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Education and Leisure in Progressive Life

THE extent of unemployment in the world to-day in itself has forced attention on the problem of leisure. Plans have already been proposed for the wider distribution of leisure as a contribution towards the reduction of unemployment by raising the age of entry to industry at one end and lowering the age of exit at the other. Similarly, the reduction of working hours has been advocated as a means of distributing leisure and employment more equably.

Behind such proposals lies the fundamental belief that the increased powers of production which the advance of mechanical and physical science has placed within man's power, if rightly used, make possible a higher standard of living for all and also the attainment of that standard through less physical effort and with consequent greater leisure than ever before. Already this belief is challenging economic and political systems or dogma which prevent the realisation either of that higher standard of living or that fairer distribution. There is a widespread readiness to try new methods if the old prove inadequate.

The very linking of the problem of leisure with that of unemployment in such ways as these has, however, proved an obstacle to clear thinking on the fundamental issues with which the coming of leisure confronts us. Only slowly are we coming to see that education must be a preparation for leisure as much as for work.

Work and leisure cannot well be separated ; one is complementary to the other. Life must be viewed as a whole, and, whether from the educational point of view or the wider social point of view, a society which does not provide the training or the facilities for the adequate enjoyment of leisure is in as dangerous a condition as a society in which training and opportunities for earning a livelihood are defective. The view of education as a preparation not merely for work but also for life, the conception that the provision of adequate facilities for recreation and the right use of leisure is a prime function of the State, are so revolutionary as to involve a radical change in our views on education and other questions.

The situation calls for much creative and fundamental thought, and it was with this conviction that in 1934 the New Education Fellowship commenced a comprehensive inquiry into the subject. The outcome of the first part of this inquiry is embodied in a report which has recently been issued under the title "The Coming of Leisure"*. This report outlines the problem as it exists in England to-day, and shows the directions in which solutions are being sought. It formed one basis of the discussions at a conference held at the University of St. Andrews on August 13–22.

The report naturally starts with the problem which leisure presents to education in its narrower sense. If education, whether at school or in adolescence or in adult life, is to be a preparation not merely for work but also for life, the fundamental policies in our system of national education require drastic modification. The belief that we have merely to teach a child a certain number of subjects with some relevance to the way in which he is to earn his living, and which will provide him with a modicum of knowledge and give him the facility for acquiring more, is hopelessly inadequate if we are to educate for leisure.

If therefore education is to help youth to master the means of making life worth while a new method of approach may be required if not an entirely new technique, and a complete change in

* The Coming of Leisure : the Problem in England. Edited by E. B. Castle, A. K. C. Ottaway and W. T. R. Rawson. Pp. 78. (London : New Education Fellowship, 1935.) 2*s.* 6*d.*

the attitude of both teachers and administrators. Notably is this true in the reorganised elementary school if the purpose of the Hadow report is to be realised, and unhappily all too rarely is there betrayed in discussions on the raising of the school leaving age any realisation of the possibilities of wider experiment and adventure in education which are bound up in the reorganisation outlined in that report.

The difficult problems which leisure and education present in adolescence are largely the result of defective education at an earlier stage. Even in adolescence, the question of idle hours due to unemployment can assume serious dimensions. Such idle hours must not be termed leisure. Neither education for leisure nor any other kind of education is possible for human beings living a precarious and hand-to-mouth existence. The essential basis for the education of the adult, whether regularly employed or not, is freedom from the grosser evils of poverty, helplessness and the sense of not being wanted. It is only in an atmosphere of freedom from these evils that the expression of personality is possible and the creative instinct finds full play.

This, in fact, is the centre of the problem—the securing of full play for human personality and the creative instinct within the ranks of an organised society. It involves, of course, much more than education. It involves the evolution of sociology into an organised science, as distinct from a mere body of organised knowledge, as well as the working out of ways and means by which the enormous increase in the productive powers placed in man's hands may be utilised to secure a wider and more equable distribution of leisure for all, together with the higher standard of living which is possible with the wise use of such powers.

These are tasks demanding no small measure of scientific investigation and creative thought as well as wise statesmanship, and it is only when they have been accomplished that the educationist can enter on his full opportunity. In the meantime he has much preparatory work to do. Apart altogether from his influence in the training of the right type of leader, his influence may easily be decisive in the formation of a society and a public mind which is capable of supporting and following great leadership. The statesman, it must be remembered, too often has to content himself with what he believes it to be possible to get accepted, not with what he believes to be the most altruistic and noblest solution of a problem.

Even in this work of developing a society with a capacity to accept change and advance to a finer social order, the educationist has much to do. What may be termed the educational climate of the country has completely changed. The extensive growth of social amenities, the cheap production of books, magazines and newspapers, the influence of the cinema, the wireless and gramophone have diminished the demand for formal education. The educational process has become more and more one of unconscious absorption and less and less the deliberate satisfaction of a conscious need.

This change has several consequences. It enforces close consideration of possibilities which both the cinema and broadcasting offer for cultural purposes, and the development of a new and appropriate technique both for schools and for adult education. It demands also the development of a new technique of art education which shall contribute to the enrichment of leisure hours, and encourage the expression of creative instincts and personality whether in speech or drama, in reading or in writing. Again, the advance of science and the gradual replacement of physical labour by mechanical power have enhanced the need for physical education, so that physical recreation represents one of the major problems in the right use of leisure. Scarcely anywhere is there more need of wise and skilful guidance to secure the full value from existing opportunities and to guard against unbalanced or untoward effects whether in games, in handicraft or in gardening and like activities.

Much the same applies to the opportunities for what may be described as social adventures provided by young people's clubs and societies whether of the indoor type or for camping and rambling or the like. Wise guidance is again needed if gifts for leadership are to be encouraged and developed and not repressed, and the full value of such activities realised.

Yet another consequence is even more fundamental. Progress may well depend finally on whether we are able to liberate the world from what Prof. William McClelland has rightly termed the degrading exploitation of mass suggestion. All the evidence suggests that we are in the midst of a new renaissance through which humanity is struggling to rise to a higher level of culture. We have to prepare youth for a world where everything is in a state of flux, and the fundamental need is to train up a strong flexible creative generation with

the spirit of adventure of the pioneer on the intellectual side. To do this, education must be continuously directed towards preparing youth to think for itself. Freedom of thought is an essential preliminary alike to the creative thought which is our supreme need or to that intelligent thought on vital issues in social and international relationship in which statesmanship can function.

More and more it becomes apparent that what is needed is not merely the capacity to deal with and evaluate facts, but also the capacity to deal with contingent truth. Far too little training is given in arriving at opinions, weighing evidence, sifting motives, discounting prejudices and resisting suggestions. The very advance of science itself depends upon the development of such capacity. Prof. Julian Huxley has recently indicated how sociology can only develop into a true science as it formulates its methods for dealing with multiple effect and multiple causation.

The coming of leisure thus sets before us not indeed the problem of education for leisure but of re-examining and re-orientating our whole system of education for life. Very largely indeed the survival of civilisation depends upon our capacity to plan and put into force an educational policy, wisely co-ordinated over the whole field, so as to produce citizens capable not merely of efficient workmanship but also physically and mentally equipped to enjoy the full resources of life at our disposal. These are the conditions in which independent and creative thought is possible and in which leadership will flourish. Our task, as Whitehead reminds us, is not the production of great leaders. A great society will always put up the great men for the occasion. It is the task of establishing a great society in which adventurous and creative thought and living flourish, and to that task the whole range of problems involved in the increase of leisure summon us anew.

Agricultural Production and National Nutrition

The Agricultural Dilemma:
a Report of an Enquiry organised by Viscount Astor and Mr. B. Seebohm Rowntree. Pp. xiii + 101. (London: P. S. King and Son, Ltd., 1935.) 2*s*. 6*d*. net.

IN the volume before us Lord Astor and Mr. B. Seebohm Rowntree present the results of an inquiry organised by them into the possibilities of increasing the agricultural population of Great Britain. The 'dilemma' which the authors postulate is the difficulty of reconciling increasing employment in the production of foodstuffs at home with increasing technical efficiency, falling population, the nationalistic policies of other countries, and Great Britain's relationship—in peace and in war—with the Empire overseas, and with friendly neutral countries. The conclusion is reached that the present conditions of over-production and unremunerative prices will prove in some degree a persistent rather than a transient phenomena: that imports of vegetables, poultry, fruit, etc., have already been reduced to the limit that is desirable: that any drastic reduction of our imports of such special foodstuffs as wheat, beef, mutton and bacon (which alone could allow of a specific increase in domestic production) would seriously aggravate the economic difficulties of the world, would entail a further loss of export trade and imperil the solidarity of the British Empire and our good relations with neutral food-producing countries.

If it were not for the element of truth in some of these arguments, our agricultural policy would be easy—no need for quotas, trade agreements or marketing boards. What a delightful life for the Minister of Agriculture. As it is, however, he has to build a structure within the main girders of a national policy, utilising as best he can those girders which are already in position, adjusting others, or persuading his colleagues that the main building will be the more secure if a few of his brand new ones take the place of theirs.

What this book in fact tells us is that we had better give up hopes of any material increase in agricultural production. Whereas the inquiry specifically set out to determine the possibilities of expanding land settlement, the conclusions must relate to increased production, whether from new or existing producers. Is it unfair to presume that the same conclusions would have been reached by the same authors four years ago? We think not, for the arguments applied then as now. Yet they have been entirely falsified. Production has increased, agriculture has received considerable benefit, and neither the cost of living nor our export trade has suffered.

Although the authors prove to their satisfaction that it is illusory to suppose agriculture offers a promising outlook for the absorption of large numbers of unemployed, this is not really the case at issue. It is true that there are some who dream of settling a million men on the land of Great Britain, but those with responsible knowledge know full well that such a policy is bound to remain a dream. It is quite unnecessary to argue that it is undesirable because of the increased food production that would result. Even this is not necessarily certain, and in any event land settlement is an experiment in men and management, not an experiment in farming or in increasing food production. It is equally unnecessary to condemn such endeavours as can be made to meet local demands and social needs for land settlement in carefully selected areas and with carefully selected men. The whole world situation may well have changed long before such a policy leads to any dilemma of over-production from this cause.

Again, many of us think that such a report, based on discussion of general principles and setting forth conclusions, the limited application of which may not be realised by the general reader, is doing definite harm to the cause of agriculture as a whole. Lord Astor has pursued a similar course before. When limited assistance to wheat-growing in Great Britain was introduced, he reviewed the position of wheat-growers as a whole in the world and this country and spared no pains to convince the general public that any assistance to British wheat-growers was unsound in principle and in practice. Even in the book now under review the old subject is introduced by the arbitrary statement, "Wheat is marked out by the peculiarities of the British climate as a commodity which is appropriate for us to import largely from abroad". It is a pity that the authors of such statements cannot review the intricacies of British agriculture as a whole. They might then well come to the conclusion that "Wheat is marked out by the peculiarities of British farming in certain districts as a commodity which it is not only appropriate but necessary to grow as the basis of arable cultivation until such times as some other crop of like nature appears to take its place". This habit of taking some agricultural measure in theoretical argument to its extreme and then condemning it, ignores the complexity of the agricultural structure and the urgent need to strengthen each separate section by suitable and often diverse means, each designed for its own specific purpose and often strictly limited in either its time or area of application.

Apart from all these general considerations, the whole 'agricultural dilemma', as set forth in this book, ceases to exist if consumption of foodstuffs in Great Britain can be increased. Such a possibility is somewhat lightly dismissed; for example, "There is a possibility that consumption might be increased by better marketing arrangements, but there is no indication that the reforms proposed would result in economy sufficiently large to stimulate consumption materially". Again, "The operations of the statutory marketing boards, which represent the existing experiments in the improved marketing of agricultural products, are not in the main of a character calculated to promote the growth of consumption . . . if, for example, the consumption of one-fifth of the population were increased by 20%, the aggregate consumption of food by the community would be increased by only 4%". On the other hand, it is admitted that "Measures that would increase the aggregate consumption of food would meet what is probably the chief need of the economic situation".

This last sentence, in our view, counteracts the whole argument of the book, and the previous quotation regarding marketing boards and the possibilities of increased home consumption by no means tells the whole story. We know that marketing boards during the first months of their existence have not been able to devote much time to the reduction of marketing costs and to increasing consumption, but that is because they have been primarily engaged in saving the livelihood of the industries which elected them. Their existence to-day provides the best opportunity of action being taken along the required lines, and evidence is daily accumulating that they are fully alive to these responsibilities. Then as regards the possibility of increased consumption the figures quoted are definitely misleading. The dietary of at least 20 million persons is markedly deficient from the point of view of health. To raise it to that consumed by families with total incomes of only 20*s*. a head a week involves an increased consumption of ten per cent; to raise it to the standard of those with 25*s*. a week income would involve an increase of twenty per cent, that is, at retail prices some £200,000,000 more would require to be spent on food. As Sir John Orr has pointed out, to bring consumption up to that of families with incomes of 35*s*. a head a week (£335 a family per annum) would call for an increased consumption of 42 per cent of milk, 27 per cent butter, 28 per cent eggs and 53 per cent fruit and vegetables. At present only the wealthiest ten per cent of the population approach the standard of one pint of milk a person each day which medical opinion holds is adequate, the national average being rather less than three pints a week. To bring the entire population up to the ideal would wipe out the whole surplus and create a very severe milk

famine, which could only be brought to an end by a fifty per cent increase in output.

These may be dreams of perfection, but is it correct when the authors of this report imply that the possibilities in this direction are limited? If we can correct malnutrition—this glaring mistake in our national life and national economy—then the agricultural dilemma vanishes: fears of over-production can be relegated to the distant future.

Few will quarrel with the conclusion that the settlement of vast numbers of unemployed on the land is impracticable. This book, however, bids us believe that any considerable increase in home production, from whatever source it arises, is impracticable. Such a statement we submit is unsound and definitely harmful to the cause of agriculture.

In saying this we wish particularly to add that no one could possibly imagine that Lord Astor and every one of his colleagues responsible for the inquiry do not sincerely and profoundly desire to see renewed prosperity reaching the English countryside. They themselves state that they arrived at their conclusions with very great disappointment. The reviewer, while feeling bound to attack these conclusions with all the force at his command, consoles himself with the thought that, if his view is correct, then the authors' disappointment can vanish with the dilemma which they have conjured up. The real problem before the country is to increase consumption of home foodstuffs to the mutual betterment of agriculture and of national health. W. GAVIN.

A New "Outline"

Science: a New Outline
By J. W. N. Sullivan. Pp. xii+286+4 plates. (London and Edinburgh: Thomas Nelson and Sons, Ltd., 1935.) 5*s*. net.

IT is perhaps insufficiently recognised that the writing of a good "Outline", of the kind which the public, or the publishers, seem to go on demanding, is a vastly more difficult task than the writing of a good monograph. The ratio of difficulty is that of Dürer or Cézanne to the village photographer. Dürers and Cézannes being scarce, it is a natural consequence that most "Outlines" are disappointing and few wholly satisfying. Mr. Sullivan has on previous occasions demonstrated his understanding of modern scientific thought and method, and his present "Outline" is an interesting and readable assemblage of usually accurate information from the physical and biological sciences. There is a gallant attempt to carry the pencil on without discontinuity from the physical to the biological, and the author may be congratulated on his general success in this difficult undertaking.

But whether Mr. Sullivan and his publishers are doing a service to 'science' in this new outline is very doubtful. Too frequently the reviewer sees in it a highly intelligent Jack Horner, pulling out of the scientific pie a number of attractive plums which are chosen merely "pour épater le bourgeois". It would be much better for the consumer to be told how and why the plums got there than to have them pulled out ready-cooked.

The plum-pulling encourages carelessness in the author. The most worthy of his chosen audience will stop at every third page to ask about the how and why, and will find no answer in this outline. He will be repelled by the slovenliness of exposition in the introductory note, of "a certain very simple notation which is universally adopted by scientific men", in which one-millionth = 10^{-6}. He will wonder what is really meant when the polar diameter of the earth is stated to an accuracy of fifty feet. He will probably know enough to see that he is being misinformed when the aeroplane height record is implicitly put so low as seven miles; he will probably *not* know enough to see that he is being equally misinformed when he is told that "at something over sixty miles the atmosphere is almost entirely composed of hydrogen . . . while oxygen seems to disappear completely". He is not unlikely to be surprised by the author's neglect of the main factor in a simple problem in statics. Mr. Sullivan says, "Whenever we crook a finger all the hosts of heaven are affected", and goes on to use the inverse square law to mitigate the disturbance. An intelligent schoolboy will be able to tell him that a much more important reason why the hosts of heaven are substantially indifferent to one crooked finger or ten million extended right arms is that the earth side-slips to counter the crook.

These are small specimens from early pages, but they are representative of that culpable lack of care which is dangerously common in works of popularisation. It is culpable and dangerous because, in sum, the world will remain unfit for civilisation so long as the reader of "Outlines" is fed on the facts of science untempered by an education in its stringent honesty of aim and method. W.

F. H. Bradley's Psychological Principles

Collected Essays
By F. H. Bradley. Vol. 1. Pp. x+347. Vol. 2. Pp. v+349–708. (Oxford: Clarendon Press; London: Oxford University Press, 1935.) 36*s*. net.

THESE two imposing volumes are a very welcome addition to philosophical and psychological literature. It is true that with two exceptions all the essays here included have already seen the light. But each of the pamphlets containing the opening papers of the present collection —those on "The Presuppositions of Critical History" (the author's earliest production) and on "Sidgwick's Hedonism"—have long been out of print, and the other published articles have remained more or less buried in the back numbers of the periodicals in which they first appeared.

Bradley was the author of several epoch-making works in the fields of ethics, logic, metaphysics and epistemology; and some of the papers in the volumes before us deal with ethical questions. But, although he was a psychologist of rare independence and insight, he did not write any separate book on psychology; he was content to let his psychological contributions appear as articles in the pages of *Mind*. These occupy by far the larger, and I think it may be said the more important, part of the new volumes now under notice.

It was perhaps unfortunate that Bradley should have persisted in designating the point of view which seemed to him the right one in psychology as that of "phenomenalism", because he was using the term 'phenomenon' in a peculiar sense (familiar to readers of his work "Appearance and Reality"), whereas it usually carries with it implications which he would have repudiated. What, however, he meant was that the mere course of psychical events as such, happening and experienced within a single organism, and the laws of coexistence and sequence between these events, constitute the subject-matter of empirical psychology, while questions about the ultimate nature of mind or soul do not belong to its domain. He was trying, as he himself expressed it, to work in the spirit of the best English tradition (and, one may add, of the best Herbartian tradition), although rejecting absolutely the doctrine that had become associated with it of 'psychical atomism', and refusing to admit what had been so often taken for granted that *all* psychical facts can be treated as objects to be observed.

The association psychology went into bankruptcy, it has been said, when J. S. Mill felt himself compelled to suggest the hypothesis of 'mental chemistry'; and in the later decades of last century a new phase of psychological theory was taking its place. So far as stress was laid in the latter upon the primary importance of evolution or development in the mental life Bradley was in complete accord therewith. But he found in the writings of its two most prominent exponents, Wilhelm Wundt and James Ward, an underlying notion of the nature of mind which appeared to him not only unpsychological but also devoid otherwise of justification. Ward had laid it down, namely, that for psychology, as the science of individual experience, the duality of subject and object is fundamental and primordial. On one side, he maintained, is the active subject, with its one primitive capacity—that of feeling—and, on the other side, are the objects of its activity, the presentations attended to. And since the feeling agent, that is, the knower, and the known are antithetic and distinct, direct presentation or representation of feeling and activity must be alike impossible; we can know of these only mediately through their effects, through certain changes which they bring about in the character and succession of our presentations.

Whether one agrees with it or no, Bradley's criticism of the positions just indicated must be allowed to be searching and penetrating. He argued that to interpret the consciousness of force or energy as being itself a mode of exerting, or putting forth, force or energy is wholly illegitimate. He denied that this consciousness is in any sense a revelation of activity or energy, as an unanalysable element. It gives us, he urged, not a fact but an intellectual construction, and a thoroughly baseless intellectual construction. The notion of an arbitrary force proceeding from the self is, in truth, he contended, a notion to which no intelligible meaning can be attached. Not only so. It seemed to him that no valid reason whatsoever had been offered for assuming that the relation of subject and object is implied in all conscious experience. It is, he averred, inconceivable that experience at its poor and blurred beginning divides itself into two parts with a relation between them. Until the primitive whole of feeling becomes to some extent differentiated into feelings, and until within this whole a core had grown together, over against which different groups of presentations can come to appear as an 'other', it is, he

insisted, impossible to see how there can be any aspect of *self-feeling*, and still less how there can be anything like what is ordinarily meant by subject and object. In short, what I take Bradley's contention to be amounts to this, that the general terms "subject" and "object" have their meaning fixed only in and through the concrete experiences which enter into and serve to establish a recognised distinction between them.

Starting, then, with a conception of the beginnings of mental life such as he held we are warranted in framing, Bradley's constructive work in psychology consisted in endeavouring to trace the way in which the several so-called faculties of mind—attention, thought, will, and so on—gradually came to be. Thus, in dealing with attention, he shows, in the first place, how the process of involuntary attention may be regarded as having been initiated by differences in the intensity of feeling-tone accompanying certain presentations, the latter thereby attaining predominance in consciousness. And he tries, in the second place, to make manifest how from the undoubted facts of involuntary attention an intelligible account of the emergence of active or voluntary attention can be given without calling to our aid the idea of some mysterious "force" proceeding from the self. Briefly, it is with the rise into consciousness of a definitely recognised distinction between the self and the not-self that there become possible those experiences of strain or effort which characterise attention as we are familiar with it. Whilst recognising the influence of muscular and motor factors, Bradley conceived that the origin of the experiences in question lies in what he called a feeling of expansion consequent upon the enlargement of the self. When we get to know from repeated experience that changes ensue upon modes of our self, this expansion of our area, beginning from within, gives the feeling of activity.

The chief characteristic of conceptual thought, as regards its content, is, Bradley contended, objectivity; and, pursuing still the genetic method, he sought to render explicable the transition to thought from feeling or sentience by resort to the theory of Association, but that theory radically modified. Not only is atomism wholly banished, and with it likewise the "law of similarity"; but also the law of contiguity has to be so restated as to make it depend always on identity of content, not of existence. The law then becomes that of Redintegration, expressible in the form "every mental element when present tends to reinstate those elements with which it has been presented". Further, there is to be postulated what he called a law of Blending or Fusion—the law, namely, that "where different elements (or relations of elements) have any feature the same, they may unite wholly or partially". Lastly, underlying these two laws there is to be discerned, so he argued, one principle—the principle which may be described as that of Individuation, according to which "every mental element strives to make itself a whole or to lose itself in one"; or, in other words, "tends to give itself a context through identity of content". Such was the "machinery" which, working in all psychical processes, appeared to Bradley adequate to account for the fact that from a basis of mere feeling the development of thought, as the apprehension of something real by itself and independent of its connexion with a feeling-centre, emanates.

In a similar manner Bradley endeavoured to trace the genesis and development of volition or will. Obviously, will, involving as it does the consciousness of self, cannot be regarded as original or ultimate. It can be no other than a product or result from that which by itself is not volition. Its essence, on Bradley's view, consists in the passage of an idea into existence; and that passage depends on machinery—the machinery already alluded to. If an idea works itself out ideally and subject to identity, we have the process of thought. If, on the other hand, it produces fact, if it alters the existent object into accordance with its own character, the process is will; and unless the idea carries itself out into the changed existent there is no will.

My space is exhausted, but I may perhaps be allowed to indicate the sort of difficulty I feel in regard to the assertion just mentioned. If by 'idea' be meant, as I take it was meant, a content apprehended, then one may well ask whether an 'idea' ever does 'carry itself out'. The carrying out of what is willed, so far at least as that involves a change in the outer world, is surely a bodily affair, the details of which, as Lotze pointed out, entirely escape the consciousness of the willing subject. Indeed, I am possessed of an uneasy suspicion that having, as I think, rightly refused to picture consciousness as exerting force or energy, Bradley tended to transfer this notion to 'presentations' and 'ideas'; and to imply, after the manner of Herbart, that although a 'presentation' or 'idea' taken *per se* is not a force, yet a number of 'presentations' and 'ideas' when in conjunction do operate on one another as though they were forces.

Despite, however, the criticism they will certainly elicit, no competent judge will hesitate to acknowledge that these essays together form an extremely valuable contribution to psychological science. The volumes have been most carefully edited. They only lack one thing—an adequate index.

G. DAWES HICKS.

Gmelins Handbuch der anorganischen Chemie

Achte Auflage. Herausgegeben von der Deutschen Chemischen Gesellschaft. System-Nummer 35: Aluminium. Teil A, Lief. 2. Pp. 285–450. 26 gold marks. Teil B: Die Verbindungen des Aluminiums, Lief. 2. Pp. 309–613. 49 gold marks. (Berlin: Verlag Chemie G.m.b.H., 1934.)

THE well-known property possessed by aluminium of coating its surface with an invisible, firmly adhering and continuous skin of oxide has rendered the systematic investigation of its electrochemical behaviour extraordinarily difficult, while at the same time it has had most important practical results in the industrial application of the metal. Thus the properties of pure aluminium may be very different from those of the commercial metal. Accordingly, about one quarter of Part A, Section 2, of the volumes on aluminium is occupied with a discussion of electrochemical measurements. The remainder deals with the chemical action on aluminium of non-metals, water, acids and alkalis, including organic reagents.

Part B, Section 2, deals with a large variety of compounds of aluminium, including the silicates and the changes which kaolin undergoes when subjected to heat, natural and synthetic zeolites, the various alums and ultramarines. Historical accounts of the uses of alum and ultramarine are given. The latter has been in use as a dye since the eleventh century. Recent work upon its constitution has shown that in all ultramarines the ratio $SiO_2 : Al_2O_3$ remains practically constant in the silicate frame, and the colour depends not only upon the sulphur which is present but also upon the alkali. The latter can be partly or almost completely extracted from blue ultramarine by means of chlorine and certain organic solvents. The colour is thereby destroyed, but it can be restored by the addition of alkali. When chlorine was used it was found that the colourless product retained the original crystal lattice structure.

Chinese Art

Edited by Leigh Ashton. Introduction, by Laurence Binyon; Painting and Calligraphy, by Laurence Binyon; Sculpture and Lacquer, by Leigh Ashton; The Potter's Art, by R. L. Hobson; Bronzes, by A. J. Koop; Jades, by Una Pope-Hennessy; Textiles, by Leigh Ashton. Pp. xvi+111+23 plates. (London: Kegan Paul and Co., Ltd., 1935.) Paper, 2*s*. 6*d*. net; cloth, 3*s*. 6*d*. net.

THIS little book, which has been prepared in anticipation of the exhibition of Chinese art being held at the Royal Academy, Burlington House, does not call for extended comment, excellent though it is. It is intended for the uninitiated, and has been written by experts in the respective fields with which each deals, as indicated in the title-page. The essays are short, but have been skilfully adapted to their purpose of giving the Western visitor to the exhibition an idea of the Chinese artistic and technical achievement, as well as of the mentality and range of imagination of the Chinese artist. The dynastic and chronological relations of the exhibits—of the first importance in the appreciation of Chinese culture—receive due attention. The book is liberally illustrated.

Modern Production among Backward Peoples

By Dr. I. C. Greaves. (London School of Economics and Political Science: Studies in Economics and Commerce, No. 5.) Pp. 229. (London: George Allen and Unwin, Ltd., 1935.) 10*s*. 6*d*. net.

DR. GREAVES has broken new ground in her study of the economic activities and organisation found among backward peoples as the result of the introduction of European methods of exploitation of their resources. The data she has collected, as well as her conclusions, are of interest to economist, anthropologist and administrator alike. For the anthropologist they form an object lesson in culture contact, available equally for academic use and practical application; for the administrator, a message of guidance and warning; and for the economist, in the author's attitude to cultural differences, a new orientation in the assessment of comparative values.

Dr. Greaves passes under review the function of the State in administering backward territory in relation to imports, exports and the investments of capital from outside sources. She shows how, still keeping this triple aim in view, policy has changed direction from promoting the interests of the European, whether settler or ruling people, to a substantial, if not exclusive, support of indigenous activity. How far this is general depends upon local conditions, and all stages of development are to be found, going indeed so far in one direction as the complete segregation which is the ideal, not, however, realised in practice, in South Africa.

A wide variety of economic problems has been brought under review by the author, and her book is a store of information, as well as a well thought out and impartial survey of conditions and tendencies.

Low Temperature Physics

By Dr. L. C. Jackson. (Methuen's Monographs on Physical Subjects.) Pp. vii+122. (London: Methuen and Co., Ltd., 1934.) 3*s*. net.

UNTIL quite recently, the development of low temperature research has been carried on almost entirely abroad, and although the book has had to be restricted to a few sections of especial interest and, in particular, dealing largely with the range of temperature 1°–20° abs., a remarkably comprehensive survey is compressed into the six chapters on the production of low temperatures, their measurement, liquid and solid helium, specific heats, electrical conductivity and magnetism. The latest work on the region below 1° abs. is notable, and, in view of the interest and importance of electrical and magnetic phenomena at low temperatures in connexion with atomic and lattice structure, the last two chapters give a valuable summary of recent experimental and theoretical advances.

Although the book is mainly concerned with the description of experimental technique, given in many cases with illustrative curves and numerical data for a large number of substances, the mathematical theory and expression of the various aspects of the subject are not neglected. References to more than a hundred original papers are provided. N. M. B.

Hydrogenation of Coal

IN a country which had formed the habit of assessing power in terms of coal-burning in a furnace or under a boiler, the decline in the coal mining industry and the rapid expansion in the use of the internal combustion engine are two facts about which chemists and engineers have been thinking for a long time. Interest in the production of petrol from coal is now nation-wide; it has been stimulated by the hope—indeed by the conviction—that this branch of chemical industry will appreciably help British coal mining to surmount its financial difficulties, bringing work and wages into many homes that have long known neither; and it has been maintained by the success which Imperial Chemical Industries, Ltd., has already achieved in placing the operation on a commercially promising basis. For that reason alone, and apart from its obvious technical interest, Mr. Kenneth Gordon's lecture on November 21 to the Institute of Fuel, entitled "The Development of Coal Hydrogenation by Imperial Chemical Industries, Ltd.", deserves to be regarded as an event of more than passing significance.

Mr. Gordon reminded us that there are three types of reaction to be distinguished. First, there is the transformation of impure carbonaceous material into hydrocarbons, other elements being removed in the form of their compounds with hydrogen, that is, as water, ammonia and hydrogen sulphide. Then there is the saturation with hydrogen of unsaturated bonds between carbon atoms. Finally, there is the splitting up by heat of the saturated molecules so formed to give light hydrocarbons, although a certain amount of hydrocarbon gas, and even of coke, is also formed, particularly when the saturation has been inadequate. "The art of hydrogenation," Mr. Gordon said, "consists in choosing the proper conditions of temperature, pressure, time of reaction, and catalysis, so that the three desired reactions take place to the greatest extent, and the fourth reaction, the undesired formation of gas, to the minimum extent." In practice, pressures of at least 200 atmospheres, and temperatures of 300°–500° C. are employed, suitable means being used to dissipate the heat liberated during the chemical reaction; the catalyst may be mixed with a liquid, or vapours mixed with hydrogen may be passed over it. The choice of a catalyst is governed by its activity in promoting the hydrogenation reaction, the thermal decomposition ('cracking') reaction, or both, and its susceptibility to inactivation ('poisoning') by certain materials, for example, sulphur, often present in the original coal or oil.

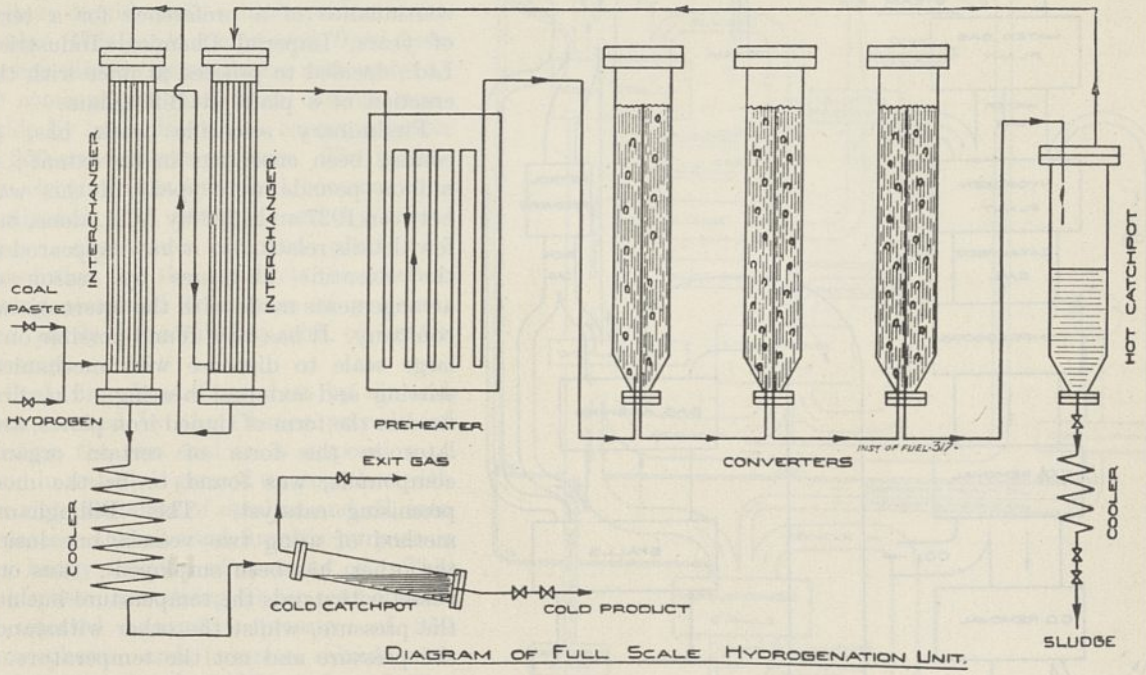
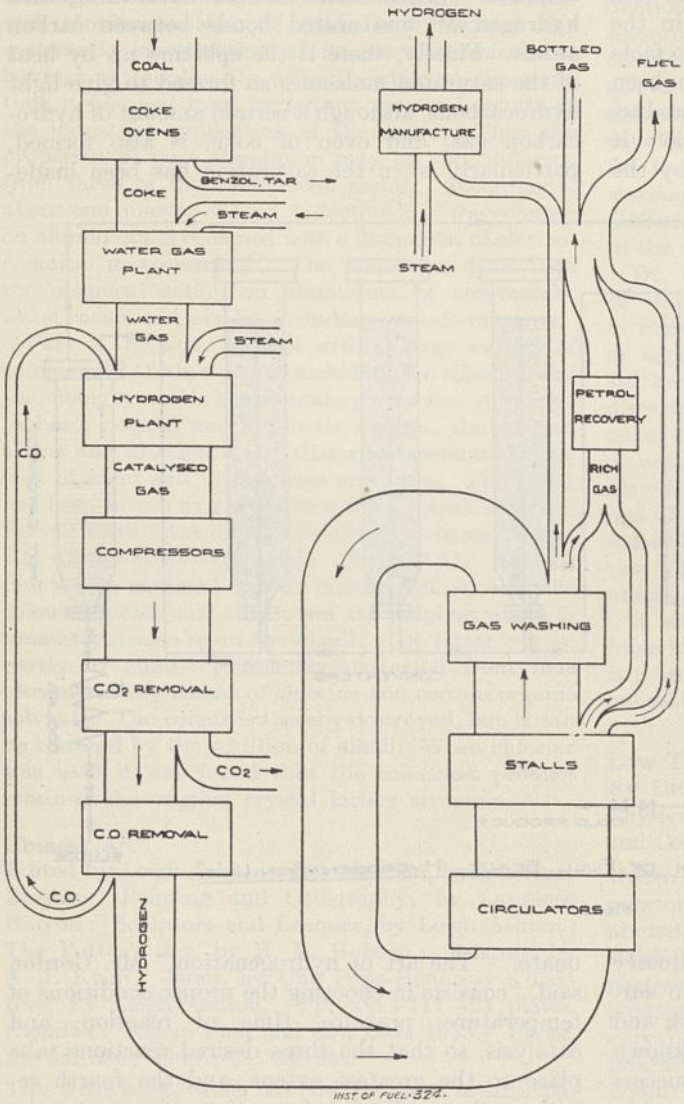


FIG. 1.

The solution of this important problem was an essential preliminary to any advance in the direction of commercial hydrogenation.

The original Bergius process, as developed by the German combine known as the Interessen Gemeinschaft für Farbenindustrie, or more briefly as the "I.G.", working at first independently and later in association with the Standard Oil Co. of New Jersey, afforded as products petrol, tar acids, heavy oil and pitch. Tests on British coals were carried out, but it was soon decided by Imperial Chemical Industries, Ltd. (equally well known as "I.C.I."), that modification in the direction of the production of petrol alone was desirable. Experiments were commenced at Billingham in 1927, and a plant treating 10 tons of coal a day was operated from 1929 until 1931. Following a demonstration in 1930 that 60 per cent by weight of petrol (a figure since exceeded) could be obtained from coal, the formation, in 1931, of the International Hydrogenation Patents Co. (a company formed by the "I.G.", "I.C.I.", the Standard Oil Co. of New Jersey, and the Royal Dutch-Shell Group) placed the interested companies in a very strong patent and technical position. During 1932 technical advances were being made, and schemes for operating on a large scale were maturing; so that when, in 1933, the British Government announced its intention to protect the new industry by guaranteeing the continuance of a preference for a term of years, Imperial Chemical Industries, Ltd., decided to proceed at once with the erection of a plant at Billingham.



FLOW DIAGRAM OF HYDROGEN PRODUCTION & TREATMENT OF HYDROGENATION PLANT GASES

FIG. 2.

Preliminary scientific work has, of course, been enormous in its extent; a million pounds were spent in this way between 1927 and 1933 by I.C.I. alone, but few details relating to it have appeared in the scientific literature by reason of arrangements made with the international company. It has been found possible on a large scale to dispense with mechanical stirring and external heating; tin, first used in the form of tinned iron plates, and later in the form of certain organic compounds, was found to be the most promising catalyst. The "Billingham" method of using two vessels, one inside the other, has been employed; thus one vessel withstands the temperature but not the pressure, whilst the other withstands the pressure and not the temperature.

The process affords petrol, middle oil and heavy oil; the heavy oil is recirculated with coal, but the middle oil has to be subjected to hydrogenation in the state of vapour. Cleaned coal is found to be much more satisfactory than raw coal, partly because it avoids the expense of processing mere ash, but partly also because the alkaline ash interferes with the catalytic reaction. The residual ash can be neutralised by the addition of hydrogen chloride now that its subsequent removal (in order to prevent corrosion) can be accomplished by scrubbing the hot vapours at 450° C. with a suspension of alkali in oil.

On the large scale, the hydrogenation of coal is at present associated with that of creosote oil, supplied by tar distillers, and of low-temperature tar; but if market conditions require, small adjustments to the plant will adapt it to the desired

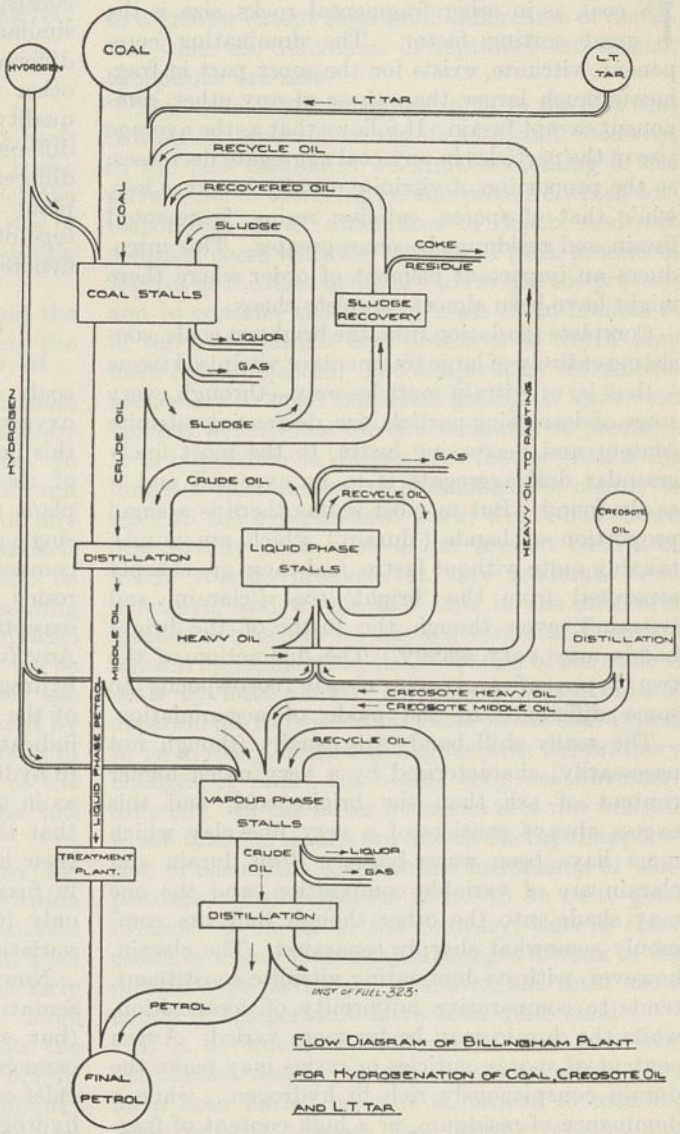
extent for the treatment of coal. In fact the Billingham plant is deliberately designed to provide for flexibility. The hydrogen comes from coal by way of coke and water-gas, but it is intended to manufacture hydrogen from waste hydrocarbon gases by catalytic treatment with steam instead of using these gases as fuel. Part of the waste gas is, however, already used commercially; liquefied butane is supplied for sale for domestic purposes where coal gas is not available.

The process is operated as follows: The coke, from coke ovens, is used for making water-gas, which is freed from sulphur, and then treated with steam in the presence of a catalyst to afford a mixture of hydrogen, carbon dioxide and a little carbon monoxide. This gas is compressed, freed from carbon dioxide by scrubbing with water at 50 atmospheres, and from carbon monoxide by scrubbing with a copper solution at 250 atmospheres pressure. The hydrogen circulating in the plant becomes contaminated with nitrogen and hydrocarbons; these are removed partly by dissolution in the products themselves (being recovered on release of pressure) and partly by scrubbing with oil under pressure.

Coal, first freed from dust by air and then cleaned by the Chance process (of floating the raw coal on a suspension of sand in water), is ground up, together with the right amounts of catalyst and oil, into a paste; the oil used for this purpose is the heavy fraction of creosote oil. This fluid paste, containing 50 per cent of coal, is injected against a pressure of 250 atmospheres, and becomes mixed with hydrogen, being brought to the reaction temperature first in heat exchangers and then in gas-fired pre-heaters. After passage through the converters the product is separated into gases and vapours on one hand and residual oil, ash and coal on the other.

The units, or 'stalls', comprise converters, heat exchangers and pre-heaters, which are arranged in one line and tended for maintenance by a Titan crane of 170 tons capacity; each pair of stalls has a control room containing the instruments and valves. The gas released from the crude products by the removal of pressure in stages is separated into 'lean' and 'rich' gas, the latter being further treated for recovery of the light fractions of petrol. All petrol is washed with caustic soda to remove hydrogen sulphide, and is stored under nitrogen; liquid phase petrol requires treatment with sulphuric acid as well.

It is estimated that the over-all consumption of raw coal would, on a new plant, be 3·5–4 tons per ton of petrol; the thermal efficiency is 40 per cent, whilst that for the generation of electric power is 25 per cent, and that for gasification is 55 per cent. In the Billingham plant, the over-all raw coal consumption is 5 tons per ton of petrol.



FLOW DIAGRAM OF BILLINGHAM PLANT FOR HYDROGENATION OF COAL, CREOSOTE OIL AND L.T. TAR

FIG. 3.

The petrol is of uniformly good quality, and has a high volatility. Concluding his paper, Mr. Gordon remarked that the company has not had much time to study the production of Diesel oil from coal, but that there is no insuperable difficulty in producing a satisfactory oil. Heavy oil obtained from coal is suitable for use as fuel oil without further treatment; whilst the problem of lubricating oil manufacture still awaits attention.

Some Geological Aspects of Recent Research on Coal*

By Prof. H. G. A. Hickling

Types of Coal Aggregate

In coal, as in other fragmental rocks, size is the great sorting factor. The dominating component, vitrinite, exists for the most part in fragments much larger than those of any other component except fusain. It follows that as the average size of the particles in any coal aggregate decreases, so the proportion of vitrinite usually becomes less, while that of spores, cuticles, resins, fragmented fusain and residuum becomes greater. This introduces an important element of order where there might have been almost complete chaos.

Complete gradation from the brightest coals, consisting entirely of large fragments of vitrinised tissue —that is, of vitrain lenticles only—through every stage of decreasing particle size, decreasing vitrinite content and decreasing lustre, to the most finely granular dull aggregate is to be expected and is easily found. But in most seams there is a small proportion of bands ('durain') which are unmistakably quite without lustre, and these are sharply separated from the 'bright' coal ('clarain' and 'vitrain'), even though the lustre of the bright bands may vary widely. The distinction of the two types of aggregate clearly corresponds to some difference in the mode of accumulation.

The really dull bands are usually (though not necessarily) characterised by a very much higher content of ash than the bright coal, and this excess always consists of a very fine clay which must have been water-borne. Both durain and clarain are of variable composition, and the one may shade into the other though they are commonly somewhat sharply separated. The clarain, however, with its dominating vitrinite constituent, tends to comparative uniformity of composition, while the durain may be far more varied. A rich content of spores, cuticles or resins may make the durain conspicuously rich in hydrogen; while a dominance of residuum, or a high content of fragmented fusain, may have the opposite result. It is the variable part of the coal.

Rank of Coals

From the geological point of view, the greatest contribution which is made by the microscope to the study of coal is, that it enables us to determine definitely whether the difference in quality of two coals can or cannot be attributed to original difference of composition. If they can be seen to consist of entirely similar plant materials in a similar state of preservation, then any considerable difference in quality must be attributed to some other factor. Conversely, we may compare the quality of coals which are visibly composed of different materials, and find what are the constant differences between them. The differences due to plant ingredients and mode of origin define the *type* of coal; those due to subsequent alteration denote the *rank*.

* *Continued from p.* 819.

Composition of Coal Components

In common with most vegetable substances, coals consist mainly of carbon, hydrogen and oxygen, and as the first step in the discussion of this problem we may inquire how the proportions of these constituents vary among the different plant materials which may be isolated from any single piece of coal. The vitrinite is of very uniform composition. The group of cuticles, spores and resins is notably high in hydrogen, but is not exceptional in the ratio of carbon and oxygen. Any fusain present will be very deficient in both hydrogen and oxygen. The chemical composition of the residuum needs further investigation; the indications are that it is usually a little deficient in hydrogen and oxygen, but not to such an extent as in the case of fusain. The outstanding fact is that the different components vary strikingly in their hydrogen content (from about 3·5 per cent in fusain to 8·0 per cent in some spores), while only in the case of fusain is there any notable variation in the oxygen.

Now, if we take a very large number of representative analyses of lignites and bituminous coals (but exclude for the moment anthracites and cannels) we shall find the limits of variation of the chief constituents to be approximately as follows: hydrogen, 4·5–6·0 per cent; carbon, 65–90 per cent; oxygen (varying in almost exactly complementary proportion to the carbon), 30–5 per cent. We see clearly that the whole variation of hydrogen content is well within the range observed among the different plant constituents in a single piece of coal. But the observed range of oxygen content in different coals is, on the contrary, many times greater than could be produced by any known variations of the plant constitution. It is this difference of oxygen content, in fact, which chiefly denotes the *rank* of the

coal, distinguishing the lignites, bituminous coals and anthracites.

A very significant feature of this variation in rank is the fact that it is *continuous* throughout its long range, and the significance of this continuity is emphasised in an interesting way by the work of Prof. Bone and his colleagues, who have shown that the proportions of the different types of organic compounds present in the coal vary progressively throughout the series.

Significance of Ranks

The thesis towards which all my remarks have been preparatory is that the rank of a coal is the measure of the alteration in composition which the deposit has suffered in consequence of the rise of temperature and increase of pressure resulting from its burial in the crust.

What do we know of the relation between the rank of coals and their distribution in the rocks ?

The fact which appears to me to establish most clearly that change of rank must be caused by some geological factors is its areal distribution. In every coalfield where substantial variation of rank has been noted and examined, the rank of any given seam is found to change *progressively* as it is followed across the field. If the variation be plotted on a map by means of lines representing volatile content, carbon content, or any suitable measure of rank, these lines are found to be arranged in an orderly pattern and—this is the important point—the same pattern is repeated by each seam within the area. Wherever the rank of one seam is increased, there also is that of the others. Whatever cause has affected one has affected all.

Valuable light is shed on this matter by the detailed information concerning the composition of many of our own coal seams and their variation which is being accumulated by the National Fuel Survey. Many of the seams examined, particularly in Northumberland and Durham, show large changes in rank as they are followed across the coalfields. Some of the seams are notably 'bright' coals, with a relatively high hydrogen content ; others contain a larger proportion of durain and (commonly) a lower percentage of hydrogen. A careful comparison of the analyses shows clearly that the seams which are high in hydrogen retain that peculiarity regardless of change in rank, while those which are low remain low. The chemical evidence supports that provided by the detailed examination of the physical peculiarities of the seams, and the cumulative evidence leaves no room for doubt that in these instances the change of rank is quite independent of the original constitution of the seams.

Hilt's Law

The simplest and most familiar evidence of a relation between rank and geological conditions is Hilt's law : that, in any single vertical section, the deeper seams are of higher rank than the upper seams. Apparent failure of the rule in some cases is doubtless due to the fact that original differences between seams may affect their present composition to a greater extent than small differences of depth. But when the differences of depth are substantial, exceptions are rare.

The value of Hilt's law lies, first, in the fact that it is unambiguous in its significance, and, secondly, in the fact that since we know something of the increments of temperature and pressure which correspond to given differences of depth, and can compare these with the changes of rank produced, it gives us the data necessary to reverse the process, and to consider the rank of coals as an indication of the temperatures and pressures to which they have been subjected. The temperature increments are clearly so small that most geologists have been inclined to attribute the effects mainly to pressure. It is impossible to discuss this matter within the limits of this address, so it must suffice merely to refer to the experimental work, which has shown how readily coal, even in its present condition, yields volatile products at very moderate temperatures, and to the fact that in the effects of igneous intrusions we have a series of beautiful natural experiments in the alteration of the rank of coals by heat alone. In some of these natural experiments the resultant effects on the coal appear to be in every respect analogous with the ordinary changes of rank ; in others they are obviously different. In the latter instances it is not difficult to see that the results are due to the rapid application of somewhat considerable increments of temperature. There appears to me to be quite good evidence to show, on the contrary, that in those cases, in which considerable changes of rank of the normal type have been produced, the total increments of temperature have been quite small.

If it be true that the rank of coals has been determined mainly by the depths to which they have been buried, then it is natural to look for some relation between the varying rank of any seam and its present depth below the surface, or to relate the variation to axes of folding. Much has been written on this subject, and completely contradictory conclusions reached. But this is to be expected. The coal can only indicate the *maximum* temperature or pressure to which it has been subjected, since change of rank is almost certainly an irreversible process ; decrease of temperature and pressure will not restore it to its former level. Now a little reflection will show that, after the completion of the coal-bearing series, the most

general result of subsequent folding will be elevation and denudation, leading to a decrease rather than an increase of load. In so far as this is true, the folding will not be reflected by any variation of rank ; while, on the contrary, any circumstance which does lead to a further increment of temperature will leave its mark. Later burial of the whole series below an uncomformable cover may lead to a change of rank in the deeper parts of the seams, while leaving the upper portions untouched. The time factor, moreover, can by no means be left out of account. Geo-isotherms creep with exceeding slowness, even in terms of the rate of sedimentation and denudation. The duration of burial as well as its depth is therefore material. In fact, the whole sequence of events which have determined the maximum temperature and pressure reached at any point must have been much too complicated to be readily decipherable from the present disposition of the rocks.

In all these complications, however, one cardinal principle remains. At any given place, both temperature and pressure must always have increased downwards—apart, of course, from the influence of igneous intrusions. So, while the interpretation of the lateral variation of rank is involved in many complicating factors, Hilt's law remains as a simple and significant sign. Even in this case the significance is liable to be obscured by the variation of the original coal substance of the different seams ; but the technique of the microscopic study of coal has now reached the point at which, I believe, the effect of this factor can be almost completely assessed and eliminated. If this be so, then we are in a position to use coal as a geological thermometer—or, perhaps, combined thermometer and barometer—and we may set about calibrating it by means of a thorough study of Hilt's law and of the effects of igneous intrusions. But we must never forget that the thermometer has one peculiarity—it is a maximum thermometer only.

Obituary

Prof. Sylvain Lévi

THE death is reported from Paris of Prof. Sylvain Lévi, France's most distinguished orientalist, which took place suddenly on October 30, at the age of seventy-two years.

Sylvain Lévi was born in Paris on March 28, 1863. From an early age he applied himself to the study of oriental languages, especially those of China and Tibet, and in 1886 he was appointed a lecturer in the Ecole des Hautes Etudes. He was a special lecturer in Sanskrit in the Faculty of Letters of the University of Paris from 1889 until 1894, when he was appointed to a chair in the Collège de France. At the time of his death, he was president of the Société Asiatique and of the section of religious studies in the Ecole des Hautes Etudes. Among other honours he was an officer of the Légion d'Honneur and an Hon. Litt.D. of the University of Calcutta.

Lévi had travelled frequently and far in the East to further his researches, applying himself deeply to the study of epigraphy, manuscripts and art, notably in China, Tonkin, India and Nepal, spending three years in the last-named country. On several occasions he held temporary appointments in Asia, at one time being a tutor in Sir Rabindranath Tagore's school at Santiniketan at Bolpur, Bengal, and later in charge of the Franco-Japanese Institute at Tokyo.

Although Lévi's approach to oriental studies had been through linguistics, his outlook and interests were never bounded by the limitations of the philologist or the purely literary scholar. His wide knowledge of eastern iconography, his sympathetic understanding of Eastern art, and his profound study of Buddhism, gave him an insight into the strength as well as the weaknesses of Indian culture, tradition and character, such as have been possessed by few European scholars. It was this quality, perhaps, more than any other, that gave Lévi his position of authority and influence among British orientalists, to whom, indeed, he was perhaps more closely akin than to the members of the German school of orientalists of his day. He was continuously in close touch with the Royal Asiatic Society and the India Society ; and it is said that it was largely owing to his advice and his evidence before the committee, of which Lord Reay was chairman, that the School of Oriental Studies of the University of London was founded.

Among Lévi's more important works, apart from a large number of valuable contributions to the journal of the Société Asiatique and other specialist publications, are a study of the Indian theatre (1900), monographs on Nepal (1905–8), "Buddhachariya", an epic life of the Buddha by Asbaghosha, a dictionary of Buddhism from Chinese and Japanese sources, and two books on India, which appeared in 1925.

WE regret to announce the following deaths :

Prof. Jakob Schetelig, professor of mineralogy and geology in the University of Oslo.

Dr. Eugene W. Shaw, chief geologist of the Iraq Petroleum Co., formerly of the U.S. Geological Survey, on October 7, aged fifty-four years.

News and Views.

Exploitation of Science in Company Promotion

CONSIDERABLE interest has been aroused in financial circles by a circular letter issued by the Chancellor of the Exchequer prior to the General Election to the clearing banks, issuing houses, and the various stock exchanges, relative to securing scientific and technical advice as to the value of processes which form the subject matter of new company prospectuses. The interest, probably, would have found wider expression, but for the turmoil of the elections. The text of the letter itself is as follows :

"The Chancellor of the Exchequer has been giving some thought to the question whether he could aid in strengthening existing means for checking the flotation of companies designed to exploit processes based on a scientific foundation which is intrinsically dubious or even unsound.

"Mr. Chamberlain is, of course, aware that when new projects are brought to the notice of Banks, Issuing Houses and Brokers they scrutinise them with great care before associating themselves with them. Nor does he fail to recognise the many contacts which exist to-day between industry and science.

"On the other hand, it would, no doubt, be generally recognised that within recent times a number of prospectuses have been issued containing claims for the scientific value of particular methods or substances which would not have been endorsed by the best scientific authority.

"Mr. Chamberlain has ascertained that the three research organisations of the Government (the Department of Scientific and Industrial Research, the Medical Research Council, and the Agricultural Research Council) would be willing, if asked to do so in any particular case, to suggest the names of scientists of the highest standing who could be invited by Banks, Issuing Houses or Brokers to furnish them with reports on the scientific merits of the methods or substances for the development of which it might be proposed to make a public issue.

"Any request of the kind above mentioned can be addressed to the Secretaries of the three Government Research organisations named above."

Safeguarding Interests of Investors

THE motive underlying the Chancellor's circular letter is excellent, indicating, as it does, a sense of governmental responsibility for the safeguarding of the interests of the investing public. The method suggested is plausibly sound ; but several aspects require to be considered. It is understood that if a request were made for advice to any of the three organisations mentioned, they would first consult with the particular learned institution whose field of activity was involved. Nevertheless, such a practice is calculated to occasion uneasiness to practising consultants in the fields of science and technology. The safeguard suggested by the Chancellor would not confer on an investor who had lost money the right to prosecute either of the Departments concerned ; and altogether it is rather a heavy responsibility to be shouldered by any Government department if it is to be effective. Consultants have suffered from the depression of recent years, and it would not be in the public interest if regulations were to be made limiting the prospects of the consulting field in science and technology. Just recently the question of scientific and technical advice has been exercising those connected with the mining industry in South Africa ; and a suggestion has been made that the Companies Acts should be so amended as to make it illegal for a mining company to be formed unless its board includes a scientific expert or technician of independent status. Provided that the experts so appointed are actually independent, there is a good deal to be said for such a suggestion ; but it would probably prove necessary to make such experts personally and financially responsible for their advice.

Prof. Henry Balfour and the Pitt-Rivers Museum, Oxford

IN conferring the title of 'professor' on Dr. Henry Balfour, curator of the Pitt-Rivers Museum since 1891, the University of Oxford has elected to honour one of her sons whose lifelong devotion to an idea, pursued with characteristic self-effacement and sanity of outlook, has built up from its modest beginnings an institution of world-wide repute and of unique standing among ethnographical collections. In the Pitt-Rivers Museum and in his many writings on technology in cultural development, Prof. Balfour has applied and extended the principle of evolution in material culture formulated by General Pitt-Rivers, whose collections provided the nucleus of the Museum, in such a manner that it has become one of the most powerful instruments of research in the hands of the student of artistic and technical achievement, as well as of the movements and contacts of peoples in the history of civilisation in the broadest sense. Since the death of Sir Edward Tylor in 1917—indeed from the time he relinquished his office in 1909—the chair of anthropology in the University of Oxford, for purely domestic reasons, has been vacant. The organisation of separate studies in the subject, which has obtained in the interval, no doubt has not been without its advantages, academic and other. Though anthropologists may entertain some feeling of regret that this group of studies at Oxford is still without its professor, they will admit that this circumstance enhances the signal character of the honour now conferred on the technological studies associated with the Pitt-Rivers Museum and of the personal tribute to its curator.

Presentation of the Petrie Medal to the Abbé H. Breuil

IN the proceedings of Foundation Day of the University of London on November 21, over which the Chancellor, Major-General the Earl of Athlone,

presided, the premier honours were accorded to the Abbé H. Breuil, who was present to receive the Petrie Medal awarded him in recognition of his services to archæology. The study of the origin and growth of civilisation from its earliest beginnings down to historic times is fortunate at the present day in having in its service a number of brilliant exponents in practice and in theory of archæological methods of investigation, whose authority receives world-wide recognition. Among these, the Abbé Breuil is a commanding figure. For a generation he has stood in the front rank of French archæologists. His investigations in the caves and occupation sites of palæolithic man in France, Spain and North Africa have added a mass of facts to the sum total of our knowledge of the history of man's early development, while his personal examination of all the more important archæological sites, and the archæological and palæontological material derived from them, throughout the world has given breadth and vision to that innate aptitude for the analysis of evidence and the logical classification of scientific data, which has won acceptance of his verdict in all questions relating to prehistoric archæology as a final court of appeal. The ovation given the Abbé Breuil at the close of the more formal proceedings of the assembly on Foundation Day was no more than an endorsement of an award, which in the fullest sense of the term was deserved.

Rudolph Fittig (1835–1910)

THE centenary of the birth of Rudolph Fittig, who made important contributions to the development of organic chemistry, falls on December 6. His early scientific work was carried out at Göttingen where he was assistant to Wöhler, and became *Privatdocent* in 1860 and professor in 1866. Whilst at Göttingen, Fittig was the late Sir William Ramsay's tutor (1871). From 1876 until his death, he was professor of organic chemistry at Strassburg. He is best remembered for his synthesis of the higher hydrocarbons, particularly the benzene homologues, by the action of sodium upon alkyl or aryl halides or on mixtures of both. It is not so generally realised that Fittig also studied the action of sodium on aldehydes and other series of organic compounds and carried out extensive researches on unsaturated acids. In the course of this work he prepared a number of sets of isomeric (active and inactive) acids and showed their relationships. He suggested a 'ketone' formula for benzoquinone in 1873 and this was afterwards adopted under the title of 'quinonoid structure' for this type of compound.

Johann Faulhaber (1580–1635)

AMONG the victims of the plague which ravaged Central Europe during the middle years of the Thirty Years' War was Johann Faulhaber. The exact date of his death, which occurred at Ulm in 1635, is unknown. Like Schickard (see NATURE of October 19, p. 636), Faulhaber was a mathematician of distinction. He dabbled in alchemy, announcing in 1621 that he would produce from one measure of gold two measures of the same metal of the finest quality. In spite of this unsubstantiated claim, he enjoyed a wide reputation as an able mathematician and as a constructor of ramparts and fortifications. He was visited in 1620 by Descartes, who was then serving in the French army in Germany.

A New Blue Pigment

THE introduction of a new insoluble blue pigment by Imperial Chemical Industries, Ltd., is of much more than passing interest. Monastral Fast Blue BS has none of the various drawbacks of the long-known Prussian blue and ultramarine or the more recently discovered blue lakes derived from coal tar colours, and will inevitably replace them in paints, distempers, varnishes, enamels, in textile printing and in the pigmentation of rubber, plastics and cements. As it is a very close approximation to a true 'minus red', the new pigment allows much brighter greens and purples to be obtained by admixture. The remarkable stability and inertness of the pigment are manifest in its exceptional fastness to light, heat, acid or alkali, and its complete insolubility in water, oil, spirit and nitrocellulose solvents. This new pigment belongs to a class of coloured substances to which the name 'phthalocyanine' was applied by Linstead, who first made clear their chemical nature (1934). The first phthalocyanine was obtained fortuitously as a by-product during the production of phthalimide at the Grangemouth Works of Scottish Dyes in 1928. It was a compound containing iron united with four molecules of phthalonitrile. Monastral Fast Blue BS is the corresponding copper derivative. Structurally, it is an aggregation of four *iso*indole units linked in a 16-membered ring of alternate carbon and nitrogen atoms around a central copper atom. The metal is held by two covalent and two co-ordinate bonds to four nitrogen atoms. The phthalocyanines are closely related to the porphyrins, which form the basis of some naturally-occurring colouring matters such as chlorophyll. Apart, therefore, from the value of the pigment in the arts, its chemical nature confers upon it a considerable scientific interest.

Darwiniana for Down House

THE British Association has recently received from Prof. Van Dyck a holograph letter of Charles Darwin's which must be one of the last from his pen, since it is dated April 2, 1882, only seventeen days before his death. The letter typifies the care and courtesy with which Darwin considered work sent to him by fellow-inquirers. He tells the young Dr. Van Dyck that "After much deliberation I have thought it best to send your very interesting paper to the Zoological Society in hope that it will be published in the Journal". He has preferred this journal to NATURE, which "has a wider circulation but is ephemeral". The journal, however, is "much addicted to more systematic work", so that if the paper be rejected by the Society it is to be offered to NATURE, as "I am very anxious that it should be published and perused". The Association has also

received from the Director of the Victoria and Albert Museum, with the generous consent of the Board of Education, a tall silk hat and a soft straw hat which were Darwin's : as a matter of history, the size is 7¼, possibly smaller than might have been supposed. Both the letter and the hats are now on exhibition at Down House.

Commemoration of Robert Hooke at Oxford

A REPRESENTATIVE Oxford gathering met in the Divinity School on November 20 to do honour to the memory of Robert Hooke of Christ Church, who was born three hundred years ago. Dr. R. T. Gunther, reader in the history of science, presided. The Warden of New College gave an address on the earliest 'Oxford Movement', that resulted in the formation of the Royal Society and, in particular, on the manifold activities in science and art of Hooke and Christopher Wren in London during the reign of Charles II. He pointed out why it was that the former, despite his many qualities, missed supreme greatness. Dr. Gunther spoke of Hooke's discoveries in mechanics, optics, biology and astronomy, and of his great inventive genius generally. Dr. Russell said what could be said of the work done in relating combustion and respiration to the gas afterwards named oxygen. Accounts were read of Hooke's activities in geology and other subjects. The Dean of Christ Church recalled in a witty speech some of the admirable qualities which Hooke showed as a man. He afterwards opened an exhibition devoted to Hooke's work, arranged by Dr. Gunther in one of the rooms of the Old Ashmolean Building. This contained early editions of the "Micrographia" including the beautiful original plates, books owned and annotated by Hooke, modern books about him, models of his microscope, of his mechanical inventions and of the apparatus he used in demonstrations. Particularly interesting was a photograph of the first foraminifer figured and described by Hooke in 1661. There was a nice collection of drawings and photographs of the buildings that Hooke had designed. Prof. F. Soddy had had prepared many models to illustrate different modern applications of Hooke's joint. He demonstrated their working to the visitors, and spoke of the applications of the joint made more than sixty years ago by Franz Reuleaux.

T. H. Huxley as Anthropologist

SIR GRAFTON ELLIOT-SMITH made an especially happy choice of subject for his Huxley Memorial Lecture to the Royal Anthropological Institute on November 26, when he spoke on "The Place of Thomas Henry Huxley in Anthropology"—a topic which, as he pointed out, has been neglected, curiously enough, in the many lectures delivered previously in memory of Huxley. Yet Huxley was not only mainly responsible for the amalgamation of the two rival societies concerned with anthropological studies, which led to the foundation of the Anthropological Institute in 1871, but he was also the real founder of the scientific study of man in Great Britain. By his insistence on the biological point of view in the study of man, he effectually disposed of the loose and facile argument on so-called evolutionary lines, which paraded in the 'sixties of the last century as scientific theory. In emphasising man's place in Nature, he provided the science of human biology with its chief instrument, the means of interpreting and applying to mankind the knowledge acquired by the investigation of man's nearest kindred and merging it in biology as a whole. In recalling the controversy, now almost forgotten, over the 'Hippocampus', in which Sir Richard Owen figured, Sir Grafton rightly stressed the importance of Huxley's identification and pioneer work on the calcarine region which made possible the definition of the characters that conferred its unique qualities on the human brain. Incidentally, he revealed that Huxley's work on this subject was the starting point of his own investigations of the brain and the comparative study of the development of its functions, especially in connexion with the acquisition of stereoscopic vision and its consequences for human evolution.

New Foreign Members and Correspondents of the Geological Society of London

AT the meeting of the Geological Society of London on November 20, Prof. C. P. Berkey and Prof. P. D. Quensel were elected foreign members, and Prof. F. Broili and Dr. E. P. de Oliveira foreign correspondents, of the Society. Prof. Charles P. Berkey, of Columbia University, is well known to geologists in Great Britain as the secretary of the Geological Society of America, a position he has held since 1922. His publications cover a wide field, but in recent years have been principally devoted to the geology of Mongolia, and have appeared as the reports of the Central Asiatic Expeditions of the American Museum of Natural History. Prof. Percy Quensel, of the University of Stockholm, has on several occasions lectured in Great Britain. His researches have been devoted principally to the elucidation of the problems of the petrology and structural features of the older rocks of Sweden ; but he has also published papers on the geology and petrology of Patagonia. Prof. Ferdinand Broili, of the University of Munich, is noted for his studies on the fossil reptiles and Stegocephalians, and has also published papers on the Permian brachiopods and the Devonian trilobites. Dr. Euzebio Paulo de Oliveira is the director of the Serviço Geologico e Mineralogico do Brasil. His published works have been principally descriptive of the mineral resources of Brazil.

Air Transport Exhibition at the Science Museum

AN exhibition portraying the organisation and operation of the air services over Empire air-routes will be opened at the Science Museum, South Kensington, by the Secretary of State for Air on December 5, and will be on view to the public from December 6 until January 31. The exhibition, which is being organised and staged by Imperial Airways Ltd., is popular in character, both in scope and treatment, and will illustrate the development of air communications within the Empire by means of

models, charts, maps and photographs. It will include models of every type of air liner which has been owned by the Company since its inception, and sectional models of the new "Empire" flying-boat, the new Armstrong-Whitworth 4-engined land machine (A.W. 27) and the Short-Mayo "composite" marine aircraft, now under construction. The latter is of special interest as an entirely new project designed to meet the requirements of trans-Atlantic services. A part of the exhibition will be devoted to the design of air ports, and will include a large model of a modern combined land and air port, and dioramas of three famous Empire air ports. There will also be working models showing the part which wireless plays in the control of aircraft when flying in fog or above cloud. There will be sections devoted to the building of a flying-boat and a land machine and to aero engines. Operable models of a wind tunnel and a tank will enable the visitor to gain some idea of the part which these instruments play in the design of air liners. The exhibition should prove of considerable educational interest at the present time, and will serve to show the remarkable developments which have taken place in air transport during recent years; by way of comparison, the earlier historical development in aviation can be seen in the usual gallery of the National Aeronautical Collections in the Museum.

Alchemy and Music

THE audience for the Friday evening discourse delivered at the Royal Institution on November 22 had a double treat, for after listening to Prof. John Read's address entitled "A Musical Alchemist", some recently transcribed music by Count Michael Maier (1618) was sung by student members of the St. Andrews University Choir under the direction of Mr. F. H. Sawyer, lecturer in music in the University. Certain alchemical works published at or near Frankfort during the seventeenth century, largely under the name of Michael Maier, are rich in allegorical illustrations, which Prof. Read terms, for convenience, 'the Frankfort emblems'. The publishing firm of Lucas Jennis of Frankfort took a prominent part in issuing Maier's works. His emblems are often provided with a Latin epigram, together with a cryptic title and a discourse in the same language. "Atalanta Fugiens", or "Atalanta Fleeing", published by Maier at Oppenheim in 1618, contains fifty such epigrams, written in elegiac couplets and set to music by the versatile author. Maier's so-called 'fugues' are in reality rounds, or canons, for three voices. At the end of Prof. Read's discourse, Mr. F. H. Sawyer, who has made a close study of this interesting alchemical music, explained its construction and characteristics, after which examples were sung. It is to be presumed that these 'incantations' were intended to be sung at critical moments during the decoction of the Philosopher's Stone, such operations being directed also by prayer and astrological influences. To what extent Maier, or other alchemists, endeavoured to influence their laboratory operations by means of music is not clear. However, in view of the alchemical belief in the beneficent influence of music, it is likely that the processes of the 'Great Work' were sometimes performed to the accompaniment of musical chants or incantations.

Dangerous Reflexes of Car Drivers

"How Cars go out of Control: an Analysis of the Driver's Reflexes" is the title of a paper by Dr. Yandell Henderson, professor of applied physiology in Yale University, read before the National Academy of Sciences, Washington, on November 18. He attributes this situation to the 'self-righting' reaction which is instinctively and irresistibly excited by any sudden severe disturbance of equilibrium. The self-righting reaction is proverbial in the cat: no matter how the cat is dropped, it lands always on its feet. Into this neuro-muscular complex in man enters the 'extensor thrust' reflex of the lower limbs, owing to which a motor-car driver, often quite unawaredly, presses the accelerator pedal hard down, and continues to do, thus sending the car completely 'out of control'. Prof. Henderson realises that we cannot change the nature of so primitive a danger-response. His remedy consists in placing a pedal for the left foot "so low as scarcely to rise above the floor, but wide enough so that extension of the leg will always bring the foot to bear on it". The extensor thrust reflex involves both feet. The left pedal will be so connected that heavy pressure on it will either counteract the action of the right foot and so close the throttle, or will directly shut down the carburetter. From statistical studies, Prof. Henderson believes that at least ten per cent of fatal car accidents are attributable to the car being 'out of control' through the 'extensor thrust' of the driver's legs.

Rectifiers used on the London Underground Railways

WHEN an alternating current arc is established in a vacuum tube between a mercury and an iron or graphite electrode, the current only passes during half the time, namely, when the mercury pool is the negative electrode. The alternating current is thus converted into a pulsating direct current, the tube (rectifier) thus acting as a valve allowing the current to flow in one direction and not in the other. In a paper on the steel tank rectifiers operating on the underground railways of the London Passenger Transport Board, read by A. L. Lunn to the Institution of Electrical Engineers on November 7, a description of the rectifier substations is given and also much useful information of the working of these rectifiers for traction purposes. When the electric railways first started, they were supplied by three phase A.C. from the Lots Road generating station, the current being converted into direct current by means of rotary converters before reaching the trains. These machines were virtually A.C. motors on one side and D.C. dynamos on the other. For running machines, rotary converters are comparatively quiet, and there is little vibration; but in these respects the rectifier is much superior. The substation buildings for operating the traction system of the London

Underground are in very densely populated districts, and so the light weight and freedom from vibration of the rectifiers enable appreciable economies to be effected on the building costs. Mr. Lunn looks forward to the time when the continued development of the railway area may lead to the changing-over of a number of existing substations to new supply networks, probably involving a change of frequency. With the present system of rectifiers this would offer no difficulty.

Second-hand Electrical Plant

THE policy of the Central Electricity Board in closing down obsolescent electricity supply stations has had the effect of crowding the machinery and equipment market with plant at very low prices. In his presidential address to the Midland Centre of the Institution of Electrical Engineers, Colonel H. C. Fraser said that this plant is being bought by industrial users, and that this is detrimental to the supply industry. The user having very small capital charges is placed in a strong position to compete with the public supply. The recent sales of electrical plant and fittings from ocean liners, such as the *Mauretania* and the *Olympic*, have also decreased to a certain extent the capital charges of the purchasers. On the other hand, mill owners and others are very reluctant to dispose of existing moderately efficient plant at scrap values. The question is one of economics. When the user has capital at his disposal, he can estimate the cost of the renovation of plant and the increase in profits that will probably ensue; and if satisfied, he should not delay the change-over too long. We think that the gain to the community effected by scrapping plant at the proper economical time far more than counterbalances the loss to manufacturers due to the consequent diminished demand for machines and equipment.

Antarctic Discoveries

SOME of the more important discoveries made by Admiral R. E. Byrd's American Antarctic Expedition of 1934–35 are indicated in sketch maps accompanying an article by Admiral Byrd in the *National Geographic Magazine* of October. There seems now to be no probability of a sea-strait joining the Ross and Weddell Seas, a suggestion made some years ago on slender evidence. It appears that Marie Byrd Land, which lies south-east of King Edward Land, extends in a plateau of over a thousand feet, called the Rockefeller Plateau, to the base of the Queen Maud Range, which has been extended another two hundred miles eastward. At the south-eastern end of the Ross Sea a gulf extends into this plateau to about long. 140° W. Another discovery is that the Edsel Ford ranges which lie east of the Alexandra Mountains of King Edward Land extend east and west, and suggest possible extensions of the Andean foldings of Graham Land. A third striking discovery, made by sonic soundings, is that much of the Ross Ice Barrier is aground and not afloat. South of the Bay of Whales, Admiral Byrd has tentatively marked an area of the Barrier extending between lat. 78° 40′ S. and 80° 20′ S. and long. 160° W. and 164° W. as Roosevelt Island. This he believes to be underlaid by land. Several altitudes in this area are well above the general level of the Barrier.

Science and Social Needs

IN his Halley Stewart Trust Lecture delivered in the Memorial Hall, Farringdon Street, London, on November 21, Prof. Julian Huxley discussed "Science and Social Needs". The academic view of science is that it is "pure"—a disinterested explorer of the unknown, and thus an accumulator of organised knowledge. Opposed to this is the view that science is essentially practical, showering upon humanity gifts in the shape of inventions and technical improvements. A third view is that science, far from being beneficent, is actually an evil genius. Of course, the application of scientific methods in the mechanisation of industry may result in unemployment. But the blame does not lie with the scientific worker, but rather with the present economic system. Science is actually a tool, and is therefore ethically neutral. The tempo of scientific discovery may be too fast for modern society; but that is a matter for practical adjustment, not for moral condemnation. The true fact is that science embodies both the first and second views, in that it is both knowledge and control, pure and applied. Progress may flow either from theory to practice or vice versa.

SCIENCE is a function of society, influencing the social system and being influenced by it in return. To-day it is often frustrated—actual discoveries already made are not applied. In fact, science is prosecuted and applied much more from the angle of the producer and the State than from that of the consumer or the individual citizen. Research where an immediate profit can be discerned obtains far greater financial support than long-range research where the advantage is indirect. Prejudice too may often interfere with the use of scientific methods of analysis. This applies especially to social science, education, etc. Social forces could be scientifically analysed and controlled, and social machinery scientifically designed and planned in the same way as has been done for natural forces and industrial machinery. In order to prevent the present piecemeal or lop-sided development of science, we need a new discipline—the scientific study of science itself, in its capacity as a social function.

Journal of the Institution of Civil Engineers

WITH the opening of the 1935–36 session, there appears the new *Journal of the Institution of Civil Engineers*—an occasion which marks another stage in the development of the Institution's publications, and should increase the facilities for "the acquirements of knowledge in engineering", laid down by the founders as one of its objects. Portraits of the first president, Thomas Telford (1820–34), and of Mr. John D. Watson, who now occupies this office, appear in the first number, which opens with a foreword by Mr. Watson and an interesting account of the origin and progress of the Institution. Then follows the presidential address for the current

session, which dealt with the problems of water-supply, sewerage and sewage disposal during the last fifty years. Whilst maintaining continuity with previous publications, it is intended that the *Journal* shall enable the earlier publication of papers and the wide dissemination of the reports of the Research Committee and its sub-committees, one of the important activities of the Institution. Eight numbers of the *Journal* will appear each year, six in the session and two in recess. In the form in which the first number appears, the *Journal* is assured of a favourable reception from all who are interested in the work of the Institution.

THE present issue of the *Journal* contains details of the work of the Research Committee, four papers published by the Institution and a special lecture on "Surveying from Air Photographs" by Brevet-Major Martin Hotine, R.E. Among these, the most important contributions are Mr. E. H. Bateman's paper on "The Open Frame Girder" and J. P. R. N. Stroyer's on "Earth-Pressure on Flexible Walls". The former is an extended analysis, by the strain energy method, of uniform and non-uniform girders, and tables and diagrams are given to show the effect of variation in the stiffness-ratio, from which the effect of variation in the number of panels can be inferred. Mr. Stroyer's paper records the nature and results of an investigation by means of special apparatus on the pressures produced by several materials on wall panels flexing between supports, and sets out the several conclusions at which the author has arrived. Written communications on these papers have been invited by the Council.

Recent Acquisitions at the Natural History Museum

AMONG recent additions to the zoological collections at the British Museum (Natural History) are six skins of Malagasy mammals, including a rare insectivore (*Limnogale mergulus*) presented by Sir Frank Colyer. Acquisitions by the Department of Geology include a series of invertebrate fossils from the Permian of Durham, presented by Dr. C. T. Trechmann. These are arranged to show how the increasing salinity of the sea in which the animals lived led to progressive dwarfing and finally to the extinction of the forms. The Mineral Department has acquired by purchase a faceted cassiterite (tin-stone), weighing 13½ carats (2·713 gm.), together with a crystal of similar material, from Uganda. Cassiterite, known since classical times as the important ore of tin, has seldom provided transparent pieces of sufficient size for cutting for ornamental purposes, so that this specimen is an interesting addition to the collection of faceted stones. The purchases include a carefully collected and labelled set of Swiss rocks, together with the corresponding thin sections, which form a valuable addition to the collection of rocks. Thanks to the courtesy of the Director of the Royal Museum of Natural History at Brussels, the Museum has received part of five rock specimens which, though collected by the *Challenger* Expedition, were described by A. F. Renard and retained at Brussels.

Everyday Science in Civil Service Examinations

WE directed attention in our last issue (p. 825) to the withdrawal of "Everyday Science" from the list of obligatory subjects in the examination for admission to the Administrative Group of Civil Services—a step which appears to us regrettable. The policy of the Civil Service Commissioners in determining the type of the questions set in the examinations in science subjects is also called in question in an article by Dr. Herbert Dingle in *Time and Tide* of November 16. In discussing the part played by examinations in causing the ineffectiveness of scientific training in public life, Dr. Dingle relates his experience in the preparation of questions in astronomy. This confirms us in our opinion that the place of science in these examinations is not all that it should be.

British Institute of Radiology: Annual Congress

THE ninth Annual Congress of the British Institute of Radiology (incorporated with the Röntgen Society) will be held on December 4–6, in the Central Hall, Westminster, S.W.1. The Congress will be opened on December 4 at 3 p.m. by the Right Hon. Lord Nuffield. An exhibition of apparatus, organised by the British X-ray industry, will be held at the same time. On December 5, Dr. G. W. C. Kaye will deliver the eighteenth Silvanus Thompson Memorial Lecture entitled: "Forty Years of Radiology (1895–1935): a Review and Some Reminiscences". On the same day, several physical, technical and therapeutical papers will be read. On December 6, Dr. G. Harrison Orton will deliver the sixteenth Mackenzie Davidson Memorial Lecture entitled "Calcium Changes and their Importance in Diagnostic Radiology", and some papers on diagnostics will be read. Further information concerning the Congress can be obtained from the General Secretary, British Institute of Radiology, 82 Welbeck Street, W.1.

The Leonids

ATTENTION was first directed to this shower of meteors by Humboldt, who observed a great display at Cumana, Venezuela, on November 11, 1799. It was not, however, until the meteor 'storm' of 1833 that the shower was observed scientifically. The next return of the main swarm was observed in England in 1866 and in America in 1867. The period of about 33¼ years was now, by researches into records of past great 'storms', fully established. The next return, 1899, was eagerly awaited, but in the general excitement the work of Drs. Stoney and Downing was overlooked. They showed that planetary perturbations would probably deflect the richest portion of the stream so that it would escape encounter with the earth, and thus the recurrence of a great 'storm' was doubtful. The failure of the Leonids of 1899 has become historic, although good showers were seen in America in 1901 and in England in 1903. Observations have shown a steady increase of Leonid activity year by year in the few years up to 1931, giving hope of another 'storm' about 1933. The promise, however, was not fulfilled. Mr. A. King informs us that this year on November 15, about a day before

the probable maximum, the Leonids were again very scarce. It therefore seems unlikely that there was any extraordinary display at that epoch. British observers generally experienced cloudy skies at that time, so that a definite statement cannot be made until reports from more favoured localities come in. Dr. S. C. Blacktin, 20 Denton Avenue, Roundhay, Leeds 8, has sent a report of a meteor seen at Leeds at 5.30 p.m. on November 16. This could not have been a Leonid, since the radiant at that time was 13° below the north-north-west horizon.

Recent Shower of Meteors

A WIRELESS message from Mohd. A. R. Khan, of Begumpet, Deccan, India, presumably sent on November 22, reads as follows: "Splendid meteoric shower last night. Gamma Monocerotis radiant." Assuming the radiant to have been exactly at γ Monocerotis (R.A. 114·5°; $\delta - 9{\cdot}4°$), and taking the date as Greenwich midnight of November 21 (November 22, 0h. U.T.), Mr. A. King has computed the following parabolic orbit: ι, 115·0°; π, 135·4°; Ω, 58·8°; q, 0·608. The recently published "Index to Southern Meteor Showers" by Mr. R. A. McIntosh, of Auckland, N.Z., gives two radiants at 114½°–9°, November 15–16. Possibly Mr. Khan's shower represents a continuation of this stream, but more cannot be said until definitive details come to hand.

Announcements

THE Symons Gold Medal for 1936 of the Royal Meteorological Society has been awarded to Prof. Wilhelm Schmidt, director of the Central Institution for Meteorology and Geodynamics, Vienna. The medal is awarded biennially for distinguished work in connexion with meteorological science and will be presented at the annual general meeting of the Society on January 15, 1936.

THE Thomas Young Oration of the Physical Society will be given by Prof. Charles Fabry of the Institut d'Optique, Paris, on December 6 at 5 p.m. at the Imperial College of Science and Technology, South Kensington, S.W.7. The title of the lecture will be "Vision in Optical Instruments".

THE Right Hon. Lord Rutherford will open the new Research Laboratory of the London Midland and Scottish Railway Company at Derby on Tuesday, December 10 at 1.50 p.m.

THE opening of the next annual meeting of the Institution of Naval Architects will fall on April 1, 1936. A joint summer meeting will be held in the United States on September 14–19, 1936, at the invitation of the American Society of Naval Architects and Marine Engineers. Other British and foreign institutions will take part.

THE tenth Triennial Congress of the International Society of Surgery, of which 1,200 surgeons from 42 different countries are members, will be held at Cairo on December 30–January 4, under the presidency of Dr. Jan Schoemaker of The Hague. Further information can be obtained from the general secretary, Dr. L. Mayer, 72 rue de la Loi, Brussels.

ON the occasion of the seventy-fifth anniversary of its foundation, the Dr. C. Schleussner Company of Frankfort-on-Main offers a prize of 2,000 gold marks for the best scientific work on röntgenology. The president of the German Röntgen Society, in conjunction with the Dr. C. Schleussner Company, will decide the award. Purely technical and statistical works as well as those already published are excluded from the competition.

THE sixth assembly of the Spanish League of Mental Hygiene will be held in Madrid on December 2–6, when the following subjects will be discussed: suicide in Spain in its psychological and social aspects, the organisation of psychiatric assistance in families, and the intervention of the psychiatrist in tribunals for minors. The fee of five pesetas should be sent to the treasurer, Dr. A. Garma Cisne, 10, Madrid, from whom further information can be obtained.

ERRATUM.—In the last line of the letter "Records of Fatalities from Falling Meteorites", by Mohd. A. R. Khan, in NATURE of October 12, p. 607, for "Kawagam" read "Kawagaon".

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

A principal of the Rochdale Municipal Technical School—The Secretary, Education Office, Townhead, Rochdale (Dec. 5).

The following appointments in the University of Cambridge: a University lecturer and a University demonstrator in biochemistry (Sir F. G. Hopkins, Dec. 7); two University demonstrators in chemistry (Dr. R. G. W. Norrish); University demonstrator in zoology (Prof. J. Stanley Gardiner, Dec. 31).

A principal of the North-Western Polytechnic, Prince of Wales Road, Kentish Town, London, N.W.5—The Clerk to the Governors (Dec. 12).

An assistant (Grade III) in metallurgy and a junior scientific officer in the Royal Aircraft Establishment, South Farnborough, Hants—The Chief Superintendent (Dec. 13).

A lecturer in organic chemistry in the Birmingham Central Technical College—The Principal (Dec. 14).

A lecturer in chemistry in the University of Capetown—The Secretary, Office of the High Commissioner for South Africa, Trafalgar Square, London (Dec. 31).

A professor of chemistry in the University of Otago—The High Commissioner for New Zealand, 415 Strand, London, W.C.2 (Jan. 6).

A lecturer (woman) in biology in the Darlington Training College—The Principal.

A lecturer in electrical engineering in the Burmah Oil Company's College of Mining and Engineering, University of Rangoon—The Secretary, Universities Bureau of the British Empire, 88A Gower Street, W.C.1.

Letters to the Editor

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

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 874.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Influence of Certain Polycyclic Hydrocarbons on the Growth of the Jensen Rat Sarcoma

As the outcome of considerations which will be discussed more fully in a forthcoming paper, experiments were performed to test the effect of certain polycyclic hydrocarbons on the growth-rate of the Jensen rat sarcoma. The present note is the first report on this investigation, and records the results obtained in experiments involving a total of 350 animals.

On account of the insolubility of these hydrocarbons in aqueous media, and in order to ensure a certain degree of absorption into the general circulation, the compounds to be tested were administered in the form of an aqueous colloidal suspension in 0·5 per cent gelatin, prepared by the method described by Boyland[1]. In most experiments the animals received daily intra-peritoneal injections of such preparations.

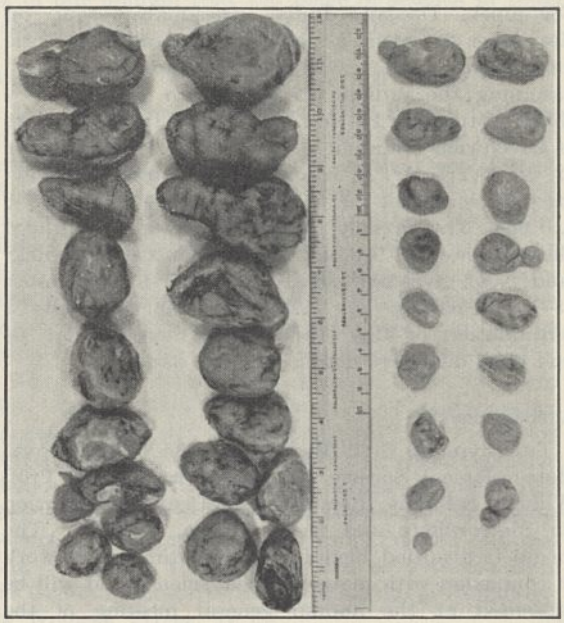
The effects of this treatment were studied by observing the behaviour of the Jensen transplantable sarcoma growing subcutaneously in the right flank, either by making daily measurements or by weighing the tumours after removal at the termination of each experiment. The significance to be attached to any given test was assessed by comparing such data with the corresponding results from simultaneous controls. The latter received similar daily injections of a gelatin solution treated exactly as in the preparation of colloid except for the addition of hydrocarbon.

In most experiments, treatment was started on the day of implantation and continued for 14–20 days, when the tumours were removed, weighed and photographed. Each test animal received a total dosage, varying in different experiments, of 15–40 mgm. of hydrocarbon. Although in certain experiments the treated animals appeared to grow less rapidly as compared with the controls, their general condition and activity remained good.

The data were studied by the application of Fisher's *t* method, and the accompanying table summarises the results in eleven experiments with six hydrocarbons. As a representative example, Fig. 1 shows the effect as seen in Experiment 7.

Expt.	Duration (days)	Hydrocarbon	Mean tumour weights (gm.)		*n*	*t*	*P*
			Controls	Treated			
1	21	1 : 2 : 5 : 6-dibenz-anthracene	33·2	6·9	14	9·39	< 0·01
2	19	,, ,,	17·1	4·7	20	4·36	,,
3	18	,, ,,	12·0	1·7	11	5·30	,,
4	14	,, ,,	5·8	1·7	17	4·21	,,
5	10	1 : 2-benzpyrene	2·5	0·7	31	4·68	,,
6	15	,, ,,	7·6	2·0	9	11·03	,,
7	18	5 : 6-*cyclo*penteno-1 : 2-benzanthracene	18·3	3·5	24	5·54	,,
8	18	1 : 2-benzanthracene	18·3	7·5	28	3·58	,,
9	18	Anthracene	19·7	22·8	12	0·67	*c.* 0·5
10	15	Phenanthrene	10·6	12·0	20	0·64	0·6–0·5
11	15	,, ,,	11·2	11·5	15	0·13	0·9

It is clear that these experiments are sharply divided into two groups, and this has been indicated in the table. Under the conditions described, there



(*a*) (*b*) (*c*) (*d*)

FIG. 1. *Experiment 7:* Appearance of tumours after removal on eighteenth day following implantation:
(*a*) from animals injected daily with 2·5 c.c. control material.
(*b*) from control animals uninjected.
(*c*) and (*d*) from experimental series (animals injected daily with 2·5 c.c. of a 0·03 per cent colloidal preparation of 5 : 6-*cyclo*penteno-1 : 2-benzanthracene).

can be no doubt that colloidal preparations of 1 : 2 : 5 : 6-dibenzanthracene, 1 : 2-benzpyrene, 5 : 6-*cyclo*penteno-1 : 2-benzanthracene and 1 : 2-benzanthracene produced a highly significant inhibition of the growth of the implanted tumour. On the other hand, anthracene and phenanthrene proved completely devoid of inhibitory power under the same conditions.

From other evidence (which will be reserved for future discussion), it seems possible that carcinogenic substances and agencies may act primarily by producing a certain type of inhibition in the activity of the normal cell, and it is of interest that the inhibitory effects described above are most obvious in the case of the substances 1 : 2 : 5 : 6-dibenzanthracene, 1 : 2-benzpyrene and

5 : 6-*cyclo*penteno-1 : 2-benzanthracene—the marked carcinogenic properties of which have been proved by the work of Kennaway and Cook and their collaborators[2, 3, 4]—less so in the case of 1 : 2-benzanthracene, the carcinogenic activity of which is feeble[4] and completely absent in the non-carcinogenic substances anthracene and phenanthrene.

Much further work is obviously required in order to test this hypothesis, but should a definite correlation be found to exist between carcinogenicity and inhibitory power, it is perhaps legitimate to point out that the paradox is only apparent, and is matched by the double action of X-radiation in inducing tumour formation or in controlling the growth of a tumour already established.

These experiments are accordingly being extended to determine (*a*) the effect on other tumours ; (*b*) the action of other hydrocarbons both carcinogenic and non-carcinogenic ; and (*c*) the effect of higher dosage. Full details of this and related work will be published in due course.

This investigation is being carried out with the aid of an expenses grant from the British Empire Cancer Campaign, and certain additional costs were defrayed by a payment from the Roughhead Fund of the University of Edinburgh.

My best thanks are due to Prof. J. W. Cook for his generosity in providing me with various pure samples (prepared in the Research Institute of the Cancer Hospital) of 5 : 6-*cyclo*penteno-1 : 2-benzanthracene and 1 : 2-benzanthracene, and for a supply of 1 : 2 : 5 : 6-dibenzanthracene. Without these the present work would have been impossible.

The tumour employed was originally obtained through the kindness of Dr. J. A. Murray. The majority of the animals were hooded rats of the Lister Institute strain, since previous experience had shown these to be particularly suitable for use with the Jensen sarcoma. For facilities in obtaining supplies of these animals I am indebted to Prof. J. C. G. Ledingham and Miss H. H. Smith. I wish also to express my gratitude to Col. A. G. McKendrick for his kind help in the statistical examination of results.

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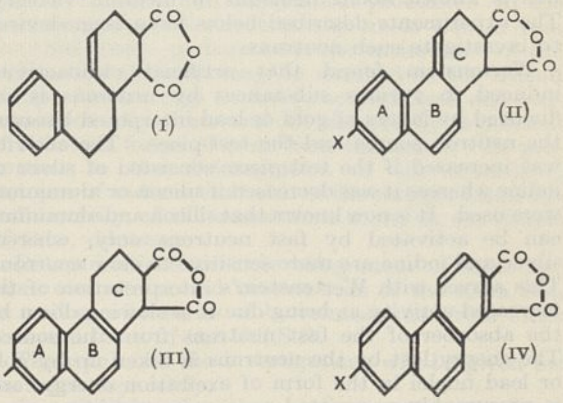
Nov. 10.

[1] E. Boyland, *Lancet*, ii, 1108 ; 1932.
[2] J. W. Cook, I. Hieger, E. L. Kennaway and W. V. Mayneord, *Proc. Roy. Soc.*, B, **111**, 455 ; 1932.
[3] J. W. Cook, *Proc. Roy. Soc.*, B, **111**, 485 ; 1932.
[4] G. Barry, J. W. Cook, G. A. D. Haslewood, C. L. Hewett, I. Hieger and E. L. Kennaway, *Proc. Roy. Soc.*, B, **117**, 318 ; 1935.

Synthesis in the Sex Hormone Group

INVESTIGATIONS into the application of the 'diene-synthesis' to the above problem have been continued in this laboratory since the completion of experiments described in an earlier communication[1]. The latter was chiefly concerned with the synthesis of 3-β-phenylethyltetrahydrophthalic anhydride (I), which, however, could not be cyclised to an octahydrophenanthrene derivative related to oxidative degradation products obtained from œstriol monomethyl ether by Doisy and his co-workers[2].

An obvious alternative route, which would obviate necessity for cyclisation, lay in employment, in the Diels-Alder reaction, of suitable naphthalene and hydronaphthalene derivatives containing an α-vinyl group. This has been carried out in a remarkably simple manner. 1-Vinyl-3 : 4-dihydronaphthalene could not be obtained through the Reformatsky reaction between α-tetralone and ethyl bromoacetate, a result by no means unexpected. But 1-vinylnaphthalene readily combines with maleic anhydride at ordinary temperature, affording the hydrophenanthrene-1 : 2-dicarboxylic anhydride (II or III ; X = H) m.p. 186°–189° (decomp.) (Found : C 75·9, H 5·1 per cent. $C_{16}H_{12}O_3$ requires C 76·15, H 4·8 per cent), which is dehydrogenated by platinum black at 300° to phenanthrene-1 : 2-dicarboxylic anhydride (IV ; X = H) (m.p. 310° corr.), recently described by Fieser and Herschberg[3].



[X = H or OCH_3]

After the completion of these experiments, there appeared a communication by Robinson and Walker[4], who had attempted to effect this type of synthesis. They were likewise unable to prepare 1-vinyl-3 : 4-dihydronaphthalene from α-tetralone, but stated that "no addition occurred" between 1-vinylnaphthalene and maleic anhydride.

In addition, dehydration of 6-methoxynaphthylethyl alcohol yields 1-vinyl-6-methoxynaphthalene, m.p. 41°–42°, which forms an orange-red picrate m.p. 114·5° (Found : C 54·7, H 3·7 per cent. $C_{19}H_{15}O_8N_3$ requires C 55·2, H 3·7 per cent) and combines with maleic anhydride, forming the methoxy-anhydride (II or III ; X = OMe) m.p. 171°–175° (decomp.) (Found : C 72·2, H 5·2 per cent. $C_{17}H_{14}O_4$ requires C 72·3, H 5·0 per cent). The latter is dehydrogenated by platinum black at 280°–300° to 7-methoxyphenanthrene-1 : 2-dicarboxylic anhydride (IV : X = OMe) m.p. 253° (260° corr.) which is identical with a specimen obtained by a synthesis to be described elsewhere in a communication to be made jointly with Prof. J. W. Cook and Dr. C. L. Hewett. (Found : C 73·2, H 3·7 per cent. $C_{17}H_{10}O_4$ requires C 73·35, H 3·6 per cent).

Formula (II) represents the structure of the primary addition products from vinylnaphthalenes and maleic anhydride, and, in agreement with this formulation, the two compounds isolated (X = H and OMe) rapidly reduce cold alkaline permanganate. However, isomerisation to the naphthalene structure (III) by migration of an ethylenic linking from ring *C* to ring *B*, is not excluded. Indeed, if (II) is correct, the possibility of effecting both isomerisation to the

equilenin type (III) and reduction to the œstrone type (one aromatic ring) is envisaged.

These experiments are being extended in several directions, and will be described in detail elsewhere.

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Nov. 15.

[1] Cohen, *J. Chem. Soc.*, 429; 1935.
[2] Doisy *et al.*, *J. Biol. Chem.*, **101**, 753; 1933.
[3] Fieser and Herschberg, *J. Amer. Chem. Soc.*, **57**, 1508, 1853; 1935.
[4] Robinson and Walker, *J. Chem. Soc.*, 1530; 1935.

Excitation of Nuclei by Neutrons

THOUGH many investigations have been made both of fast neutrons and those of thermal energy, much less is known about neutrons of medium velocity. The experiments described below have been devised to investigate such neutrons.

Wertenstein found that artificial radioactivity induced in various substances by neutrons is influenced by layers of gold or lead interposed between the neutron source and the test-piece. The activity was increased if the test-piece consisted of silver or iodine whereas it was decreased if silicon or aluminium were used. It is now known that silicon and aluminium can be activated by fast neutrons only, whereas silver and iodine are more sensitive to slow neutrons. This agrees with Wertenstein's interpretation of the increased activity as being due to a slowing down by the absorber of the fast neutrons from the source. The energy lost by the neutrons is taken up by gold or lead nuclei in the form of excitation energy, and is presumably re-emitted as gamma radiation.

Now neither gold nor lead is strongly activated by neutrons. We thought it interesting to extend Wertenstein's measurements[1] to silver since this is a substance which can be strongly activated. For this purpose we prepared a silver cylinder with walls 15 mm. thick and measured the activation produced in different test-pieces by a Rn–Be source with and without the silver cylinder surrounding the source. Table 1 shows the observed change in the activation as a fraction of that obtained without the silver cylinder.

Test-piece	Increase of activation
Silicon	-23 ± 4 per cent
Aluminium	-19 ± 3 ,,
Silver	$+40 \pm 5$,,
Iodine	$+19 \pm 1{\cdot}7$,,
Rhodium	$0 \pm 2{\cdot}5$,,

From these results, the following conclusions can be drawn:

(1) The effect observed by Wertenstein is not restricted to the substances investigated by him.

(2) The decrease of activation of aluminium and silicon gives directly the cross section for the total absorption of fast neutrons by slowing down and possibly by capture. This cross section comes to 3×10^{-24} cm.^{2}.

(3) Collisions of neutrons with silver nuclei can lead either to an excitation of the nucleus without capture of the neutron, or to capture resulting in the formation of a radioactive element. This conclusion depends on the fact that both the existing isotopes of silver can be activated by capture and so no isotope is left that possibly could only be excited, but not activated.

(4) The activity induced in silver and rhodium is very differently affected by the absorber although these substances show almost the same increase when the neutrons are slowed down by paraffin. This proves that the neutrons slowed down by silver have different energies from those slowed down by paraffin. It further shows that the variation of the activation cross section with neutron energy is markedly different for different elements, at least in the energy range of the neutrons slowed down by silver.

Additional measurements gave the result that the increase of the activation of a silver test-piece is approximately proportional to the thickness of the retarding silver layer between 1 mm. and 15 mm. This result confirms Wertenstein's view that the slowing down of a fast neutron is effected by a single collision. It also shows that no appreciable part of the activity induced by neutrons in a thin silver test-piece is due to neutrons slowed down in the test-piece itself.

We have also studied the influence of a 3 mm. cadmium absorber interposed between the source and the test-piece. No decrease in activity was produced by the cadmium either with or without the silver cylinder surrounding the source. Provided cadmium does not retard neutrons to an extent comparable with silver, it follows from the margin of error in these measurements, that for the neutrons responsible for the activation by a bare source the cross section for absorption in cadmium is smaller than 10^{-23} sq. cm. In the case of the neutrons slowed down by silver the experimental error is larger; the lower limit for the cross section comes therefore to about 2×10^{-23} cm.^{2}.

According to Bethe's[2] theory of the variation of capture cross section with velocity, these limits indicate that the energies of both types of neutrons are of the order of 1,000 volts or higher.

To check directly the assumption that the neutrons are really slowed down by the silver we made the following experiments: A silver test-piece was placed at such a distance from the source that no measurable activity was produced. Then it was backed by a paraffin block in such a way that there was no paraffin between the source and the test-piece. With this arrangement the measured activity was enhanced by 25 per cent when the source was covered with the silver cylinder. Thus the elimination of primary neutrons in the silver block is more than compensated by the increased efficiency of those slowed down in the silver. This is to be expected as slower neutrons reach thermal velocity more quickly in paraffin since they need fewer collisions. As, on the other hand, slow neutrons are absorbed by paraffin, one should expect the effect to decrease if paraffin was interposed between the retarding cylinder and the test-piece. This was verified: When, in addition to the paraffin block behind the source, a block of paraffin 11 cm. thick was put in front of the test-piece the increase produced by the silver cylinder was only ten per cent.

Our thanks are due to Mr. Alton, of the Radium Institute, for supplying the radium emanation and for filling the sources.

W. EHRENBERG.

Birkbeck College,
London.
Nov. 10.

[1] NATURE, **134**, 970, Dec. 22, 1934.
[2] *Phys. Rev.*, **47**, 747; 1935.

Radioactivity of Ferro-Manganese Formations in Seas and Lakes of the U.S.S.R.

THE radioactivity of bottom sediments has been but little investigated. Data published by Joly, Pettersson, Piggot and Iimori refer to determinations of radium, contained mainly in oceanic deep-water sediments in red clays, radiolarian, globigerina oozes, blue muds and manganese concretions. The determinations have shown the manganese concretions to be richest as regards content of radium (up to 10^{-8} per cent); red clays and radiolarian ooze also possess a rather high content of radium. Other types of sediments are less rich in radium.

There are but very few determinations of radium in terrigenous sediments. The radioactivity of the bottom sediments of the U.S.S.R. is entirely unknown. I have therefore commenced a systematic investigation of these sediments. As a preliminary to the study of the radioactivity of the bottom sediments of each sea and lake separately, it seemed expedient to determine the radioactivity of a small number of the most characteristic types of bottom sediments from different seas and lakes. As the largest content of radium might be expected in deposits rich in iron and manganese, the ferro-manganese bottom deposits of different seas and lakes of the U.S.S.R. and two deep water concretions from the Pacific were used for the first investigations.

Besides radium, determinations have been made also of thorium X, the production of emanation and intensity of α-radiation. The results of radium determinations may be seen in the accompanying table.

Table 1.

No. of station	Depth in metres	Name of sea or lake	Radium content (per cent × 10^{-10})
1	512	Kara Sea	5·5
X	234	Barents Sea	1·8
425	181	White Sea	5·4
13	42	Lake Onega	9·2
3	10–12	Lake Konch	8·3
23	26	Bay of Finland	15·4
—	—	Black Sea	31·8
36	20	Caspian Sea	1·2
8,706	98	Lake Baikal	19·5
13	4,919	Pacific Ocean	146·6
285	4,343	Pacific Ocean	47·6

A more detailed table containing the co-ordinates and other data, as well as the characteristics of the samples, will be given in a special paper.

The results obtained make it possible to draw the following conclusions.

All the ferro-manganese formations of the seas and lakes of the U.S.S.R. investigated are to some degree radioactive.

Their radium content varies within wide limits—from $1{\cdot}2 \times 10^{-10}$ per cent (Caspian Sea) to $31{\cdot}8 \times 10^{-10}$ per cent (Black Sea); the mean for nine samples was $10{\cdot}9 \times 10^{-10}$ per cent. In comparison with the oceanic deep-water concretions ($47{\cdot}6 - 146{\cdot}6 \times 10^{-10}$ per cent) the radium content in these ferro-manganese formations is considerably lower.

The determinations of the thorium X have shown that its content is small—less than 1×10^{-3} per cent Th X equiv. Th. The relation of radium to thorium shows that in the ferro-manganese formations, in comparison to the rocks, there is a manifest lack of elements of the thorium group. This fact indicates the want of the thorium in the concretions, and the partial, or entire disintegration of the short-lived isotope of radium—the mesothorium I.

The observations made show small concretions to be more radioactive than large ones or crusts, and also the surface layer to be more active than the central part of the concretion.

The different contents of radium and mesothorium I – thorium X in separate layers of the concretions, and the different correlations of separate elements, enable an approach to be made to the solution of the problem of the rate of formation of the ferro-manganese concretions by radioactive methods. A thorough radiological investigation of several concretions is being made for this purpose.

The radioactive elements in the bottom deposits may be divided into two groups: elements contained in the fragmentary material forming deposits, and elements derived from the water, as the result of various chemical and biochemical processes. In the ferro-manganese concretions and muds rich in iron the chief mass—perhaps even the entire one—of the radioactive elements may be ascribed to the second group. In this case we have encroachment and concentration of radium and its isotopes by deposition of colloidal forms of iron from the water. In proportion to the disintegration of the short-lived isotopes of radium, and also of the radium itself, the radioactivity of the concretions must, in the course of time, decrease.

Determinations are now being made of some few score concretions and bottom soils of the Kara Sea, as well as of a series of bottom samples from other seas and lakes of the U.S.S.R.

The results of the investigations will be given for each sea separately.

In conclusion, I wish to express my gratitude to A. D. Archangealsky (member of the Academy), Prof. A. L. Bening, Prof. K. M. Derugin, Prof. M. V. Klenova, Prof. J. M. Shokalsky and G. F. Ul, for their courtesy in putting at my disposal the samples, and furnishing me with the necessary data.

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A Simple Relay for Spark Counters of the Greinacher Type

H. GREINACHER[1] has described a valuable method for counting α- and β-particles by means of a spark-gap. A water-jet that is turned by the electrostatic forces between it and a pointed electrode allows an objective registration by opening and closing an electric contact. R. D. Summers[2] has pointed out that this arrangement can be used also as a relay.

I have found that it is possible to avoid the disadvantages connected with the use of a water-jet by constructing a mechanical relay. The electrostatic forces between a piece of spring steel and a copper sheet covered with a thin layer of mica are strong enough to attract the spring; this shuts the contact of a telephone counter circuit. The relay shunts the spark-gap. At the moment of ionisation of the air in the gap by a particle, a discharge occurs and the potential between the two electrodes of the gap breaks down. Therefore the relay is released for a moment and opens the circuit of the counter, which registers in this manner the presence of a particle.

The advantages of this mechanical relay are that it works without an auxiliary substance (water) and

it can be depended on for counts extending over a long period.

A detailed discussion will be published elsewhere (*Z. tech. Phys.*). The relay will be manufactured by E. Leybold, Köln a/Rh. I was enabled to construct the apparatus by a grant of the Deutsche Forschungsgemeinschaft.

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[1] H. Greinacher, *Helv. Phys. Acta*, **7**, 360 and 514; 1934. **8**, 89 and 265; 1935. *Z. tech. Phys.*, **16**, 165; 1935.
[2] R. D. Summers, *Rev. Sci. Inst.*, **6**, 39; 1935.

Effect of Light on Diamagnetic Susceptibilities

THE effect of light on paramagnetic susceptibilities of the ions of the iron group has already been reported by Bose and Raha[1]. They have shown how the *l*-component of the magnetic moment, which is more or less quenched in these ions, is partially freed on exposure to light. We have since performed the corresponding experiment for some diamagnetics in a Curie-Chéneveau balance with a fine phosphor-bronze suspension.

The halogens in their $^1\Sigma_g$ states are all known to be diamagnetic. Experiments with halogen vapours (chlorine, bromine and iodine) indicate that on exposure to light from which the infra-red portion was cut out, the susceptibilities increase in all cases. The exaltation of diamagnetism is evanescent at the red end, and remains very small until the violet end is reached. It is too early to offer a definite explanation, as the halogen molecule by absorbing light of wave-length shorter than the convergence limit (4785 A., 5107 A., 4995 A. for chlorine, bromine, iodine respectively) is adiabatically dissociated into two atoms ($^2P_{3/2}$ and $^2P_{1/2}$), both of which ought to be paramagnetic. This should result in a decrease, rather than an increase, of the average diamagnetic susceptibility of the vapour as a whole. But we may tentatively assume that the stationary concentration of atomic halogen is extremely small, and as such its effect is more than offset by the excited molecules to which the exaltation is due. The last we suggest in view of the fact that the effect, although small, is detectable even in the banded region.

The phenomenon is of the nature of a temporary shift of equilibrium only, as we could reproduce the dark deflection almost immediately the light was off. A side experiment with an air tube gave identical deflections both in the dark and in light.

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[1] Bose and Raha, *Phil. Mag.*, July 1935.

Archæology in South and East Africa

SOUTH AFRICANS interested in archæology are following the work in East Africa with keen interest in the hope that it may throw light on our problems, and that discoveries there may be interpreted with a due regard to our results. Mr. T. B. O'Brien's[1] views are therefore important to us.

He correlates (by implication, in time) the large-core phase of the Stellenbosch culture with the East African Early Acheulean, since the latter "marks the beginning of a large-core technique", and, further on, says that "Evidence is available in Uganda which suggests the presence here of a large-flake culture, separate from, but contemporary with the Chellean".

If Mr. O'Brien is correct in his correlation and van Riet Lowe[2] is correct in his classification of the Stellenbosch culture, according to which the Lower Stellenbosch uses "core and flake in almost equal proportions", then we must conclude that human history commenced at a very much later date in South than in East Africa.

Mr. O'Brien's correlation is, however, based purely on typology, deductions from which are vitiated by the inclusion of very serious assumptions in the line of reasoning, and Prof. Lowe's classification dates from a time when stratification of layers bearing various phases of the Stellenbosch culture, so far as natural deposits are concerned, were not known. Such a site is now known[3] and the successive, stratified phases are :

(1) Small Clacton flakes. (2) Very large Clacton flakes made into very rough *coups-de-poing* and cleavers. (3) Smaller Clacton flakes used for making the *coups-de-poing* described by Mr. Goodwin[4] from this area. A phase, apparently intermediate between (2) and (3), was found in a raised beach (about 20 feet) a few miles away ; and on the surface of eroded sites there was also : (4) Still smaller Clacton flakes and small, beautifully made *coups-de-poing* of the Fauresmith type. (5) A very numerous association of still smaller flakes, not reddened like those of phases (3) and (4) but with surfaces such as could have been formed by the action of wind-blown sand. No *coups-de-poing* could be found among these and typical levallois cores are very common. The use of cores is very rare in phase II, but the core technique is used to an increasing extent in phases III and IV.

We have thus at Mossel Bay an evolutionary series demanding as large a slice of time as can be demanded for the evolution of any similar series in any other part of the world.

When I mentioned, in a previous letter[5], a Late Stellenbosch layer five or six feet above human remains in a shelter at Plettenberg Bay, I referred to a phase apparently intermediate between phases III and IV. I should perhaps have been more explicit than, for the sake of brevity, I was.

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Oct. 20.

[1] NATURE, **136**, 475, Sept. 21, 1935.
[2] *S.A. J. Sci.*, **29**, Oct. 1932.
[3] *Roy. Soc. S.A.*, **22**, Pt. 3; 1934.
[4] *Annals S.A. Mus.*, **27**, and *Roy. Soc. S.A.*, **16**, Pt. 1.
[5] NATURE, **135**, 620, April 20, 1935.

Inhibitory Effect of Phloridzin on an Enzymic Dismutation

RECENTLY it has been shown that phloridzin exerts an inhibitory effect on phosphorylations and dephosphorylations[1]. The action on enzymes other than diastase has not yet been investigated. On diastase no poisonous action of phloridzin was demonstrable[1,2] ; however, phloridzin is not a specific inhibitor of phosphorylation and dephosphorylation. As the present communication shows, the dismutative conversion of triosephosphoric acid into phosphoglyceric acid and glycerophosphoric acid is also prevented or markedly inhibited by phloridzin in concentrations of about $N/100$.

Extract of rabbit muscles was used for the investigation. To the muscle extract, buffered at a *p*H of about 7·5, sodium fluoride phloridzin and finally the substrate hexosediphosphate were added. In the samples the decrease of P-compounds labile to acid hydrolysis and the increase of P-compounds resistant to acid hydrolysis were determined. Further, the hydrolysis of P-compounds in alkali at room temperature before and after oxidation with iodine was determined in order to estimate the accumulation of dihydroxyacetonphosphate and glyceraldehydphosphate[3,4]. In order to study the action of phloridzin on the formation of the last two substances, it is necessary to dilute the extract more than 100 times[3].

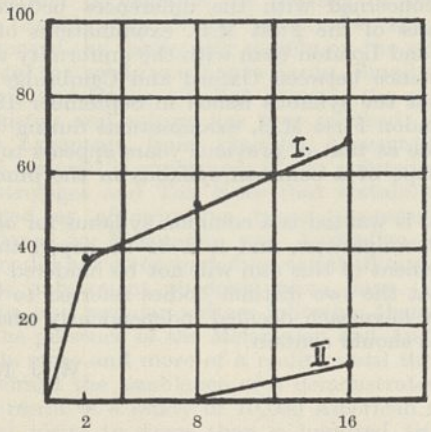

FIG. 1. Relation of percentage conversion into acid-resistant P-compounds (ordinates) to time in minutes (abscissæ). I: without phloridzin; II: with *N*/100 phloridzin.

The velocity of the conversion of hexosediphosphate into dihydroxyacetonphosphate and of this into glyceraldehydphosphate is not affected by phloridzin in concentrations of about *N*/100. On the other hand, the dismutative conversion of triosephosphate into phosphoglyceric acid and glycerophosphoric acid is inhibited 70–100 per cent by phloridzin in the same concentrations. In the same extract with starch as substrate, the well-known inhibition of the phosphorylation was observed. At the phloridzin concentration mentioned above, this inhibition was of the same order as the inhibition of the dismutation.

Further experiments must determine whether the inhibition of oxidation-reduction is an essential action of phloridzin.

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[1] Lundsgaard, *Biochem. Z.*, **264**, 209; 1933.
[2] Barth, *Biochem. Z.*, **270**, 63; 1934.
[3] Meyerhof and Lohmann, *Biochem. Z.*, **271**, 89; 1934.
[4] Meyerhof and Kiessling, *Biochem. Z.*, **279**, 40; 1935.

A Toxic Emanation from Rubber

APPARATUS of several types for measuring and controlling the humidity of the air in entomological experiments was recently described by us[1]. We mentioned a convenient type of glass jar, which is now in rather common use among entomologists and botanists, for studying the effects of climatic factors on insects or plants. It is a commercial glass storage jar with a screw-on metal cap. The joint between the glass and metal is sealed by a thick rubber washer. The humidity inside the jar is controlled by means of a layer of a suitable solution (of potash, acid, etc.) and the insects are placed in the jar in a celluloid and gauze container.

Since describing this apparatus, and after using it frequently, one of us has discovered a potential source of error. If new rubber washers are used to seal the jars, they may, under certain conditions only, give out a toxic substance. This poisonous emanation is much more powerful when the humidity in the jar is high than when it is low. Thus sometimes moist air may appear to be more unfavourable to an insect than dry, when the difference is actually due to a fault of the apparatus. Certain conclusions obtained using this type of apparatus, for example with regard to the unfavourable effects of high humidities on tsetse fly[2], must therefore be accepted with caution.

After exposure to air for four months, the rubber washers which we have been using completely lose their toxic properties, and it is safe to use them even in saturated air. Different samples of rubber vary considerably, and any apparatus for investigating effects of humidity which contains rubber joints should be carefully tested.

K. MELLANBY.
P. A. BUXTON.

[1] Buxton and Mellanby, *Bull. Ent. Res.*, **25**, 171; 1934.
[2] Buxton and Lewis, *Phil. Trans. Roy. Soc.*, B, **224**, 175; 1934.

Cytological Significance of the Nature of Sexual Fusion in Hymenomycetes

THE late Hans Kniep from 1915 onwards and Mlle. Bensaude in 1918 described the union of two mycelia of + and − strains as a necessary preliminary to the formation of the sporophore in heterothallic species of Hymenomycetes. In such cases, plasmogamy is usually separated from karyogamy in the basidium by several successive divisions of conjugate nuclei through clamp connexions. This is held as indicating a "degeneration of the sexual process", and as the principal point of distinction from the type of sexual fusion known in green plants, where there is *simultaneous* fusion of protoplasm and nuclei of two conjugating gametes. But a closer reflection would lessen this difference.

No doubt in the higher plants we have fusion of the two nuclei with the formation of the zygote and the initiation of the diplophase, but not the fusion of two sets of chromosomes (male and female), which simply lie together in the fusion nucleus; the actual fusion of chromosomes is delayed there by almost the same long steps until the prophase of the reduction division or meiosis in connexion with microsporogenesis or megasporogenesis. In the Hymenomycetes, on the other hand, the fusion of the two nuclei in the basidium is followed almost at once by the fusion of their chromosomes in connexion with meiosis. Thus, the only difference is that in the Hymenomycetes the two conjugate nuclei from two different strains (plus and minus) are not in actual contact with each other in the form of one fusion-nucleus as in the higher plants, though they lie very close together in each cell of the hyphæ.

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Calcutta. Oct. 28.

The Schools and Pre-Medical Studies

THE writer of the article on "The Schools and Pre-Medical Studies", which appeared in NATURE of November 2, p. 706, very rightly stresses the need for a common syllabus for all First M.B. examinations. He refers to the differences between the London syllabus and the (new) Cambridge syllabus as regards biology. He does not, however, mention the fact that this new Cambridge syllabus is the fruit of the labours of the Joint First M.B. Committee of the Universities of Oxford, Cambridge and London. This Committee produced an agreed list of types to be included in the biology syllabus, "with a recommendation that each University should adopt a syllabus within the common outline". To this, not only Cambridge, but now also Oxford has subscribed. As a result, a schoolmaster will now require only a single course in biology to prepare a boy for the First M.B. at either Oxford or Cambridge; and if, as is very much hoped, the University of London sees its way to accept the report of the Joint First M.B. Committee, a great step will have been taken to secure that uniformity of syllabus which is so much desired. But it should be known that such uniformity is already in existence between Oxford and Cambridge.

It may perhaps be helpful to readers to remind them that the Joint First M.B. Committee of the Universities of Oxford, Cambridge and London is a body independent of the Conference of Representatives nominated by the Universities of Oxford, Cambridge and London, the Royal College of Physicians of London, the Royal College of Surgeons of England and the Society of Apothecaries of London, whose report on the Medical Curriculum forms the subject of the article in NATURE of November 2.

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To justify the need for a common syllabus, I was more concerned with the differences between the syllabuses of the First M.B. examinations of Cambridge and London than with the uniformity already in existence between Oxford and Cambridge. The fact that the syllabus issued in September 1935 for the London First M.B. examinations during 1936 is the same as that of previous years appears to afford little hope of a common syllabus in the immediate future.

What is wanted is a common syllabus for *all* First M.B. examinations, and it is to be hoped that the achievement of this aim will not be hindered by the fact that the two distinct bodies referred to by Dr. de Beer have each decided independently what that syllabus should contain.

W. J. R. D.

Points from Foregoing Letters

A MARKED inhibition of the growth of implanted tumours in rats is found by A. Haddow when colloidal preparations of several benzanthracene compounds and of benzpyrene are injected intra-peritoneally. The same substances are known to produce cancer after prolonged application. The author points out that this behaviour is similar to that of X-radiation, which can both control and produce cancer.

Dr. A. Cohen describes the synthesis and structure of compounds of maleic anhydride and vinylnaphthalenes. These may prove useful in the synthesis of sex hormones of the equilenin and œstrone type.

Neutrons, apparently of medium velocity, from a radon-beryllium source surrounded by a 15 mm. silver shield, produced a greater activity in test pieces of silver and of iodine, and a smaller activity in silicon and aluminium, than that produced by the unshielded source. W. Ehrenberg concludes that collision of neutrons with silver nuclei may result either in capture of the neutrons with formation of a radioactive element, or in the transfer of energy to the nucleus (excitation) and consequent slowing down of the neutron. The reduced energy of the neutron is different from, and greater than that of, the neutrons slowed down by paraffin wax.

A table showing the radioactivity of ferro-manganese concretions and deposits obtained from seas and lakes of the U.S.S.R. is given by L. M. Kurbatov. The percentage and the relative proportions of radium, mesothorium I and thorium X in the separate layers of the concretions may give an estimate of the rate at which such concretions are formed.

A mechanical relay and spark counter (for counting alpha and beta particles) is described by Dr. H. Teichmann. It consists of a piece of spring steel and a copper sheet covered with a thin layer of mica, and it is claimed that it has certain advantages over the similar water-jet device devised by Greinacher.

H. C. Bhuyan reports that the diamagnetic susceptibilities of chlorine, bromine and iodine vapours are temporarily increased on exposure to visible light. Only a small increase is produced by the red end of the spectrum, but this becomes greater at the violet end.

Prof. T. F. Dreyer enumerates the stratification of layers at Mossel Bay, South Africa, bearing various phases of prehistoric implements of Stellenbosch culture. He disagrees with O'Brien's correlation of the Stellenbosch culture with the East African Early Acheulean, because it would indicate that human history commences at a very much later date in South than in East Africa.

Phloridzin, a bitter principle obtainable from the bark of apple and other trees, has been found to inhibit the reaction between the phosphate radicle and glycogen, the sugar-like substance in the muscle, the oxidation of which provides energy to the organism. H. Kalckar now points out that phloridzin also inhibits another reaction, namely, the oxidation-reduction ('dismutation') of triosephosphate into phosphoglyceric acid and glycerophosphoric acid.

Dr. K. Mellanby and Dr. P. A. Buxton direct attention to the occasional emanation, under the influence of moisture, of a poisonous gas from rubber washers used to seal the jars in which living insects are kept. This may vitiate experiments such as those on the influence of humidity upon the tsetse fly.

Research Items

Racial Origins of the American Aborigines

ARGUMENTS which have been advanced recently, based primarily on somatological evidence, in support of the view that Melanesian and Australian elements are to be found in the indigenous peoples of America, have induced Dr. Aleš Hrdlička of the Smithsonian Institution, Washington, D.C., to recapitulate the evidence and to examine the validity of the conclusion (*Smithsonian Misc. Collect.*, **94**, 11). The supporters of the theory rely mainly on the evidence of skeletal material from Lagoa Santa, Brazil, Lower California and Patagonia, but recently the evidence of linguistics and culture has been invoked. So far as the argument from physical characters and skeletal material is concerned, it was pointed out by de Quatrefages and Ten Kate that certain crania, recognised as of primitive type, presented close resemblance to Melanesian and Australian skulls; but they did not go on to deduce racial affinity therefrom as subsequent theorists have done. These theorists, and popular writers following them, have given the presence of the Melanesian and Australian elements more and more of a reality until the belief has assumed the semblance of a demonstrated fact. As the result of a study of 10,000 American crania, personal visits to more than a hundred tribes in America and the study of a larger number of Australian skulls than any other man, the author is unable to accept the theory. The basic foundations of the theory are built on sand. So far as the skulls from Lower California are concerned, these skulls do bear a resemblance to some of those of Melanesia; but this type is found also in not a few other widely separated regions of America, both among Indians and Eskimo. There it is contemporaneous with other types of these people, connects with them, and is only one of several.

Romano-British Gloucester

FURTHER evidence of the culture of Romano-British Gloucester is afforded by pottery from two sites in the city, which has been described by Mr. Charles Green (Public Museum, Gloucester, Occasional Papers No. 3, 1935; 2*d*.). The first group, of which part has recently been acquired by the Museum, was found in excavating the foundations of the girls' school at the corner of Denmark and Lansdown Roads. It has been ascribed to the period A.D. 250–300, but this dating is too late. The potter's mark *off. Calvi*, referring to the factory of Calvus at La Graufesenque, fixes the date of manufacture in the period A.D. 54–94. The evidence afforded by the collections in the Museum, mostly unpublished, points to the introduction of *terra sigillata* into Gloucester during the Flavian period. The coarse ware here described falls into well-known types, most of which are dateable and can be compared with dated pottery from other sites in the district. Most of it is late Flavian. The second group is from a double interment found in the garden of a house in Dean's Way. Iron nails, some showing traces of wood, were found, which possibly had belonged to a coffin. Other fragments of iron were with parts of a small bronze bowl, for which it is difficult to find a parallel, as unlike the bronze pans of the period, it has no traces of handles. The pottery is in a fair state of preservation. A bulbous beaker belongs to a type which did not appear earlier than the beginning of the fourth century, while a pseudo-Samian bowl is also late. The jars belong to a type which persisted throughout the whole Romano-British period.

Psychology and Nutrition

AN article by David Katz on "Some Problems of Feeding in relation to Industrial Psychology" appears in the *Human Factor* (**9**, No. 4). The writer stresses the difference between rational and irrational aspects of nutrition. Man manages, in normal circumstances, to obtain a sufficient quantity of the basic substances of his diet as protein, carbohydrates and fats together with nutritive salts and vitamins, but the way he gets them is entirely at the mercy of the particular taste or preference that has been developed by the nation, race or climate, in which religious taboos, tradition and subconscious factors play an important role. Mr. Katz refers to the international results of the Japanese food habits compared with those of the Europeans; to Germany's errors in food policy during the War; to the increasing 'democratisation' of food; sex differences; and changes of taste with age. If it should seem necessary to modify the acquired taste of a people, the administration should always keep in mind the important difference between rational and irrational ways of satisfying human appetite.

New Zealand Whitebait

IN the *Victorian Naturalist* (**52**, No. 3; 1935) Mr. Gilbert Whiteley gives an account of the Galaxiidae, a family which includes the whitebait of New Zealand and the mountain trout, minnow, jollytail, eel gudgeon or native trout of Australia. They are mostly found in fresh water, from sea-level to the tops of mountains, some, like the whitebait, migrating to and from salt-water, but probably not travelling very far out to sea. The New Zealand whitebait of commerce consists of the young of more than one species which ascend rivers in hordes towards the end of the year. The chief species is usually called *Galaxias attenuatus*, although strictly speaking it should be named *Austrocobites attenuatus*. The breeding habits are peculiar: in spring, countless numbers of these small adult fishes are seen in the lower reaches of the rivers within tidal limits where are mud flats and muddy creeks with salt rushes and stranded brushwood débris. There, ova in huge numbers are laid and cling to the rushes and water plants near the surface of the water. In order that the young may hatch, the ripe ova must be washed from the plants at high spring tides and the newly hatched fry driven out to sea, where they remain for a few weeks and then struggle up the rivers against the current. In the day an advance of a mile in three hours may be made. In the fresh water they remain for a few months and then descend again to breed.

Insects of the Kalahari Expedition

In the *Annals of the Transvaal Museum*, 7, Part 1, October 1935, are a series of reports on various groups of insects collected by the Vernay-Lang Kalahari Expedition (March–September 1930). Mr. Louis B. Prout deals with the moths of the family Geometridæ. Concerning this group, he remarks that, with the exception of a very few species, contained in the British Museum, from the N'Gami country, no specimens appear to have been previously obtained from the Kalahari Desert and its immediate vicinity. The number of Geometrid species collected was 51, distributed among 34 genera: six species and one subspecies are described as new. In the report of Mr. L. Gschwendtner, water beetles of the families Haliplidæ and Dytiscidæ are discussed. Altogether, 53 species are identified, three being described as being previously unknown, together with one new subspecies and one new variety. Beetles of the family Buprestidæ are reported upon by Dr. Jan Obenberger, who records 36 species, three being previously unknown. Dr. A. J. Hesse deals with the weevils (Curculionidæ). Out of 76 species, four are described as being new while the undetermined forms are represented either singly or belong to groups not sufficiently known at present. The last report, by Prof. T. D. A. Cockerell, is concerned with the bees. A very considerable proportion of these insects are described as new, namely, 29 forms out of a total of 62 species. The various reports make a substantial contribution to a knowledge of the fauna of a region of notable biological interest.

Role of Organic Matter in Plant Nutrition

Continuing the series of researches on the above subject, three further papers by Subrahmanyan and his associates have appeared (*Proc. Ind. Acad. Sci.*, 1, No. 12). These deal respectively with the economy of carbon during decomposition of cane molasses in swamp soil, the influence of fermentable organic matter on the transformation of iron, and the relation of the oxidation of organic matter in the soil to plant assimilation. Addition of molasses to water-logged soil was accompanied by much loss of carbon in gaseous forms, and still greater loss occurred after flooding. The distribution of total carbon was not appreciably affected by the concentration of molasses. Flooding removed the bulk of the organic matter in all cases. Fermentation and loss of carbon were increased by increase of temperature and access of oxygen. It is suggested that in the growing of rice it would be advantageous to convert the bulk of the added organic matter to insoluble forms before flooding. Addition of fermentable organic matter to swamp soils brought quantities of ferrous iron into solution, the amount varying with different soils, whilst insoluble ferrous iron in the soil sediment increased in all cases. Increasing concentration of organic matter increased the amount of ferrous iron brought into solution, and solution and subsequent precipitation were hastened by rise of temperature to 45° C. Evidence is presented to show that ferrous iron in solution is largely present in association with organic acids produced during fermentation, whilst insoluble ferrous iron is present as carbonate and sulphide. A survey of tropical soils showed most of them to be poor in organic carbon compared with soils from temperate regions. Addition of minerals may increase or depress the beneficial effect of organic manuring.

Fossil Fishes of Sokoto Province

Dr. E. T. White has described collections of fossil fishes collected by the officers of the Geological Survey during the course of water supply investigations in Sokoto Province (Geological Survey of Nigeria, Bull. No. 14, 1934). Two very distinct faunas are present, one from the Upper Cretacean, the other from the Lower Eocene. The material consists largely of isolated teeth and bones, but there are a number of skulls of bony fishes, chiefly cat-fishes (Siluroids) which still abound in this region and are a characteristic feature of the modern fauna. These fossil forms, however, cannot be referred to any living genera, therefore new genera have been established for them. The fishes from the Upper Cretaceous fauna include a Porbeagle shark (*Lamna*) of the same type as the living species, and a curious genus of saw-fishes (*Schizorhina*) of which no representatives have survived. Sokoto Province at the time when they lived was probably a tropical or sub-tropical sea. In the early Eocene period the deposits were coastal and the fishes were mainly sharks and rays and also cat-fishes. The cat-fishes very possibly did not actually inhabit the brackish waters in which the beds were formed, but are likely to have been carried down the rivers to the coast when dead or in a dying condition. Figures of the nearest living relatives of most of the fishes are given and there are several good text figures and photographic plates of the bones and teeth.

Origin of Copper Deposits

A group of copper-bearing pyrrhotite veins of the Ducktown type and genetically related ore-bodies are widely distributed in the southern Appalachian region. The origin of these is the subject of a contribution by C. S. Ross (U.S. Geol. Surv., Prof. Paper 179; 1935) which is of particular importance on account of the valuable discussion which it contains of replacement phenomena and the criteria by means of which mineral sequences can be determined. A magnificent series of forty-four plates illustrates the evidence most convincingly. The veins are thought to have been derived from a differentiating magma, but no parental igneous rock has been traced in the region. The first event in vein formation was the intrusion of a felspathic magma. This was followed by introduction of vein quartz, after which followed a stage characterised by a large group of ferromagnesian minerals. Replacement of quartz by hornblende and actinolite is of particular interest. In most of the veins, this stage was succeeded by one in which calcite was the dominant mineral, associated in some cases with later dolomite and ankerite. There is good evidence that the carbonates do not represent replaced limestone, but are hydrothermal deposits. A small group of silicates followed and replaced carbonates, and finally (with insignificant exceptions) sulphides were introduced and replaced carbonates, quartz, felspars, ferromagnesian minerals and schists. As regards the physical chemistry of the processes involved, our knowledge is woefully deficient, and after a lengthy discussion the author is obliged to confess that the character, concentration and reactions of the volatile substances that formed the solvents and the transporting agents for the vein materials are little understood. As a demonstration of replacement, however, the occurrences described are of fundamental petrological importance, since there is a steadily growing body of evidence that certain

igneous rocks, commonly thought to be crystallisation products from magmas, may actually be complex metasomatic replacements of pre-existing crustal materials.

The Asama-yama (Japan) Eruption of 1935

FOR more than two years since the explosions of 1932, the volcano Asama remained inactive. In October 1934, however, the floor of the crater began to rise at the rate of about 8 in. a day, and the surface of the ground at the Volcano Observatory, three miles east of the crater, showed a considerable tilting. These changes were the preludes of the series of eruptions, in April and May 1935, that are now described by Mr. T. Minakami (*Bull. Earthq. Res. Inst.*, 13, 629–643; 1935). The first and greatest eruption occurred on April 20, and was followed by forty others until May 28. During the explosions, the crater floor was broken up, and bombs, weighing altogether 4½ million tons—one of them 200 tons—were scattered over the surface of the cone. Ashes fell over a narrow zone entirely to the east of the volcano and including Tokyo and Tiba. In the same direction, there was no trace of a silent zone in the sound-area, but towards the north, west and south the zone was clearly developed, the boundary of the inner sound-area having a mean radius of 30 miles, while the boundaries of the outer area had mean radii of about 90 and 150 miles. During March, the ground of the Observatory tilted at the mean daily rate of 1·5″ towards the south-east. On April 17, the direction of tilting was reversed, and on April 20, the tilt was 2·5″. Another reversal occurred on May 2, and, after that, the daily rate of tilt began to decrease. It is interesting to notice that extraordinary tilts of the ground were invariably accompanied by violent explosions.

Physiology of Illumination

IN a paper read to the Illuminating Engineering Society on November 12, Dr. R. J. Lythgoe said that the eye can function over a range of illuminations between 0·00001 and 10,000 foot candles. It has been recently shown that even in occupations only requiring the crudest visual perception, the work is speeded up by an increase in illumination. Extremes of contrast are subjectively uncomfortable, and so it is advisable not to have a great difference in brightness between the task and the surrounding field of vision. It was stated that a single 'glaring' source of light hanging on a black wall near a visual test object may actually improve the perception. The general increase in the standards of artificial illumination is in keeping with the more generous economic outlook of to-day. Along with the rise of the level of living there has been an increase in the illumination of factories. Before the Great War, four foot candles was the minimum recommended; it is now ten foot candles. So far as evidence goes, the standard of illumination seems to be continually rising. The limit is governed by technical and economic reasons. Skill is necessary to make a little go a long way. Anyone can take a snapshot out of doors in 5,000 foot candles, but skill enables us to arrange lights indoors so that a good portrait can be obtained with 100 foot candles only.

Miniature Thermionic Valves

THE midget type of three-electrode valve referred to in NATURE of October 27, 1934, is now accompanied by a pentode of the same general form and construction. These 'acorn' tubes, as they are known in the United States, have been developed by the R.C.A. Manufacturing Company, and a brief, illustrated description of them and their characteristics is given in a paper by B. Salzberg and D. G. Burnside in the October issue of the *Proceedings of the Institute of Radio Engineers*. On account of the decreased impedances of the leads and the lower inter-electrode capacities and transit times, these valves permit of considerable improvement to be made in receiving equipment for ultra-short wave-lengths. The triode can be operated as an oscillator in a conventional circuit down to a wave-length of about 40 cm., while the pentode can be used as a radio-frequency amplifier at wave-lengths down to about 70 cm. It is claimed that, at a wave-length of three metres, these pentodes enable an amplification of 10–15 times to be obtained under conditions at which the ordinary valve would be quite useless. The small size of the valves and their novel structural arrangements permit the construction of compact and convenient receiving apparatus. Even at longer wave-lengths, the excellent characteristics of the valves make them applicable to purposes where their small size and low weight are of importance.

Reaction of Hydrogen with Oxygen

MANY investigations have been made of the reaction of hydrogen atoms with oxygen molecules, but it has remained uncertain whether the reaction $H + O_2$ occurs as a two-body or as a three-body process. G. A. Cook and J. R. Bates (*J. Amer. Chem. Soc.*, 57, 1775; 1935) have reinvestigated the reaction, the hydrogen atoms being obtained by the photo-dissociation of hydrogen iodide. A similar study was also made of the reaction between deuterium iodide and oxygen. It was found that, in parallel runs, more deuterium is oxidised than hydrogen, and that addition of nitrogen greatly increases the oxidation of hydrogen or deuterium. The results indicate that the reaction between hydrogen atoms and oxygen molecules is a three-body process. An analysis of two possible reaction mechanisms is made. It is also concluded that Steiner's value for the velocity coefficient k_{H+H+H_2} is to be preferred to the very different one given more recently by Smallwood.

Structure of Elliptical Nebulæ

THE true nature of the elliptical nebulæ is at present a problem of considerable difficulty, partly owing to the lack of sufficient observational data on which to found a satisfactory theory. With the object of remedying this deficiency, Sinclair Smith (*Astrophysical J.*, 82, 192) has recently made observations of polarisation, nuclear size and spectral character in Messier 32, a nebula which is regarded as typical of its class. He has found a definite nucleus of diameter approximately 0·8″, but no detectable polarisation within 75″ of this nucleus. The spectral type is *dG*3 and shows no variation along the major axis. Much work remains to be done on these lines; but at present the observations do not support Jeans's gas-sphere model, or ten Bruggencate's hypothesis of an assembly of small particles illuminated by the nucleus. It is suggested that a star cluster model accounts best for the facts, though the resulting central density of $8{\cdot}8 \times 10^5$ stars per cubic parsec is extraordinarily high.

International Exhibition of Chinese Art

THE exhibition of Chinese art, which opened at the Royal Academy of Art, Burlington House, Piccadilly, London, on November 28, is a unique opportunity for student and connoisseur alike. No such collection of objects from the Far East has ever been gathered together in Europe before; and it is an opportunity that is not likely to recur. Nearly four thousand objects are shown, of which every one is of interest, either for its æsthetic excellence, or for its historical significance.

The nucleus of the exhibition is drawn from the Chinese national collections and has been selected from the Imperial treasures which came from the Forbidden City. Not a few of these were made specially for palace use, and bear the emperor's commemorative inscription. In addition, exhibits have been contributed from public and private collections in Japan and the United States, and among European countries, Great Britain, France, Germany, Sweden, Russia, Turkey and the City of Danzig. Even Egypt has helped. In fact, every effort has been made to secure that the exhibits should be as fully representative as possible.

The range of the exhibits is almost as varied as the sources from which they have now been brought together. Every side of Chinese artistic achievement has been covered—in all instances adequately to meet the needs of the student, in many with abundance. Bronzes, carpets, enamels, embroideries, glass, ivories, lacquer, paintings, calligraphy, sculpture, textiles, and, needless to say, numerous examples of the most characteristic products of Chinese culture, jades and pottery and porcelain, all are shown at the highest point of attainment in technique and artistic development in the respective periods.

The exhibition has been arranged on a chronological basis, in dynastic periods. Some idea of the impressive character of Chinese civilisation will be gathered from the fact that the exhibits, of which the earliest in date may well stand comparison in artistic merit with later objects in their own class, cover a period of no less than thirty-five centuries, ending at A.D. 1800 and beginning with the Bronze Age at about the middle of the eighteenth century B.C. This is a record with which not even Egypt, with all its long history, can compete.

In an exhibition such as this, in which the principle of selection has been either purely æsthetic or relative to the history of artistic development, the objects shown are unfortunately but necessarily divorced from their cultural context—an association of the greatest importance, as all will admit, who have any acquaintance with Chinese culture. Of the purely æsthetic aspect of the exhibition, NATURE may well leave others to speak. It is far from being without significance for scientific studies.

The ethnologist, and still more the archæologist, will find much of supreme interest and no little importance here. This indeed is no more than might be expected when so long a period of development is covered. The ethnologist, for example, will note the early appearance in the bronzes of the Shang-Yin dynasty (? 1766– ? 1122 B.C.) of the characteristic feeling of China for form and ornament, as well as the delicacy of handling in technique. Nor will he overlook how, notwithstanding ethnic movement at various periods, after being influenced for a time, these qualities reassert themselves, except possibly in the last period under the Manchu dynasty, when the effect of influences making for an elaboration of form and colour seem to have been unusually prolonged. This persistence of the native stamp may perhaps be appreciated most readily in the sculptures and figures of the T'ang period (A.D. 618–819), when Chinese Buddhist art, purified from corrupting elements by fresh contacts with India through the Chinese pilgrims who journeyed to that country, rapidly reasserted its native qualities in the imported art forms. It is perhaps scarcely necessary to add that the objects belonging to the earlier dynasties, and especially the human figures, coming from burials, are of the greatest significance for Chinese religious belief, legend and domestic culture.

To the archæologist and student of prehistory, the interest of the exhibition, especially in the chronologically earlier sections, is even greater. Early Chinese history in its annals is obscured in the mists of time. The records of the emperors and of their achievements stretch well back into the third millennium B.C. Until recently it had been held—and even then with some doubt—that authentic history did not begin at the earliest before the Chou dynasty (? 1122–249 B.C.). Excavation, however, which began with a Japanese expedition in 1906, was continued by Dr. J. C. Andersson after the Great War, and recently has been prosecuted with vigour by the Chinese themselves, has revealed the existence in North and Central China of a chalcolithic civilisation, which followed on a neolithic culture ending about 2000 B.C. It would appear from recent research that this chalcolithic civilisation reached, or at least influenced, southern China about the beginning of the Chou dynasty, or slightly before (see NATURE of August 31, p. 346). Among the objects of this early culture there appears a painted pottery, apparently belonging to the groups of early painted pottery which have been found in eastern Europe, western Asia, Baluchistan and northern India. In China it appears to be an intrusion which dies out, a second type of unpainted ware being the characteristic form, persisting through the later period.

Interesting as this early civilisation undoubtedly is in view of its possible Western affinities, its connexion with the period which follows, on present evidence, is of no less moment. For it is to be noted that the early ceremonial bronzes and other objects of the Bronze Age from recent excavations, some of which are inscribed, appear to confirm the records of the emperors of the Shang-Yin dynasty in the annals previously regarded as legendary.

Unfortunately, it has not been possible to do more than refer in passing to the remarkable series of exhibits of the T'ang period, perhaps China's age of greatest expansion. Here the most noteworthy exhibits are the paintings recovered by Sir Aurel Stein from Tun-huang; but the whole exhibit of this period is of the greatest importance for the student of cultural contacts between East and West, notably in the sculpture, where Greek influence still lingers, permeating through India after many centuries.

Lenses Employed in the Technicolor Process of Cinematography

By H. W. Lee, Research Department of Taylor, Taylor and Hobson, Ltd.

IN colour photography it is necessary to analyse the light reflected by coloured objects into at least three spectral regions which, where there are three only, may be termed red, green and blue respectively. This is done by means of colour filters which transmit definite portions of the spectrum and absorb the rest; the three negatives are produced either successively or simultaneously. In cinematography the negatives must, of course, be made simultaneously unless the rate of movement of the film is increased threefold, to which there are grave objections. The three negatives may be made simultaneously by means of three lenses; this results in colour parallax, and the three images will never exactly superpose. Alternatively, the beam of light issuing from a single objective must be divided. This division may be made by means of superposed filters, the components of white light being successively subtracted and acting on sensitised films superposed. The objections to this are that the films and filters must be very thin if the composite 'tri-pack' and filter film is not to be too thick, and that each layer of emulsion produces a certain amount of scattering, so that the successive images are more and more diffused. Other methods of dividing the beam are by successive reflections from thin, partly-reflecting and partly-transmitting films, which may be either isolated films of collodion or films of silver on glass surfaces. The silver may be in the form of totally reflecting films partly covering the surfaces they are deposited on, a method not without objection since the areas of film must be small if there is not to be differentiation between different parts of the light beams; alternatively, the silver films may be so thin as both to reflect and transmit.

The Technicolor process is, optically speaking, a combination of two processes suggested above. *One* semi-reflecting metallic film on the diagonal plane of a glass cube is combined with a bi-pack, to which the objections of the tri-pack do not altogether apply, as the two sensitive films can be placed in contact.

The glass cube placed between the lens and the film has considerable thickness (being approximately equal to the size of field covered) and therefore produces considerable aberration. This fact was not sufficiently realised by early experimenters in colour photography, who tried to combine prism 'beam splitters' with normal lenses on the market, which of course had not been computed for use with considerable thicknesses of glass. The result was poor definition and images of unequal sizes. Technicolor, however, early realised the necessity for taking the prism into account in the design of the lens system, and in 1918, D. F. Comstock took out a patent (British patent 131,422) for several constructions, having apertures up to $f/3{\cdot}9$, for lens systems combined with prisms. In 1927, however, their prism system was simplified and the need felt for lenses of larger aperture, owing to the change in cinema technique from outdoor to studio photography. Technicolor approached Taylor, Taylor and Hobson, Ltd., who were making lenses having an aperture of $F/2$, and asked them to design a special lens for their needs. This was for two-colour work. With the change to three-colour work in 1931, a further change was needed, and, moreover, the matter of colour correction became more stringent.

It is possible to equalise the focusing position and the focal lengths for two parts of the spectrum which would, in practice, be the 'centres of gravity' of the spectrum bands passed by the two filters used, but when three colours are in question there is the difficulty that the third colour must necessarily be out of focus owing to the so-called secondary spectrum. This secondary spectrum can be reduced in certain optical systems such as telescopic objectives and photographic lenses of small aperture by the aid of special glasses; but the dispersive power of these glasses, the so-called 'telescope flints', which have partial dispersions more nearly proportional to those of crown glasses than the flints in ordinary use, is so low that, in photographic systems of large aperture and considerable field dependent entirely upon these glasses, the construction is prohibitively complicated. However, since, in the new Technicolor process, only two images are formed in a plane at right angles thereto, it is possible to allow for the slightly different focus for the green, if the foci for the red and blue coincide. These, then, were the conditions to be fulfilled; the red and blue foci must coincide, the tolerance being that the blue focus might be 0·0005 in. longer than the red as the blue negative is the rear one of the bi-pack. The green focus could be 0·003 in. shorter than the common focus for the blue and red. These conditions were for the 'standard' focal length of 50 mm. The aperture required was $F/1{\cdot}7$. As there is inevitably some loss of definition in colour processing, the definition of the lenses was to be better than that of lenses for non-colour work. Other lenses of focal length 70 mm., 100 mm. and 140 mm. were also required.

Now the 'secondary spectrum', which required an adjustment of 0·003 in. for the green on the 50 mm. lens, increases with focal length, so that it becomes 0·008 in. with the 140 mm. lens, while the 'adjustment', being made on the camera, is fixed. It thus became necessary to reduce the secondary spectrum with the longer focus lenses. Fortunately, the Parsons Optical Glass Co. (now Chance-Parsons) came to the rescue with a new glass; an experimental melting produced a glass having a reduced secondary spectrum and having the low V of 44·9 (as against 52·2 in the old 'telescopic flint'). By judicious incorporation of this glass in one or two components in the longer focus lenses, these were designed to give approximately the same difference between the green focus and the red-blue focus, as in the standard lens.

A further interesting problem arose when short focus lenses were required, because, with normal types, there is not sufficient clearance between the lens and the focal plane to accommodate the prism. Mr. J. A. Ball, of Technicolor, had tried placing a negative lens in front of an ordinary cinematograph-

taking lens, the distance between the two being greater than the focal length of the positive lens; thereby he decreased the focal length and at the same time displaced the nodal plane towards the focal plane, giving greater clearance.

A negative lens so placed, however, introduces considerable barrel distortion. Ball reduced this by using two negative components, each a cemented doublet, but when the problem was put to Taylor, Taylor and Hobson, Ltd. to provide a lens of aperture $F/2$ free from distortion, a complete solution was forthcoming with a negative consisting of only two simple elements. Fig. 1 shows the Taylor-Hobson lens. The same stringency as to colour correction, of course, applies to this lens.

The closeness of the limits for colour correction necessitates special precautions in manufacture. In a batch of lenses made to very close tolerances of radius and thickness and made from identical glass melts, it is rare to find the chromatic corrections identical to the Technicolor specification, owing to small variations in the composition of glass throughout the pot. The assembled lenses are first tested for focus throughout the spectrum on a collimator illuminated through a constant deviation prism. If necessary, alterations are then made, to bring the

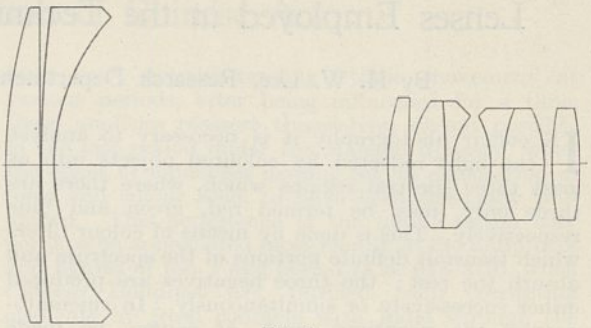

FIG. 1.

chromatic corrections right. Finally, a photographic check is made. An inclined object consisting of parallel lines is photographed through the actual colour filters used by Technicolor.

Bacteriology of the Atmosphere*

THE study of the bacteriology of the atmosphere dates back to the time of Ehrenberg, who published twenty-five papers dealing microscopically with dust and its biological concomitants in the air. The great impetus to the study was, however, the controversy over the question of spontaneous generation, with which the name of Pasteur is indelibly associated. He was not, however, the pioneer in this respect, for Gaulthier de Claubry in 1832 and Baudrimont in 1855 had already given definite experimental proof of the existence of living 'germs' in air, capable of provoking decomposition. It was the experimental genius of Pasteur which eventually settled the controversy beyond all doubt, and incidentally opened the eyes of scientific workers to the existence of a circumambient flora of unknown potentialities.

The epoch-making development of these discoveries lies in the antiseptic surgery of Lister. Researches on the sanitary quality of air multiplied exceedingly at this period, but, while much of scientific interest was revealed, the general result was to make clear that among the numerous organisms suspended in air and capable of growth, there were, as a rule, very few of pathogenic or of surgical importance. For this reason, there has been of late years a considerable waning of medical interest in the air-borne flora, to the point of positive neglect. Yet, while the above statement may be true of the surgical aspect, there is no doubt that from the physician's point of view, air-borne infection is, in certain cases, of primary importance. This is particularly true of pulmonary diseases.

Some excuse for this state of affairs may be found in the comparative dearth of knowledge about the conditions under which aerial organisms live and survive to convey infection. A few investigations have been carried out on the viability of organisms in sand or dust or suspended in water droplets; but it is still true to say, for example of the tubercle bacillus, that there is no exact knowledge of the conditions under which it can or cannot survive when floating freely in air.

If this is true of such special cases, of vital importance to man, how much more does it apply to the generality of air-borne organisms—the aeroplankton—not only of living rooms, etc., but also of the atmosphere as a whole. The biological side of oceanography has been impressively developed during this century, but the biological side of meteorology remains an unexhausted field for investigation. It has been too rashly assumed that the atmosphere cannot offer a permanent home to micro-organisms, and that those which are found there are strayed wanderers from their true homes and are either dead or in some dormant, spore form.

Investigation makes this much less certain. The number and variety of organisms found are sometimes very great, and they are in many cases not referable to types found elsewhere. Moreover, spore-bearing types are relatively rare, at least among the bacteria and the yeasts, though many fungal spores have been found. The latter have been investigated chiefly in Canada and the United States, in connexion with the spread of rust infections on crop plants, and their migrations have been traced, to some extent.

The distribution of organisms in the atmosphere is not a simple function of height, as earlier observers thought. Aeroplane surveys have made it clear that micro-organisms occur in sporadic clouds, like those of ocean plankton, which may be found at any height that has so far been investigated, that is, up to 20,000 ft. If it be true that the atmosphere does not provide permanence of vital conditions, yet it does provide undoubtedly continuity, so that there are at all times and places some portions of the atmosphere

* Substance of a Chadwick Public Lecture delivered by Prof. R. C. McLean on November 19 at the London School of Hygiene and Tropical Medicine.

in which organisms can live. Condensation of moisture takes place very readily on such small objects, and it is significant that the largest catches have been reported from just below the base of clouds, where saturation conditions obtain. In the like situations, multiplication of organisms may take place to such an extent as to give rise to a veritable cloud flora and perhaps to account for the many instances of rains of small organisms for which no terrestrial source has been reliably indicated. Even apart, however, from such favourable conditions, it is quite possible for micro-organisms to live, surrounded by condensation droplets, even at great heights. Many, if not most, are protected from the lethal action of ultra-violet rays by red or orange pigments which screen the living matter and also warm it by absorption of heat rays, so that they may survive anywhere below the ozone layer, even at air temperatures well below zero. All the elements necessary for nutrition may be obtained in the air in quantities sufficient for the exceedingly small weight of the aeroplankton. Formaldehyde and radioactive material are also present, and may play a part in stimulating growth.

When one considers the heavy contributions that air deposits make to the soil, even in country districts, there is seen to be no more reason for regarding the soil as the origin of the air flora than vice versa. Dust is in fact the mother substance of the soil.

Methods which will combine both qualitative and quantitative results still need to be worked out, and particular stress may be laid on the need for variety of growth-media and for prolonged incubation periods, since many aeroplankton organisms are of very delicate growth. Until we know why this is so and how such apparently delicate organisms can survive in the atmosphere, we are not likely to have a full understanding of the conditions of air-borne infection.

Educational Topics and Events

BIRMINGHAM.—Prof. Kenneth Neville Moss, professor of mining, has been elected to succeed Prof. Stiles as dean of the faculty of science.

Dr. E. L. Hirst has been appointed reader in the chemistry of natural products.

Work on the foundations of the new chemistry block has begun.

CAMBRIDGE.—At Clare College, J. D. Boyd, University demonstrator in anatomy, has been elected into a fellowship.

The governing body of Emmanuel College invites applications for a research studentship which will be awarded in July 1936. Applications must be sent to the Master, Emmanuel College, Cambridge, in time to reach him not later than June 30. Preference will be given to candidates who have already completed one, but not more than two, years of research. The studentship, which must be held at Emmanuel College, and has a maximum annual value of £150, is awarded and normally held for two years, but may be renewed for a third. The studentship is not tenable by a woman or by a graduate of the University of Cambridge.

LONDON.—Dr. Eric Boyland, since 1931 physiological chemist at the Research Institute of the Cancer Hospital, has been appointed University reader in biochemistry, and Dr. V. B. Wigglesworth, since 1926 assistant in the Department of Entomology at the London School of Hygiene and Tropical Medicine, has been appointed University reader in entomology.

OXFORD.—On November 23, Dr. R. T. Gunther in his lecture on the "Early Men of Science of Magdalen College" suggested that the natural amenities of the site may have attracted the attention of Edward Wotton and others to zoological studies, just as in the seventeenth century the foundation of the Botanic Garden on the College land stimulated an interesting group of botanists, among whom were William Browne, Stonehouse, Hooper and Drope. Cartwright, of power loom fame, Gowin Knight, maker of strong magnets, Charles Daubeny, vulcanologist, chemist and botanist, and Lord Rosse, were among the distinguished forerunners of the modern succession of eminent Waynflete professors now attached to the College.

The honorary degree of D.C.L. was conferred upon Sir Harry McGowan, chairman of Imperial Chemical Industries, Ltd., on November 23.

ST. ANDREWS.—Mr. R. C. Alexander has been appointed to the chair of surgery in the University, vacant through the death of Prof. John Anderson.

THE result of the parliamentary elections to the three seats for the Combined Scottish Universities was announced on November 25. The following were elected: Prof. J. Graham Kerr, formerly regius professor of zoology in the University of Glasgow (Unionist); Dr. G. A. Morrison, formerly headmaster of Robert Gordon's College, Aberdeen (National Liberal); and Mr. A. Noel Skelton (Unionist). The death of Mr. Skelton on November 22 will cause a by-election.

THE following scholarships, which are tenable for three or four years, will be offered by the Institution of Naval Architects for competition in 1936: *Naval Architecture: Martell*, £130 a year; *Trewent*, £125 a year; *Denny*, £75 a year. *Marine Engineering: Parsons*, £150 a year; *Yarrow*, £100 a year; *Denny*, £75 a year. The Denny scholarships are tenable for four years at the University of Glasgow only. Full particulars can be obtained from the Secretary of the Institution of Naval Architects, 2 Adam Street, Adelphi, London, W.C.2.

THE Association of University Teachers has written to the Rumanian Legation in London in reference to Prof. Pierre Constantinesco Iasi, professor of the history of art in the Faculty of Kichinev, who is stated to be undergoing trial on a charge of conspiracy against the State following his activities against war and fascism, activities which it is claimed have been carried out in a public and legal manner. The Association expresses the hope that the outcome of the trial will be such as to make it clear that the right of freedom of speech for university professors is upheld in Rumania, and quotes from a resolution adopted by its Council on December 14, 1934, in the course of which the Association affirms "the right of university teachers to the full exercise of their functions and privileges as citizens. It maintains that the public expression of opinion, within the limits of the law, on controversial matters is in no way incompatible with the position and responsibilities of a university teacher, it being understood that such expression of opinion is personal and does not commit the Institution to which he belongs."

Science News a Century Ago

Anniversary Meeting of the Royal Society

THE anniversary meeting of the Royal Society was held on November 30, 1835, J. W. Lubbock, vice-president and treasurer, being in the chair. The secretaries' report stated that the Copley Medal had been awarded to William Snow Harris for his "Experimental Investigations of the Forces of Electricity of high Intensity", while one of the Royal Medals had been awarded to Michael Faraday for his "Experimental Researches in Electricity" and the other to Sir William Rowan Hamilton for papers published by him in the *Transactions of the Royal Irish Academy*, vols. 16 and 17, entitled "Supplement to an Essay on the Theory of System of Rays". The report also announced the appointment of Mr. Robertson as assistant secretary "at a salary of £160 per annum with the use of a bed-room, sitting-room, coals and candles", and of Mr. Schuckard as librarian at a salary of £50 per annum. Mr. Schuckard was to attend from 12 to 4 o'clock on two days of the week. The Society consisted of 10 Royal personages, 48 foreign members and 735 home members, of whom 598 had compounded for life.

Culture of Grapes by Lord Tyrconnel

AT a meeting of the Horticultural Society on December 1, "a paper was read containing notes and observations on many kinds of grapes, cultivated at the seat of the Earl of Tyrconnel, near Catterick Bridge, in Yorkshire, the vineries at which place seem very rich in varieties of this fruit, placed under circumstances highly favourable for comparison; any remarks like these, have been the result of long experience by Mr. Whiting, Lord T's gardener, cannot fail to aid in clearing up the confusion which reigns over the nomenclature, etc. of nearly 200 supposed different sorts of grapes, and further the establishment of a standard of certainty among so much conflict of opinion". (*Athenæum.*)

The London Mechanics' Institution

ON Friday, December 4, *The Times* recorded that this Institution held its usual quarterly meeting on Wednesday evening, in its theatre, Southampton Buildings, Dr. Clutterbuck, vice-president, being in the chair. A report of the committee of managers said that the present number of members was 1,211, an increase of 180 on the preceding quarter. The funds of the Institution appeared to be in a prosperous condition, between £200 and £300 having been paid to lecturers during the preceding twelve months. The chairman congratulated the meeting on the Institution having arrived at its twelfth anniversary, and said he believed a more favourable report on its condition had not been presented before. Votes of thanks were given to Dr. Birkbeck, the president, for his exertions on behalf of the Institution, to lecturers and teachers of classes who had given their services free of charge and to the donors of books, etc.

Education in Italy

IN its column of Weekly Gossip on Literature and Art, the *Athenæum* of December 5 said, "In Italy, Silkworms, Wine-making and Education seem to occupy public attention. Silkworms, it appears, are subject to some sort of infection disease, the nature of which it is important to discover, that precautions may be taken to guard against it. . . . The attention to education we have before noticed; since then, we have seen announced in the periodicals, a 'Manual of Instruction for Infant Schools', a 'Course of Instruction for Girls', and more books for the use of young persons than we can recollect, besides sundry essays upon the subject of Education. We trust, therefore, that the rising generation of Italians will improve accordingly. . . . From Sicily we learn that not less than nine periodicals literary and scientific now flourish there. . ."

Electrostatics: Faraday Borrows a Copper

"HAVE borrowed a copper from Mr. Kipp. It is a new one, not quite finished, and having no cock fixed in it, so that its shape and condition is regular." Thus wrote Faraday on December 5, 1835, and with the borrowed copper proceeded to make the first of his electrostatic experiments. The vessel, a large one of 31 inches diameter, was set up on an insulating stool and charged by means of a frictional electrical machine. Then with a carrier ball—a small sphere covered with tinfoil and suspended by a silk thread—he examined the state of electrification at various points of the surface inside and outside the copper. The surface was touched and the charge taken by the ball transferred to a test electrometer. A series of trials soon showed him that projecting parts of the outside, for example, the edge or rim of the copper, were the most highly electrified. Very little electricity could be obtained from any point inside: the walls near the top were feebly charged, but the bottom showed no charge at all.

Societies and Academies

LONDON

Royal Society, November 21. A. R. UBBELOHDE, J. W. DRINKWATER and A. EGERTON: 'Pro-knocks' and hydrocarbon combustion. Former arrangements for sampling the gases from the engine cylinder have been so modified that the samples can be taken when ignition is made to occur every alternate cycle either in the firing or non-firing strokes. Aldehydes are formed at the end of the compression stroke in the non-fired cycle, but the concentration is much smaller than in the firing stroke. The quantities of formaldehyde and of total aldehydes have been measured when running on various fuels; the amounts produced are insufficient to account for 'knock'; for this, another source of peroxides is therefore needed. Experiments are described which suggest that most hydrocarbon fuels can be made to 'knock', provided molecules which can disrupt and give rise to a branched chain reaction are produced or made available. The main source of the nitrogen peroxide found in the previous experiments is probably the hot active surface of the exhaust valve, and is proved not to be the flame. D. T. A. TOWNEND and E. A. C. CHAMBERLAIN: The influence of pressure on the spontaneous ignition of inflammable gas-air mixtures. (4) Methane, ethane and propane-air mixtures. Whereas with the higher paraffins previously reported on, the ignition points were found to lie in two well-defined temperature ranges, location in the higher range occurring at low pressures, and in the lower

range at higher pressures, with methane or the intermediate products to which it gives rise, they were confined to an upper range even at pressures up to 30 atmospheres. The view previously put forward that ignition in the lower system occurs when temperature and pressure conditions favour the survival and further oxidation of aldehydes (mainly acetaldehydes) has found further support.

PARIS

Academy of Sciences, October 28 (*C.R.*, 201, 749–800). FÉLIX MESNIL : The jubilee of the prevention of hydrophobia produced by a bite. Pasteur's first communication to the Academy was on October 26, 1885. Between July 6, 1885 and January 1, 1935, no less than 51,057 persons have been treated in Paris by the Pasteur method, and of these 151, or less than three per thousand, have died of hydrophobia. CHARLES ACHARD and MAURICE PIETTRE : Researches on the proteins of the cancer cell. The albumin isolated from cancerous tissue has the same composition as serum albumin, but has smaller molecules than the latter. PIERRE LEJAY : A new gravimetric linking of European stations of reference. The establishment of a base at the Pic du Midi Observatory. Details of measurements of the acceleration of gravity (g) at eleven European stations, with the same pair of pendulums. PIERRE LEJAY was elected *Correspondant* for the Section of Geography and Navigation. FRÉDÉRIC MARTY : The structure of the rational fractions and autoprojections of topological coverings. JEAN LE ROUX : The idea of distance. M. PAUL VINCENSINI : Convex bodies admitting a given vectorial domain. PAUL MENTRÉ : Developable inflectional surfaces of complexes of right lines. D. TOÏDZÉ : Integral functions. LUCIEN CHADENSON : The representation of a group of operators in Hilbert space. JEAN THOUVENIN : The application of photoelasticity to the study of shocks. An application of the Séguin-Labarthe ultra-cinematograph taking 4,000 photographs a second. Four of the films obtained are reproduced. E. BARRILLON and CH. CHARTIER : The flow in the mass of a fluid round an obstacle in the form of a house resting on the ground. An experimental study, the results of which are shown in three diagrams. F. ROCHEFORT and JEAN VILLEY : A new type of aviation motor. A method of pulverising fuels such as gas oil, giving homogeneous mixtures. The method has been applied successfully to a 200 horse-power six cylinder aviation motor. BERNARD KWAL : The difficulty concerning the existence of the infinite energy of radiation at the absolute zero in quantic electrodynamics. PIERRE JACQUINOT and TSAÏ BELLING : Measurements of the Paschen-Back effect with the Bellevue electromagnet fitted with supplementary coils. With the additional coils the magnetic field was raised to 65,800 gauss. The line 5789–90 showed a considerable Paschen-Back effect : the displacement of the central component was nearly 0·2 A. and the separation of the violet component reached 0·29 A. E. VELLINGER and J. D. HERRENSCHMIDT : The critical temperature of solution of mineral oils. An application of the method of Chavannes and Simon to the study of the changes brought about in mineral oils by refining. ANDRÉ KLING and MAURICE ROUILLY : Some derivatives given by the action of phosgene, methyl chloroformate, mono-, di- and trichlormethyl chloroformates on cholesterol. ANDRÉ DEMAY : The Carboniferous age of the Guéret granite and on the facies of contact metamorphism of the Dinantian grits and tufas of the Puy-de-Dôme and of Creuse. DANIEL BARBIER, DANIEL CHALONGE and ETIENNE VASSY : Measurement of the reduced thickness of atmospheric ozone during the polar winter. The authors have developed a spectroscopic method making use of stellar spectra for determining the ozone, and give the results obtained at Abisko (lat. 68° 20′ N.). PIERRE MARTENS : Direct fertilisation and cross-fertilisation in *Parnassia palustris*. PIERRE LESAGE : Acquired and inherited precocity at Rennes and Algiers in 1935. TONY BALLU : The determination of the resistance of a soil to the passage of agricultural tools. DAVID BROUN and H. SCHEINER : The physico-chemical state of the adrenaline hormone in the blood. MLLE. LAÏA OLSZYCKA : The quantitative study of the phenomena of synergy. The potentialisation of the hypnotic action in the mouse. ANATOLE ROGOZINSKI and BARUCH SAMUEL LEVIN : The action and hæmolytic dose of the X-rays.

LENINGRAD

Academy of Sciences (*C.R.*, 3, No. 3, 1935). I. VINOGRADOV : Fractional terms of polynomials and of other functions. N. SLIOZKIN : Streamlining a gas-filled envelope by a flat stream of ideal fluid. M. MARKOV : Permutations in a vector model of an atom. J. MENDELEJEV : The abnormal density of water in the depths of Lake Baikal. A. RABINOVITSCH, P. VASILJEV and T. GATOVSKAJA : The Donnan effect in ultra-filtration of colloidal solutions. A. PARSCHIN : Influence of paraphenyldiamine on the chemical processes in striped muscles. V. SILBERMINTZ : Occurrence of vanadium in fossil coals. E. KORIDALIN and S. MASARSKIJ : Seismographic prospecting by the method of reflected waves. I. KOROBKOV : The presence in southern Daghestan of strata analogous to the Priabona strata. A. KOLMOGOROV : Deviations from Hardy's formula in partial isolation. P. NIKITIN : The Miocene seed flora near the town of Tomsk, Siberia. A. SEVERCOV : Recapitulation : morphological and histological. A. BOIKO : Septicæmia of bees and its causative agent.

MELBOURNE

Royal Society of Victoria, October 10. B. J. GRIEVE : (1) The brown rot disease of potatoes in Victoria—the bacterial organism responsible for 'brown rot' or 'sore eye' of potatoes in Victoria is described and identified as a strain of *Bacterium solanacearum*, Smith. The reasons for regarding the organism isolated as a strain are as follows : (*a*) there is little or no production of a brown water-soluble pigment in colonies on agar plates ; (*b*) there is a slight production of acid in glucose ; (*c*) no infection can be obtained when the organism is cross inoculated to tobacco. Earlier reports on the occurrence of the disease and on the organism concerned in Australia are critically discussed. (2) Occurrence of *Bacillus carotovorus*, Jones, causing a soft rot of *Iris germanica* in Victoria. An organism was isolated and its pathogenicity established. Cultural and physiological characters of the organism were found to agree essentially with those of *Bacillus carotovorous*, Jones. The three differences recorded in physiological reactions, namely, non-liquefaction of gelatine, failure to produce indol and absence of definite diastatic reaction, are within the accepted variation of *Bacillus carotovorus*.

Forthcoming Events

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

Monday, December 2

BRITISH MUSEUM (NATURAL HISTORY), at 11.30.—Dr. Ethelwynn Trewavas: "Oceanic Fishes".*

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—E. Shipton: "The Mount Everest Reconnaissance, 1935".

Tuesday, December 3

BEDFORD COLLEGE FOR WOMEN, at 5.15.—Prof. W. Wilson: "Indeterminacy in the Physical World".*

CHADWICK PUBLIC LECTURE, at 8.15.—(in Inner Temple Hall, E.C.4).—Dr. R. C. Maxwell: "Town Planning and the Housing Act".*

Wednesday, December 4

WARBURG INSTITUTE, at 5.30.—Dr. A. Mawer: "The Position of Place-names in Linguistic Studies" (succeeding lectures on December 11 and 13).*

ROYAL SOCIETY OF ARTS, at 8.—Prof. G. T. R. Hill: "Travel in the Stratosphere".

Thursday, December 5

QUEEN MARY COLLEGE, at 5.30.—Prof. H. H. Read: "The North-West Highlands of Scotland".*

Friday, December 6

PHYSICAL SOCIETY, at 5.—(at the Imperial College of Science and Technology).—Prof. Charles Fabry: "Vision in Optical Instruments" (Thomas Young Oration).

BROWN INSTITUTION (UNIVERSITY OF LONDON), at 5.30.—(at the London School of Hygiene and Tropical Medicine, W.C.1).—Prof. F. W. Twort: "Modern Views on the Bacteriolytic Agents and their Relation to Viruses" (succeeding lectures on December 9, 10, 11 and 12).*

BEDSON CLUB (ARMSTRONG COLLEGE, NEWCASTLE-UPON-TYNE), at 6.30.—Prof. J. E. Lennard-Jones: "Modern Theories of Valency". (Bedson Lecture.)

GEOLOGISTS' ASSOCIATION, at 7.30.—W. P. D. Stebbing: "From the Vaal to the Albert Nyanza: a Sketch of the Physiography and Geology along the Line of the Country Traversed".

Saturday, December 7

ROYAL INSTITUTION, at 3.—R. L. Hobson: "Chinese Porcelain".

GILBERT WHITE FELLOWSHIP, at 3.—(at the Art-Workers' Guild, 6 Queen Square, Southampton Row, W.C.).—Prof. F. E. Weiss: "A Visit to the Big Trees of Canada and California" (Presidential Address).

BRITISH INSTITUTE OF RADIOLOGY, December 5–6.—Annual Congress to be held in the Central Hall, Westminster, S.W.1.

December 5.—Dr. C. W. C. Kaye: "Forty Years of Radiology (1895–1935): A Review and Some Reminiscences" (Silvanus Thompson Memorial Lecture).

December 6.—Dr. G. Harrison Orton: "Calcium Changes and their Importance in Diagnostic Radiology" (Mackenzie Davidson Memorial Lecture).

Official Publications Received

Great Britain and Ireland

London School of Hygiene and Tropical Medicine (University of London), incorporating the Ross Institute. Eleventh Annual Report to the Court of Governors, 1934–35. Pp. 16. Report by the Dean on the Work of the School for the Year ended 31 July 1935. Pp. 63. (London: London School of Hygiene and Tropical Medicine.) [611

British Museum (Natural History). Set E 57: British Immigrant Butterflies and Moths. Pp. 10+5 plates. (London: British Museum (Natural History).) 9*d*. [611

An Economic Survey of the Colonial Empire (1933). Issued by the Colonial Office. Pp. vi+573. (London: H.M. Stationery Office.) 25*s*. net. [711

Association of Special Libraries and Information Bureaux. Aslib Book-List: Quarterly Recommendations of recently published Scientific and Technical Books. Vol. 1, No. 1, October. Pp. 24. (London: Association of Special Libraries and Information Bureaux.) Free to Members; 10*s*. 6*d*. per annum to non-Members. [711

Department of Scientific and Industrial Research. Forest Products Research Records, No. 4 (Seasoning Series, No. 1): Timber Seasoning. By R. G. Bateson. Pp. ii+15. (London: H.M. Stationery Office.) 6*d*. net. [811

Middlesbrough Public Libraries. How to Understand the Sciences: a Graduated List of Books for Intelligent People, with Copious Notes on Science, Physics, Chemistry and Biology. Pp. 28. (Middlesbrough: Public Libraries.) [1111

Transactions of the Royal Society of Edinburgh. Vol. 58, Part 3, No. 23: On the Anatomy of a Marine Copepod, *Calanus finmarchicus* (Gunnerus). By Esther Lowe. Pp. 561–603. 5*s*. 6*d*. Vol. 58, Part 3, No. 24: The Fresh-water and Terrestrial Mollusca of Northern Asia. By Alan Mozley. Pp. 605–695+5 plates. 13*s*. (Edinburgh: Robert Grant and Son, Ltd.; London: Williams and Norgate, Ltd.) [1211

Report of the Conference on Academic Freedom, Oxford, August 1935. (Published for the Academic Freedom Committee.) Pp. 94. (Cambridge: W. Heffer and Sons, Ltd.) 2*s*. 6*d*. net. [1311

Collective Index of the Journal of the Institute of Brewing, 1924 to 1934. Compiled by W. H. Bird and Kathleen F. Mapley. Pp. iv+232. (London: Institute of Brewing.) [1311

University College of North Wales. Calendar for the Session 1935–36. Pp. 446. (Bangor: University College of North Wales.) [1411

The Post Office in Pictures. Pp. 64. (London: H.M. Stationery Office.) 6*d*. [1811

University of Leeds in association with the Royal Bath Hospital, Harrogate. Annual Report of the Advisory Committee on Research into Rheumatism. Pp. 4. (Leeds: The University.) [1811

Department of Scientific and Industrial Research. Report of the Building Research Board; with the Report of the Director of Building Research for the Year 1934. Pp. x+174+14 plates. (London: H.M. Stationery Office.) 3*s*. 6*d*. net. [1811

University of Cambridge: Solar Physics Observatory. Twenty-third Annual Report of the Director of the Solar Physics Observatory to the Solar Physics Committee, 1934 August 1—1935 July 31. Pp. 4. (Cambridge: Solar Physics Observatory.) [2011

Other Countries

Department of Science and Agriculture, Jamaica. Bulletin No. 3: The Cultivation of Citrus in Jamaica. Pp. 6. Bulletin No. 5: Maturity Tests for Citrus; a Report on Laboratory Data. By H. H. Croucher. Pp. ii+8. (Jamaica: Government Printing Office.) [1211

Trabajos del Laboratorio de Investigaciones Bioquímicas de la Facultad de Ciencias de la Universidad de Zaragoza. Aportación bioquímica al problema agrícola del nitrógeno. Vol. 2. Por Prof. Dr. Antonio de Gregorio Rocasolano. Pp. 174. (Zaragoza: Universidad de Zaragoza.) 8 pesetas. [1211

Proceedings of the California Academy of Sciences, Fourth Series. Vol. 21, No. 27: The Templeton Crocker Expedition to Western Polynesian and Melanesian Islands, 1933. No. 27: Fishes. By Alvin Seale. Pp. 337–378+plates 20–23. Vol. 21, No. 28: The Templeton Crocker Expedition of the California Academy of Sciences, 1932. No. 28: The Carpenter Bees of the Galapagos Islands. By T. D. A. Cockerell. Pp. 379–382. (San Francisco: California Academy of Sciences.) [1311

U.S. Department of Agriculture. Circular No. 362: Food Habits of the Coyote in Jackson Hole, Wyo. By Olaus J. Murie. Pp. 24. (Washington, D.C.: Government Printing Office.) 5 cents. [1311

Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 87. South African Fishes received from Mr. H. W. Bell Marley in 1935. By Henry W. Fowler. Pp. 361–408. (Philadelphia: Academy of Natural Sciences.) [1311

India Meteorological Department. Scientific Notes, Vol. 6, No. 65: The Thermal Structure of the Upper Air over a Depression during the Indian South-West Monsoon. By N. K. Sur. Pp. 113–120+3 plates. (Delhi: Manager of Publications.) 8 annas; 10*d*. [1411

New Zealand: Department of Scientific and Industrial Research. Ninth Annual Report. Pp. 109+7 plates. 2*s*. Bulletin No. 47: The Grasslands of the South Island of New Zealand; an Ecological Survey. By Dr. F. W. Hilgendorf. Pp. 24. 3*s*. (Wellington: Government Printer.) [1511

Report of the First Scientific Expedition to Manchoukuo under the Leadership of Shigeyasu Tokunaga. Section 2, Part 2: The Geology of the Cheng-teh Area, Je-ho Province, Manchuria, by Saburô Shimizu and Isao Matsuzawa; Geology of the Hsing-Lung-Hsien Area, by Keinosuke Ihara; The Geology along the Route between Ku-pei-kow and Luan-ping, Je-ho Province in Manchuria, by Isao Matsuzawa; A Fossil Insect Nymph from Jehol, by Masuzô Ueno. Pp. iv+32+10+8+8. (Tokyo: Waseda University.) [1511

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 130: Mental Aspects of Accidents at a Machine Factory. By Yenziro Awadi. Pp. 329–344. (Tôkyô: Kôgyô Tosho Kabushiki Kaisha.) 20 sen. [1511

Commonwealth of Australia: Council for Scientific and Industrial Research. Pamphlet No. 56: The Occurrence of Bovine Babesiellosis in Northern Australia. By Dr. J. Legg. Pp. 48+4 plates. (Melbourne: Government Printer.) [1811

Field Museum of Natural History. Geological Series, Vol. 6, No. 13: A Skeleton of Astrapotherium. By Elmer S. Riggs. Pp. 167–176+1 plate. (Chicago: Field Museum of Natural History.) 15 cents. [1911

Ministero dell'Aeronautica: Direzione Generale dei Servizi, del Materiale e degli Aeroporti. Annali dell'Ufficio Presagi. Vol. 6. Pp. 236. Sondaggi aerologici ed osservazioni delle nubi: eseguite nei giorni stabiliti dalla Commissione Internazionale dell'Anno Polare. 28: Gennaio 1933. Pp. 76. (Roma: Istituto Poligrafico dello Stato.) [1911

Recent Scientific and Technical Books

Volumes marked with an asterisk (*) have been received at "NATURE" Office

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Bragg, Sir William. Die Welt des Lichtes. Aus dem Englischen übersetzung von G. Nagelschmidt. Roy. 8vo. Pp. 222 +26 plates. (Braunschweig: Friedr. Vieweg und Sohn A.-G., 1935.) 5 gold marks.

Bubbers, G. A. Arithmetic of Earning and Spending. (Macmillan's Senior School Series, Terminal Book D.) With Answers and Notes. Cr. 8vo. Pp. vi +104 +xvi. (London: Macmillan and Co., Ltd., 1935.) 1*s*. 6*d*.

Burnell, S. W. The Arithmetic of the Triangle. (Macmillan's Senior School Series, Terminal Book E.) Cr. 8vo. Pp. vii +103. (London: Macmillan and Co., Ltd., 1935.) 1*s*. 2*d*.; with Answers and Solutions, 1*s*. 6*d*.

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Science Museum: South Kensington. Handbook of the Collections illustrating Marine Engines. By G. L. Overton. History and Development. Roy. 8vo. Pp. 96 +20 plates. (London: H.M. Stationery Office, 1935.) 2*s.* net.*

Sothern, J. W. M. Marine Diesel Oil Engines. Fourth edition, revised and enlarged. Fcap. 4to. Pp. 1090. (London: The Technical Press, Ltd., 1935.) 45*s.* net.

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Deming, Horace G. General Chemistry: an Elementary Survey; emphasizing Industrial Applications of Fundamental Principles. Fourth edition, rewritten and revised. Demy 8vo. Pp. xiii +774. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1935.) 17*s.* 6*d.* net.*

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Astronomy

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Baker, Robert H. An Introduction to Astronomy. Med. 8vo. Pp. vi +312. (London: Macmillan and Co., Ltd., 1935.) 12*s.* 6*d.* net.*

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Danjon, André, et **Couder, André.** Lunettes et télescopes: théorie, conditions d'emploi, description, réglage. Med. 8vo. Pp. xvi +715 +14 plates. (Paris: Éditions de la *Revue d'Optique théorique et instrumentale*, 1935.) 100 francs.*

Jones, A. Spencer. Worlds Without End. Cr. 8vo. Pp. xv +262 +32 plates. (London: English Universities Press, Ltd., 1935.) 5*s.* net.*

Union Astronomique Internationale: International Astronomical Union. Named Lunar Formations. By Mary A. Blagg and K. Müller. Drawn up by them for Commission 17 and approved at the meeting of the Union held at Cambridge, Massachusetts, in 1932. Vol. 1: Catalogue. Imp. 8vo. Pp. xii +196. Vol. 2: Map of the Moon. By W. H. Wesley and Mary A. Blagg, based on the Fiducial Measures of S. A. Saunder and J. Franz. 4to. Pp. 15. (London: Percy Lund, Humphries and Co., Ltd., 1935.)*

Weisberger, Josef. The Riddle of the Earth-Moon Double Planet: an Open Letter to the Astronomers of all Countries. Med. 8vo. Pp. 20. (Wien: The Author, 6 Postgasse, 1935.)*

Meteorology: Geophysics

Köppen, W., und **Geiger, R.,** Herausgegeben von. Handbuch der Klimatologie. In 5 Bänden. Sup. Roy. 8vo. Band 2, Teil K: Klima des Kanadischen Archipels und Grönlands. 1: Übersicht über das Klima des Polarmeeres und des Kanadischen Archipels, von H. U. Sverdrup; 2: Klima der Küsten von Grönland, von Helge Petersen; 3: Klima des Grönländischen Inlandeises, von Fritz Loewe. Pp. K101. (Berlin: Gebrüder Borntraeger, 1935.) 16 gold marks.*

Kottwitz, G. Der Schwarzwald im Regenwetter: ein Beitrag zur neueren klimatologischen Methodik. Roy. 8vo. Pp. 24 +17 maps. (Tübingen: Heine Verlag, 1935.) 4.80 gold marks.

Royal Meteorological Society. Bibliography of Meteorological Literature. Prepared by the Royal Meteorological Society with the collaboration of the Meteorological Office. Vol. 3, No. 7 (January–June 1935). Roy. 8vo. Pp. ii +245–291. (London: Royal Meteorological Society, 1935.) 2*s.* 6*d.**

Wüst, Georg. Schichtung und Zirkulation des atlantischen Ozeans. Lieferung 2: Die Stratosphäre. (Wissenschaftliche Ergebnisse der Deutschen Atlantischen Expedition auf dem Forschungs- und Vermessungsschiff *Meteor* 1925–1927, herausgegeben im Auftrage der Notgemeinschaft der Deutschen Wissenschaft von A. Defant, Band 6, Teil 1.) Med. 4to. Pp. iv +109–288 +27 plates. (Berlin und Leipzig: Walter de Gruyter und Co., 1935.) 37 gold marks.*

Geology: Mineralogy

Bailey, E. B. Tectonic Essays: mainly Alpine. Roy. 8vo. Pp. xii +200. (Oxford: Clarendon Press; London: Oxford University Press, 1935.) 12*s.* 6*d.* net.*

Brunner, G. J., and **Macelwane, J. B.** The Brunner Focal Depth–Time–Distance Chart. 38 in. × 36 in., with Pamphlet. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1935.) 10*s.* net.*

Firbas, F. Die Vegetationsentwicklung des mitteleuropäischen Spätglazials. (Bibliothek Botanica, Heft 112.) Sup. Roy. 8vo. Pp. 68. (Stuttgart: E. Schweizerbart'sche Verlagsbuchhandlung (Erwin Nägele) G.m.b.H., 1935.) 23 gold marks.

Jung, Jean. Principes de géologie du pétrole. 8vo. Pp. 184. (Paris et Liège: Ch. Béranger, 1935.) 34 francs.

Klebelsberg, R. von. Geologie von Tirol. Sup. Roy. 8vo. Pp. 872. (Berlin: Gebrüder Borntraeger, 1935.) 69 gold marks.

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Geography: Travel

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Andersen, Lis. Lis Sails the Atlantic. Cr. 8vo. Pp. xvi +240 +8 plates. (London: George Routledge and Sons, Ltd., 1935.) 6*s.* net.*

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Dell, A. Morley. The British Isles. (Harrap's New Geographical Series.) Cr. 8vo. Pp. 361. (London, Bombay and Sydney: George G. Harrap and Co., Ltd., 1935.) 3*s.* net.

Diack, Hunter, and **Mackenzie, R. F.** Road Fortune: an Account of a Cycling Journal through Europe. Ex. Cr. 8vo. Pp. vii +319 +16 plates. (London: Macmillan and Co., Ltd., 1935.) 8*s.* 6*d.* net.

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Foran, W. Robert. Malayan Symphony: a Six Months' Journey through the Straits Settlements, Federated Malay States, Siam, Sumatra, Java and Bali. Med. 8vo Pp. 302. (London: Hutchinson and Co., Ltd., 1935.) 19*s.* net.

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Peattie, L. R., and **Peattie, D. C.** The Happy Kingdom: a Riviera Memoir. Demy 8vo. Pp. 263. (London, Glasgow and Bombay: Blackie and Son, Ltd., 1935.) 10*s.* 6*d.* net.

Philby, H. St. J. B. The Empty Quarter: the Great South Desert of Arabia known as Rub' al Khali. Re-issue. Demy 8vo. Pp. 457. (London: Constable and Co., Ltd., 1935.) 7*s.* 6*d.* net.

Piehler, H. A. Wales for Everyman. Edited by John Bartholomew. Fcap. 8vo. (London and Toronto: J. M. Dent and Sons, Ltd., 1935.) 2*s.* 6*d.* net.

Reeves, E. A. Hints to Travellers. Eleventh edition. Vol. 1: Survey and Field Astronomy. Gl. 8vo. Pp. viii +448 +5 plates. (London: Royal Geographical Society, 1935.) 16*s.* net.*

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Stocks, Theodor, und **Wüst, Georg.** Die Tiefenverhältnisse des offenen atlantischen Ozeans. Begleitworte zur übersichtskarte 1: 20 mill. (Sonderdruck aus Wissensch. Ergebnisse der Deutschen Atlantischen Expedition auf dem Forschungs- und Vermessungsschiff *Meteor* 1925–1927, herausgegeben von A. Defant, Band 3, Teil 1.) Roy. 4to. Pp. ii +32 +3 plates. (Berlin und Leipzig: Walter de Gruyter und Co., 1935.) 6 gold marks.*

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Connery, Robert H. Governmental Problems in Wild Life Conservation. (New York : Columbia University Press ; London : P. S. King and Son, Ltd., 1935.) 14*s.* 7*d.*

Cori, C. J. Biologische Tiere : Entwicklung, Bau und Leistung des Tierkörpers. Roy. 8vo. Pp. 280. (Berlin und Wien : Urban und Schwarzenberg, 1935.) 5.60 gold marks.

Daglish, Eric Fitch, Written and illustrated by. How to see Nature : Birds, Beasts and Pond Life. Cr. 8vo. Pp. x+102+x+110+x+108. How to see Nature : Plants, Flowers and Insects. Cr. 8vo. Pp. xii+112+x+142+x+114. (London and Toronto : J. M. Dent and Sons, Ltd., 1935.) 6*s.* net each.*

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Kükenthal, Willy, Gegründet von. Handbuch der Zoologie : eine Naturgeschichte der Stämme des Tierreiches. Herausgegeben von Thilo Krumbach. Band 4, Hälfte 2 : Insecta 2. Lieferung 4. Med. 4to. Pp. 1245–1340. (Berlin und Leipzig : Walter de Gruyter und Co., 1935.) 13 gold marks.*

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Stork, J. W., and **Renouf, L. P. W.** Fundamentals of Biology. Second edition. Cr. 8vo. Pp. xv +454. (London : John Murray, 1935.) 6*s.*

Stowell, Thora. The Book of Animal Life. (Romance of Knowledge Series.) Demy 8vo. Pp. 292+32 plates. (London, Bombay and Sydney : George G. Harrap and Co., Ltd., 1935.) 7*s.* 6*d.* net.

Tucker, Theodore F., assisted by **Pout, M.** How you Grow : a Book for Boys. Cr. 8vo. Pp. 56. (London : The Alliance of Honour, 1935.) 1*s.*

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Karsten, Rafael. The Head-Hunters of Western Amazonas: the Life and Culture of the Jibaro Indians of Eastern Ecuador and Peru. (Societas Scientiarum Fennica: Commentationes Humanarum Litterarum, 7, 1.) Roy. 8vo. Pp. xvi +598 +34 plates. (Helsingfors: Societas Scientiarum Fennica, 1935.)*

Kiekebusch, A. Germanische Geschichte und Kultur der Urzeit. (Wissen und Bildung, Band 301.) Pott 8vo. Pp. 146. (Leipzig: Quelle und Meyer, 1935.) 1.80 gold marks.

Lincoln, Jackson Steward. The Dream in Primitive Cultures. Demy 8vo. Pp. xiii +359. (London: The Cresset Press, Ltd., 1935.) 18*s.* net.*

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Philosophy: Psychology

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Psychologischen Club Zürich, Herausgegeben vom. Die kulturelle Bedeutung der komplexen Psychologie. Pp. vii +625. (Berlin: Julius Springer, 1935.) 26 gold marks.

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Bacteriology: Hygiene

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