soft radiation was found.

## Cyto-genetics of Brassica

THE genus Brassica contains species showing aneuploid chromosome numbers and is interesting from an evolutionary point of view. S. M. Sikka (*J. Genetics*, **40**, 441–509 ; 1940) has studied the chromosomes of several species and hybrids between them. *B. juncea* is an allopolyploid derived from the crossing of *B. campestris* and *B. nigra*. The hybrid between *B. tournefortii* and *B. trilocularis*, although

both have $2n = 20$ chromosomes, has an irregular meiosis showing a quadrivalent, 1–3 bivalents or a lack of pairing in different nuclei. On the other hand, *B. rapa* × *B. trilocularis* shows 10 bivalents at meiosis. The correlation between the number of satellites and number of nucleoli was observed, while secondary association indicates that the basic chromosome number of the genus is five. Hybridization has played the most important part in the evolution of the genus.

### Physiology of Storage in Bananas

A recent publication by C. W. Wardlaw (Mem. 15, Trinidad Low Temperature Research Station, May 1940), on the storage of Gros Michel bananas, centres around the possibility of transporting fruit from Trinidad by the use of refrigerated gas storage. The problem is to retard ripening without serious disturbance in the course of metabolism. The results obtained under laboratory conditions indicate that with suitable control of atmospheric conditions, bananas considerably heavier than "3/4 full" could be safely subjected to a journey of some 16 days with no deleterious effects on the fruit when afterwards ripened. Thus, when rapidly cooled to 53° F. in an atmosphere containing 5 per cent carbon dioxide and 5–7 per cent oxygen, considerable retardation of ripening is produced, in comparison with controls in air, with no evidence of chilling or gas injury. A carefully regulated series of experiments indicate these as the optimum atmospheric conditions. It is further suggested that this atmosphere could be maintained under storage, without recourse to artificial atmospheres, by the use of 'gas-tight' holds, carefully controlled ventilation and partial removal of oxygen by chemical means, and by control of the (vol. of fruit/vol. of hold) ratio. It is emphasized that fruit showing incipient ripening must be rigidly excluded, since the presence of even small quantities of such fruit tends to accelerate the ripening of immature fruit, probably by accumulation of physiologically active substances.

### Composition of Coal

The resins and hydrocarbons which exist in small proportions in coal are of considerable importance in the caking properties. In the rational analysis of coal, these resins and hydrocarbons are extracted with pyridine but it is known that this extraction is incomplete: in the residue there is still a fraction dissolved by subsequent extraction with benzene under pressure. R. Belcher and R. V. Wheeler (*J. Chem. Soc.*, 866; 1940) have examined the use of quinoline (already used by Vignon in 1914) instead of pyridine as a primary solvent but find that it has no advantage over pyridine either in rapidity or completeness of extraction. With technical quinoline exposed to daylight there is also a possibility of the photochemical formation of material liable to be confused with the true extract.

### Phosphonium, Arsonium and Stibonium Salts

J. Chatt and F. G. Mann (*J. Chem. Soc.*, 1192; 1940) have shown that tetraphenylarsonium salts can be obtained by the action of aluminium chloride on (1) arsenic trichloride and benzene, (2) phenyldichloroarsine, (3) diphenylchloroarsine, (4) triphenylarsine, (5) triphenylarsine and bromobenzene, the best yield being obtained in (5). Tetraphenylphosphonium and tetraphenylstibonium compounds can be obtained by methods analogous to (5). The tetraarylstibonium salts were hitherto unknown. The reactions evidently follow a complicated mechanism, involving the migration of phenyl radicals.

### Constitution of Pectic Acid

The structure of a pectic acid or polygalacturonic acid prepared from citrus pectin by treatment with dilute hydrochloric acid has been examined by Miss S. Luckett and F. Smith (*J. Chem. Soc.*, 1106, 1114; 1940). By methylation with methyl sulphate in presence of alkali, precipitation of the thallium salt of the methylated acid, and reaction of this with methyl iodide, the methyl ester of the methylated pectic acid was obtained as a solid. Hydrolysis of this with methyl-alcoholic hydrogen chloride gave as the main product the methyl ester of 2 : 3-dimethyl galactofuranoside, the structure of which was confirmed by its oxidation to 2 : 3-dimethyl mucic acid with silver oxide and methyl iodide, and also by the formation of the methyl ester of 2 : 3 : 5-trimethyl β-methyl galactofuranoside, which after oxidation gave the γ-lactone methyl ester of 2 : 3 : 5-trimethyl mucic acid. Citrus pectic acid is thence supposed to be composed of pyranose residues of galacturonic acid joined by 1 : 4-α-glycosidic links. The molecule of the methyl ester of methylated pectic acid appears to be relatively small, the size as determined by osmotic pressure measurements being about 13 units. The methyl ester of 2 : 3 : 5-trimethyl β-methylgalactofuranoside was synthesized from methylgalactofuranoside and its structure determined by its conversion into the crystalline γ-lactone ester of 2 : 3 : 5-trimethyl mucic acid. Some derivatives of 2 : 3 : 5-trimethyl galactonic acid were isolated in a crystalline state.

### Basic Nature of Vanadium Pentoxide

Although vanadium pentoxide $V_2O_5$ is a typical acidic oxide giving rise to series of salts (the vanadates) with bases, it has been known since the time of Berzelius that it is considerably more soluble in acids than in water, so that it also shows basic properties. Some solid compounds with sulphuric acid have been reported. These have been re-examined by O. E. Lanford and S. J. Kiehl (*J. Amer. Chem. Soc.*, **62**, 1660; 1940), who find that only the solids $V_2O_5$, $4SO_3$, $4H_2O$, $V_2O_5$, $2SO_3$, $3H_2O$ and $V_2O_5$, $2SO_3$, $8H_2O$ are formed at 30°, no indication being found of the two compounds described by Berzelius. H. T. S. Britton and G. Welford (*J. Chem. Soc.*, 895; 1940) have examined the solubility of vanadium pentoxide in solutions of acids. The solubility depends on the strength of the acid and the temperature. Hydrochloric, nitric, perchloric, sulphuric, acetic and trichloracetic acids, and sodium hydrogen sulphate were used at temperatures of 180° and 100°. The action of acids in precipitating vanadium pentoxide from solutions of sodium vanadate was also examined, in this case at the boiling point, when reproducible results could be obtained, the oxide held in colloidal suspension being then precipitated. The results show that $V_2O_5$ is amphoteric and is an extremely weak base. Even in the presence of excess of acids it does not show a basic function extending beyond the ion $VO_2^+$. The specific conductivities and freezing points of acid solutions of vanadium pentoxide were also measured; the conductivities fell and the freezing points rose slightly as the vanadium pentoxide content increased.

# RELATION OF MUSEUMS TO COMMERCE

By Dr. Walter E. Collinge,
The Yorkshire Museum, York

## Commercial Museums

COMMERCIAL museums are no new idea. Spain has long had one at Mataro, there is one at Lima in Peru, and another at Santiago in Chile, and others in Mexico, Brazil, and Japan; but the finest of all perhaps is that at Philadelphia. It arose out of the World's Columbian Exposition at Chicago in 1893. The vast exhibits there shown were secured and a permanent Board of Trustees and an Advisory Board appointed. This latter exercises a general supervision over the administration of the Museum with the object of furthering its development and fostering the efficiency of its service in the interests of commerce. Finally, there is a Diplomatic Advisory Board consisting of representatives of all foreign nations in the United States, with the object of ensuring international co-operation. In the first four years of its existence the city of Philadelphia provided £100,000 for the Museum.

The work is carried out in two separate departments, namely, a scientific department and a bureau of information. The former is concerned with the collection and exhibition of the raw products of the world, and the analysis and examination of all such materials. There is also an extensive exhibit of foreign manufactures, which shows samples of merchandise now being sold in foreign countries, especially in the markets of South America, Australia, South Africa, and other promising fields. The object is to show the American manufacturer what his competitors are doing in the foreign trade of these countries, and to suggest to him new lines of goods which he may produce and sell with profit.

The practical value of this department will at once be recognized. The manufacturer of cotton goods, for example, who is desirous of wider markets for his products, may here find thousands of samples, showing him in the greatest detail the styles of goods which are now being sold. He may inform himself concerning the weights, widths, lengths, and patterns which are in favour. Each sample is accompanied by the manufacturer's price. With this information the American manufacturer is put in a position to judge of any market as to whether it would be worth while for him to attempt to claim a share of its trade. Equal facilities are offered to manufacturers of hardware and cutlery, boots and shoes, hats, caps, woollens and many other lines of products. Novelties and improvements made by foreign manufacturers in standard goods and staples are promptly noted. By frequent additions this collection is equipped to give a good idea of important changes in the demand for any line of commodities.

The Bureau of Information consists of a reading-room provided with technical and trade journals, with the contents indexed; consular and trade reports; an index of firms, etc.

For many years past there has been a constant inflow into the Bureau of Information regarding foreign markets, foreign trade methods and foreign business houses. There is a collection of technical dictionaries, foreign catalogues, a Language Translation Department, a library of 4,500 volumes and 79,000 pamphlets, including the commercial statistics of more than a hundred Governments. Files of official tariffs, custom house regulations, banking methods, registration of trade marks, and commercial practices for all countries are also included.

The Commercial Museum covers a floor space of about 2½ acres, and the exhibits show the commercial products and the chief industries of all countries, and also illustrate the manners and customs of various races of men.

Many of the exhibits are arranged by countries, separate sections being assigned to Mexico, Brazil, Argentina, Peru, Bolivia, Chile, Cuba and other parts of the Western Hemisphere. In a like manner there are separate exhibits of larger size devoted to South Africa, Central Africa, North Africa, India, Japan, China, and the South Sea Islands. All these exhibits contain authentic samples of commercial products which are constantly being used for the help of American business men.

A separate series of exhibits, covering a large floor space, is devoted to classified collections of products. Here the visitor will find all the varnish gums brought together for the purpose of comparison, whether they come from America, Africa or the Far East. In another collection all the commercial varieties of cotton are displayed, whether grown in the United States, Brazil, Egypt, or India.

There are systematic collections of this kind illustrating such products as corn, wheat, sugar, tea, coffee, flax, silk, wool, gums, and resins, rubber, furs, leather, coal, petroleum, etc.

## Exhibitions

At different times and in different places there are held great exhibitions and fairs, such as those in London, Glasgow, Paris, Toronto, etc. Taken more seriously these might be made very useful and of great commercial value; but there is so much irrelevant matter introduced, and with better arrangements and greater pains taken in the art of exhibiting they might be greatly improved. In the United States, the administration and organization of such exhibitions is entrusted to a Board on which two or three individuals possessing a sound experience of museum administration and organization sit.

## Training of Craftsmen

In British-made goods we not infrequently find an inferiority in design and artistic skill when compared with those of other countries. The workmen are not familiar with the masterpieces and the work of the great craftsmen. There is a lack of appreciation of symmetry, form, colour, design, etc. Unless we can quicken the mental life of the people and provide them with easily accessible standards of reference of the very best, both in the industrial and fine arts, we shall continue to fall behind. We must place before the rising generation the best that has been produced in the past and the best that is being produced to-day, and this will form the right basis on which they will build for the future. It is

in our art galleries and museums that this can be done best.

Man is an imitator and inventor, and his intellectual outlook and future is largely determined by his environment; he assimilates ideas from his surroundings and from these reconstructs new things. It therefore behoves us to provide the community with the highest and most perfect standards of reference. Our museums and art galleries must play a part in the normal life of the people. From the earliest school days right on through life these institutions should be made a source of interest, pleasure, and inspiration to all.

In woodwork, metalwork, stonework, and textiles, the museum can assist the craftsman in his technique. It can interest him in the past history of his craft, and as a result he will bring new ideas into his work, and such, of course, have a commercial value.

Speaking a few years ago to the National Association of Art Masters, the President said: "As an industrial nation, our very existence, as well as our prosperity, depends on our commercial enterprise. Therefore it is our duty to consider that aspect of the case, and find out how best Art Education can be brought into closer touch with the requirements of trade and the manufacturer, because when technical skill has done its best, it is the applied art that often determines the market value of the manufactured article. There is hardly a single marketable commodity that is not touched by art at one point or another before it reaches the purchaser."

Incidentally an ethnographic museum can be made of great assistance to industry. How often do we hear of and see manufacturers sending abroad textiles with designs that offend the susceptibilities of the natives or which are opposed to their superstitions or religious beliefs, whereas a very short study of the native-made mats, baskets, etc., would have shown the designs which are appreciated and in use.

"You will do the greatest service to the state," wrote Epictetus, "if you shall raise, not the roofs of the houses, but the souls of the citizens: for it is better that great souls should dwell in small houses rather than for mean slaves to lurk in great houses."

In our modern system of education "We strain the memory instead of cultivating the mind," as Lord Avebury said.

The objects in a commercial museum should awaken imagination, stimulate intelligence and inquiry, and place a higher and a truer conception of beauty before the visitors. The very environment should act upon the individual.

It is the museum and the art gallery which will cure our blindness. It is not necessary or good for us to walk about this world in a house that is dark, with eyes that see not, and here is the evil of the present day. We have a vast concourse of people who have been instructed but not educated. Lord Avebury some thirty-seven years ago wrote: "I fear that our present system does not really train the mind, or cultivate the power of observation, or even give the amount of information which we may reasonably expect from the time devoted to it."

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# COSMIC RAYS AT HIGH ALTITUDES*

By William P. Jesse,
University of Chicago

During the past year the cosmic ray investigators at the University of Chicago have carried out three different experiments to investigate some of the interesting phenomena associated with cosmic rays at altitudes of twenty thousand feet and higher. Marcel Schein and E. O. Wollan in collaboration with the author have been able by coincidence counter apparatus carried by balloons to determine as a function of altitude (1) the vertical intensity of the mesotrons in the atmosphere, and (2) the number of mesotrons generated in a block of lead 2 cm. thick by non-ionizing radiation. The mesotron intensity was found to increase rapidly with altitude up to a maximum value at about 6·6 cm. pressure and then to decrease. The production of mesotrons in the lead block becomes noticeable at an altitude of 5 km., and from this point on increases with altitude at about the same rate as does the soft component of cosmic rays.

In a second high-altitude experiment, by G. Herzog, a counter-controlled cloud chamber and magnet were carried in an aeroplane to a height of 29,000 ft. to obtain photographs of slow mesotron tracks. Mesotrons can be distinguished from electrons in a cloud chamber by reason of the increased ionization along the tracks only when the momentum of the mesotron lies within a range of relatively low values. Mesotrons of such low momentum values occur so rarely at sea-level that from thousands of cloud chamber photographs made at the surface of the earth not more than a dozen tracks have been clearly distinguished as mesotron tracks, and mass estimates made. Above twenty thousand feet such slow mesotrons were found by Herzog in much greater abundance. From 230 photographs obtained, more than twelve tracks could be definitely identified with the passage of a mesotron.

A third experiment, by the author, has consisted of a series of thirteen balloon flights in which an ionization chamber was carried up to an altitude of approximately 25 km. in an attempt to determine a possible time variation in the total intensity of cosmic rays near the top of the atmosphere. Time changes of more than fifteen per cent have been observed during the past year. Such changes follow quite closely the 'world-wide' variations of Forbush and others and are probably due, in part at least, to intensity changes in the magnetic field surrounding the earth. However, when the high-altitude values are corrected on the basis of ground values for the 'world-wide' variations, a residual effect remains with a maximum in the early spring and minimum in the late summer. Further experiments are necessary to determine whether this is a true seasonal effect.

* Substance of a paper read at the annual meeting of the U.S. National Academy of Sciences held during April 22–23.

# FORMATION OF 3/2 ELECTRON COMPOUNDS IN ALLOYS OF COPPER, SILVER, AND GOLD

IN many alloys of copper, silver, and gold with the elements of the *B*-sub-groups, the phase next to the α solid solution has a composition near that required by an electron concentration of 1·5, and for convenience these may be called the 3/2 electron compounds. The crystal structures of these are of three types: (1) body-centred cubic structures, either disordered (β) or ordered (β′); (2) close-packed hexagonal types (ζ or ζ′); (3) β-manganese type (denoted μ).

A review of the existing data by W. Hume-Rothery, P. W. Reynolds and G. V. Raynor (*J. Inst. Metals*, **66**, 1940), shows that the 3/2 electron compounds are formed only when the size-factors are reasonably favourable, the term 'size-factor' being used to denote the difference between the atomic diameters of solvent and solute. A detailed examination leads to the following generalizations: (*a*) increasing valency favours the ζ or μ structures at the expense of the β or β′ structures; (*b*) increasing temperature favours the β structures at the expense of the β′, ζ, or μ structures; (*c*) increasing size-factor favours the β structures at the expense of the ζ or μ structures; (*d*) increasing the size-factor moves the composition of the 3/2 electron compounds in the direction of lower electron concentration, and also narrows the range of composition of the phases in terms of electron concentration; (*e*) the tendency to form ordered β′ structures in copper, silver, and gold alloys is in the order gold > silver > copper.

A review of the data shows that considerations of size-factor and electron concentration are not by themselves sufficient to explain the facts, but that an additional factor is present to an increasing extent, as the solvent and solute metals differ in their electrochemical properties. In their alloys with electropositive metals (such as magnesium or zinc), copper, silver, and gold are the electronegative members, and the electrochemical factors are in the order gold > silver > copper. In alloys with the electronegative elements (such as arsenic), copper, silver, and gold are electropositive, and the electrochemical factors are in the reverse order, copper > silver > gold. This reversal of the relative electrochemical nature of the solvent and solute takes place at about Group IV.

The tendency to form the β′ structures with long-range order is favoured by an increasing electrochemical factor, and, when this is sufficiently pronounced, the β′ liquids and solidus curves rise to a maximum, as in the system gold-magnesium. A consideration of the effect of the development of long-range order on the form of the equilibrium diagram leads to an explanation of the form of the copper-beryllium diagram. An examination of the phase boundaries of the equilibrium diagrams shows that, in many cases where the percentage of the solute is high, the diagrams begin to acquire characteristics that would be expected in ordered structures, even though X-ray investigations show that long-range order does not exist. It is suggested that a short-range order may be present, and it is shown that this conception accounts for the shapes of parts of the equilibrium diagrams, and for the limiting compositions to which some of the phase boundaries approach.

# FORTHCOMING EVENTS

### Tuesday, October 22

ILLUMINATING ENGINEERING SOCIETY (at the E.L.M.A. Lighting Service Bureau, 2 Savoy Hill, London, W.C.2), at 2.30 p.m.—Mr. H. C. Weston: "Industrial Lighting and the Black-out."

### Wednesday, October 23

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Student Section) (at Bolbec Hall, Newcastle-upon-Tyne), at 6.45 p.m.—Mr. George Wright, jr.: "Relative Merits of Marine Fuels". (Chairman's address).

### Thursday, October 24

INSTITUTION OF ELECTRICAL ENGINEERS (at Savoy Place, Victoria Embankment, London, W.C.2), at 2.30 p.m. —Mr. J. R. Beard: Presidential address.

# REPORTS AND OTHER PUBLICATIONS

*(not included in the monthly Books Supplement)*

### Great Britain and Ireland

Department of Scientific and Industrial Research. The Investigation of Atmospheric Pollution: Report on Observations in the Year ended 31st March 1939. (Twenty-fifth Report.) Pp. vi+132+6 plates. (London: H.M. Stationery Office.) 2*s*. 6*d*. net. [710

British Electrical and Allied Industries Research Association. Technical Report, Reference L/T 114: The Electric Strength of Solid Dielectrics in relation to the Theory of Electronic Breakdown. Pp. 18+9 plates. (London: British Electrical and Allied Industries Research Association.) 3*s*. [810

### Other Countries

Field Museum of Natural History. Botany Leaflet 25: The Story of Food Plants. By B. E. Dahlgren. Pp. iv+33. (Chicago: Field Museum of Natural History.) 25 cents. [710

Proceedings of the American Academy of Arts and Sciences. Vol. 73, No. 15: A Symposium on Social Progress. What is Social Progress? by L. J. Henderson; A Paper on Social Progress, by Crane Brinton; Social Progress, by Edwin Bidwell Wilson. Pp. 457–472. (Boston: American Academy of Arts and Sciences.) 50 cents. [710

Smithsonian Miscellaneous Collections. Vol. 99, No. 6: The Time Course of Photosynthesis and Fluorescence observed Simultaneously. By E. D. McAlister and Jack Myers. (Publication 3591.) Pp. ii+37. (Washington, D.C.: Smithsonian Institution.) [710

U.S. Department of Agriculture. Technical Bulletin No. 732: Arsenic Distribution in Soils and its Presence in Certain Plants. By Kenneth T. Williams and Richard R. Whetstone. Pp. 20. (Washington, D.C.: Government Printing Office.) 5 cents. [710

Smithsonian Institution: United States National Museum. Bulletin 100, Vol. 14, Part 1: Contributions to the Biology of the Philippine Archipelago and Adjacent Regions—Report on the Echinoidea collected by the U.S. Fisheries Steamer *Albatross* during the Philippine Expedition 1907–1910, Part 2: The Echinothuridæ, Salenidæ, Arbaciidæ, Aspipodiadematidæ, Micropygidæ, Diadematidæ, Pedinidæ, Temnopleuridæ, Toxopneustidæ and Echinometridæ. By Theodor Mortensen. Pp. iv+52. (Washington, D.C.: Government Printing Office.) 10 cents. [710

Indian Forest Records (New Series). Silviculture, Vol. 4, No. 1: Canadian Aerial Forestry for Burma. By J. D. Braithwaite. Pp. ix+96+18 plates. (Delhi: Manager of Publications.) 3.12 rupees. 6*s*. [710

United States National Museum. Bulletin 176: Life Histories of North American Cuckoos, Goatsuckers, Hummingbirds and their Allies; Orders Psittaciformes, Cuculiformes, Trogoniformes, Coraciiformes, Caprimulgiformes and Micropodiformes. By Arthur Cleveland Bent. Pp. viii+506+73 plates. (Washington, D.C.: Government Printing Office.) 75 cents. [810

Canada: Department of Mines and Resources, Mines and Geology Branch: Geological Survey. Paper 40–1: Preliminary Map, Jumpingpound, Alberta. By G. S. Hume. 1 map. 10 cents. Paper 40–6: Preliminary Map, Bragg Creek, Alberta. By G. S. Hume and H. H. Beach. 1 map. 10 cents. Paper 40–8: The Structure and Oil Prospects of the Foothills of Alberta between Highwood and Bow Rivers. By G. S. Hume. Pp. iii+22+1 map. 10 cents. Paper 40–10: Stony Rapids and Porcupine River Areas, Saskatchewan. By G. M. Furnival. Pp. ii+10+2 maps. 10 cents. Paper 40–11: The Lloydminster Gas and Oil Area, Alberta and Saskatchewan. By G. S. Hume and C. O. Hage. Pp. iii+12. 10 cents. Paper 40–12: Zeballos Mining District and Vicinity, British Columbia. By M. F. Bancroft. Pp. iii+39. 10 cents. Paper 40–14: Quyta Lake and Parts of Fishing Lake and Prosperous Lake Areas, Northwest Territories. By A. W. Jolliffe. Pp. iii+9. 10 cents. (Ottawa: King's Printer.) [810

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