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NATIONAL CHARACTER

EVERYDAY assertions of differences in character between one nation and another have for long been maintained in the face of scepticism, and the scepticism has often seemed the more scientific attitude. It is as easy to show confusions, contradictions and over-simplifications in the popular conceptions as it is difficult to find scientific proof of the real differences which, in a confused way, they may be registering. What then should be the role of a scientific treatment of the question? Scepticism is scarcely enough. Differences of national character (in some sense of the term) have certainly not been disproved. That they have also not been proved may well reflect on the crudity of the sociological and scientific techniques at our service. In these circumstances it would seem that a proper function of scientific discussion is that of sympathetically clarifying the popular conceptions and showing what, at their most plausible, they would be, and in what directions scientific proof or disproof could most profitably be sought.

Some such purpose informs an address on national character given by Prof. Morris Ginsberg at a recent meeting of the British Psychological Society. Prof. Ginsberg's caution and legitimate scepticism could scarcely be greater than they are. Yet his attitude towards the popular conceptions is sympathetic and constructive. At the present time such an approach is particularly welcome, attempting as it does a reconciliation between the standards of scientific thinking and the demand for positive contributions to an important topical question of wide interest.

Allowing fully for the effects of prejudice in observers and for the difficulties of defining both 'nation' and 'character', Prof. Ginsberg still thinks it a mistake to dismiss the idea of national character as a mere illusion. Instead, he asks in what direction there lies most hope of detecting and identifying differences in national character. With our present techniques for observing group behaviour he sees small likelihood of demonstrating by direct observation that particular traits of personality are more prevalent among one nation than another. The belief, for example, that the Germans are more docile than the English, or the French more articulate, cannot yet be scientifically

confirmed or disproved by the observation of individual behaviour. As a sociologist, Prof. Ginsberg puts more faith in analysing "the psychological basis of the collective achievements of peoples", their institutions and their corporate policies.

The pitfalls in the way of deducing national character from national institutions are not overlooked. In particular, allowance has to be made for the historical background of the institution (and often its geographical background) and for the class structure from which it emerged. This caution would be needed, for example, in estimating the significance for the English national character of our public schools, our non-conformist churches, our traditions of diplomacy. Prof. Ginsberg is of opinion that these and other similar difficulties can be sufficiently allowed for to permit of some valid deductions as to the national character implicit in collective achievements.

In illustration of this viewpoint he suggests that both the empiricism and the individualism which many observers regard as characteristically English can best be seen in our institutions. Individualism is evident "in the spirit of the English law which is a law of the liberty of the individual subject, in the strength of local government and resistance to centralisation, in the stress laid by Puritanism on the autonomy of the individual and in a very widespread and deeply rooted impatience of compulsion and restraint". An extreme form of individualism is also deeply rooted, according to widespread opinion, in the German character.

But there is an important difference between the two peoples in that among the English the individualism is counterpoised by a capacity for spontaneous organization, seen in the number of our voluntary societies, and in the history of the trade unions, the co-operative movement and the friendly societies. With this goes also the capacity for what Madariaga has called "collaboration in opposition", important no less in politics than sport. Among the Germans, on the other hand, individualism shows itself in politics as "a strong tendency to particularism and discord and an incapacity for wider unions except when they come under the influence of dominant leaders". Prof. Ginsberg inclines to the view that it is the Germans' lack of capacity for spontaneous organization which makes them seek unity through authoritarian discipline. "It is clear that, for whatever reasons, the need for authority is deeply rooted in German life and that the relationship of inferior and superior pervades all spheres of activity."

The English empirical tendency can be shown in our legislation and our politics, in both of which "there is a disinclination to formulate general principles, and piece-meal enactments are preferred". English international policy is especially tentative and piecemeal, its consistency over long periods being due to the constant influence of our geographical and economic situation and not to a formulated plan. The lack of deliberated, abstract planning in the growth of the British Empire contrasts with the French, and still more with the German, policy towards colonial possessions. A similar tendency is to be seen in English domestic politics and Church history : "in dealing with the practical problems of life the English mind prefers to proceed tentatively, by trial and error."

In contrast to the English tendency stands the German concern for system and generalization. The systematic regulation of practical public affairs, and painstaking and exact investigation in scientific work, form one aspect of the Germans' effort to maintain a balance against excessive individualism and vague emotionalism. In their intellectual life, however, there is a liking for abstract generalizations which "do not seem to be reached by analysis of sense experience but rather by a sweep of imagination or fantasy". Here their interest in system "is often not rooted in the need for order, not the product of a drive to classify and understand, but rather of an imaginative longing for grandiose architectural schemes".

It goes without saying that these views cannot claim the status of scientific conclusions. They reflect subjective impressions. But as distinct from impressions of transient everyday behaviour, observed under conditions which are seldom defined and never exactly repeatable, these views are interpretations of a body of permanent material —institutions, writings, historical policies—which remains available for further inspection and re-interpretation. No one, and certainly not Prof. Ginsberg, would deny that by the standards of experimental science we are here on most uncertain ground. Yet a consensus of the opinion of observers who differ in nationality but who are examining much the same data can claim a degree of probability which should ensure serious attention and provisional belief.

To explain differences in national character is even more hazardous than to identify them. The view that national character is based on the biologically inherited constitution of a people, the so-called racial theory, has in democratic countries received ample criticism. Prof. Ginsberg ignores, no doubt wisely, the complication which Jung's doctrine of the 'collective unconscious' has introduced into an already confused problem. But he effectively re-states the objections to the main theory. He insists, however, that we should not go to the other extreme of denying to biological

inheritance all significance as a factor in group character. "Unless we are prepared to deny the inheritance of mental characteristics we must regard it as highly probable that just as there are individual differences there are also group differences and that these play their part in shaping the collective life of groups. . . . The inherited constitution must in some sense put a limit to what can be achieved by social organisation." But Prof. Ginsberg has no hesitation in concluding that historical and social conditions play a much greater part than genetic factors in moulding national character. As he says, "it must be remembered that the range of human potentialities is extraordinarily wide and that upon the same hereditary elements very different social structures may be built. There seems no warrant for assuming any such differences between national groups as would amount to an inherited incapacity of any one for the arts and institutions achieved by another."

The immediate practical significance of this conclusion lies in the consequent recognition that national character is, for all its relative stability, capable of enormous changes. Those who might wish to make an end of the German nation on the grounds of its incorrigibility will find no support in Prof. Ginsberg's careful and comprehensive survey of the problem. He takes the view that even if there is "an inherited element in the character of nations of long standing they nevertheless retain considerable powers of adaptation and the limits of these powers cannot be determined with any accuracy from their previous history".

The means by which profound changes in national outlook and character may come about—such, for example, as the abandonment by the Germans of over-emphasis on authoritarian organization—deserve the fullest attention of social scientists. This question did not fall within Prof. Ginsberg's purview, but it is one on which both sociologists and social psychologists should have important matter to contribute. The former have evidence on the workings of the broader social institutions. The latter may be expected to throw light on the importance in this respect of the characteristic structure of the family in different nations. It is in the family that many of our most enduring social attitudes are learnt and certain fundamental social expectations formed. There can be little doubt that the intimate structure of the family, influenced as it always is by the position accorded to women in the world outside the family, is highly relevant to the emergence of a particular social outlook in adult life. Tempted to despair of a changed outlook in some nations, we have to remember that effective changes in such profound emotional dispositions must occur very largely in childhood—certainly with immense difficulty at any other period—and in the history of a nation like Germany there have not been many generations of children who have grown up during periods when the ideals of democratic co-operation had currency among the adult population.

The impossibility of scientific certainty in predicting the trends of development in national character is no good reason for abandoning all attempt at prediction. Where one observer goes completely astray, another, with greater insight and better opportunities of observation, will be far more dependable. At the present time it may well be that the practical judgment of men of affairs is as good a guide as any more scholarly or scientific assessment. In speaking of the Greeks, for example, Prof. Ginsberg thinks that their recent political and military behaviour "would have been predicted by no student of their character". Yet it is worth while to recall that Mr. Churchill (in "The World Crisis : the Aftermath") reports the belief of Mr. Lloyd George shortly after the War of 1914–18 that "The Greeks are the people of the future in the Eastern Mediterranean. . . . Their fighting power is grotesquely underrated by our generals. A greater Greece will be an invaluable advantage to the British Empire. The Greeks by tradition, inclination, and interest are friendly to us ; . . . The Greeks have a strong sense of gratitude, and if we are the staunch friends of Greece at the period of her national expansion she will become one of the guarantees by which the intercommunications of the British Empire can be preserved. One day the mouse may gnaw the cords that bind the lion" (p. 391).

Some of the urgent, practical needs of warfare, notably the guidance of propaganda, demand the close study and collation of all that is known and alleged about the characters of the various nations. To a great extent such a study must be *ad hoc*, directed to answering limited questions of perhaps transient importance. For not only the relatively enduring character of a nation, but also its more transient moods and the particular aspects of character which are uppermost at the moment, are vitally important to the propagandist. To the statesman who must handle the broad issues of future policy the enduring features of national character and the trends of its development are equally significant. There can be few more important tasks for the social sciences than to contribute to a full understanding of the character, mood and prevailing interests of the nations among which the War is being fought, and by which an international order must be reconstituted, wherein all nations of the world may be able to advance along the road of civilization in peace and security.

THE BEHAVIOUR OF NATIONS

The Behaviour of Nations

An Essay in the Conduct of National Organisms in the Nutritional Field. By Morley Roberts. Pp. xi+180. (London: J. M. Dent and Sons, Ltd., 1941.) 12*s*. 6*d*. net.

THE author begins with an analogy that biological readers find difficult, namely, that between the State or nation and an organism. Its limitations concerning phases and duration of life, integration of component units, reproduction and external relations reduce its value. If, however, even a partial value be attached to the analogy, then the special parallel the author draws between the State and a low-grade organism becomes valuable, for there must be few who have not reflected that the greatest common measure of a large mass of humanity must be low; and Machiavelli has told us this for centuries in his own grim fashion.

Morley Roberts sets forth for us here in all its nakedness, gaunt and unashamed, the Machiavellian doctrine that society is based on force, that groups of mankind inevitably compete for nutrition—by which he means supplies of all kinds—that phases without war are but interludes, usually preparatory to another struggle. To him, leaders are chiefly those who perceive and express the movements of their time for new or increased supplies. He does not know what is meant by international morality, and decries the romantic conceptions of the Churches and other idealists. This is accordingly a book for idealists to read if they still feel disposed to indulge in that form of escapism which devotes itself to making paper plans for a better world.

In the world as it is, occupation without effective power of defence against organized mechanism is not real possession. Holland, Belgium, Norway, Poland, Yugoslavia, Greece, Italy, even France, were not really the possessors of their territories; they were temporary holders until such time as the great mechanism should descend upon them. Paper treaties professing to give security to the weak are frail; even worse, they are death-traps not seldom used by the great mechanism to gain time that it may do one job at a time, and that thoroughly.

Irritated national organisms which are equipped with mechanical power have not been amenable to moral reproof or to the diplomatic nursing that has come to be known as appeasement. Appease them by concession, and, at once, by the very principle of their being, they start scheming for more. Moral reproof, as in the pitiful case of Italy and Abyssinia in 1936, is equally futile, and still more irritating, a still greater excitant for the have-not organism which can obtain mechanical resources. Machiavelli told the Prince that he must either destroy or make a (subordinate) friend of his adversary; intermediate policies are disastrous.

Morley Roberts thinks history is largely a record of social pathology; even some of the more optimistic of us will go as far as to say it tells us, in the main, what comes of choosing the second, often even the third best.

The book is full of challenging opinions. Norway, Holland, Belgium, France were really destroyed before a gun was fired. Nationalism is a dream that is fading, and men in each nation can be found to co-operate with the enemy and to accept his crusade for a unified Europe, based on what the author calls the tribe, wherein are no differentiations, no parties, for parties would mean differentiation. The collapsed nation States of the west and north-west had advanced dangerously far beyond this tribal stage, and they acted as hypnotized rabbits facing a giant stoat. Nothing that has happened in the last three years but could have been foretold by any German boy of reasonable intelligence between Passau and Heligoland as the inevitable line of action of eighty million claustrophobes, lured, as ever, by the open sea and the sunny south, and pressed on by the spectre of the Slav birth-rate. Long-range politics are in large measure a function of the birth-rate. The author is fond of Spinoza's statement that he wished to understand rather than to abuse a thunderstorm, and the publisher refers to the book's passionless analyses; but, for all that, the fire burns fiercely under a biological cover.

There is another picture to be drawn. Units within which there is some legal restraint, some mutual aid, have grown from the days of hunter-collector groups through those of village cultivators and of rival city States to, and now just beyond, those of tribes and nations. What next? Are we to witness rival giant powers, Atlantic or Anglo-American, European or Germanic, Russian or 'Heartland', in the sense of Mackinder's remarkable forecast in "Democratic Ideals and Reality", and Oriental? Or can we try, by reducing divergences of standards of living, to achieve a world order with a backing of adequate strength?

H. J. FLEURE.

SCIENCE OF DIETETICS

Hutchison's Food and the Principles of Dietetics Revised by Prof. V. H. Mottram and Dr. George Graham. Ninth Edition. Pp. xxvii+648. (London: Edward Arnold and Co., 1940.) 21*s*. net.

I THINK some who read this book will have much the same thoughts that flash to mind when, after years, one meets an old friend of boyhood days. Pleasant memories of the past intermingle with instant impressions that his hair is greying and that he has acquired a 'middle-aged spread'.

I first met "Hutchison" nearly thirty years ago when he was a youngster of ten and showing vigorous and sturdy growth. He must have inspired many thousands as well as myself with his youthful enthusiasm for the science of food and nutrition. Then came maturity and well-earned distinction. Now, he is admittedly in early middle age and there appear to be signs that the prime of life is passed. It may be nothing more than a climacteric, because with the ninth edition, and the twenty-third printing "Hutchison" is in the course of becoming "Mottram and Graham". A transition of this character is always rather a critical period in the life of a standard text-book, which it may or may not successfully survive. Some years ago a group of Bayliss's friends—the reviewer was one of them—'revised' his famous book on "General Physiology". The motive was admirable because he was at that time too ill to undertake the revision himself, and his friends and colleagues were happy to show their deep affection for him by taking on a task which he had set his heart on completing. Well-meaning as were our efforts, they were, I think, a failure. The book lost almost all that had formerly reflected the personality of Bayliss himself. Sometimes there is more success, "Kirke" became "Halliburton", "Halliburton" became "McDowall" and, still, after getting on for a century, we have a widely read and 'standard' work.

I feel sure many thousands of "Hutchison's" old friends will sincerely hope that "Mottram and Graham" survive as fortunately, for there is certainly real need for a trustworthy text-book on this subject, particularly at the present time, when knowledge of the composition and function of foods is of such vital importance.

The reader will find in the first five chapters a good general account of current views on the part played by components of food. Of particularly topical interest is the discussion of protein requirements, a subject upon which experts are prone to differ in a rather alarming manner. Few of us realized, I think, how little definite was actually known about the protein requirements of adults until the exigencies of the War brought us face to face with the need for precise estimates. It is one thing for a committee of the League of Nations to sit around a table in peace-time and declare, quite arbitrarily it must be remembered, that 1 gm. per kilo of body weight is the desirable daily intake of protein for any ordinary man or woman. It is a very different story when an estimate is required of the least quantity of protein that must be provided to keep the population in good health under war, or even siege, conditions.

Uncertainty of a no less disturbing nature troubles us when we try to provide for the children, and one cannot but admit a feeling of humiliation when so great a volume of literature on protein reveals so little clean-cut information.

The chapter on vitamins is not the best in this section of the book. It is a little scrappy and could be greatly improved with small effort. For example, the references to the part played by vitamin D in calcification of bones and teeth is particularly disappointing. The reader might easily get a wrong impression from a statement such as that on p. 130 that the members of this group of vitamins act as catalysts at the site of calcification. There should have been a wider treatment of the influence of these vitamins on absorption of bone-forming elements, particularly phosphates, from the gut. Last, but by no means least, there is reference to Mellanby's "toxamin", which has been 'as dead as mutton' since the function of phytic acid in cereals was revealed.

The chapters on the composition of foods provide, as they have always done, a wealth of useful information. They would be even better if subjected to a little judicious pruning here and there, for one still comes across analyses and comments which seem to date from the 'good old days'.

This is a minor criticism but by no means an unimportant one. It may be illustrated by reference to the chapter on wines, which dates, all too obviously, from the days of Thudichum and Dupré's classic work, which, however dear to the heart of a wine-lover, is scarcely to be regarded to-day as a standard work on the composition of wines. The table of analyses on p. 457 is a museum

piece for a Victorian setting, but it strikes no note to-day, except one of sorrow for the passing of the lovely Château d'Issan, a victim of the tragic year 1932.

There are several useful chapters on practical dietetics in health and in sickness. They, too, need a little further careful pruning and grafting here and there to make them as good as one would wish, but they contain a great deal of valuable information. J. C. D

THE USES OF X-RAYS

Applied X-Rays

By Prof. George L. Clark. (International Series in Physics.) Third edition. Pp. xvii+674. (New York and London: McGraw-Hill Book Co., Inc., 1940.) 42*s*.

IT was the late Lord Rutherford who reminded us again and again that the advance of knowledge depends upon the development of technique. Alongside this, it is equally certain that the last decade or so has provided a continuous reciprocity between the fascinating task of finding new outlets for applied physics, and the urge to press on still further with instrumentation in order to attack new problems. Probably this dual process is nowhere better seen at work than in the field of X-rays. A bare half-century has in fact sufficed to bring us from that charmingly modest—almost detached—announcement by Roentgen at Würzburg to the present moment, when X-rays are nothing accounted of in everyday life.

A consequence of all this is that to appreciate what X-rays can do constitutes a minor research in itself, since their uses extend to almost every industry, and to medicine, biology and the arts. A case in point is that of non-destructive testing. To control at every step the fabrication of a product is often essential, but may be comparatively easy, since one is not confronted with the complexity and value of the finished article. Obviously, only very special physical methods can cope with this final stage, at which X-rays have proved their worth time and time again. Examples are the examination of golf-balls for correct concentration, of shells and cartridges for proper filling, the counting of packed materials, including the possibility of locating 'foreign bodies', whether they got there by accident or by design.

Of more purely scientific interest has been the rapid advance in our quest for substances displaying exceptional properties, like the long-chain polymers, and synthetic materials in general. X-rays have been the means whereby the desired characteristics can be explored, and the edifice erected according to the laws of molecular architecture. Strength and resilience, plasticity and flow, are features which are not beyond us to produce at will. Moreover, when the work is done, it may well be a thing of beauty and a joy for ever.

In the third edition of his "Applied X-Rays", Prof. Clark provides a distinguished survey of the whole terrain of X-ray applications. He is careful to devote a considerable portion of his book to a detailed discussion of the tools at command—tubes and high-tension equipment—together with the amount of theory essential for the proper interpretation of results. This portion is decidedly well done; it avoids the common mistake of overloading the text with complexities far in excess of the needs of most readers. There is a somewhat large corpus of semi-classical subjects like X-ray and atomic spectra, which might perhaps have been more curtailed: it is a moot point how necessary these topics are in a volume dedicated essentially to applications.

It is likely that the chapter on radiography will give the reader the greatest satisfaction, for the reason that it brings together a host of matters rarely found in print together. In the section dealing with the arts, there are unfortunately a number of minor inaccuracies; an important point, however, which the author scarcely makes clear, is that the success—or otherwise—of a radiographic investigation of a painting depends largely upon the varying thicknesses of paint traversed, and not upon their chemical composition. Coal-tar pigments, naturally, do not occur in the Old Masters, and yet X-ray results have often proved extremely revealing in such cases. The reason lies in the fact that the visible paint layers are very thin.

A most intriguing subject is that of micro-radiography, in which a small exposed spot is magnified about a hundred times microscopically, or by projection. A plate of illustrations shows the capabilities of the method.

Prof. Clark has produced an admirable guide to the applications of X-rays; his volume is expensive, but there is nothing quite like it in Great Britain. It can be sure of a welcome.

F. IAN G. RAWLINS.

STEREOGRAPHIC PROJECTION

The Stereographic Projection

By F. W. Sohon. Pp. ix+210. (Brooklyn, N.Y.: The Chemical Publishing Co., Inc., 1941.) 4 dollars.

F. W. SOHON, S.J., director of the Seismological Observatory of Georgetown University, has written a very valuable book. This is a method of representing a solid body (usually figures on the surface of a sphere) on a plane, the centre of projection being a point on the surface of a sphere, and the whole sphere being represented once on an infinite plane. The projection has the merit that circles are represented as circles and that angles are retained. The book was not intended by the author to be exhaustive, but it contains a good selection of proofs, some by vector methods, and explicit applications to many problems including some in astronomy, hydrodynamics and seismology.

The seismological problem discussed by Sohon is the determination of the epicentre of an earthquake from a knowledge of its great circle distances from several seismograph stations by the semi-tangent method using geocentric latitudes (compression $\frac{1}{297}$). The degree of accuracy of this method will naturally depend on the accuracy of the seismograph timing, the accuracy of the travel-time tables for the two pulses recognized, and the degree to which the depth of focus may be allowed for in computing the great circle distances.

The book is recommended to students and research workers in mathematics (especially geometry, differential geometry, complex variable and hydrodynamics), cartography, astronomy, seismology and crystallography. It is handy in form, well arranged, printed and produced, contains tables including stereographic projection elements for all seismograph stations computed by Weston-Woodstock students, and there is an adequate index. E. T.

POWER PLANT FOR AIRCRAFT

Aircraft Engines

By A. W. Judge. Vol. 2. Pp. vii+446+93 plates. (London: Chapman and Hall, Ltd., 1941.) 30*s*. net.

THIS is the second volume of what is intended to be a comprehensive treatise on aircraft engines and accessories. The first volume, reviewed in NATURE of February 8 (p. 158), dealt largely with the factors which influence the performance of the engine under varying conditions of operation, but included also descriptive matter relating to carburetters, superchargers and cooling devices. The present volume deals mainly with engine types, details of construction, the remaining accessories, operation and testing.

Steady and rapid improvements in specific output and economy have taken place in recent years, largely due to supercharging, higher compression ratios, the use of light alloys and of high-tension steels. In the twelve years prior to 1940, speed has increased from 1,800 to 2,800 r.p.m., and piston speeds of more than 2,500 ft. per min. are now normal practice. Brake mean effective pressures have also increased from 125 to 220 lb. per sq. in. and more, so that the b.h.p. obtainable from a given cylinder capacity has increased by 150 per cent in this period. There is little doubt that these figures are conservative in relation to still more recent developments, and the author quotes brake mean effective pressures of more than 300 lb. per sq. in. at 2,400 r.p.m. which have been obtained from engines operated by sleeve valves.

In making comparisons between different types of engines, there are a number of important factors to be considered. These include power plant drag, moments of inertia of the engine about axes perpendicular to the axis of rotation, vulnerability to attack in the case of military aircraft, specific fuel consumption, specific weight, reliability under operation at full power for lengthy periods, accessibility for overhauls and adjustments, possible obstruction of view of pilot, convenience of attachment to fuselage, variations of torque reaction, cooling arrangements and silencing. The degree of complication involved will also influence the cost of manufacture and rate of output, in addition to increasing the necessary stock of spare parts. The relative importance of the different items will, of course, depend upon the nature of the duty for which the engine is designed, and this accounts to a large extent for the variations in size and type of the engines in actual use.

The author of the volume under review has borne all of these factors in mind and has presented a considerable amount of information which is not easily available in other than scattered publications, a list of which is given in an appendix, and gives a clearer picture of modern developments, accompanied by diagrams and illustrations which are really informative. Search for information on a particular type of engine or accessory, which is facilitated by an excellent index, seldom fails to supply the required data in a concise but intelligible and useful form.

The development, present position and future possibilities of the compression-ignition engine, both two-stroke and four-stroke, are given adequate discussion and accompanied by descriptions of recent types. There are undoubted possibilities in compression-ignition engines for long-distance flights, particularly where flights at high altitudes are concerned, and in some respects the design problems are simpler than is the case with road vehicles operating at widely varying loads and speeds, so that the information and data given by the author will be welcomed.

Components, lubricating systems, the ignition system and exhaust systems all receive concise but adequate treatment, and in no case does the author descend to mere catalogue particulars.

There are very few misprints, and these are fairly obvious. On p. 225 the author refers twice to the 'Mitchell' thrust bearing, on p. 324 a plug gap of 0·24 in. is mentioned and on p. 372 the Kadenacy effect is referred to as an exhaust pipe effect, which is, of course, not the case.

The publishers have studied the convenience of users by the adoption of a flexible type of binding which permits of the book being left open at any desired page, by the clear reproduction of the numerous diagrams and half-tone illustrations, and the clearness of the type used.

Generally the second volume maintains the high standard of the first volume, and is a very useful and up-to-date contribution to the study of aircraft engines. A. T. J. K.

ELECTROCHEMISTRY IN THE UNITED STATES

Industrial Electrochemistry

By Dr. C. L. Mantell. (Chemical Engineering Series.) Second edition. Pp. x+656. (New York and London: McGraw-Hill Book Co., Inc., 1940.) 38*s*.

THE first edition of Dr. Mantell's valuable work has been thoroughly revised and brought up to date, and has grown by some 130 pages in the process. The text has been rewritten almost entirely, so much so that it may be asked whether the author has not taken unnecessary trouble in this respect, since quite large portions of the present version are mere paraphrases of the original.

A feature of the book which cannot fail to strike an English reader is that it appears to indicate the United States as the source of nearly every electrochemical discovery and development subsequent to those of the early pioneers. While admitting the great progress made in the United States and the magnitude of its electrochemical industries, it is to be hoped that the importance of maintaining the international character of the best scientific works is not being forgotten. Such a state of affairs has prevailed for some time in certain parts of Europe, where it is probably due to a deliberate national policy. No such accusation is made against the author of the present work, for it is clear that the fault, if such it can be called, is not easily avoidable. The best chapters are evidently compiled from data supplied by men with a thorough practical knowledge of their subject, and it is to this fact that they owe their excellence. Any attempt to apply the same procedure for foreign countries must necessarily be very difficult and, in present circumstances, almost impossible. Rather than present second-rate material, the author has decided to confine his attention to a high-grade, but somewhat restricted, source of supply.

It is suggested that the difficulty might be met in a future edition by largely increasing the number of references to foreign literature and by adding a few more descriptions of European plant when obtainable. Space for this could be saved by omitting much of the theoretical matter, which may be found in any text-book on physical chemistry, the chapter on electronics and most of the appendix; surely a table giving the pounds of xenon deposited by 1,000 ampere hours is not of much practical importance.

Leaving the question of nationalism, which is perhaps a side issue, full support may be given to the author's contention that electrochemical engineering should be regarded as a branch of chemical engineering. Chemical engineering involves not merely a description of plant, but also its efficient operation, and for this purpose data are required. The chapters on electro-plating, electro-refining and electro-winning, which have

been expanded very considerably and, as already mentioned, bear the impress of the expert, are of particular value in this respect. They illustrate also the importance in commercial practice of small traces of impurities and the careful control of conditions, factors which are sometimes neglected by the inexperienced.

The short chapter on power generation and economics, while admirable for its conciseness, might be further expanded with advantage, and the same applies to materials of construction for electrochemical apparatus, which, considering their importance, are treated with undesirable brevity. On the other hand, the first part of the chapter on electrical discharge in gases seems somewhat out of place.

The whole work is profusely illustrated with flow sheets, diagrams and drawings of plant, while the text is clear, carefully arranged and with no suspicion of dullness. In short, this member of the Chemical Engineering Series is fully up to the high standard of its predecessors and in some respects is in advance.

H. E. WATSON.

REPTILES OF CEYLON

The Tetrapod Reptiles of Ceylon
Vol. 1: Testudinates and Crocodilians. By P. E. P. Deraniyagala. (Colombo Museum Natural History Series.) Pp. xxxii + 412 + 24 plates. (Colombo: Colombo Museum; London: Dulau and Co., Ltd., 1939.) 10 rupees; 15*s*.

MUSEUMS of natural history exist in order that they may make collections, and by the development of systematic zoology and botany, and of similar aspects of mineralogy and geology, so organize them that they are available to scientific workers. Their own publications have therefore been concerned primarily with taxonomy, taking the form of systematic catalogues. But recently, when old-fashioned 'systematics' have reached a point at which further exploitation has given diminishing returns, the interest of museum staffs has spread into wider fields, and such portents as the establishment of a department of experimental zoology, with an exceptionally well-equipped laboratory, by the American Museum of Natural History, have made their appearance.

Thus the publication by the Colombo Museum of a "Monograph of the Tetrapod Reptiles of Ceylon", which in 412 pages discusses only ten species of Chelonia and Crocodilia, is less surprising than it would have been ten or twenty years ago.

In this most interesting work, the author, Mr. P. E. P. Deraniyagala, gives very full and excellent taxonomic descriptions of these species, which are founded on abundant materials and include valuable quantitative accounts of the range of variation within each species. But he adds to this expected information an immense mass of 'natural history'. His own work in the field and the laboratory, combined with facts drawn from the experiences of commercial fishermen and country dwellers, has enabled him to record the life-history of these reptiles, their nesting habits, the time of incubation, the behaviour of the young, their rate of growth, the feeding habits of the adult and indeed to enable us to see them as living animals pursuing their daily lives in the seas and lands of Ceylon.

Such information has very seldom been brought together in a collected form, and is most useful to anyone who, as a palæontologist or otherwise, has to consider the possible habits of animals, so far as they may be deduced from their structures.

In addition to this mass of new knowledge, the author gives us more. He has fetched into the laboratory, or rather into the garden, the eggs of some of these reptiles and has followed the course of the development of their external features in stages of a known age of incubation. The most important and interesting form with which he has worked is Dermochelys, the leathery turtle, an animal which differs so much from all other living Chelonia in the structure of its shell that it has necessarily taken a leading place in all discussions of Chelonian phylogeny. Mr. Deraniyagala not only collected the eggs of this animal and hatched them artificially, but also was able to rear the young, and indeed keep an individual until it was accidentally killed when nearly two years old. He has thus been enabled to give much new and most interesting information about the whole course of development, including that of the shell.

The monograph includes similar, though usually less complete accounts of the development of other forms, and for many of them gives an account of the development of the bones of the head, especially of those relatively late stages which have so seldom been considered, but which often present facts of much interest.

The whole is richly illustrated by the author's own often very vivid drawings and by photographs, and reflects great credit, not only on the author, but also on the Museum of which he is the director.

D. M. S. WATSON.

THE ORIGIN OF LIFE*

By Dr. C. F. A. Pantin, F.R.S.
Department of Zoology, University of Cambridge

UNTIL one hundred years ago the origin of living organisms was not a major problem in biology. Apart from the biblical creation, the view was frequently held that many at least of the simpler organisms were produced by spontaneous generation. The ease with which this idea was accepted was partly due to imperfect observation and partly to the view that there was a completely graded sequence between the living and the non-living. This found its most complete expression in the detailed 'scale of beings' of the eighteenth century. The disproof of individual cases of abiogenesis did not change this attitude until Pasteur showed that every supposed case of spontaneous generation was, in fact, due to infection by living organisms.

Pasteur's work raised the question of how the first organisms came into being. The publication of the "Origin of Species" made this one of the fundamental questions of biology. It is certain that at one time life, as we know it, could not have existed on earth. It must, therefore, either have arisen spontaneously from lifeless matter or have been conveyed to the earth from elsewhere after it had become inhabitable. The theory that life originated by infection from without has been discussed by Arrhenius and others. Bacterial spores may be conveyed to outer space by being carried to the upper atmosphere and then repelled from the earth by virtue of their electrical charge. Arrhenius showed that light pressure could then distribute such spores throughout the universe at an astonishingly high speed. In this way it would be possible to spread life from planet to planet. But apart from the fact that this hypothesis only shelves the question of how life began, it is rendered impossible by the physical conditions to which any living organism must be exposed in outer space. Spores might survive intense cold or a fair degree of heat. But they could not withstand the intense short-wave radiation from which we are shielded by the oxygen of our atmosphere. A minute spore can have no protection against this radiation, for the individual molecules of which it is composed will be destroyed.

We are thus forced to suppose that life began on this earth, and Pasteur's experiments must be taken to mean that life can only begin under very special conditions and that such special conditions must be sought for in the geological past. We can therefore ask three questions: What were the first organisms like? When did they arise? Under what conditions did they arise?

Evolution has carried life from simple to more complex organisms. Side by side with the complex existing organisms we find others which are far simpler. It was supposed that among these we might find more or less unchanged survivals of the primitive living organisms of an earlier age. There is much to be said for this view, though it involves a very important assumption. Evolutionary trees were made and still are made which are based upon it. Haeckel constructed a phylogeny based on existing organisms. An amœba was not only an existing organism, but its grade of organization also corresponded to that of an actual ancestor. More primitive than amœba was Haeckel's 'monera', structureless protoplasm supposedly without a nucleus. Existing monera disappeared in the light of investigation, but the idea of a 'primordial slime' remained.

'Primordial slime' was an invention of zoologists. It was, therefore, an animal. But animals require food, and their normal food can be traced to plants. Ray Lankester tried to evade this difficulty by supposing that original organisms "fed upon the antecedent products of its own evolution". One must, however, explain the presence of 'albuminoids' in a suitable form for animal consumption, and also how the animals obtained oxygen for respiration. There is good reason for supposing that all our oxygen was produced by plants; and the physical and chemical requirements of plants for growth are far simpler than those of animals. Church supposed that the first organism was a planktonic flagellate producing its substance by photosynthesis.

It is difficult to suppose that an organism so complex as a flagellate could arise by the spontaneous aggregation of its parts from non-living material. Even the smallest flagellate must contain about 10^{10} organic molecules. But is the aggregation of matter into a simple organism so improbable as it seems? May their morphological complexity be a natural property like the complexity of crystal structures? Leduc reproduced some of the obvious features of living organisms by inorganic models such as osmotic growths in silicate solutions. But the correspondence between these models and living organisms was very incomplete, and unquestionably the structure of a flagellate is

* Substance of a lecture delivered at the Royal Institution on May 27.

far too complex for us to suppose that it has arisen spontaneously. Nor is there any need for us to suppose this, because there exist much simpler organisms than flagellates.

The smallest known living organisms are the bacteria. These grade into the yet smaller viruses. It is a question of definition whether the latter are considered as living or not. Bacteria are of far simpler organization than flagellates. They are still, however, sufficiently complex to make it difficult to suppose that any bacterium could ever have come into being by the chance aggregation of material. They are saprophytes and require complex organic media which they make use of in very varied ways. Many are anærobic. In the viruses we have still smaller units than bacteria. Their properties as infective agents resemble those of pathogenic bacteria. They possess properties which are associated both with living and non-living systems. Their power of growth and reproduction is a characteristic feature of living organisms. At the same time their extremely small size overlaps the size of large molecules, and they have been obtained in the crystalline state. It seems scarcely possible to make this property agree with our normal ideas of the structure of living matter. Instead of a complex arrangement of different kinds of molecules on a small scale, it seems that some viruses simply consist of nucleo-protein molecules. Whether the virus particle is living or not, it is always associated with living tissue, though we may yet find a non-living medium suited to its requirements.

Our search for the simplest type of existing organism leads us into a rather curious position. We can find bacteria of smaller and smaller size, and still smaller things, the viruses. Whatever view is taken of the nature of the virus, it certainly makes conceivable the existence of living material on an almost molecular scale. From the point of view of finding the simplest organism, this is certainly a great step forward. But from the point of view of conceiving of the first living organism, what has been 'gained on the swings seems to have been lost on the roundabouts'. Compared with plants the chemical environment required by bacteria is very complex and varied. It may even require the absence of oxygen. Viruses even seem to require living tissue itself for their existence. While it is easier to suppose that these minute forms might arise spontaneously, we can only suppose their existence in an environment which is very different from, and much more complicated than, that which exists to-day. The origin of a suitable environment becomes as much a problem as the origin of the organism.

When and under what conditions did life arise ? It is still one of the remarkable facts of palæontology that the fossil record suddenly fails below the beginning of Cambrian times. Unequivocal remains of Pre-Cambrian organisms are few, and none are easy to interpret. Yet the abundant fauna of the Cambrian itself already shows all the main groups of animals, so that there must have been a long period of evolution before this time. Though poor in fossils, Pre-Cambrian rocks offer important information. The oldest rocks dated by radioactive methods are some 1,700 million years old. Before that there is evidence of sedimentary rocks which it has been suggested carry us back to 2,000 million years. Radioactive study of the age of meteorites leads us to conclude that the age of the solar system is not greater than 2,800 million years. Estimates by other methods agree with this. We can therefore examine rocks which cover a substantial portion of the earth history. The occurrence of graphite in the Pre-Cambrian is of particular interest because it suggests the early existence of organic matter and possibly of life. Most of the evidence of the earliest rocks suggests that conditions on the Earth's surface did not differ substantially from those of the present day. The existence of very old sedimentary rocks indicates the existence of exposed land and familiar weather conditions. There is some reason for supposing that the sea has not altered fundamentally in its composition since very early times. The Earth probably only took a matter of thousands of years to cool to approximately its present temperature ; and there appear to have been Pre-Cambrian ice-ages. Whatever factors control the temperature on the earth, they appear to have operated for a very long time.

There is, however, evidence of one important change in the course of Pre-Cambrian times. These ancient rocks have been exposed to great changes, but there is some reason for supposing that before the middle Pre-Cambrian iron was laid down in them in the ferrous form, and not until after this time was it laid down in the fully oxidized ferric form. This is important because it suggests a lack of oxygen in lower Pre-Cambrian times. The idea that the early atmosphere lacked oxygen is an old one. The present oxygen content of the atmosphere certainly depends on plants. Photosynthesis by marine planktonic diatoms alone produces oxygen at a rate which would regenerate the whole oxygen of the air in about 100,000 years—a geologically negligible period. Photosynthesis by plants may have become an important factor in middle Pre-Cambrian times. Before that an atmosphere of carbon dioxide such as that which occurs upon Venus probably predominated on the earth. The geological record thus suggests the existence of organic matter at a

very early period under physical conditions not wholly different from those of the present day, except that there may have been a change from anærobic to aerobic conditions during the Pre-Cambrian.

The early presence of an anærobic organic medium finds support from another quarter. We know now that the larger planets have developed enormous atmospheres of hydrocarbons and ammonia from the solar material of which they are composed. The overwhelming reducing character of this material thus leads to the development on a planet of an anærobic organic medium. In a planet such as Venus, there has been further atmospheric evolution through the inability of the gravitational field to retain hydrogen, so that carbon dioxide has been produced. Venus and the Earth are very close in size. A similar condition must once have prevailed on the Earth, and would rapidly do so again if photosynthesis ceased. The reducing character of planetary material leaves no place for free oxygen except through the intervention of photosynthesis or some analogous process.

We do not know how complex would be the organic molecules formed in the original medium. Molecules of kinds utilizable by bacteria would fairly certainly be produced. We have seen that still simpler organisms require a still more complex organic environment, the nature of which we do not yet know. It helps us little to point out in our ignorance that an original planetary organic medium might develop the required environment. But one thing seems certain, an organic environment developed in physical equilibrium on a planet could not of itself develop living organisms. For one of the characteristics of life is that its existence requires a supply of energy, either as radiation or as substances at a higher chemical potential than their surroundings. A system in equilibrium cannot provide this; but solar radiation might have done so, at least before the atmosphere developed oxygen and absorbed its most active components.

The answer to the question "How did life originate?" thus seems to depend on the question "What are the environmental requirements of simple bodies such as the viruses, and could these requirements have been met in the original organic environment?" The answer to these questions will carry with it the answer to many other fundamental questions in biology.

THE SEARCH FOR ECONOMIC PLANTS*

By ARTHUR W. HILL, K.C.M.G., F.R.S.
DIRECTOR, ROYAL BOTANIC GARDENS, KEW

THE history of the spice plants has been dealt with at some length since they have played so important a part in geographical discovery, territorial acquisitions, and wars between European nations. There are however several plants of great economic importance which have travelled far from their lands of origin, of the wanderings of which we have no certain records. Among these are the coco-nut, sugar cane, banana, cassava, ground nut, and possibly the West African oil palm.

The coco-nut has no doubt been transported partly by ocean currents and partly by natives voyaging from island to island in the remote past when they took the nuts with them for food and planted them in the islands or coastal regions to which they migrated. Of ocean transport we have recent evidence in the germination of coco-nuts washed up on Anak Krakatau IV in 1932. The original home of the coco-nut seems definitely to have been the East Indian Islands, whence it has travelled to the West Indies and to America.

* *Continued from p.* 16.

Sugar cane, also East Indian, must have been similarly conveyed by natives for food on their voyages and then planted by the settlers in their new homes. In this way it has been distributed throughout the tropics before the existence of historical records. The edible banana, probably native in Thailand and Malaya, must also have been transported in much the same way.

Both the ground nut (*Arachis hypogea*) and the oil palm (*Elæis guineensis*) afford puzzling problems. The ground nut is now the staple product of The Gambia, but all its near allies are natives of Brazil and there is none in Africa. Similarly, the closely related species of Elœis occur in Brazil, but there is an allied species in Madagascar. It is an open question whether either economic plant is truly native in West Africa; if not, then it seems probable that natives voyaging from Brazil to West Africa may have brought over both the ground nut and oil palm, and also the American cassava (*Manihot utilissima*), as food in their

vessels, and so they became established on the west coast of Africa.

The cashew nut (*Anacardium occidentale*), much used in confectionery and like salted almonds and pine kernels on our dinner tables, which is a native of tropical South America, was introduced into South India in early days probably by the Portuguese. South India now supplies the major part of the world demand, and particularly the large markets of the United States of America. Nearly all the nuts imported to Great Britain and to the United States come from the south-west coast of India. Cheapness in the preparation of the product is the main reason for this somewhat anomalous condition of affairs.

Two misconceptions as to the original homes of economic plants may be mentioned here. First, the Jerusalem artichoke had nothing to do with the Holy Land—the name Jerusalem probably being a corruption of Terneusen in Holland, as Sir David Prain has ingeniously suggested, where tubers were first landed when they were brought over from America. Nor were either the New World pine-apple or prickly pear to be found in the Garden of Eden as figured by Parkinson on the title-page of his "Paradisus".

Coming to more recent times, one is reminded of the attempt by Captain Bligh in the ill-fated voyage of the *Bounty* to introduce the bread fruit (Artocarpus) from Tahiti to the West Indies, and of the success of his efforts on his second voyage, and of the introductions of economic plants and also, alas, of weeds to Australia and New Zealand as impurities in the seeds of the imported crop plants.

A brief reference must be made to the introduction of Cinchona and Para rubber from South America to Kew, and thence to India, Jamaica, Ceylon and Malaya, in 1861 and 1876 respectively. Flourishing plantations of Cinchona exist in the Nilghiri Hills and at Mungpoo and Munsong near Darjeeling, but those in Jamaica have not been maintained. Attempts are now being made to extend the cultivation in East Africa and also in Panama and Porto Rico. Java, however, is the chief source of the drug, mainly because the climate of the island is particularly favourable for the cultivation of the species which yield the greatest amount of quinine. Java, unlike India, has two rainy seasons, the south-west and north-east monsoons, which produce conditions very like those which occur in the Andes. The soil also is very favourable, but Java's success with *Cinchona Calisaya* types is mainly due to climate. Java has also been fortunate in obtaining seed of a high-yielding form of *C. Calisaya—C. Ledgeriana*—which has flourished under Javan conditions.

After the stocks of *C. succirubra* and *C. Calisaya* had reached India, Mr. Charles Ledger, who had obtained seed of a high-yielding form of *C. Calisaya* collected near Pelechuco, to the east of Lake Titicaca, offered this seed to the superintendent of the Government Cinchona Plantations at Ootacamund, who rejected it. He then offered it to the Dutch, who had been experimenting, somewhat unsuccessfully, with Cinchona in Java. The Dutch bought the seed, and so came about the flourishing industry in the island.

One of the assistants in the Nilghiris, however, a gardener from Kew, extracted some of Ledger's seed, and sowed half of it in the Nilghiris and sent the other half to Mungpoo. When the superintendent saw the seedlings and learnt their origin he had them all thrown away. Those at Mungpoo, however, were under the care of Mr. Gammie, who appreciated their value and kept them; they proved to be as valuable as had been stated by Ledger. This form and other good-yielding strains of *C. Calisaya* are still in cultivation at Mungpoo and Munsong. In any event, as it has since been found, *C. Calisaya* and its forms do not succeed under the conditions in the Nilghiris, nor do they thrive quite as well in northern India as they do in the better climatic conditions of Java.

More recently Kew has taken an active part in the growing and distribution of species of Hydnocarpus (Flacourtiaceæ), native in Burma, Indo-China and the East Indies, the seeds of which yield chaulmoogra oil, a specific for leprosy. With regard to this product it is interesting to mention that the resident physician of an asylum at Bangkok was treating the lepers there and trying to get chaulmoogra oil for the purpose when a botanist visiting the hospital was able to point out that supplies were close at hand: a tree was actually growing in the hospital compound, and it grows plentifully in Thailand.

Seeds of Aleurites (Euphorbiaceæ), the source of the Chinese tung oil, a high-class drying oil used for paint and varnish, have also recently been distributed by Kew to suitable parts of the Empire.

The recent widespread introduction of plants of economic importance to the tropical possessions of Great Britain and other countries has opened up political, as well as botanical, problems of considerable difficulty.

The growing of the West African oil palm in the Dutch East Indies, where they have been fortunate in establishing a pure-breeding type of good quality oil palm, is a case in point which may set up a state of economic warfare, as also the establishment of the clove industry in Madagascar and cocoa in West Africa versus Trinidad. The effect of the sugar beet subsidy on sugar-cane

cultivation in the West Indies, the competition of sisal in East Africa with the native product from Mexico, and the plantations of uniform varieties of New Zealand flax in the Argentine afford further examples where economic botany and policy may conflict.

Then again, the ease of transport and the cultivation of economic plants under plantation conditions disclose serious botanical problems. Not only may insidious diseases be easily transported by air, but also large areas of crops grown under plantation conditions afford a very ready means for the spread of any insect or fungus disease. Among the diseases which now threaten important economic products may be mentioned the Panama and the leaf spot diseases of bananas. Cacao witchbroom of cocoa, mosaic of cassava and other economic crops, wither tip of limes and cloves in particular. Such maladies necessitate researches in order to try to produce forms and varieties which may be immune to the diseases, and research in this direction is being undertaken especially by the Imperial College of Tropical Agriculture in Trinidad (see NATURE, March 8, p. 282; March 15, p. 313; March 22, p. 344; March 29, p. 380) and the East African Research Station, Amani, as well as by specialist officers in the Departments of Agriculture in the Dominions, Colonies, and in India. Attempts are also being made to discover higher-yielding forms of such economic plants as sugar cane, rice, para rubber and cacao, by cross-breeding and selection, and when found, propagating them by budding and grafting, cuttings or seed.

With regard to bananas, research is being undertaken to find wild types of Musa in the original home of the edible banana, in the hope of finding types immune to Panama disease, which can be used for cross-fertilizing with cultivated forms; similar work is also being undertaken in Trinidad with regard to Cacao. As we have recently found at Kew that young shoots of Cacao strike fairly rapidly, it will be possible to take cuttings from pure races of high-yielding plants, and so save the labour of budding and grafting.

Other economic plants which are receiving the attention of Kew at the present time for the benefit of our tropical possessions include passion fruit, papaw, cassava, Ephedra, Derris and tuba root or barbasco. The first three mentioned are affected by virus diseases and various types have been sent out to Amani in order that forms resistant to the virus disease may be raised in East Africa. Ephedra, Derris and tuba root yield important insecticides, and attempts are being made to cultivate plants yielding the highest quantity of rotenone, which is very variable in different strains and species. Stocks obtained at Kew have been sent to the West Indies in the hope that a profitable industry may be established to meet the demand.

It may be useful to summarize, in conclusion, some of the more important economic plants which now form the principal industries of the countries to which they have been introduced.

Cacao, which is native of South and Central America, has been introduced to Trinidad and other West Indian islands and has for many years been one of their staple crops. More recently it has been introduced to the Gold Coast and is now the mainstay of that Colony.

Cinchona, also from South America, has been of great benefit to India and to Java.

Para Rubber (*Hevea*), which was brought from South America, is now an important source of revenue to Malaya.

Sisal (*Agave*), native of Central America, is now extensively planted in Kenya and Tanganyika and is a staple product in East Africa.

Cloves from the Spice Islands are the chief product of Zanzibar and Pemba.

Cotton has been introduced to various parts of the Empire, and is now a very important source of revenue to the Sudan, Uganda, Nigeria, etc.

The introduction of *Tea* from China to Ceylon and India has transformed vast areas of these countries and is a very important source of their revenue, while the introduction of *Coffee* to Jamaica and Costa Rica has resulted in important economic developments in those countries.

Reference may also be made to the introduction of *Wheat* to Canada and Australia, which has added so largely to the prosperity of these Dominions. Nor should we forget what the introduction of the *Potato* from South America, and the American *Tomato* has meant in the way of valuable foodstuffs and financial benefit to the growers of these plants in Great Britain and Eire, on the Continent of Europe and elsewhere.

Then, as one further example, there is the great bulb industry of Holland, where the growing of hyacinths and tulips especially, natives of the near East, has brought so much wealth to the country.

The problems raised by the introduction of economic plants from one country to another and their cultivation under plantation conditions provide ample occupation—apart from political considerations which may arise—for the plant pathologist, physiologist, agricultural chemist, the geneticist and systematic botanist. As the writer of the book Ecclesiasticus has so truly said, "When a man thinketh he hath finished, then he is but at the beginning, and when he ceaseth, then shall he be in perplexity".

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C. G. BURTON,
Secretary.

The University,
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OBITUARIES

Sir D'Arcy Power, K.B.E.

SIR D'ARCY POWER, who died on May 18, at the age of eighty-five, was first and foremost a writer. This was his finest asset. He gave evidence of this talent early in life, for when he was at the Merchant Taylors' School he won the Tyler Prize for history, and about the same time the prize for the boy best suited for a merchant's office. From that time almost to his death he wrote, and when at the age of seventy-five his works were collected in a complimentary volume, the items numbered more than six hundred.

He wrote on many subjects, though mostly in relation to his own profession. He wrote on the craft of surgery, on the history of medicine, biographies of past surgeons, and of such interesting details as the eyesight of Samuel Pepys and the reason why he discontinued his Diary, and how and when 'Surgeons' became 'Gentlemen'. He had a pretty pen and a happy phrasing, which make what he wrote a pleasure to read. He will be remembered by his writings long after more fashionable surgeons have been forgotten.

At St. Bartholomew's Hospital Sir D'Arcy became surgeon and consulting surgeon. At the Royal College of Surgeons he occupied successively all the more important posts. He was Hunterian lecturer, Hunterian orator, Vicary lecturer, and finally vice-president, as his father, Henry Power, was before him. But his activities did not cease there : he was an authority on Harvey and Hunter, a member of innumerable hospital and benevolent associations, a member of dining clubs and antiquarian societies, and a collector of books. The catalogue of the sale of his books at Sotheby's in the near future is an indication of his wide interests and catholic tastes. His circle of friends, both in Great Britain and abroad, especially in the United States, was immense ; and he had a large post from all quarters requesting his help in all matters relating to medical historical research.

In his later years Sir D'Arcy occupied himself congenially and usefully as honorary librarian at the Royal College of Surgeons , there he compiled notices of the lives of the fellows, He was also archivist at St. Bartholomew's Hospital, where he was working on an incomparable set of deeds and documents dating back to the twelfth century, which have so far escaped fire and damage.

In his personal disposition D'Arcy Power was happy. He was full of cheeriness, so much so that students, often apt to discern, dubbed him "Sunny Jim", a nickname that stuck. Though he has now gone, and we miss him, we need have no regrets ; for his life was pleasing and all our memories of him are pleasant. He was getting very tired, and was glad to lay down his pack. His seed, too, lives after him ; for he leaves a son, D'Arcy, who holds a distinguished position in the medical service of the Royal Air Force; his grandson, D'Arcy Tertius, has entered the medical profession, and his granddaughter holds a commission in His Majesty's Forces.

G. E. GASK.

Mr. John Crompton, O.B.E.

MR. JOHN CROMPTON, president in 1937–38 of the Textile Institute, Manchester, died on May 31 at the age of seventy-eight. We are indebted to the *Textile Journal* for the following particulars. He was of the family that numbered one of the fathers of the cotton industry, namely, Samuel Crompton, the inventor of the cotton spinning mule. His father was a hand-loom weaver of silk fabrics, who eventually found his way into a cotton mill in Walkden, where his son joined him at a later date. It was from his father that John Crompton had his first lessons in cloth structure —a subject in which he perfected his knowledge at a later date by means of a model loom he devised. His studentship meant long and arduous study, but his tenacity of purpose and keen application overcame the many difficulties. He was one of the pioneers of technical education, first as a student and then as a teacher ; eventually he became an examiner in his subject for the City and Guilds of London Institute.

Mr. Crompton contributed many articles to the technical trade press at a time when textile literature was very scanty. No doubt it was his appreciation of the lack of reliable information that caused him to welcome the advent of the Textile Institute, for which he did much useful work as a member of council for many years and of several of the Institute's committees. In 1930 he was awarded the Textile Institute Medal. He established in memory of his son, Lieut. Harry Dent Crompton, who was killed in the War of 1914–18, the Crompton Prize Fund for textile design. In 1923 the University of Manchester conferred on him the degree of M.Sc. in recognition of his work for the advancement of textile technology.

WE regret to announce the following deaths :

Sir Francis Anderson, emeritus professor of philosophy in the University of Sydney, aged eighty-two.

Prof. A. C. Carson, of the Department of Geology, Mineralogy and Geography in the University of South Carolina, Columbia, distinguished for his contributions to seismology.

Dr. G. van Dijk, of the Royal Meteorological Institute of the Netherlands, noted for his work in seismology, on December 19.

Mr. G. R. Redgrave, formerly inspector of schools under the old Department of Science and Art, and later chief senior inspector of technical schools at the Board of Education, on June 14, aged ninety-seven.

Prof. J. E. Taylor, emeritus professor of thermodynamics in Cornell University, on May 4, aged seventy-six.

Dr. Eric Therkelson, head of the Department of Mechanical Engineering of Montana State College at Bozeman, and Collaborator in Seismology for the United States Coast and Geodetic Survey.

NEWS AND VIEWS

Sir Arthur Evans, F.R.S.

SIR ARTHUR EVANS, the well-known archæologist, celebrated his ninetieth birthday on July 8. He has been honorary keeper of the Ashmolean Museum since 1890, having been keeper during 1884–1908. Sir Arthur is undoubtedly the leading British authority in the classical archæological studies, for which he was awarded the Copley Medal of the Royal Society in 1936. In his earlier years he made important contributions to the science of numismatics. His researches in Crete from 1893 onwards resulted in the discovery of the remains of a civilization which he named Minoan after the sea-king, Minos. He traced the Minoan civilization from approximately 3200 to 1400 B.C. His work, "The Palace of Minos", published in six volumes, revolutionized our knowledge of the ancient history of the Near East.

On the occasion of Sir Arthur's ninetieth birthday, Prof. J. L. Myres and Prof. R. M. Dawkins, both former presidents of the Society for the Promotion of Hellenic Studies, presented him on behalf of the Society with an illuminated address. Prof. Myres also presented an address from the British School of Archæology in Athens, of which Sir Arthur was one of the founders and to which he presented some years ago the site of the Palace of Knossos and his property in Crete to be a centre for Cretan studies. Sir Arthur was president of the British Association during 1916–19 and of the Society of Antiquaries during 1914–19. He has been the recipient of many honours from British and foreign universities and societies. All readers of NATURE will doubtless wish to be associated with our congratulations to a scientific worker whose contributions to archæology and anthropology have been of such outstanding importance.

University of London: Air Raid Damage

SOME brief notes on damage done during air raids to buildings of the University of London have already appeared in NATURE (December 21, 1940, p. 802). Information has now been made available of further damage:

UNIVERSITY COLLEGE. Extensive additional damage. The libraries south of the Dome have been burnt out, and also the Exhibition Room, the General Office, the Provost's and Secretary's Rooms, the Council Room, the Botanical Theatre and the whole of the Mathematical Department above it.

KING'S COLLEGE. Damage from blast, fairly extensive in area, and a rough estimate for full repairs is £10,000.

KING'S COLLEGE OF HOUSEHOLD AND SOCIAL SCIENCE. Fairly extensive damage was done when a German bomber crashed on the College.

BEDFORD COLLEGE. Severe damage both by high explosive and incendiary bombs, to the administrative block, the Biological Science block and the Dining Hall. There is slight damage by blast to other parts of the buildings.

QUEEN MARY COLLEGE. Damage by blast in various parts of the building. The West Lodge in the forecourt had a direct hit and was demolished. A rough estimate of the cost of repairs of damage suffered is £5,000.

BIRKBECK COLLEGE. On the occasion of one attack, a small fire was started in the Department of Chemistry, but was brought under control. During one of the fire attacks on London, fires broke out in the surrounding buildings, but the main building of the College escaped; 90 per cent of the College library has been destroyed.

SCHOOL OF ORIENTAL AND AFRICAN STUDIES. Slight damage, mostly by blast, to new (unfinished) building.

MEDICAL SCHOOLS. *St. Bartholomew's Hospital Medical College:* The chemistry block, the old medical school buildings in Giltspur Street, the physiological block, including the library, students' common room, theatre and Pharmacology Department, have been completely burnt out. *St. George's Hospital Medical School:* Roofs of the large lecture theatre and library damaged, and a number of books destroyed. *London School of Hygiene and Tropical Medicine:* The eastern frontage has been completely wrecked: Minor damage by high explosive and incendiary bombs, and by blast, has also been done at St. Thomas's, Westminster, Middlesex, Charing Cross, University College and King's College Hospital Medical Schools, while the London School of Medicine for Women has lost £3,000 worth of furniture and equipment stored in Messrs. Thomas Wallis's depositories.

Social Reconstruction Survey

MR. GREENWOOD, Minister without Portfolio, has announced in the House of Commons that the Committee of the Social Reconstruction Survey consists of the following members appointed by the committee of Nuffield College:—Mr. G. D. H. Cole, reader in economics in the University of Oxford (chairman), the Master of Balliol, the Principal of Lady Margaret Hall, Prof. A. G. B. Fisher, Prof. D. H. Macgregor, Price professor of international economics of the Royal Institute of International Affairs, Prof. A. L. Bowley, emeritus professor of statistics in the University of London; Mr. R. C. K. Ensor, senior research fellow of Corpus Christi College, Oxford; Miss A. Headlam-Morley, and Mr. C. H. Wilson. The committee of the Survey has co-opted Dr. C. S. Orwin, director of the Agricultural Economics Research Institute; Miss Margery Perham, reader in colonial administration in the University of Oxford; Mr. G. Montagu Harris, research lecturer in public administration in the University of Oxford; and Prof. Patrick Abercrombie, professor of town planning in the Bartlett School of Architecture, University College, London.

The terms of reference of the Survey are, briefly to inquire into the redistribution of industry and

population brought about by the War, and the extent to which this redistribution was likely to persist in the post-war period ; into the effects of war conditions on the working of public social services (other than the hospital service) ; into the changes in conditions of living due to evacuation and similar measures taken to meet the war situation, and into the bearing of all these factors on the general problem of national re-organization after the War. The bulk of the expenses of the survey during the current financial year will be borne by the independent resources of Nuffield College, but the Government has undertaken to make a grant not exceeding £5,000 towards the expenses of the Survey in that year.

Provision of Fine Chemicals

REFERENCE has already been made to the scheme inaugurated by the Advisory Research Council of the Chemical Society to facilitate the supply of fine chemicals needed for work of national importance, but which are not available commercially. The sub-committee organizing this work particularly desires to direct the attention of all users of fine chemicals to the existence of this scheme, in order that the greatest possible use may be made of the generous offers of help which have been received from numerous chemists in universities, technical colleges and schools, who have suitable laboratory facilities at their disposal. The scheme, which works in close collaboration with the Association of British Chemical Manufacturers, is an attempt to use to the best possible advantage both the laboratory facilities and the skilled man-power in teaching institutions and other laboratories which may not at present be fully harnessed to the war effort.

Before a substance can be accepted for preparation under this scheme, the Committee must be satisfied that the chemical is unobtainable from any British manufacturing firm and that it is required for urgent work of national importance within the British Empire. The scheme provides for the manufacture of approved items at basic charges which represent only the cost of raw material and such overheads as gas, electricity, etc. There is no charge for the chemist's services. Inquiries from both individuals and firms for chemicals which might be produced under the scheme should be made to the Secretary, Mr. S. E. Carr, Chemical Society, Burlington House, Piccadilly, London, W.1.

War and Industry in India

COMMENTS on the relation of industry in India to the country's war effort are made in an article by J. C. Ghosh in the February issue of *Current Science*. Mr. Ghosh believes that Indian nationalists have a genuine grievance against the Government for lack of vision in dealing with industrial development. During the War of 1914–18, much encouragement was given to many new industries, and, in the post-war years, it was withdrawn on the grounds that only those industries likely to become independent of State support should be supported. Thus the industries commanding an abundant supply of raw material and a ready market for finished products, such as cotton, paper and cement, have gone ahead ; unfortunately, this gain has been offset by decreasing prices and shrinking foreign markets for agricultural products. Mr. Ghosh's remedy for this state of affairs—and he thinks it is also a means of assisting defence measures—is to establish as key industries those which are included under the broad heading of metallurgical, engineering and machine tools, chemical and transportation industries.

Mr. Ghosh then discusses what has already been done in these fields. The Tata concern has been responsible for large developments in the iron and steel industry, and it is claimed that India could supply all the steel requirements of the countries represented at the Eastern Group Conference. Non-ferrous industries are not so advanced, but a plant for the production of aluminium with a capacity of 5,000 tons a year is being erected. Engineering is also backward. The heavy chemical industries are developing and may soon satisfy a large part of the country's requirements, but the dye-stuff and fine chemical industry is not satisfactory. The production in India is also urged of locomotives, ocean-going vessels and aeroplanes. It is stated that Indian industrialists fear that the manufacture of motor-vehicles is too difficult to be undertaken by Indian workmen in the near future, forgetting that "the thought and skill required in manufacture have been transferred from workmen to automatic machines". Non-official opinion in India is said, however, to be strongly in favour of starting such industries, and maintaining them as a part of the defence programme of the country.

Health of the Army in India

ACCORDING to the annual report for 1939 on the health of the Army in India, there were no serious epidemics during the year among British or Indian troops, although civilian areas in which troops were placed suffered from cholera, plague, small-pox, dysentery, malaria and enteric fever. The hospital admission-rate among British troops was as large as 666 per 1,000 of strength during the year, and was an increase on the rate for the previous year, but the death-rate of 2·75 per 1,000 and the invaliding-rate of 9·14 per 1,000 were lower. Among the Indian troops the death-rate was also down, but the hospital admission- and invaliding-rates were up. This increase, however, was undoubtedly due to the conditions of war service and the return or influx of large numbers of men potentially infected with malaria and other prevalent diseases. Malaria and dysentery held the first place in the list of principal causes of sickness among British officers, and were followed by cellulitis and catarrhal jaundice. Malaria also held the chief place among soldiers, and next came cellulitis, and a good way down tonsillitis ; but dysentery came sixth and was only half as frequent as a cause of admission as malaria. The prevalence of dysenteric infections was found to be due to lack of sanitation surrounding the troops' area. Respiratory diseases

were little in evidence, and there were no epidemics beyond minor outbreaks of mild influenza and pharyngitis. Nor was there any sign among the military population of the steady increase in tuberculosis which appeared to be occurring in the civilian population.

George Green Centenary

GEORGE GREEN, author of the famous "Essay on the Application of Mathematical Analysis to the Theories of Electricity and Magnetism", in which appeared for the first time what is now known as Green's theorem, died at Nottingham on May 31, 1841. The circumstances in which a miller was able to engage in mathematical research of fundamental importance have always puzzled the scientific world. New light has been thrown on the problem by Mr. H. G. Green, who has been investigating the matter for several years. In a lecture delivered at University College, Nottingham, to commemorate the centenary, he showed that at least one resident in the locality was well acquainted with the works of the great French mathematicians Laplace and Lagrange, and that the library of the Bromley House Society, of which Green was a member, had no difficulty, even in time of war, in obtaining copies of their researches. Among the members of this Society were several men of high learning and culture, who subscribed for the publication of Green's Essay in 1828. A full account of the investigations will be published in *Osiris*, the journal of the history of science, in due course.

Two French Botanical Pioneers

THE Botanical Garden at Montpellier has grown under the ægis of many distinguished botanists, some of whom made vast contributions to the science without the *éclat* of fame. Dora Maw provides, in a recent article (*J. Roy. Hort. Soc.*, 66, Pts. 4 and 5, April and May 1941), a chapter of history which shows in vivid fashion the work of two earlier directors of the Montpellier Garden. Pierre Richer de Balleval (1564–1632) was the actual founder, and was a vigorous exponent of the rising science of pharmacognosy. He gathered together a consocies of 1,332 species, lost them during the military manœuvres of inter-religious strife, and started again with characteristic determination. Modern pharmacy owes to him the discovery of galenicals such as *Aristolochia longa*, *Artemisia campestris* and *Scrophularia aquatica*. Pierre Marie Auguste Broussonet (1761–1807) was a native of Montpellier, and became director of the gardens after a life of epic adventure. He travelled restlessly in south-western Europe and North Africa, after a thrilling succession of political reverses from posts of honour to expedient incarceration. Botanical awareness marked all his journeys, for he brought back knowledge of many useful plants—*Tetraclinis articulata* (citrus wood), *Argania spinosa* (iron-wood), *Acacia gummifera* (the source of gum arabic), and many species of medicinal value. His tenure of the directorship was relatively short, but the background of his extensive travels made it illustrious.

Statistics in Public Policy

MR. H. W. MACROSTY's inaugural presidential address to the Royal Statistical Society, which has now appeared in the *Journal* of the Society, in reviewing the evolution of official statistics in the last fifty years or so, emphasizes their importance for post-war reconstruction. Policy can only be sound if it is founded on a reliable ascertainment of all the facts. Society is never static; our theories must explain and conform to changes which appear to be spontaneously generated and our records must keep step with the changes. No trade policy has any chance of success which is not founded on the most careful study and understanding of the facts, and although the Economic Section of the League of Nations has already provided us with useful comparative studies of the course of international trade in the last twenty years, these do not appear to have penetrated far beyond the study and the lecture room.

Mr. Macrosty also doubts whether we have exhausted the methods of statistical analysis of trade data and whether something more of importance might be learned by the application of some of the methods of modern mathematical research. It is certain that, in the future, nutrition must form the basis of policy, even of international trade, and the repercussion of different lines of policy on each other must be carefully watched. Despite the researches of the last few years, we have still much to learn, and in the collection and study of what is yet unknown, as well as of what is at present known, statisticians are needed for the service of the future. Referring to gaps in our knowledge, Mr. Macrosty pointed out that we have still no quinquennial census; we know little about the distribution of incomes assessed for income tax except in the topmost range; we have no reliable figures of working class earnings and expenditure; calculations of the national income and of savings require much estimation; we have no census of distribution and the monetary and other suggestions of the Macmillan report have not all been adopted although nine years have passed. These statistics are of the most intimate importance for the determination of public policy.

Neanderthal Remains from Hither Asia

THE current number of *Antiquity* as usual contains several important papers. These include among others an article on "The Viking Taste in Pre-Conquest England" with excellent illustrations, and an account of "A Datable Ritual Barrow in Glamorganshire" by Sir Cyril Fox. But perhaps the most important information appears under the "Notes and News" and concerns a prehistoric find in Uzbekistan of flake tool industries associated with the remains of a Neanderthal child. Those who would like more details than this excellent précis can give should consult *Asia* (July and August, 1940) where A. P. Okladnikov has published two interim reports. The discovery itself was made in an immense rock-shelter called Teshik-Tash high up in the side of the Zautolosh Darya gorge not far from Tashkent and the Soviet-Afghan frontier. The rock-shelter is

61 ft. wide and 64 ft. deep; it is above the contour-levels frequented by shepherds and herds, and so has remained undisturbed by modern intruders. On the other hand, the plentiful remains of wild mountain goats found in the deposits evoke no surprise. There were four black archæological levels separated by clay-like sterile ones, but the industries from bottom to top showed no great culture-change.

The tools are well made of local flinty limestone, quartzite, prase, etc., and include scrapers, disks, flakes and a sort of rough Audi knife (judging from the illustrations) as well as "utilised" bones. There were no real bone tools. It seemed not unreasonable to assign the whole industry to a late Mousterian culture, and this conclusion was confirmed when the skull of a 7–8-year-old child showing unmistakable Neanderthal characteristics was unearthed from definitely within the uppermost archæological level. A point of especial interest was that the skull appeared to have been partly surrounded by a ring of goats' horns arranged in pairs. Indeed, it seems evident that a ceremonial or ritual burial comparable to those of La Ferrassie in France had taken place as far away from western Europe as Tashkent. Geographically nearer, comparisons of implements can be made between the new Teshik-Tash finds and those of such Russian flake-tool sites as Chokurcha, Akhtyr, etc.; but the appearance of a Neanderthal ritual burial puts the former in a different category, enables a more precise dating to be made, and is intrinsically exciting, opening up as it does new ideas as to the possible distribution of the Neanderthal race.

Radiography of the Chest in Recruits

At a meeting of the Section of Medicine of the Royal Society of Medicine on May 27, Dr. Philip Ellman read a paper on "Mass Radiography of the Chest in the Early Detection of Intrathoracic Disease, with Special Reference to Pulmonary Tuberculosis in Recruits", in which he maintained that this method offers an invaluable contribution to preventive medicine. He recorded some results which he had obtained by (1) full-sized radiograms, (2) fluoroscopy and (3) miniature screen photography, the last being the most practical means of carrying out mass X-ray examination of the chest. As the result of his experience of this method with control experiments with full-sized radiograms, he suggested that for correct interpretation miniature screen photography demands a technically satisfactory film, which involves the closer co-operation of technician, radiologist and chest physician. The method offers an invaluable contribution to the detection of pre-clinical asymptomatic pulmonary lesions in a presumably healthy population. It can therefore add much to the prevention and control of pulmonary tuberculosis—in war by the examination of recruits, and in peace by the examination of selected groups of the population, for example, where pulmonary tuberculosis is known to be frequent and in certain trades where the pneumokonioses are known to be common. In dealing with the application of the method to cardiology in the detection of cardio-vascular lesions, Dr. Ellman urged that serial examinations should be made, and that its general adoption in routine health examinations will be of great value.

The Farmers' Club Library

The Farmers' Club (2 Whitehall Court, London, S.W.1) has recently added considerably to its library. To extend the use of it, a loan service is being instituted by which members (now numbering 1,320) may borrow books, free of charge. A classified catalogue of the library has been printed, and supplemental lists will be added from time to time. The range of subjects covered is comprehensive, and the dates of publication extend from the eighteenth century up to the present day. Suggestions for additions to the library will be welcomed from members, and inquiries for books not listed in the catalogue may be made as they may be obtainable from other sources. The addition of an author index in any further issues of the catalogue would add considerably to its value

River Flow Records

It is now two years (June 3, 1939) since there was noticed in these columns an annual report (the third) on Inland Water Survey in Great Britain, issued by the Ministry of Health and the Scottish Office. Unfortunately, there seems to be little or no likelihood that further reports will be published at present. This abrupt cessation of the reports makes a serious hiatus in the useful work of the Survey, which was begun by the Government in 1935 at the instance of the British Association and the Institution of Civil Engineers, and it is greatly to be regretted from a hydrological point of view, since the data collected were, undoubtedly, of great value for a properly systematized estimation of the water resources of the country. To remedy the omission in some measure, Captain W. N. McClean, the director of River Flow Records (Parliament Mansions, Victoria Street, S.W.1), to whose initiative and enterprise the institution of the Survey is due, has just issued a small pamphlet of ten sheets, entitled "River Flow Records of the River Moriston at Invermoriston", giving recorded readings of that river in Inverness-shire during the years 1937–40, in continuation of those which have previously been recorded since 1929. Both water-levels and river flow have been tabulated daily for each month of the period to September 1940. The relationship between them has been established at Invermoriston for any water-level up to an ordinary high flood. Extreme low flow may drop to less than 30 cu. ft. per sec., and an extreme high flood may reach a flow of 16,000 cu. ft. per sec. The area drained is 151 square miles and the run-off for a year of average rainfall is estimated to be about 68 inches. Captain McClean's persistent and painstaking efforts in maintaining these scientific observations are deserving of the highest commendation. It is greatly to be desired that publication of the results of the national survey should be resumed as soon as possible.

Automatic Electrical Farm Boiler

IN the *Electrical Review* of June 6, Mr. Theodore Rich gives a complete description of an apparatus developed particularly in the province of Brandenburg in Germany whereby steamed potatoes are prepared for pig food. The steamer consists of a galvanized cylindrical vessel, with an insulating jacket and lid. It is mounted on bearings like a churn, and is fitted with a tipping-locking lever. Three sizes are made for about 80, 155 and 308 lb. of potatoes respectively. The potatoes and necessary water are put in at night, and thanks to automatic control, the potatoes are correctly cooked by the early morning. The food keeps warm throughout the day without the apparatus being switched on and the operational cost is low owing to the special low night rates. The apparatus is protected against running dry. It is claimed that the floury product is much liked by stock.

Basic Costs in Electricity Supply

ONE of the principal problems in the management of public electricity supply companies is how to reconcile the costs with the charges not only from year to year but also in their irregular secular changes. Cost data are a matter of fact, but the application of such facts to the special circumstances of individual cases is often a question of policy. There are many ways of segregating and arranging cost data, although any process of segregation so far as electricity is concerned is entirely empirical. Some method of averaging has necessarily to be adopted, and probably the greatest difficulty lies in the determination of the proper allowances to be made for load diversity. As Mr. G. D. Bond points out in the *Electrician* of May 2, each extension of the field of development makes the problem harder, and it is hardest when the variety of the load on the public network is the greatest. A modern factor which increases the difficulty of diversity-measurement is arising in those undertakings, where, owing to the development of new loads, there is a consequent shift in the time of incidence of the peak-load.

In addition to the short-term division of costs as 'fixed' and 'running', there is a long-term division of costs into 'differential' and 'residual' costs. This latter division of costs may be explained by considering the domestic and commercial development of load, which is necessarily a long-term process. Up to a point, extra supplies can be given without recourse to additional capital expenditure (particularly when the demands are extensive and not intensive); later on, as local network difficulties arise, some fortification of mains is required, until at a later stage heavy capital expenditure is needed to cope possibly with peak loads of relatively short duration. At this point, the short-term supposition of cost incidence becomes invalid because the differential cost of giving the extra supplies is higher than the residual cost. With intensive development the differential cost decreases provided selective loads are taken to improve consumers' loads and diversity factors.

Franklin Institute Medallists

THE complete list of medal awards by the Franklin Institute (see NATURE, July 5, p. 19) is now available: *Franklin Medals:* Sir C. V. Raman; Prof. E. H. Armstrong, professor of electrical engineering, Columbia University; *Cresson Medal:* The United States Navy, received by the Hon. Ralph A. Bard, assistant secretary of the Navy, Washington, D.C.; *Potts Medal:* Prof. H. E. Edgerton, associate professor of electrical engineering, Massachusetts Institute of Technology; *Levy Medal:* Profs. J. M. Lessells and C. W. MacGregor, of the Massachusetts Institute of Technology; *Clark Medal:* Raymond Mower Conner, director of the Testing Laboratories, American Gas Association, Cleveland; *Brown Medal:* W. H. Carrier, chairman of the board, Carrier Corporation, Syracuse; *Wetherill Medal:* H. S. Black, Bell Telephone Laboratories, New York City; *Longstreth Medal:* B. J. Wilson, chief of the mechanical division, Research Department, Leeds and Northrup Company, Philadelphia.

Magnetic Storm

A MAGNETIC storm was registered at Abinger on July 5. The storm began at 6 hr. and remained intense until 16 hr. G.M.T. The range in declination was 1° 17′; in horizontal intensity, 950 γ; in vertical intensity, 745 γ.

Announcements

PROF. EMIL ABDERHALDEN, professor of physiology in the University of Halle, has been made an honorary member of the Société de Physique et d'Histoire naturelle of Geneva.

PROF. PICCININI has founded an Institute for the History of Medicine at the University of Milan, where he occupies the chair in that subject.

THE University of Oxford is making a grant to the Department of Chemistry to carry out a nutritional survey and a study of antiseptics in relation to burns.

THE Ministry of Health is arranging for children attending clinics to have black currant syrup made from a formula drawn up by the Long Ashton Research Station (University of Bristol). Black currants are well known to be very rich in ascorbic acid, and the syrup is stated to contain five times the vitamin C content of orange juice.

THE British Psychological Society is arranging a whole-day meeting to be held in London on July 26 to discuss psychological problems of air-raid shelters and evacuation. Those interested should communicate with the honorary general secretary, Mr. R. J. Bartlett, 14 Barchester Road, Harrow Weald, Middlesex.

ACCORDING to the latest report of the Registrar-General the highest marriage-rate ever known in Great Britain occurred in 1940. Marriages in England and Wales totalled 468,267 and exceeded the record figure in 1939 by 28,573; the marriage-rate per 1,000 of the population was 22·6, and the previous highest rate except for 1939 was 20·2 in 1920. During the War of 1914–18 the highest marriage-rate was in 1915.

LETTERS TO THE EDITORS

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

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

Trunk Diameter of Trees of *Hevea brasiliensis*: Experiments with a New Dendrometer

A SENSITIVE dendrometer was designed and constructed at this Institute to study the daily changes which occur in the trunk diameters of rubber trees, and the extent to which the outflow of latex on tapping affects the diameter in the region of the cut. For this purpose there was required an instrument more sensitive than the self-recording dendrograph of MacDougal[1], but optical methods of magnification (*cf.* Mallock[2]) were precluded on account of the difficulty of setting up, protecting and operating the dendrograph in the plantation.

The new instrument consists of a steel U-shaped braced member which carries a system of three levers connected in series, the last one being similar to the Dye optical lever[3] but carrying a light pointer, moving over a scale instead of a mirror, giving a total magnification of about 450. The design of this lever system follows modern practice for precision measuring instruments, all bearings being of kinematic design and the linkages consisting of steel strips so as practically to eliminate friction and backlash. As nickel-iron alloys of low thermal expansion were not available, compensation for expansion of the steel frame was provided by a zinc rod of appropriate length in the lever system, which reduces temperature errors to a negligible value. The instrument can measure rapid small changes of diameter to a limit of about 0·0005 mm.

In use, small metal studs are cemented with grafting wax to scraped areas of the trunk diametrically opposite to each other. The contact points of the instrument, which are 5/32 in. diameter steel balls, engage in trihedral sockets in the studs so as to provide positive location, and the instrument is suspended by chains or wires attached higher up the trunk so that the frame lies horizontally.

Trunks of Hevea trees are found to show a daily variation in diameter similar to that found by MacDougal[1] for many trees of the temperate zone, namely, a rapid diminution starting soon after sunrise or when the sun first strikes the crown of the tree (about 7.00 a.m. Malayan time) and continuing at a diminishing rate throughout the morning and afternoon, tailing off to a minimum between 2 and 3 p.m., followed by a rise which continues during the evening and very slowly throughout the night, reaching a maximum shortly before dawn. This curve closely follows that of atmospheric relative humidity. The daily variation is greatest on hot bright days, when the reduction in diameter at five feet above ground, of a trunk 20 cm. in diameter, may be as much as 0·25 mm. between 8 a.m. and 2 p.m. On rainy or overcast days the total reduction may be only half as much. The trees respond remarkably quickly to changes of insolation; thus in one observation during overclouding of the sun at noon for 22 minutes, a trunk increased in diameter by 0·007 mm., although previously it had been steadily decreasing. An increase was apparent in the dendrometer reading within two minutes of the sun being obscured.

The immediate effect of tapping is clearly shown by the dendrometer. No effect is observed on an instrument mounted above the cut, but on one placed just below a rapid decrease of diameter begins within a few seconds and is often almost complete within 3 minutes of opening the tapping cut. The amount of this shrinkage varies from tree to tree and also appears to depend upon the period since the last tapping and upon the time of day of tapping, but it is usually about 0·03 mm. The effect is less at 50 cm. below the cut but is still quite distinct, and can usually be detected at 75 cm. but not definitely at 100 cm., upon the trees used so far.

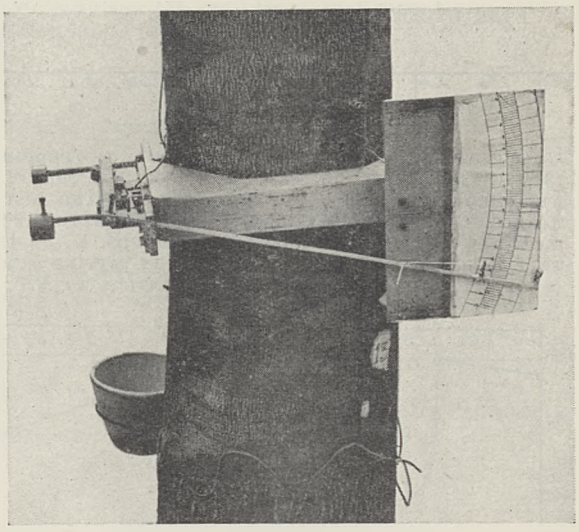

Fig. 1.

FRONT VIEW OF DENDROMETER TO REAR OF TAPPING PANEL.

In early morning tappings, that is, tapping at about 6.30 a.m., the dendrometer records show a recovery to almost the original diameter within about 1½ hours after tapping. A further effect is, however, frequently shown by the tapped tree during the morning and early afternoon following tappings, especially if the weather is hot and dry and no rain has fallen for several days. This is a considerably greater reduction in diameter compared with the records for 'resting' days or with an untapped control tree. Insufficient data have so far been obtained, however, to state definitely whether this effect is general or is a peculiarity of the tree at present under observation.

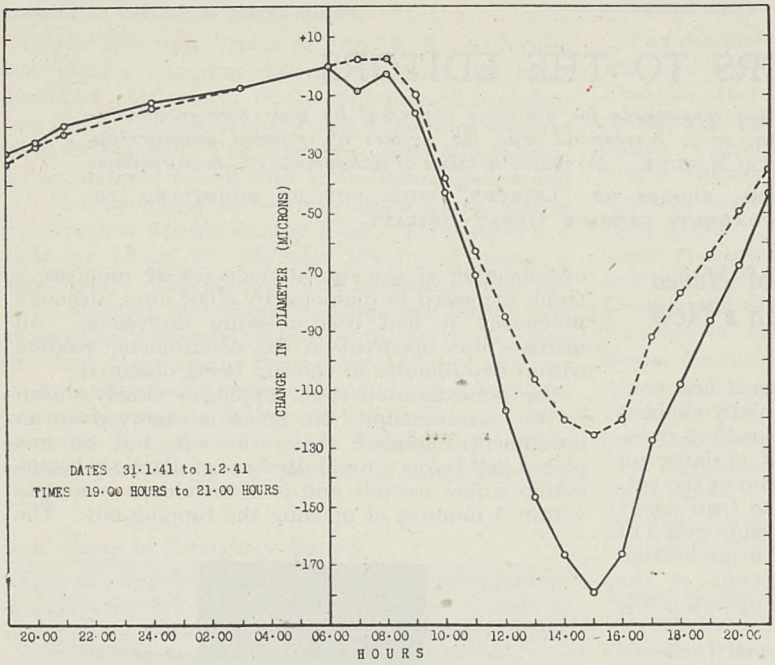

Fig. 2.

GRAPHS OF CHANGES OF TRUNK DIAMETERS IN THE PERIOD OF 19.00 HOURS (31 . 1 . 41) TO 21.00 HOURS (1 . 2 . 41) OF TWO TREES; DENDROMETERS ATTACHED TO EACH AT 84 cm. ABOVE GROUND AND JUST BELOW TAPPING PANELS. *Continuous line:* TREE A, GROSS DIAMETER 19·9 cm. IN 'ALTERNATE-DAY' TAPPING (TAPPED AT 06.35 HOURS, 1 . 2 . 41); *broken line:* TREE B, GROSS DIAMETER 19·6 cm. NOT IN TAPPING DURING THE EXPERIMENT, ACTING AS CONTROL TO A.

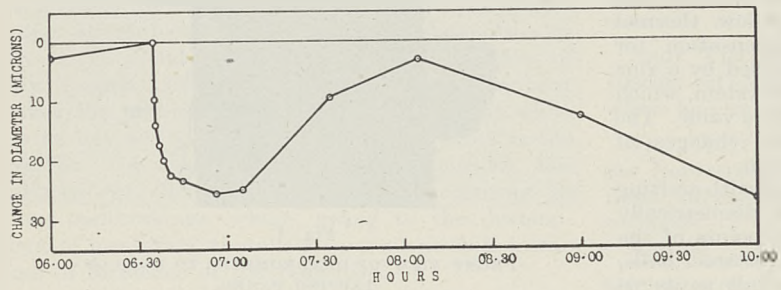

Fig. 3.

IMMEDIATE EFFECT OF TAPPING ON TRUNK DIAMETER JUST BELOW THE TAPPING PANEL. THE TREE TAPPED AT 06.35 HOURS (19 . 2 . 41) SHOWING A REDUCTION OF 25·5 μ WITHIN TWENTY-ONE MINUTES, AND ALMOST COMPLETE RECOVERY WITHIN 1½ HOURS OF TAPPING.

This investigation forms part of a programme of research on the physiology of latex, which was begun at South Kensington under the direction of Prof. V. H. Blackman, with a grant from the Rubber Growers' Association, and is now jointly supported by the British Rubber Producers' Research Association and the Rubber Research Institute of Malaya.

E. E. PYKE.

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March 1.

[1] MacDougal, D. T., "Growth in Trees and Massive Organs of Plants" (Carnegie Inst., Washington, 1924).

[2] Mallock, A., *Proc. Roy. Soc.*, B, 90 (1919).

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Relative Growth in the Individual

IN view of the criticism[1] that a curve of relative growth derived from contemporaneous data on many individuals of all sizes (population curve) may not apply to actual growth in the individual, as is frequently assumed[4], data on the latter are much to be desired[2]. From careful measurements on series of moults of individual *Carcinus mœnas*, populations of which have been much used for relative growth studies[3, 4], the following conclusions seem to be justified.

(1) Simple allometry[5] does apply to growth in the individual, and is not merely a feature of the population curve; straight-line graphs are obtained by log/log plotting of one dimension against another (see graph on p. 53). For carapace-length/carapace-width in No. 1 there is a single phase of simple allometry from metamorphosis at 1·7 mm. carapace length to the moderately large adult at 45·5 mm. The fitting of the points is so close that these further conclusions are probably justified, in spite of the small number of individuals.

(2) For 'frontal-width'/carapace-width there are two phases of simple allometry (accompanying graph, No. 1). The transition occurs abruptly at a certain moult (the fifth—unfortunately missing from the series). The gradual transition usually seen in population curves may therefore be due to individual variation in body size at transition[6].

(3) For 'dentary-margin'/carapace-width there are similarly two phases, but transition occurs at the third moult, and is therefore probably quite independent of that for frontal width (in these early stages dentary margin is almost a length dimension).

(4) The curve of relative growth between two particular dimensions shows variations in different individuals. There may be variations only in the constant b of the allometry equation $y = bx^{\alpha}$, giving two parallel curves (accompanying graph; Nos. 2, 3; *C.L./C.W.*), or in α also (accompanying graph; Nos. 2, 3; *F.W./C.W.*), in different pairs of dimensions of the same two individuals.

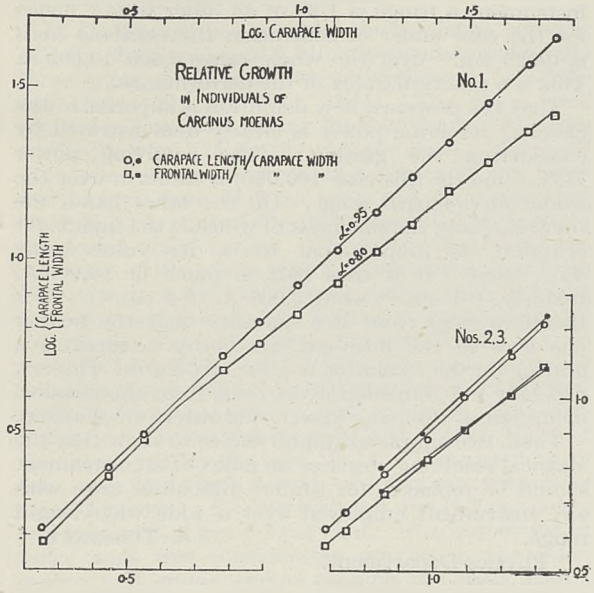
Concerning absolute growth the following points are worth recording:

(5) The increase in body size after each ecdysis is in accord with Brooks's law[7], the constant factor of geometric increase being very near Przibram's constant ($\sqrt[3]{2}$, = 1·26)[8]. The absence of moults 2, 5 in No. 1 is clear. There are small individual differences in the factor.

(6) By contrast to body size the intermoult time increases very irregularly. There is, however, a suggestion of orderliness in a large body of data, and of

a change, about 8 mm. body size, to a more rapid rate of increase. In Corophium[2] the intermoult time is constant over the whole of post-embryonic life.

Data from two short series of both *Maia squinado* and Stenorhynchus sp., and from other short series of Carcinus, essentially support the above conclusions.



(7) In Carcinus No. 1, a female, a record was obtained of the growth in width of the abdominal segments relative to carapace-length, though less complete than that of the carapace dimensions. For the abdomen 1 segment there is a single phase of simple allometry ($\alpha = 1{\cdot}07$), but for other segments three phases, with the two transitions at approximately 2·5 and 12·5 mm. body size (? metamorphic and adolescent transitions). The transitions are abrupt but the data did not show this to be simultaneous in all segments, possibly owing to the incompleteness of the data. The growth-centre is in abd. 3 segment during the short first phase and in abd. 6 throughout the rest of growth ($\alpha = 1{\cdot}5$ for 3rd phase) (*c.f.*[3]).

I am indebted to Dr. I. Gordon for the use of the material, from the British Museum Collection.

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June 10.

[1] Davenport, C., Symposium on Quantitative Biology, Cold Spring Harbor, No. 1, 203 (1934).
[2] Harrison, R. J., *J. Mar. Biol. Ass.*, **24**, 2, 483–93 (1940).
[3] Day, J. H., Rep. Dove Marine Lab. (3rd Series), **3**, 49 (1935).
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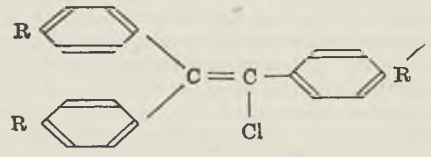
Preparation of Triphenylchloroethylene*

THE preparation of triphenylchloroethylene has been effected in various ways [1, 2, 3, 4, 5, 6]. A better mode of preparation of the compound seems to be through the following series of operations.

To the Grignard reagent prepared from magnesium (12 gm.), benzyl chloride (60 gm.) and ether (250 c.c.), benzophenone (60 gm.) was added, and after two hours' stirring the solution was left for two hours more and then decomposed with cold aqueous ammonium chloride. Ether extracted the carbinol[7] which separated from petroleum (b.p. 70–80°) in colourless crystals m.p. 88–89°. Yield was 80–85 gm. The triphenylethylene[7,8,9] was best prepared by the vacuum distillation of the carbinol (100 gm.) in presence of 2 drops 20 per cent sulphuric acid. It separated from alcohol in colourless crystals m.p. 70°. Yield was 75 gm. To prepare triphenylchloroethylene, sulphuryl chloride (35 gm.) and a solution of triphenylethylene (50 gm.) in carbon tetrachloride (25 c.c.) were mixed together and benzoyl peroxide (0·2 gm.) was added. The solution was refluxed on a water bath for forty-five minutes, excess of sulphuryl chloride was distilled under reduced pressure, and the oily residue was recrystallized twice from alcohol. The mother liquors were concentrated, and the oily material which thus separated was again recrystallized from the same solvent. Triphenyl chloroethylene (45 gm.), m.p. and mixed m.p. 117° was obtained in colourless crystals.



The preparation, on similar lines, of compounds related to triphenylchloroethylene (where R=H, Cl, Br, COOH, Me, MeO, EtO, α Pro, β Pro, etc., and R′= H, Cl, Br, COOH, Me, MeO, etc., in the formula above) is now in progress.

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* Abridged.

Catalytic Aromatization and Isomerization of 2.2.4.-Trimethyl Pentane

Hoog, Verheus and Zuiderweg[1] have concluded generally that paraffins with structures not readily permitting the formation of a six-membered carbon ring are not appreciably aromatized or isomerized over cyclization catalysts. While studying the cyclization of hydrocarbon mixtures in these laboratories, however, it was found that at 550° C. with a liquid catalyst-space velocity of 0·33 c.c./c.c./hour

and a 6 atomic per cent molybdenum oxide-activated alumina catalyst in a mild steel catalyst tube, considerable formation of aromatics from pure 2.2.4. trimethyl pentane resulted, accompanied by cracking. The aromatics contained mixed xylenes, *o*-xylene being identified, together with some naphthalene.

The full results will be published elsewhere.

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[1] *Trans. Farad. Soc.*, **35**, 993 (1939).

Use of the Term 'Resolving Power' in Spectroscopy

THE classical description of the limit of applicability of an instrument by the resolving power $\lambda/d\lambda$ has been used in spectroscopy for many years in spite of very obvious drawbacks. Since the advent of the Bohr theory of spectra, the spectroscopist is not concerned with *wave-lengths* but with *frequencies* and *frequency differences*. If a concept of the power of instruments to resolve close lines is adopted in terms of frequencies, there results a considerable improvement in clarity and in practical applicability.

Consider as typical examples the use of a Fabry–Perot interferometer and of a grating to separate close components. The interferometer, air gap of thickness $t = 1$cm., is coated with aluminium mirrors having a uniform reflecting coefficient between 5,000 A. and 10,000 A. The grating has 100,000 lines to the inch and is to be used in the first order. Consider the use of the instruments for the resolution of close lines at 5,000 A. and 10,000 A.

With the interferometer the frequency difference which can be resolved at any wave-length is $d\nu = dn/2t$; that is, resolution depends only upon the fraction of an order dn which can just be separated with the gap used. This does not involve the wave-length if we have a uniform reflecting coefficient (the same is effectively true with the Lummer plate). The *shapes* of the fringes at 5,000 A. and 10,000 A. can be considered to be identical and as a result the *same* frequency difference can just be resolved at these two wave-lengths, or at any in between. The effectiveness or practical 'power' of the instrument is therefore *uniform* over the whole range. But if we evaluate $\lambda/d\lambda$, we find that the resolving power in the strict classical sense increases regularly with diminishing wave-length, being in fact twice as great at 5,000 A. as at 10,000 A. Clearly, as a description of the effectiveness of the instrument the resolving power is undesirable and should be modified.

With a strictly monochromatic source any instrument produces an apparent line width, owing to diffraction, etc., and it is, of course, this which sets the lower limit to the resolution. Instead of regarding this width as a wave-length difference, the frequency difference should be considered.

I propose that instead of using resolving power we define the ability of an instrument to resolve lines at any wave-length by $d\nu = \nu.d\lambda/\lambda$, that is, by the *instrumental line width in cm.$^{-1}$ at that wave-length*. This quantity, being equal to the wave number of a line divided by the classical value of resolving power, can readily be evaluated. A convenient name for this quantity would be the *resolving limit*, and it will be seen that it is a practical measure of the effective applicability of an instrument and in actual practice of more use than the classical resolving power. Thus in the interferometer, the line width is a certain fraction of an order (depending only upon the reflecting coefficient) divided by twice the gap. With a good instrument a fringe is 1/20 of an order wide; hence for the case under consideration the *resolving limit* is 0·025 cm.$^{-1}$ over the whole range 5,000–10,000 A. This is a practical index of the performance.

That the proposed new definition is superior to the classical resolving power is clearly demonstrated by considering the grating. The resolving power $\lambda/d\lambda = nm$ (in this case 100,000) is uniform over the whole wave-length range. On the other hand, the *resolving limit*, the *smallness* of which is the significant criterion, is proportional to ν, its value being $d\nu = \nu/nm$. It is thus half as much at 10,000 A. (namely, 0·1 cm.$^{-1}$) as at 5,000 A. (0·2 cm.$^{-1}$). It is therefore clear from this quantity that the farther one goes in the infra-red the better adapted is a grating for the resolution of close structures. This is a property not immediately obvious from the classical definition of resolving power, and rarely emphasized.

These two simple examples suffice to show that the classical resolving power as an index of an instrument should be replaced, for similar difficulties arise with any instrument employed over a wide wave-length range.

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June 21.

"'Pancake' Ice in the Pennines"

SINCE my letter on the above subject was published in NATURE of May 3, I have received one or two communications commenting on the phenomenon, to which it may be of further interest to refer.

Mr. R. I. Lewis has kindly directed my attention to a note by his friend Mr. D. J. P. Phillips, of University College, Cardiff, which appeared in NATURE of February 5, 1914, under the title "A Curious Ice Formation". Having now had the opportunity of referring to the latter, I find that the short description given suggests quite clearly a parallel occurrence of 'pancake' ice formed under similar, though somewhat more artificial, conditions to those I described at High Force in Upper Teesdale. Mr. Phillips's illustrated example exhibited circular floes of ice encrusted with snow and having the appearance of water-lilies. They were found in the River Ure at Brecon where it had just passed over a weir, and they were apparently formed following the night of December 31, 1913, when 14° of frost had been registered locally.

From Mr. Henry Bury, of Bournemouth, I have received a short description of 'pancake' ice seen by him on January 23, 1933, on the River Loire at Gien (Loiret). He records that circular rafts of ice estimated at 4–6 ft. diameter, and covered with snow, were being carried along in a flooded and swiftly flowing river. The whirling motion imparted to these rafts, and the frequent collisions between them, were, in Mr. Bury's opinion, sufficient to account both for their form and for their conspicuous raised borders.

Consequently, it would seem amply clear that, under suitable and sufficiently 'rigorous' conditions, 'pancake' ice can be formed in other than the polar regions.

N. E. ODELL.

RESEARCH ITEMS

Distribution of types of *C. diphtheriæ*

H. D. WRIGHT has analysed the incidence, severity and age-distribution of 8,040 infections caused by the three types of *Corynebacterium diphtheriæ* (*J. Path. and Bact.*, **52**, 283–294; 1941). The cases were notified in Liverpool during the four years 1937–1940; and there were 475 deaths (5·9 per cent). The *mitis* type was cultivated from 29·8 per cent, the *intermedius* type from 18·9 per cent, and the *gravis* type from 51·3 per cent of the total cases of diphtheria in the period under review. The figures show that the incidence of the *gravis* type increased each year from 34·2 per cent in 1937 to 69·6 per cent in 1940, but that the *mitis* and *intermedius* incidence correspondingly decreased. The proportion of the *mitis* cases in each year that were included within the age-group 0–4 was higher than that of the *intermedius* and the *gravis* cases in this age-period; and, similarly, the *intermedius* percentage figures were higher than those of the *mitis* type for the ages 10–14. The case-fatality rate, over the whole period, of infections with *mitis* was 2·2 per cent; for *intermedius* it was 10·7 per cent; and for *gravis* it was 6·3 per cent. The proportion of toxic cases was considerably greater in the *intermedius* and *gravis* groups than in the *mitis* group. The author discusses the validity of subdividing strains of the diphtheria bacillus into the above-mentioned types. This classification originated ten years ago in Leeds and has been widely confirmed, although critical reports have recently come from the United States. The Liverpool experience has convinced Wright that the types are founded on well-established criteria; that, with practice, they are readily distinguishable; and that they serve a useful purpose in helping to make clear the pathological and epidemiological features of the disease.

Isotopic Constitution of Potassium *in vivo*

POTASSIUM is known to have three natural isotopes $^{39}_{19}K$, $^{40}_{19}K$ and $^{41}_{19}K$. The 39 isotope represents the bulk of the element, the 41 isotope a relatively small fraction, while the radioactive 40 isotope occurs only in minute quantity. It is known that the abundance ratio of the 39 and 41 isotopes is not a constant figure for all organic tissues. A. Lasnitzki and A. K. Brewer (*Biochem. J.*, **35**, 144; 1941) have now studied the isotopic constitution of potassium present in various rat tissues by mass-spectrographic measurement on the ash. In the living animal a continuous potassium exchange takes place between the various tissue cells and the blood plasma. The actual potassium content of tissues is on the average perhaps twenty times higher than that of blood plasma. It was found that the isotopic ratio $^{39}_{19}K/^{41}_{19}K$ in the ashes from bone marrow and blood plasma was distinctly lower than that of ordinary mineral potassium (purified KCl) or from the ashes of other tissues. A kinetic mechanism has been proposed accounting for the observed effect depending on the condition that the intracellular potassium, in contrast to the extracellular potassium, is completely associated with heavy molecules. A fractionation of the 39 and 41 isotopes due to the difference in velocity of the ions in their passage through the cell membrane thus occurs. The isotope ratios of tissue potassium and plasma potassium do not depend solely on the mechanism responsible for their difference, but also on the isotopic ratio of the potassium which enters the blood-stream via the intestine. Fractionation of isotopes due to slight differences in chemical properties can be obtained by exchange reactions. Thus if zeolites containing sodium as a basic constituent are brought into contact with solutions of lithium or potassium salts, the sodium is exchanged for lithium or potassium, but the light isotope of lithium and the heavy isotope of potassium are taken up preferentially.

Genetics of Cotton

S. C. Harland and O. M. Atteck (*J. Gen.*, **42**, 1–21; 1941) have given important facts regarding the genetics of cotton. They have been able to introduce genes from the diploid *Gossypium Thurberi*, *G. Armourianum* and *G. aridum* to the tetraploid *G. barbadense* and *G. hirsutum*. By continual back-crossing they were able to study the effect of one gene on the background of *barbadense* and *hirsutum*. The *Armourianum* petal spot due to S^{arm} was proved to be an allelomorph of *hirsutum* R^h. On a *hirsutum* background, the size of the petal is not reduced in size or intensity. S^{ari} of *G. aridum* is another allelomorph of R^h. The character is reduced on a *hirsutum* background, where it becomes mutable, although it is stable in *aridum*. The evidence that S^{ari} of *aridum* and S^{arm} of *Armourianum* are allelomorphic to R^h of *G. hirsutum* provides proof that the tetraploid New World cottons contain two genoms of Asiatic and North American affinities respectively.

Sex-linked Albinism in the Fowl

A USEFUL new gene (*al*), giving a dingy white, pink-eyed chick, is reported by C. D. Mueller and F. B. Hutt (*J. Hered.*, **32**, 71–80; 1941). As the fowls grow, some melanin is found in the eye and a ghost pattern may be seen on the plumage. Sight, viability and productivity appear to be normal. The gene is sex-linked and raises to nine the number of genes known to be carried on the sex chromosome. It is highly probable that the mutation was found in the first generation after its occurrence.

Cyanogenesis in Lotus

ONE form of *Lotus corniculatus* liberates hydrogen cyanide when its leaves are killed, while another form morphologically indistinguishable from the first is acyanogenetic. Cyanogenesis is inherited in a tetrasomic manner as a dominant (C. D. R. Dawson, *J. Gen.*, **42**, 49–72; 1941). The observed numbers approximate to those expected on chromosome segregation. Cytological examination shows that this species is a tetraploid with $2n = 24$ chromosomes, but that quadrivalents are rare. The author points out that genetical data of segregation are safer than cytological as a criterion of autopolyploidy. It is considered that *L. tenuis*, which also has both acyanogenetic and cyanogenetic forms, is a diploid relative of *L. corniculatus*.

Reaction of Aliphatic Amines with Nitrous Acid

IT might be assumed that primary aliphatic amines of low molecular weight would react easily with nitrous acid to form primary alcohols with liberation of nitrogen according to the equation: $RNH_2+HNO_2=ROH+N_2+H_2O$, and this reaction has been shown to occur with butylamine to the extent of 25 per cent. Very little information is available on the general aspects of the reaction. F. C. Whitmore and R. S. Thorpe (*J. Amer. Chem. Soc.*, **63**, 1118; 1941) have examined the effect of nitrous acid on methylamine, ethylamine and *n*-propylamine under varying conditions. In sixteen experiments with methylamine and nitrous acid under a wide variety of conditions, no methyl alcohol or other reaction product could be isolated from the reaction mixture, some methylamine being always recovered unchanged. The amount of unchanged amine was never less than 25 per cent, and was sometimes more than 90 per cent, although conditions like those employed with *n*-butylamine were used in several cases. Solvents other than water were also used, and a reaction in the gas phase with methylamine, nitrous vapours and a trace of moisture was attempted. The amine nitrite seems to be more easily hydrolysed than decomposed. Small amounts of methyl alcohol were obtained with silver nitrite and methylamine hydrochloride. Ethylamine with nitrous acid gave a 60 per cent yield of ethyl alcohol; *n*-propylamine gave 7 per cent of *n*-propyl alcohol, 32 per cent of isopropyl alcohol and 29 per cent of propylene. Traces of ether were also formed with ethyl and propyl amines.

The Antimony Electrode

MANY investigations have been carried out on electrodes of the metal–metal oxide type. The only one of them which has met with much success is the antimony–antimony oxide electrode. The values reported in the literature for the standard potential and the slope of the *p*H curve vary widely. F. Hovorka and G. H. Chapman (*J. Amer. Chem. Soc.*, **63**, 955; 1941) have obtained very satisfactory antimony electrodes by casting pure antimony (obtained by electrolysis from hydrofluoric acid solution) into sticks under reduced pressure. These castings were free from surface pits and were very lustrous; they were cleaned by electrolysis in sodium carbonate solution and repolished before use. The sticks were immersed directly in the buffer solutions and the other electrode was a hydrogen electrode. It has been known for some time that it is unnecessary to add any antimony oxide. The potential at 25° was found to be $0{\cdot}2552 - 0{\cdot}05893\ p$H referred to the normal hydrogen electrode, a deviation of the potential at $p\text{H}=8$ reported by other investigators being confirmed. Between *p*H 2·2 and 8 the slope of the curve was constant, and the value 0·05893 is quite close to the value 0·05912 predicted by the Nernst equation.

Heat Capacity of Nickel Sulphate

ONE of the more important problems arising from the use of the third law of thermodynamics is the persistence of multiple electronic states in some solids at low temperatures. This is indicated by a change of magnetic susceptibility with temperature. Heat capacity measurements give no indication of the entropy contribution due to these states unless they are carried to such low temperatures that the electronic contribution is 'frozen out'. In a study of the heat capacity and magnetic susceptibility of nickel sulphate heptahydrate, $NiSO_4, 7H_2O$, at liquid helium temperatures, Stout and Giauque (*J. Amer. Chem. Soc.*, **63**, 714; 1914) find that the electronic system makes a large contribution to the heat capacity at temperatures where the lattice energy is unimportant, and there is a maximum in the heat capacity about 1·8° abs. The entropy contribution associated with the electronic system is shown to be $R \ln 3$, which shows that the system has three electronic levels. These are about equally separated by about 2·6 cm.$^{-1}$, equivalent to 7·4 cal. mol^{-1}. The character of the heat capacity curve of the substance down to 15° abs. gives no indication that electronic entropy exists, so that if it were extrapolated on the assumption that no abnormal change would occur at much lower temperatures, the calculation would be in error by 2·2 cal. deg.$^{-1}$ mol^{-1}. The adiabatic change of temperature on magnetization was also measured.

Ionization of Sulphurous Acid

IT is established that sulphurous acid ionizes in two stages: $SO_2 + H_2O \rightleftarrows H_2SO_3 \rightleftarrows H^{\cdot} + HSO_3' \rightleftarrows 2H^{\cdot} + SO_3''$, and the values of the two dissociation constants have been determined. The first ionization constant has been calculated fairly recently, but with the assumption that the activity coefficient of sulphurous acid is the same as that of hydrochloric acid for the same ionic strength. The second ionization constant had not been determined by a modern method. H. V. Tartar and H. H. Garretson (*J. Amer. Chem. Soc.*, **63**, 808; 1941) have determined both constants by electromotive force methods involving the use of glass electrodes containing suitable buffer solutions. For the first constant the electrolyte was a solution containing sodium chloride and sodium hydrogen sulphite with excess of sulphur dioxide, and for the second dissociation constant the solution contained sodium chloride or bromide, sodium sulphite and sodium hydrogen sulphite, the terminals at each side of the cell being silver and silver halide in both cases. A special investigation of the solubility of silver chloride in sodium sulphite disclosed the existence of the complex ion $Ag(SO_3)_2'''$. The values of the thermodynamic dissociation constants at 25° found were: $K_1=1{\cdot}72\times10^{-2}$ and $K_2=6{\cdot}24\times10^{-8}$. The first is in fair agreement with previous determinations by conductivity methods; the second is only in qualitative agreement with other reported values made by much less accurate methods.

Researches on the Meson

THE mesons (mesotrons) found in cosmic radiation are supposed to be capable of spontaneous decay. W. M. Nielsen, C. M. Ryerson, L. W. Nordheim and K. Z. Morgan (*Phys. Rev.*, **59**, 54) have measured the mean lifetime of the meson by comparing the intensity of the hard cosmic rays under a graphite block on top of a mountain with the intensity measured at a lower altitude under an additional layer of atmosphere equivalent in mass to the carbon. The absorption of the mesons in the air and the carbon is the same, and the lower intensity under air is ascribed to the spontaneous decay of the mesons in the time required to traverse the air layer. The calculations of mean lifetime do not depend on assumptions regarding the energy distribution of the particles or the height in the atmosphere at which they are produced. The result obtained is about 1·25 microseconds (for a meson mass 200 electron masses), which is appreciably shorter than previous estimates. Nordheim (*ibid.*, **59**, 554) calculates the ratio of hard and soft component

of the cosmic rays at sea-level, taking this decay period, and considers that the soft component observed is smaller than that calculated on the view that the products of decay are a proton and an electron, and he suggests that some of the energy is carried off by neutrons. F. Rasetti (*ibid.*, **59**, 613) has used a coincidence counter system to count occasions on which a meson is absorbed in iron and a shower is emitted after a delay of a few microseconds. This event is supposed to be the stoppage of a meson followed by decay and the emission of an electron which initiates a shower, and an analysis of the delay results indicates that the life of the meson at rest is about 3 microseconds. L. Leprince-Ringuet, S. Gondelsky, E. Nageotti and R. Richard-Foy (*ibid.*, **59**, 460) have analysed a cloud-chamber photograph of a collision between a cosmic ray meson and an electron. The collision took place in a magnetic field, and by good fortune all the track curvatures are suitable for accurate measurement. The mass of the meson is therefore obtainable and the authors estimate it at 240 ± 20 electron masses.

A Neutrino Theory of Stellar Collapse

G. Gamow and M. Schoenberg (*Phys. Rev.*, **59**, 539) have suggested a novel process to account for the appearance of stellar novæ. At the very high temperatures and pressures which exist in the deep interior of a contracting star, nuclear processes may be expected in which neutrons are formed. These particles can escape from the interior without giving up energy, and thus provide a mechanism for cooling the star from the centre. As the centre of the star collapses from this cause, layers just outside the centre are left unsupported and fall in, much gravitational energy being converted into heat. It is shown that the process which takes place involves simultaneously the collapse of the inner layers and the rapid expansion of the outermost layers, with great increase in the luminosity of the star. The process grows more and more violent as the pressure and temperature of the central regions increase. The marked difference between 'novæ' and 'supernovæ' is probably to be ascribed to a difference in mass, since it has previously been shown that a star having less than a certain central mass contracts to a stable configuration of definite radius while bigger stars are subject to unlimited contraction.

The Great Spot on Jupiter in 1939

B. M. PEEK has discussed his twenty-five observations of a dusky spot at the north edge of the South Temperate Belt of Jupiter during July 31–Dec. 21, 1939 (*Mon. Not. Roy. Astro. Soc.*, **101**, 2; 1941). On plotting these observations against the time, they suggested a damped oscillation of some kind, superposed upon a fairly uniform decrease of longitude. Wildt and Peek have shown that the density of Jupiter's atmosphere must increase very rapidly with the depth, unless the internal temperature is high, and it is fairly certain that in the lower strata the gas is practically indistinguishable from a liquid except for the absence of a bounding surface. In his presidential address to the British Astronomical Association (*J. Brit. Ast. Assoc.*, **50**, 2; 1939), Peek expressed the view that masses of light solids which were floating in denser gases might explain some of the surface phenomena of the planet. It is now suggested that the spot observed was associated with the presence of a solid body performing vertical oscillations near the level at which it would have floated in equilibrium. It is possible to derive the density gradient and also the compressibility of the atmosphere at the equilibrium level from the hypothesis. Unfortunately for the hypothesis, the compressibility should be multiplied by a factor 10^7 to make it commensurable with the compressibility of typical fluids.

Dimensions of the Andromeda Nebula

THE great nebula in Andromeda, as seen visually on suitably exposed negatives, can be easily contained in an ellipse measuring $3° \times 1°$. Direct photo-electric measurements made at the focus of the 100-in. telescope at Mt. Wilson have suggested that in reality it extends nearly to $6° \times 1{\cdot}5°$. R. C. Williams and W. A. Hiltner (*Pub. Obs. Univ. Mich.*, **8**, 103; 1941) have recently extended these limits still farther on a long-exposure Mt. Palomar photograph taken with the 18-inch $f/1{\cdot}9$ Schmidt camera. The direct-intensity microphotometer used for tracing isophotes on this negative easily measures a density difference of 0·003, and shows that the apparent diameter along the major axis must be at least 6·7°, corresponding to a real diameter of 80,000 light-years. The surface luminosity at these outer regions is only about 27·8 mag./sec.^{2}. The outer isophotes reveal two hitherto unsuspected elongated extensions of the nebula lying on opposite sides of the major axis and suggesting a slight counter-clockwise curvature, though the well-defined inner arms are curved clockwise. This work still further reduces the discrepancy in size between the Andromeda nebula and our own galaxy: we must now regard ourselves as inhabiting a galaxy the dimensions of which, though large, are not of a different order of magnitude from those of neighbouring nebulæ.

Birth Distribution of Sunspots

G. H. A. ARCHENHOLD has constructed a frequency curve of observed first appearances of sunspots (*Mon. Not. Roy. Astro. Soc.*, **101**, 2; 1941). The work is based on Minnaert's method (*Astron. Nach.*, **263**, 13; 1937; also **268**, 81; 1939) with slight modifications. Minnaert's construction gives, for any individual form of life-curves of sunspots, the number of spots which reach the minimum size necessary to be detected in a given interval of longitude. But this theoretical number can only be compared with the one observed at that longitude if the first appearances of sunspots were recorded by continuous observation, and as most statistics are based on daily observations, the first appearances are registered too late—in other words, they are registered in a more westerly position. In addition, spots having a duration of less than 24 hours may completely escape observation. The mean daily synodic motion of a sunspot is 13·2°, for which reason, in the case of daily observations, a spot will be seen somewhere in the interval of 13·2° following the point where it reaches the limit of visibility, and Archenhold adopts this procedure to make the theoretical results comparable with the observations. A full explanation with examples is given. The curve of visibility derived for the Greenwich instruments has been applied, as the results of the investigation are compared with the Greenwich observations. The figure representing the birth distribution shows a very decided correspondence between the theoretical distribution and that observed at Greenwich between 1886 and 1935. It justifies certain assumptions which the author has made on the curve of visibility, on the form and number of the life-curves of spots, and on the intervals in which the observations of the sun are made.

THERMAL EFFECTS IN TRANSFORMATIONS IN METALS

"THERMAL Effects in Transformations in Metals" was the title of a lecture delivered on May 13 by Dr. C. Sykes, superintendent of the Metallurgy Department, National Physical Laboratory, to the London and Home Counties' Branch of the Institute of Physics in the lecture hall of Messrs. Kodak Ltd., Harrow.

Dr. Sykes instanced the change which occurs during the cooling of eutectoid steel as a familiar and typical phase transformation. This transformation from face-centred γ-iron to body-centred α-iron and iron carbide (Fe_3C) has formed the subject of many investigations, and its suitable control has led to important variations being realized in the properties of steel. The temperature at which a transformation takes place has usually been determined from observations on either the direct cooling curve or the inverse-rate curve, or is deduced from the microstructures of samples which have been quenched or slowly cooled from various temperatures. In recent years the limitations of these methods have become apparent. The furnace-cooling methods clearly define the temperature at which a transformation commences, for there the energy released within the specimen causes a definite change in its rate of cooling. This change in rate has but little effect on the cooling of the more massive furnace, and the resultant variation in the difference in temperature between the furnace and the specimen affects the rate of cooling of the latter, so that great care is needed in the interpretation of subsequent results. In the case of β-brass a transformation occurs which commences at about 460° C. and continues down to about 160° C. Transformations of this type require entirely new methods of thermal analysis. Furthermore, since the change consists merely of a rearrangement of the atoms within the solid solution, an examination of the microstructure is no longer helpful.

Little progress was made in the study of such transformations until Tammann observed that they nearly always occur with binary alloys of the types XY and X_3Y. For the body-centred cubic crystal CuZn (β-brass), he suggested that, whereas at high temperatures the atoms are randomly arranged, at low temperatures the copper and zinc atoms are each on separate lattices. Thus, on cooling, heat will be evolved as the atoms settle into the more orderly arrangement. The theory of an ordering process based on similar assumptions to those of Tammann has been worked out by Bragg and Williams. They introduced the quantity s to represent the degree of order of the alloy, and postulate that $s = 1$ corresponds to perfect order and $s = 0$ to complete disorder, that is, the random arrangement. For an XY alloy such as CuZn, it is shown that s can be represented by $\tanh(V/4kT)$, where V, the energy required to interchange a Cu and Zn atom, is not constant but equal to sV_0. These equations have been solved for s as a function of T.

There is shown to be a definite critical temperature, T_c, where the value of s commences to rise steeply from zero and to tend asymptotically to unity at a lower temperature. The X_3Y alloy differs in that s rises from zero to a finite value at T_c and then shows a similar increase towards unity at lower temperatures. It is possible to calculate the energy changes associated with these transformations and so to predict the variation of specific heat with temperature. The transformation should cause the specific heat to exceed the normal value, to rise to a sharp maximum at T_c, and then fall back on to the normal curve. With an alloy of the X_3Y type there should be a definite latent heat at T_c. In the Bragg–Williams theory the average degree of order in the whole crystal has been considered, and a slightly modified result has been obtained by Bethe, who defines order from considerations of the nature of the neighbouring atoms around a given atom of either kind in the structure. Bethe's theory predicts that although superlattice order disappears at the critical temperature, a high degree of local order persists, giving an abnormally high specific heat, which only vanishes at very high temperatures.

At this stage the need for more precise methods for the determination of specific heats over wide ranges of temperature became imperative, and Dr. Sykes was responsible for the development of a method which proved highly satisfactory. The specimen, in the form of a small cylinder fitted with an internal heating coil, is mounted inside a cylindrical copper block from which it is thermally insulated. The whole is inserted in a furnace and can be evacuated. Now suppose the furnace is so controlled that the temperature of the copper block increases at a constant rate, then the temperature of the specimen will rise along a lower curve. If, however, energy is generated in the coil within the specimen, it is possible to bring the temperature of the latter above that of the furnace. At the instant at which their temperatures are the same, no external heat is received by the specimen and so $Q = MC_p(dT/dt)$, where Q is the power supplied to the specimen, C_p its instantaneous specific heat and dT/dt the rate of temperature rise of the specimen. By suitable manipulation of Q, the temperatures of specimen and furnace can frequently be brought into equality and a series of determinations of C_p can be made at increasing temperatures.

Much skill and ingenuity has been used in the development of the apparatus, and the accuracy obtainable is ± 1 per cent at 400° C. and ± 2 per cent at 600° C. It has been possible to ensure that the temperature of the specimen does not depart from that of the block by more than 0·1° C. Under these conditions the experiment can be modified to give the total heat content for a specified range of temperature. When this is done, the specimen heater current is passed through a copper voltameter so as to obtain an integrated value of the power supplied.

Detailed experimental results were described for two alloys, CuZn and Cu_3Au. For CuZn the total energy associated with the ordering transformation was found to be 9·8 cal./gm., whereas the Bragg–Williams theory gave 11·4 and the Bethe theory 10·8 cal./gm. Above the critical temperature the specific heat remains abnormally high, owing presumably to the presence of local order.

Further confirmation that β-brass undergoes an order–disorder transformation has been obtained from

X-ray spectrographs. Extra lines, the so-called superlattice lines, have been observed in X-ray photographs of the ordered structure taken with zinc radiation.

Cu_3Au has a face-centred lattice with gold atoms at the corners of each cube and copper atoms at the centre of each face. In this instance it is easy to establish the existence of a superlattice by means of X-ray analysis; in fact, an idea of the completeness of the ordering can be formed from an examination of the intensities of the superlattice lines. The thermal measurements, on the other hand, are somewhat more complicated owing to the slowness with which equilibrium is attained. To overcome this difficulty the following technique had to be adopted. From 420° C. upwards it was found that the specific heat curve was independent of the initial state of the alloy, so presumably it was always in equilibrium at this temperature. The effect of temperature on the energy content was therefore obtained by annealing a specimen at a temperature T until equilibrium was attained and then measuring the energy necessary to heat the alloy from T to 420° C. Since the specimen is in equilibrium both at the beginning and end of the experiment, the energy input to the specimen heater is equal to the difference in equilibrium energy contents corresponding to the initial and final temperatures, although at intermediate temperatures the alloy need not be in equilibrium. The anticipated latent heat is observed and the general agreement with theory is reasonably good, although neither theory gives a correct representation of the release of energy near the critical temperature. The Bragg–Williams theory gives a curve rising too slowly with decreasing temperature, and Peierls's (who has applied Bethe's theory to this alloy) theory gives too great a latent heat.

Other alloys which have been examined are Cu_3Pd and Ni_3Fe, and in both cases fairly good agreement with theory has resulted. Ni_3Fe, which closely resembles mumetal, is of interest in that it has been found that the best magnetic properties are obtained when the alloy is in a state of partial order.

The development of these precise methods of thermal analysis are thus seen to have done much to remove the difficulties which metallurgists have encountered in dealing with order–disorder transformations. R. W. POWELL.

EFFECT OF THE WAR ON BIRD LIFE

By R. S. R. FITTER

RECORDER OF THE ORNITHOLOGICAL SECTION, LONDON NATURAL HISTORY SOCIETY

VERY little is yet known about the effect of the War on bird life in Britain, though the secretary of the British Trust for Ornithology has appealed for information on the subject. It is easy enough to make a number of theoretical deductions from the known variations in ecological and other factors. The decrease of gamekeepers' activity should result in an increase of hawks and owls; the increase of arable and decrease of pasture land is bound to affect the balance of Nature in various ways; the felling of many woodlands will certainly make the woodland birds scarcer after the War; the reduction in the number of oil-discharging boats frequenting the British seas should result in a smaller death-rate among sea-birds; and so on.

A good many scattered records about the actual effect of the War on bird life have appeared in various journals, and should be collated. The present article is based on records sent in to the London Natural History Society during the past year.

Actual casualties among birds appear fortunately to have been very few. A research-worker in the north of England wrote asking to be sent the corpses of any starlings that might be found lying about London after a night of air raid, but though the starlings still come in to roost in London every night, I have not heard of any being killed in an air raid, though doubtless a large number have been. The only definite casualty reported is a missel-thrush killed by a bomb explosion in Hertfordshire. It was found dead thirty yards from where the bomb burst, and there was a wooden fence in between.

Several records have come in of birds taking fright at day-time bomb explosions. The explosion of delayed-action bombs in one area sent a heron screaming over a neighbouring garden, and on another occasion eight crows flew over after a similar explosion. From the same area comes a report that heavy gunfire sends the gulls home to roost early. A barn-owl, on the other hand, has been reported screeching during an anti-aircraft barrage, while a swift was seen circling around quite unperturbed by an air battle going on overhead. A green sandpiper, too, was not driven from its customary roosting-place by the fact that three bombs fell in a neighbouring field, while in two heronries numbers breeding in 1941 were undiminished in spite of many bombs falling in unpleasantly close proximity. Once a wheatear was seen flitting about over the wreckage in one of the worst devastated areas of the East End.

House-sparrows, too, have shown their enterprise. In one suburban town they were quick to explore the new nooks and crannies in a bombed house, and showed a marked partiality for new putty, possibly because of the linseed oil it contained. One result of the bombing of London has been to provide an abundance of potential nesting sites for the black redstarts, which are showing a tendency to colonize London. So far, however, the birds which have appeared in 1941 have favoured only Westminster Abbey, where they bred last year, and the British Museum (Natural History) in South Kensington, where they have been reported in several previous years.

Not many effects of the War on birds' feeding habits were reported, but a large number of black-headed gulls, together with several great and lesser black-backed gulls and carrion crows were seen feasting on the fish apparently killed by bombs falling in the Thames. When two small lakes were drained, black-headed gulls came and cleared the mud of mussels.

The activities of soldiers have had a detrimental effect on bird life in at least one area, where smaller numbers of redstarts and whitethroats are reported to have nested, as a result of military operations, and a cock whinchat disappeared after being alarmed by

soldiers training. No adaptation of nesting habits to war-time changes has been reported that equals the resourcefulness of the sand-martins that nested in a trench dug for military training near Gidea Park Station in 1917.

OBSERVATIONS FOR THE CAPE ASTROGRAPHIC ZONE

THE work which the Royal Observatory, Cape of Good Hope, undertook on the Astrographic Zones $-40°$ to $-52°$ has been completed and is now available in the volume referred to below*. It was felt that the value of the work would be greatly increased if the spectral types were also given and accordingly these were entered in the copy for the Press from the Henry Draper Catalogue. Owing to the faintness of the stars, however, spectral types were available for only a very limited number, about a quarter of the stars being available.

Dr. Shapley, of Harvard Observatory, agreed that this work was of great importance and the late Miss Cannon undertook the responsibility for it. Unfortunately, the identification of the stars by their Right Ascension and Declination proved too laborious, but the method finally adopted was highly successful. The positions of the stars in a region of the sky photographed by Dr. Shapley having been calculated from rectangular co-ordinates, it was possible by means of the latter to identify the stars on the Astrographic plates by the réseau. It is highly creditable that the spectral types of nearly 90 per cent of the stars were determined and at the same time the spectral types of most of the outstanding stars of the Zone Catalogue. The latter appear as an appendix.

Altogether fifteen tables are given in the volume, and a full explanation accompanies each of these. Under Magnitudes, Table 1 compares the magnitudes in various catalogues with the Cape mean photographic magnitudes. The basis of the system for the "Cape Magnitudes" is explained at the beginning of this section. A sequence of 71 stars from mag. 5 to mag. 12 was selected in the neighbourhood of the South Pole, and an accurate photographic scale was established among these stars by means of a diffraction grating and a series of exposures ranging from 3 sec. to 30 min. The zero point of each plate was based on the Harvard visual magnitude of the brightest star, σ Octantis, mag. 5·48, corrected for the type *F*0. This scale was then transferred to twenty-four Astrographic Regions in declination $-45°$, each region being photographed on the same plate as the polar sequence.

Other sections, most of which contain one or more tables, deal with star counts, spectral types, mean colour index, faint stars of large proper motion, stars with large proper motion, motion of stars in general, the nearest stars, mean parallaxes. The Catalogue itself is preceded by a brief "Explanation", though the headings of the columns are generally sufficient to explain what follows.

* Catalogue of 20,554 Faint Stars in the Cape Astrographic Zone $-40°$ to $-52°$ for the Equinox of 1900·0 giving Positions, Precessions, Proper Motions and Photographic Magnitudes derived from Photographs taken at the Royal Observatory, Cape of Good Hope, under the direction of Dr. H. Spencer Jones and Dr. J. Jackson; also Spectral Types classified from Plates at the Harvard College Observatory, Cambridge, Mass., U.S.A., by Miss Annie J. Cannon. Pp. lvii+414. (London: H.M. Stationery Office, 1939.) 42*s*. net.

FORTHCOMING EVENTS

[*Meeting marked with an asterisk is open to the public.*]

THURSDAY, JULY 17

ROYAL SOCIETY (at Burlington House, Piccadilly, London, W.1), at 4.30 p.m.—Prof. W. W. C. Topley, F.R.S.: "On the Biology of Epidemics (Croonian Lecture).

FRIDAY, JULY 18

INSTITUTE OF PHYSICS (MANCHESTER BRANCH) (in the Physics Department, University, Manchester), at 7 p.m.—Dr. H. Spencer Jones, F.R.S.: "The 200-inch Instrument".*

APPOINTMENTS VACANT

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

DEPUTY DIRECTOR OF EDUCATION—The Director of Education, County Hall, Chichester (July 18).

LECTURER IN MATHEMATICS—The Acting Clerk to the Governors, South-East Essex Technical College, Longbridge Road, Dagenham, Essex (July 19).

HEAD OF THE SCHOOL OF PHARMACY—The Principal, College of Technology and Commerce, Leicester (July 21).

DEMONSTRATOR OF PHYSIOLOGY AND BIOCHEMISTRY—The School Secretary, St. Mary's Hospital Medical School, London, W.2 (July 26).

REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Ministry of Agriculture and Fisheries. Bulletin No. 122: Specifications and Methods of Analysis for Tar Oil Winter Washes. Pp. iv+22. (London: H.M. Stationery Office.) 6*d*. net. [166

Home Office Circular 807624 (Board of Education Circular 1554): Juvenile Offences. Pp. 16. (London: H.M. Stationery Office.) 3*d*. net. [176

The Farmers' Club Library. A Classified List of Books. Pp. 48. (London: The Farmers' Club.) [186

The College of the Pharmaceutical Society. Annual Report of Research Work, 1940. Pp. 30. (London: Pharmaceutical Society.) [196

University of St. Andrews: The Chair of Chemistry in the United College of St. Salvator and St. Leonard. Centenary Lecture, 6th December 1940. By Sir James Colquhoun Irvine. Pp. 27+6 plates. (Edinburgh and London: Oliver and Boyd.) [236

Other Countries

U.S. Department of Agriculture. Farmers' Bulletin No. 1855: Culture, Disease and Pests of the Box Tree. By Freeman Weiss and L. G. Baumhofer. Pp. ii+18. 5 cents. Farmers' Bulletin No. 1861: Insect Pests of the Peach in the Eastern States. By Oliver I. Snapp. Pp. ii+34. 10 cents. Miscellaneous Publication No. 369: The Mineral Composition of Crops with particular reference to the Soils in which they are Grown; a Review and Compilation. By Kenneth C. Beeson. Pp. 164. 20 cents. Technical Bulletin No. 762: Structure and Development of the Alimentary Canal of the Southern Armyworm Larva. By Paul A. Woke. Pp. 30. 5 cents. (Washington, D.C.: Government Printing Office.) [166

Transactions of the San Diego Society of Natural History. Vol. 9, No. 25: The Paleontology and Stratigraphy of the Pleistocene at Signal Hill, Long Beach, California. By James H. DeLong, Jr. Pp. 229–252. Vol. 9, No. 26: A Key to the Pycnogonida of the Pacific Coast of North America. By Joel W. Hedgpeth. Pp. 253–264 (plates 9–11). Vol. 9, No. 27: The Distribution of Pocket Gophers in Southeastern California. By John E. Chattin. Pp. 265–284. Vol. 9, No. 28: A New Chuckwalla from Santa Catalina Island, Gulf of California, Mexico. By Charles E. Shaw. Pp. 285–288. (San Diego, Calif.: San Diego Society of Natural History.) [256

Bernice P. Bishop Museum. Bulletin 161: The Hawaiian Planter. Vol. 1: His Plants, Methods and Area of Cultivation. By E. S. Craighill Handy. Pp. iii+227+8 plates. Bulletin 162: Southern Lau, Fiji; an Ethnography. By Laura Thompson. Pp. iii+228+5 plates. Bulletin 166: Zonitid Snails from Pacific Islands, Parts 3 and 4; 3: Genera other than Microcystinae; 4: Distribution and Indexes. By H. Burrington Baker. Pp. iii+205–370+plates 43–65. Bulletin 168: Oceanic, American Indian and African Myths of Snaring the Sun. By Katharine Luomala. Pp. 58. Bulletin 169: Geology of Borabora, Society Islands. By J. T. Stark and A. L. Howland. Pp. 43+4 plates. (Honolulu: Bernice P. Bishop Museum.) 256

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