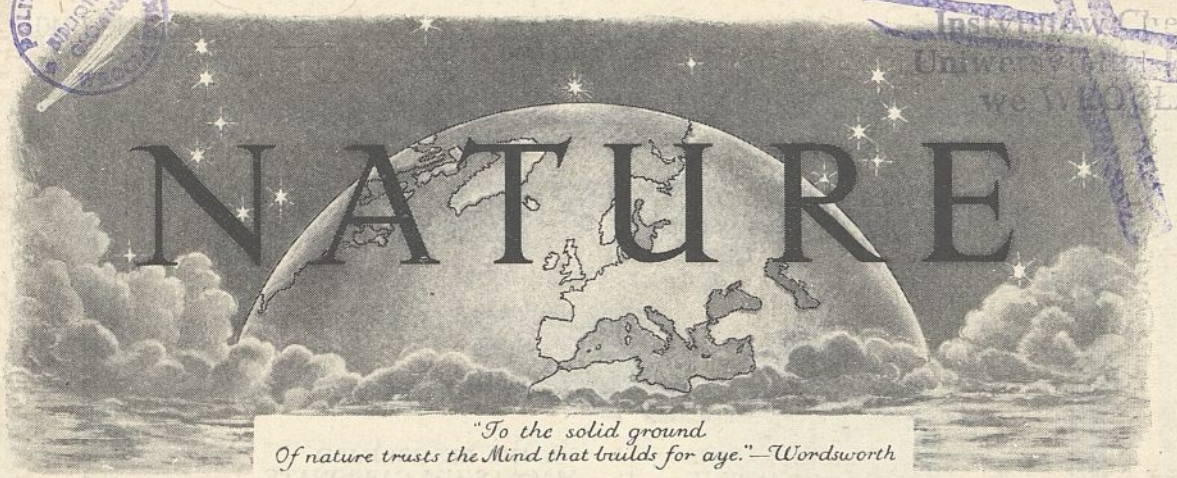

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SCIENTIFIC SOCIETIES IN WAR-TIME

IN times of peace London is unquestionably the focus of the scientific life of the British nation and Commonwealth. The reason is not that London is the seat of the metropolitan university, though this, by its system of external degrees, is also in a special sense the central university of the Empire ; moreover, it enfolds within itself many special institutions, like the Schools of Economics and of Hygiene and Tropical Medicine, which are themselves imperial centres for special branches of science. Nor is it that London is the seat of the chief national scientific departments, like that of Scientific and Industrial Research, or the Medical and Agricultural Research Councils. London had attained its position as the national scientific centre long before these modern bodies had been constituted, and before the University of London had come to be comparable, in size and influence, with the older Universities of Oxford and Cambridge (though as a centre of medical teaching London had long been pre-eminent). During two centuries and more in which the venerable sister Universities were still unrivalled except by each other, as centres of learning and research, their scientific members found a common meeting ground in London, in the rooms of the Royal Society : and during the nineteenth century London became the centre also of many more specialized scientific societies.

The relatively small size of the British Isles, and the excellence of their railway communications, make it conveniently possible for those who follow any special branch of science to come together, from all parts of Great Britain, to meet in London several times yearly. In this respect British men of science have an advantage not enjoyed by their colleagues in greater and more widespread communities like those of the Dominions, the United States, the U.S.S.R., or even Germany. In these countries regional centres have consequently developed, and national meetings tend to be annual and peripatetic, like those of the British Association. Such regional centres flourished also in Great Britain in the days before speedy travel became possible, but except in Dublin and Edinburgh they seldom attained the distinction of some of the principal academies of Germany, and with few exceptions they have declined since the days, for example, when Dalton was the glory of the Manchester Literary and Philosophical Society. Some of the chief British technical scientific societies, however, have in modern times developed valuable regional activities, in centres where meetings are held in addition to those at their main headquarters in London.

While the present War was still only a threatening possibility, the controlling bodies of some of the national scientific societies tried to prepare for future eventualities by arranging for the transfer of their offices from London, the safeguarding of their most cherished property, and alternative arrangements for meetings, in case the expected *Blitzkrieg* on London became a reality. On the outbreak of the War, some of these plans were carried out ; in other cases the councils of the scientific societies met to consider whether or not their pre-arranged series of meetings should be held. There were pessimists who thought it would be useless and undesirable to hold meetings, because of the absence, or absorption in war work, of many members, including some of the leading personalities. But in the main such counsels were not followed, and many societies held their meetings as usual throughout the session, from October

or November until June, during the unexpectedly prolonged immunity of London from aerial attack. Towards the end of the 1939–1940 session, some of the societies reverted partly to their pre-War condition, by the return of their offices and staff to London, or by the partial reopening of their premises or library. Even through the dark days of the over-running of Norway, Denmark, Holland and Belgium, followed by the ominous signs of weakness that preceded the collapse of France, much of the scientific life of London was maintained. At the beginning of the summer recess there seemed hope that if the threatened invasion were forestalled or repelled, the autumn might see a resumption of London scientific meetings, little changed except for some decline in the numbers of those attending and of the papers presented.

In August, however, the long-postponed air attack fell upon London, and before the usual date of reassembly of the scientific societies, daily and nightly raids became a regular feature of London life. The question of the continuance of meetings has now acquired a more serious and perhaps controversial aspect in the new circumstances. Not only has the 'black-out' assumed if anything a deeper tinge than before, but also interruption and dislocation of road and rail transport has been caused from time to time by the enemy bombing. Especially after darkness has fallen and night raids have begun, travel is difficult and unpleasant, and late afternoon meetings, which in winter fall during the hours of darkness, are for this reason likely to attract few attenders. Still less likely is it that members would continue to stay to club dinners after such meetings, though in peace-time such dinners form a useful and pleasant supplement to the formal gatherings of the scientific societies.

The safest course would naturally be to discontinue meeting at all, at least during the darkest months of the winter. As a set-off against such a lapse in the ordinary activity of the societies, the sessions might be prolonged into what is in normal times the summer vacation, but which in these years of shortened or suspended holidays would be fully appropriate for scientific meetings. Some societies have already suspended their usual winter meetings, with or without an indication of the expected date of their resumption.

Others, bolder and (in the judgment of some) more admirable, are continuing to meet in London, either as usual or at an earlier hour, so that the meeting may be concluded before nightfall. In some quarters the holding of the regular meetings outside London has been considered, but except where societies have developed regional activities and centres in peace-time, it seems unlikely that such meetings would be so successful as afternoon meetings in London would be; this is partly because it remains much easier to travel to than any other centre, from places more than a few miles away, and partly because London and the surrounding counties still contain the largest number of potential visitors to scientific meetings. To those who live at a distance, in regions that have not suffered serious air attacks, it may seem to be merely foolish bravado to propose that scientific men should foregather in London; it should be remembered, however, that the millions of people who continue to inhabit the London area include many who would welcome scientific meetings not less than in peace-time, and who would feel no more in danger at such meetings than in any of the other places, of work or dwelling or recreation, which they frequent. This is perhaps insufficiently considered by some council members of scientific societies who, for whatever reasons, being unable or not wishing themselves to take part in such meetings, lend their influence to abandonment or postponement.

A more fundamental objection to the continuance or resumption of the winter scientific programme is raised in some quarters, as it was also in the War of 1914–18—that scientific meetings are intrinsically unjustifiable in war-time, being a misuse of hours that ought to be devoted to definite war work. This view ignores the fact that there are still many scientific workers, capable of helping to overcome our enemies, and anxious to be thus used, whose services have not been called upon, or have even been declined when offered. But even as regards those whose time is actively occupied in scientific war work, the criticism seems answerable. Neither manual nor intellectual workers can work all their waking hours; some leisure and refreshment of mind are necessary to enable a man to do his best work; and the solution of a pressing war problem may be facilitated, not retarded, by a break in the routine hours of labour, and by meeting with colleagues who share similar peace-time scientific interests, whether or not they are likewise now engaged in war service.

Almost all the general arguments that justify the expenditure of time and travel involved in attendance at scientific meetings in peace-time remain valid also in war-time. Just as a Christian

finds no less need now than in normal days to assemble in church with his fellow worshippers, so the man of science still needs to maintain his contacts with fellow workers and with scientific progress outside his own special activity. War is not exclusively a matter of the organization and execution of material defence and attack; the mind no less than the body and the spirit must be kept in sound condition in order to continue to develop these material measures.

The officers of scientific societies, however, doubtless find other obstacles to meeting than those of risk and travel difficulties. The work of scientific technicians is now largely directed to war problems the solutions of which must for the present be kept secret; and so many workers in pure science are now drafted into the technical defence services that the output of pure research which can be safely published in war-time is much reduced. These factors are in one way a help to societies, in reducing the pressure on their resources of money (and of paper) for publications; but unless the societies are to fall into a state of suspended animation that may seriously prejudice their future revival, some degree of publication must be continued. The volume and perhaps even the standard of the papers published and read may be somewhat reduced, but the sources are scarcely likely to dry up entirely; and a shortage of papers for reading at meetings can be eked out partly by a moderate reduction in the length of the meetings, and also by arranging discussions, a course which has been so successfully followed by the Royal Society in recent years.

ENTOMOLOGY OF STORED PRODUCTS

Insect Pests in Stored Products

By H. Hayhurst. Pp. xii+83+49 plates. (London: Chapman and Hall, Ltd., 1940.) 15*s*. net.

AS a guide to the industrial chemist desirous of learning something of the appearance and mode of occurrence of the insect and arachnid pests of stored products this book is useful. The excellent illustrations by Mr. Harry Britten are numerous, the description of the insects is reasonably adequate, and the emphasis laid on cleanliness in stores and in vehicles of transport is sound. A list of "substances and their pests" is given as an appendix to the book and there is a short index of contents. The inclusion of the moths Plodia and Ephestia among the "substances" as "subject to attack" by the parasitic wasp Habrobracon is amusing.

Doubtless this book is, as Sir Harold Hartley points out in a foreword, intended for the industrial chemist. It is to be regretted that the author did not amplify on one hand, and simplify on the other, to meet the needs of warehouse managers, foremen and others who are the parties immediately concerned with infestation. While it is useful to have short descriptions of the insects infesting stores and warehouses, together with short accounts of the products on which they commonly occur, collected into a single small handbook, the most urgent need in combating insect infestation of food and other stores is a better understanding of how infestation occurs, and how it may attain an alarming extent and how only organized and concerted action can really cope with it. These matters are not discussed.

To the reader conversant with the literature, Mr. Hayhurst's sources of information are obvious; but he might have acknowledged them, including the source of material for Mr. Britten's illustrations, and in doing so have enabled his colleagues in the railway companies and elsewhere to read for themselves what is known of their problems and to keep in touch with the rapid progress in the understanding of them and towards their solution which is now being made. The early work of the Empire Marketing Board in this field is wholly ignored, although in his preface Mr. T. W. Jones refers to the subsequent work of the British Association of Research for the Cocoa, Chocolate, Sugar, Confectionery and Jam Trades. The work of Drs. Page and Lubatti in the science and practice of fumigation is not even mentioned. The great improvement in insecticides for use in warehouses, achieved by Dr. Charles Potter, is referred to; but no mention is made of any of his papers on the subject, which are of high importance, both scientifically and practically.

It is a real defect in Mr. Hayhurst's book that no bibliography of the subject is given. The cost of the book is high, and, in the absence of references to sources of information whereby the reader could extend his knowledge, excessive.

One comment on Mr. Hayhurst's book may be made. It illustrates very well how, outside the research laboratories, the entomology of stored products is still in that early stage of development where description of the insects concerned and general recommendations about their control represent the knowledge apparently acceptable and

satisfying to those dealing with infestation. That there are scientific principles underlying the problems of infestation and the methods by which they may be solved is only vaguely realized. Nevertheless Mr. Hayhurst's book shows a real awakening on the part of the industrial chemists to the need for tackling their infestation problems seriously, and the author is to be congratulated on a highly creditable performance within the rather narrow and now old-fashioned conception of applied entomology as a branch of zoology concerned less with the discovery of new laws and principles than with the immediate control of noxious insects. We may look to the work of the new Pest Infestation Laboratory of the Department of Scientific and Industrial Research to dispose once and for all of that old-fashioned view, and to give the lead in industrial entomology which has been so long deferred in Great Britain and in the Commonwealth.

J. W. MUNRO.

VEGETABLE PATHOLOGY

Diseases of Vegetable Crops

By Prof. J. C. Walker. New edition. Pp. iii+67. (Madison, Wis.: The Author, University of Wisconsin, 1939.) 1.75 dollars.

THIS publication is printed in the style known as typewriter type, being, in fact, a reproduction of the author's typed notes bound (quarto size) in stiff paper covers. It is doubtful whether this form of printing will be welcomed by readers, for the variation in ink density is tiresome and may even be tiring to the eyes.

The book is primarily intended for the use of advanced students of vegetable pathology, but the hope is expressed that it may be of some value to workers in research and applied branches of the subject. Its purpose is to supply an outline of important facts concerning diseases of vegetable crops in the United States; it follows that British readers may be unfamiliar with some of the crop plants and the methods used in their cultivation.

The diseases are arranged under headings of host plants or related host groups. Important diseases are treated in detail but with a brevity of style typical, and no doubt necessary, in publications of this kind. For each major disease the information supplied includes host range, history of the disease, its geographical distribution, its economic importance, the host symptoms, life-history and description of the causal organism, environmental conditions, varietal resistance (if any), and various other factors, concluding with particulars of control measures. After each disease there is a list of references to literature; these are indicated by numbers at suitable places in the text wherever relevant to the point under discussion.

Minor diseases, as might be expected, are dealt with less exhaustively, but a very large number are mentioned, the individual treatment varying from a single sentence to short paragraphs containing descriptions of symptoms and methods of control.

A feature that will be welcome to many readers is the inclusion, after each host heading, of notes on current methods of cultivation and of marketing the crop. Such knowledge of a crop is, as the author mentions in his introduction "basic to an adequate understanding of the development of its diseases and of their control". This point of view is one to be commended to English writers on the subject.

Workers in Great Britain who purchase the book will, in the main, find much that will interest them, although they may be surprised that such a well-known control practice as the mercuric bichloride treatment against club root in cabbages is not mentioned. Nor, in seeing some of our well-known diseases here listed as very minor troubles, must we forget that this publication is written primarily for American workers and in this respect fulfils its purpose in a very workman-like manner. It stresses the importance of a practical knowledge of crop requirements as an aid to dealing with disease problems, which aspect of plant pathology is somewhat neglected in training British students.

The references to literature are chiefly limited to American publications. This may be expected, but although the book is primarily intended for American readers it could, with little extra work, have been made more attractive to British plant pathologists. It can be considered a useful, but far from indispensable, addition to our reference shelves.

The text is singularly free from mistakes, but some unfortunate error in pagination has resulted in one half of the diseases in the index and three quarters of the table of contents possessing wrong page numbers. On page 65 in the index Crucifers (contnd) should read Curcurbits (contnd).

The book is more informative than a mere bibliography and despite the absence of any illustration is, at the price, good value. It is obviously meant for home consumption and a limited circulation.

D. E. GREEN.

CHEMISTRY OF OSMIUM AND PLATINUM

Gmelin's Handbuch der anorganischen Chemie Achte völlig neu bearbeitete Auflage. Herausgegeben von der Deutschen Chemischen Gesellschaft. System-Nummer 66 : Osmium, mit einem Anhang über Ekaosmium. Pp. xx + iv + 100. 14.25 gold marks. System-Nummer 68 : Platin. Teil A, Lief. 1 : Geschichtliches Vorkommen. Pp. 146. 16.50 gold marks. Teil B, Lief. 1 : Physikalische Eigenschaften des Metalls (bis thermische Eigenschaften). Pp. 72 + iv. 8.25 gold marks. (Berlin : Verlag Chemie, G.m.b.H., 1938–39.)

THE parts of "Gmelin's Handbuch" under notice deal with osmium and platinum. Osmium, the heaviest of all known substances, has a high melting point and is harder than glass and quartz but is scratched by topaz. Its scarcity and its tendency to form the highly poisonous, volatile, strongly smelling tetroxide prevents its commercial exploitation. It is a highly efficient catalyst, especially in hydrogenations. The tetroxide dissolves in water to give a neutral solution with an extremely small electrical conductance ratio, but it forms salts with bases. It is readily reduced to lower oxides or to the metallic state. Thus in alkaline solution its valency falls to 6, and in neutral and acid solution to 4, the dihydrate of osmium dioxide being formed ; but reoxidation by oxygen is readily affected so that it is an excellent oxygen carrier. With concentrated hydrochloric acid it gives chlorine. On heating the metal in chlorine a series of intensely coloured sublimates is formed. These are difficult to separate, but at 650° C. a black tetrachloride can be obtained.

Osmium forms a large number of complex coordination compounds, such as potassium nitrosochloride, $K_2[OsNOCl_5]$, osmiamic acid, $H[Os\,O_3N]$, a hexacyanide, $K_4[Os(CN)_6]$, and numerous organic derivatives. Six isotopes have been described by Aston and one by A. O. Nier. Eka-osmium, element 94, is known only in the form of two artificial isotopes produced by bombardment of uranium with neutrons.

The first part of the volume on platinum deals only with historical notes on the discovery of the six metals of the group and with their geological origin and geographical distribution. Although platinum has been found in ancient Egyptian works of art, it is probable that its employment for the purpose was accidental, its identity not having been recognized. There is evidence of its use in South America before the discovery of that continent by Columbus, but it was not until the middle of the eighteenth century that it began to attract general notice. W. Watson described its properties in the *Phil. Trans.* of the Royal Society in 1749, without, however, laying claim to its discovery. Thenard first observed its catalytic properties in 1813 during his investigation of the decomposition of ammonia, and in 1817 Sir Humphry Davy described the flameless combustion of various gases in presence of the metal. Palladium was discovered by Wollaston in 1803, but his discovery was first revealed anonymously and it was not until after he had obtained another new metal, rhodium, that he revealed his identity in 1805. Iridium and osmium were both discovered in 1804 by Tenant, while ruthenium remained unknown until isolated by C. Claus in 1844.

During the segregation of minerals in the earth's crust all the members of the group except palladium have passed almost completely into the metallic phase, while palladium with some platinum and ruthenium occurs in the form of sulphide. Geological maps of the distribution of platinum-bearing minerals in the Ural Mountains are given. Before the War of 1914–18, 95 per cent of the world's supply came thence. Apart from deposits in Spain and Siberia, the minerals bearing platinum occur in three zones of mountain ranges : (1) in America between Alaska and Chile ; (2) from eastern Australia through the Philippines to Japan ; and (3) from the Urals through Abyssinia to Rhodesia.

The second part of the section on platinum deals exclusively with the physical properties of the metal. Five isotopes are known, and an account is given of their formation by bombardment with deuterons and neutrons as well as of the transformation of platinum nuclei into other elements. It is suggested that the protons and neutrons of the nucleus may to some extent be combined to α-particles. The crystal lattice is made up of face-centred cubes with four atoms in each cell, no polymorphism having been established.

Hydrogen is the only gas which diffuses through the metal ; even after two months no trace of air has been found to diffuse into an evacuated vessel through platinum foil 0·02 mm. thick. Curves are given showing the influence of changes of temperature and pressure on the rate of diffusion of hydrogen. Diffusion is not noticeable below red heat, and since the rate is proportional to the square root of the pressure it has been suggested

that diffusion is preceded by molecular dissociation. Some difference of opinion exists as to whether hydrogen released in electrolysis at a platinum electrode penetrates the metal or not by true diffusion. As the rate of diffusion of heavy hydrogen is about three fourths of that for ordinary hydrogen, the difference is not enough to facilitate the separation of the isotopes.

THE CONQUEST OF ENERGY

Atoms in Action

The World of Creative Physics. By George Russell Harrison. Pp. x+370+16 plates. (London: George Allen and Unwin, Ltd., 1940.) 12*s*. 6*d*. net.

IT is sincerely to be hoped that no one will be misled by the title of this book. "Satan's invisible World Displayed" was not, as Herr Teufelsdröckh imagined, a history of the British Press; nor is "Atoms in Action" just another addition to the number of books which attempt to convey to a bewildered, and by now rather blasé, public the latest inside information about the structure of the atom. Of course, atoms come into it—atoms, as everyone who has ever attempted high vacuum technique knows only too well, leak in everywhere—but the operative word in the title of Prof. Harrison's book is not "Atoms" but "Action". "Almost every material problem of living," writes Prof. Harrison, "turns out in the last analysis to be a problem in the control of energy. That part of the cost of a lady's hat which does not represent business acumen on the part of the milliner is for stored and directed energy—the atoms of matter of which the hat is composed are permanent, and will still exist when the hat has been discarded and burned. Only energy and knowledge of how to apply it are needed to recreate a hat from its smoke and ashes."

Energy, its control, distribution, and utilization in modern times is the theme of the book, and a very stimulating theme it is. "Every dweller in the United States," we are reminded, "is now served, on the average, by energy equivalent to that which could be provided by thirty slaves such as sweated at the command of an ancient Egyptian king. In making this much energy available, science has contributed only a small fraction of what it can contribute. Human beings can be made twenty thousand times as wealthy as they are to-day; but only fundamental investigation of nature, such as is involved in 'atom smashing', will show how."

Prof. Harrison's main purpose in producing this book—which by the way was written at the instance of the American Institute of Physics—is neither entertainment nor instruction, though he gives his readers plenty of both. Essentially the book is a plea for research, and still more research. "Experience," he claims, "has shown no better way of eliminating poverty than by well-directed 'atom-smashing'," and in successive chapters of the book he drives home his statement by examples drawn from many branches of modern industry. He tells us, to mention but a few of the topics, of the applications of physics in farming and in medicine; of cold storage and illumination; of radio and television; and of the harnessing of the electron for electrical control: nor does he overlook such mundane, but important, matters as "profits" and "costs".

Even to a physicist who, for various reasons, has kept in fairly close touch with industrial developments of the subject, it is a thrilling story when compressed, as it is here, into a single volume; and Prof. Harrison tells it extremely well. He has a charming style, a flair for the exact phrase, an eye for illuminating and unusual comparisons, and a sly sense of humour which, without being obtrusive, gives sparkle and zest to the text. The chapters run on with the informality, the clarity, and the absence of intrusive technicalities which characterize the very best kind of talk; and at the end the reader finds that he has learned almost all he wanted to know of the subject, and (perhaps equally important) he has not been bored with things he did not want to know. In writing his progress reports, Prof. Harrison has been able to tap original sources of information (some of it unpublished) available in many of the largest research organizations in America. It may be taken that his stories are as authentic as they are interesting.

Some appreciation of the achievements of science, and the methods by which they have been reached, is nowadays an essential part of a good general education, and no better mentor has yet appeared than Prof. Harrison. In particular, it is much to be desired that "Atoms in Action" might find its way into the hands of all Cabinet Ministers, present or prospective, of heads of departments, and business directors. For, as its author reminds us, the end is not yet!

> "Still o'er the earth hastes opportunity,
> Seeking the hardy soul that seeks for her."

Much will depend in the future on our preparedness to seize the opportunity presented to us in the almost infinite possibilities of well-directed physical research. J. A. CROWTHER.

MEMOIRS OF AN IMMUNOLOGIST

As I Remember Him: the Biography of R. S. By Hans Zinsser. Pp. x + 369. (London: Macmillan and Co., Ltd., 1940.) 12*s*. 6*d*. net.

THIS book must be accounted a notable achievement when we consider that it is the parergon of one who spent a strenuous life devoted to researches in the fields of microbiology and immunology. The reader should keep clearly in mind that the author, Dr. Hans Zinsser, who was professor of these subjects in Harvard University until his recent death, adopted the fiction of narrating the events of his own life and experiences as if they had happened to "R. S.", a mythical friend. The author wrote the last chapter, which describes the thoughts of "R. S." during his fatal illness, when he himself was under the shadow of impending death. He did not use the device of anonymity in order to heighten his self-importance. On the contrary, he took pains to assure the reader that his objective counterpart was an ordinary intelligent person who was often not really competent to pronounce opinions on many of the topics that are discussed in the book. This modest attitude is stressed in the first chapter and also in the final sentence of the last chapter, which states that it seemed scarcely worth while to have written a book about his 'friend'—a view which is unlikely to be shared by its readers.

Zinsser's father migrated to the United States from the Rhineland and his mother from the region of the Black Forest. Their children were born in the New World, and the author tells us that he spoke no English until he was ten years of age. His youthful ambitions were directed towards a literary career, but the researches of Edmund B. Wilson on cell division so fascinated him that he chose biology as a subject of study and was later advised to take a medical course. He tells in an amusing fashion how an attempt to combine practice in New York with laboratory work proved unsuccessful and how he then specialized in bacteriology, lectured to students, directed the work of his research assistants, and in odd moments scribbled sonnets on scraps of paper.

In the course of time an intensive study of the mode of spread of typhus fever led him far afield: to Serbia, Mexico, Tunisia and Russia. He greatly admired France, had many French friends and thought Paris the most civilized city in the world. He makes vivid for us the romantic feelings aroused in him there as a youth of twenty-one; and he recalls memories of spring in the Luxembourg Gardens and of the rhymes of Ronsard, Villon and Verlaine ringing in his head. When he had become a noted man of science, he was appointed visiting professor at the University of Paris, where he lectured in French to the students, and his experience forms the basis of an interesting discussion on the relative merits of French, German and American universities. During the visit his friend Vallery-Radot gave him a copy of Pasteur's will, with permission to quote it in this book; the will consists of three simple sentences embodying two equally simple wishes. Readers in Great Britain can scarcely fail to remark that the author's love of France apparently left him little room for appreciating British characteristics and cultural values; perhaps he found it difficult to break down the barrier of British national reserve. However this may be, it is certain that we should have enjoyed his candid comments for, as his book abundantly shows, he was a kindly and tolerant observer of human nature. He deplored the political degradation of Germany and had looked forward in vain to its transformation into a free Republican State.

Towards the end of his life he visited Japan and China, and found in Peking a source of charm that no other city except Paris had ever held for him; he was attracted, too, by the people, a natural consequence of his friendship with many Chinese collaborators during a period of more than twenty years.

Dr. Zinsser was a versatile man with a wide range of intellectual interests, and thus he was drawn to those whose view of life was not bounded by their specialty but—in his own phrase—whose minds swept the horizon. He notes that his friend the late Dr. Charles Nicolle, for many years an expert in tropical medicine and director of the Pasteur Institute in Tunis, was novelist, philosopher and historian; and that Laennec, the inventor of the stethoscope, was an accomplished pathologist, classic, flute-player and horseman. Unlike some of the younger men of science of the present day he possessed a strong historical sense, and took pleasure in viewing modern ideas, customs and methods in the light of the past.

This book contains a wealth of reflections on a great variety of medical, educational and political subjects; and, since the author has an easy style with a talent for descriptive writing that is enlivened by humorous and ironical comments, the reader's interest is never allowed to relax.

G. F. Petrie.

THE UNIVERSITY OF ICELAND

BY PJETUR SIGURDSSON,
SECRETARY, UNIVERSITY OF ICELAND

THE University of Iceland was founded on June 17, 1911, the hundredth anniversary of Mr. Jón Sigurdsson, who was a profound scholar and the nation's leader in her struggle for independence in the nineteenth century. It began its activities with four faculties, namely, theology, medicine, law and philosophy, the last-named comprising the Icelandic language, history and literature, besides philosophical studies. At first the teaching staff consisted of ten professors and a few lecturers.

The University was at first housed in the Parliament building, but this accommodation soon proved too small and inconvenient, and for more than twenty years the University authorities fought strenuously to obtain a separate building. At last, in 1933, they obtained the sole right to establish a money lottery in Iceland, with the view of defraying the expenses of a new building, suitable for the University and in every way meeting modern demands.

PROF. ALEXANDER JÓHANNESSON, PH.D.
Vice-Chancellor, University of Iceland.

The lottery commenced operations in 1934, and the University building was begun two years later and brought to completion this year, partly by borrowed money to be repaid in the course of the next few years out of the profits of the lottery. The new building was dedicated on June 17 last, and teaching began there this autumn.

The main building is about 240 ft. long and is three-storied, with a wing running out from the centre at the back. On the ground floor are the offices, the lecturers' common room, the reading-room, and the library, biological, physiological and pharmacological laboratories, and a research room for the investigation of foodstuffs.

On the second floor are nine lecture rooms, the collections and apparatus belonging to the Medical Faculty, the chapel, and the great hall.

On the third floor are fourteen workrooms for the teaching staff, while the rest of this floor will, to begin with, be placed at the disposal of other schools.

The University forms the largest building in Iceland, so far, and in more respects than one it marks an epoch in Icelandic architectural style. Most building materials have to be imported from abroad, but in the new University native material has been used to a much larger extent than heretofore and in a manner different from what has hitherto been known here. Prof. Gudjón Samúelsson, the State architect, who designed the building, also supervised its construction.

Besides this new main building, there are other buildings connected with the University; such as the Students' Hostel, built in 1934, the University Research Institute, built in 1936, both standing in the University grounds, a very large and beautifully situated plot on the outskirts of Reykjavik. There are also pathological and bacteriological laboratories housed in one building near the Landspítali (State Hospital), and built in 1934, where part of the instruction in medical science is given, while the rest is given in the State Hospital and the University building. In this building, too, researches are made into animal diseases, for, besides the old endemic ones, various other dangerous sheep diseases, hitherto unknown in this country, have come in recent years.

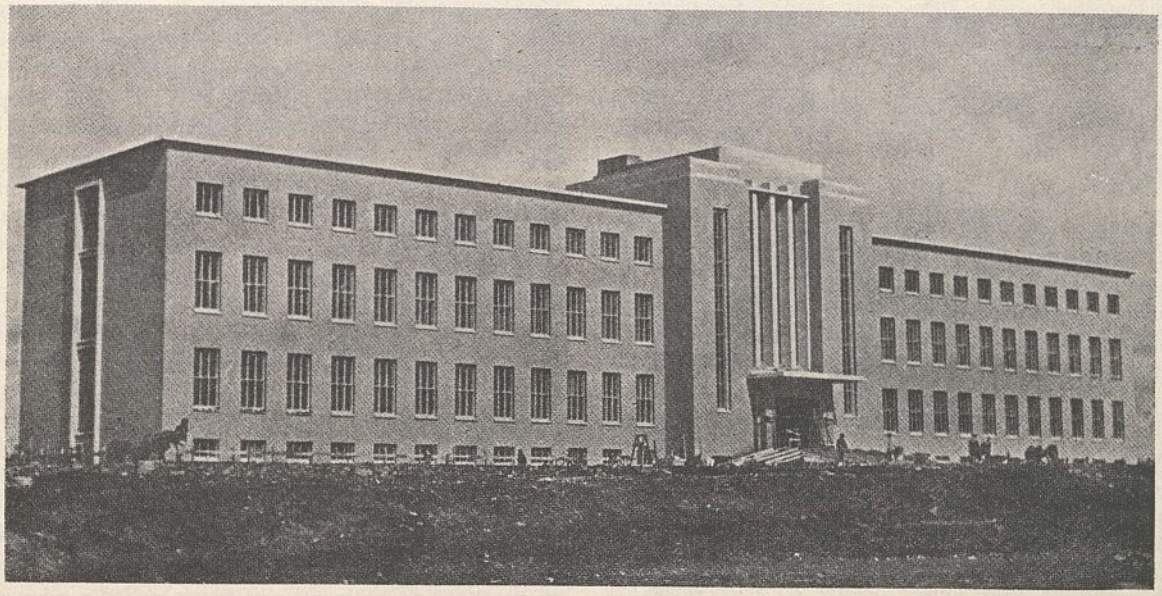
In the University Research Institute there are the Departments of Fisheries, Industry, and Agriculture.

The Students' Hostel can accommodate thirty-eight students. There are also a reading-room, a dining-room, and a sports room.

The University is attended by some 290 students, and its teaching staff comprises fourteen professors and as many lecturers. The principal aim of the teaching is to prepare the students for official careers in the State, for scientific work is more difficult here than at the big universities of other countries. Yet, as mentioned above, both the University and the medical research department have undertaken researches into animal diseases and done good work.

The Philosophical Faculty lays the main stress on teaching the Icelandic language, history, literature, and old Northern lore. This Faculty will lead in all work done in the field of national learning. Though the Icelanders have preserved the old cultural treasures of Scandinavia better than any other nation, yet most of the old manuscripts in which these treasures are to be found are kept in foreign museums, particularly in Copenhagen. These MSS. were exported to Denmark at a time when Iceland was ruled from Copenhagen. But as Iceland has now become a free and independent country and only united to Denmark by a common king (a tie which the present events rent asunder early in April last) negotiations are being carried on with the view of getting the old cultural treasures, such as MSS. written by Icelanders on Icelandic and Scandinavian matters, returned to Iceland. If this can be achieved, which there is no reason to doubt, the University of Iceland will be in a position to play a still more important part in research into the old Northern lore. For doing such work the Icelanders are better equipped than other nations, because the tie between the present and the past forms of their language and literature has never been rent asunder. Every Icelander thoroughly understands the old literary works which were written some eight hundred years ago.

Though our University is small, it works in the same spirit as other universities, and with the same zeal and sincerity for the good of the nation and for the promotion of learning.



NEW BUILDING OF THE UNIVERSITY OF ICELAND.

THE STUDY OF PREHISTORIC TIMES*

THOUGH T. H. Huxley, having established beyond the reach of criticism 'Man's Place in Nature', considered that his duty as biologist and anthropologist stopped short at the limits of organic evolution, he realized, perhaps before anyone else, that the principles of evolution did not stop there. He was well aware that when a primate had made a tool and had thus become entitled to be called a man, a new vista was opened in the realm of evolution, and that by the creation of extra-corporeal organs man had discovered a new method of adjusting himself to his

* Substance of the Huxley Memorial Lecture of the Royal Anthropological Institute delivered by Harold J. E. Peake on November 26.

environment. Just as the doctrine of evolution, when applied to plants and animals, is the fundamental theme and focus of all biological research, so the evolution of civilization should hold a like place in anthropological studies, and its most important duties should be to trace, step by step, man's progress in the development of his material civilization, the evolution of his varied forms of social organizations, allied as these are with the growth of his religious conceptions and practices, until the whole series is complete from the primitive flint tool to the aeroplane or television, from the simple family group to the nation or empire. Here attention is directed to the methods that have been used and are still being employed to reconstruct man's behaviour during the period before writing was known that is termed 'prehistoric'.

Few, if any, peoples, however primitive, are not interested in their past. They have embodied it in tradition ; while other tales, related to explain natural phenomena, are embodied in myths. This body of tradition and myth, especially in the highly elaborated forms, such as are found in the Homeric poems and other great national and tribal epics, are the only available accounts of prehistoric times. Study of these records has oscillated between acceptance and sceptism ; but sufficient confirmation has accrued from such archæological investigations as those of Schliemann at Mycenæ, Sir Arthur Evans in Crete and others, to justify acceptance of legend as containing a germ of truth about the deeds of heroes and about prehistoric times.

Philological studies, beginning with the investigations of Sir William Jones on the relations of Sanskrit, Greek, Latin and German, of which the results were embodied in an address delivered in India in 1786, have, as the result of much speculation and discussion, been responsible for theories as to linguistic and racial origins and pictures of prehistoric times, which in so far as justifying the theory of a predominant Aryan race is concerned, have failed to retain a place in scientific theory.

While the Aryan theory based on linguistic evidence has thus come to be discredited, study of the physical characters of the populations of Europe, and of human remains dating from prehistoric times, has led up to the classification which took final form in the work of W. Z. Ripley (1900), who argued that Europe had been peopled by three races, the Nordic, Alpine, and Mediterranean, though the existing populations show a large number of intermediate types owing to intermixture.

In the nineteenth century another line of research was pursued in the hope of throwing light on the social and economic organization of prehistoric peoples. Studies of the village communities of Denmark by Olufsen (1821) and of the German mark by von Maurer indicated the existence of village communities with common ownership and cultivation of the soil among all Germanic, Scandinavian and Celtic peoples. Further studies of the village communities followed, beginning with those of Sir Henry Maine based upon his experience in India. In Britain, Seebohm's view of the pre-Saxon origin of the village community has recently been revived, with additions by Peake in the suggestion that the three-field system may have reached Britain from the Danube basin about 1200 B.C., while it is suggested that both the 'Celtic' rectangular enclosure first identified by Crawford from the air and the 'long strip' system may characterize distinctions marked between the central European populations in the Middle Bronze Age, and possibly represented in successive migrations into Britain in the beginning of the Late Bronze Age, which brought two distinct types of cultivation with them.

So far, except for a number of skeletons with reliable associations, none of the evidence upon which these methods of inquiry depend is of prehistoric date. The only science which has at its disposal an almost endless supply of contemporary documents coming down to us from prehistoric times is archæology—and this, too, is strictly limited to material culture.

It is only within the last few generations that archæology has attained to sufficient precision in its methods to be worthy of being called a science. The study has passed through many phases ; and it may not be valueless to trace the succession of ideas that has marked its progress.

In very early days, men noticed ancient monuments which they attributed to their legendary heroes, as did Pausanias at Tiryns and Mycenæ. Hesiod realized there had been a bronze age before the age of iron ; but Lucretius was the first to make a clear statement on the matter ; the belief, however, that stone, and perhaps copper and bronze, implements were thunderbolts was widespread. The study of legendary material in the Middle Ages, of which the work of Geoffrey of Monmouth is a conspicuous example, continued until towards the end of the sixteenth century, when Camden in his "Britannia" started a new scientific method by interpreting ancient monuments in the light of statements made by classical writers.

The first to appreciate the true significance of stone implements was Michaelis Mercatus (*ob. c.* 1590), who made a definite pronouncement that they were made by men before they knew how to use metal, and Dugdale also, in 1656, attributed polished flints found at Oldbury in Warwickshire to men ignorant of the working of iron or brass.

Prehistoric questions aroused considerable interest in Great Britain, though early remains were usually attributed to the ancient Britons or the Druids. In the meantime, the work of a commission appointed to investigate the history of Denmark in 1806 led C. J. Thomsen, after studies extending over twenty years, to divide prehistoric times into three phases: the ages of stone, bronze and iron.

In France the work of Boucher de Perthes in the Somme valley, first published in 1838, led in 1859 to the acceptance by British geologists and archæologists of the Abbeville implements, as pointing to the existence of man here "at a period remote beyond any at which we have hitherto found them", while it was made clear from these discoveries that the Stone Age must be divided into two, as Lubbock suggested, namely the Palæolithic and Neolithic Ages.

The discrimination between cave and drift implements in the Palæolithic period initiated a series of classificatory systems which culminated in 1912, when Breuil added the Aurignacian to those familiar phases of Chellean, Acheulean, Solutrean and Magdalenian. For a time, this sequence was considered final; but discrepancies have since necessitated some revision.

The discovery of the Swiss pile-dwellings in 1853 led to the conclusion first formulated by Keller that the neolithic civilization and domesticated animals were first introduced from Asia about 5000–4000 B.C. The attempt to fill in the gap believed by some to exist between palæolithic and neolithic led to the investigation of the Danish shell-mounds by a committee appointed in 1860, the identification of the Tardenoisian and Azilian cultures, and finally in 1921 to the recognition by R. A. S. Macalister that this so-called gap covered cultures which he grouped together as "Mesolithic".

Thus between 1836, when Thomsen recognized the three ages of stone, bronze, and iron, and 1921, archæologists had framed a system of relative chronology extending from Harrison's Eolithic, the earliest period, down to the close of prehistoric times. How such a relative chronology became converted into a positive chronology, at any rate for the later phase, may now claim attention.

Excavation of archæological sites, the examination of monuments and the decipherment of inscriptions, supplemented by tradition embodied in written documents, in Egypt, Mesopotamia and Greek lands, made possible correlations to which Crete and Egypt contributed largely, and upon which it became possible to work out a chronological system making a framework for archæological discovery extending from the fourth millennium B.C. or earlier, down to historic times.

The diversion of interest in archæological excavation from buildings, objects of art, and inscriptions, to which it had been directed in the nineteenth century, to the lesser finds, and especially pottery and sherds, opened the way to the study of cultural complexes and their distribution. This led up, through the work of Ratzel, Graebner, Rivers and others, to the more extravagant theories of the Diffusionist school, which traced the origins of all cultural development back to ancient Egypt. For a time, a violent reaction against such extreme views precluded advance along these lines; but a saner perspective in more recent work, accepting the principle, and tracing the diffusion of culture elements from the Aegean area, has laid the foundations of a chronology for the greater part of central, northern and western Europe, with a margin of error of rarely more than a century, from the middle of the fourth millennium B.C. The chronology of the pre-agricultural stage is still uncertain, but hopes are entertained that this may in time be reduced to some semblance of accuracy by studies and methods which collectively may be called geochronology.

Among pitfalls to which the archæologists of the past have been prone, and to which we ourselves are still inclined, is a too rigid adherence to such classificatory distinctions as palæolithic, mesolithic, neolithic and the like, which, while convenient enough for the purposes of the museum curator, do not represent the actual conditions of life in prehistoric times, when these periods and cultures were not marked off from one another with such extreme precision. These arbitrary divisions cut across many vital distinctions. The difference between Lower and Middle Palæolithic has disappeared; while the first great break in continuity occurred, it is believed, early in Aurignacian times with the arrival of *Homo sapiens* in Europe. The next great break occurred with the cultivation of grain and the taming of wild animals, indicating the neolithic age and making settled life a possibility.

When we consider the long duration of the mesolithic age and the still greater length of time occupied by the various phases of the palæolithic, it seems unnecessary to divide into a number of comparable ages the period during which crops have been cultivated, namely, a period of little more than 7,000 years. Most archæologists are coming to the conclusion that the stages in metallurgy do not form the most convenient divisions for the grain-growing age. It has long been clear that in Britain the Middle Bronze Age, when successive waves of invaders from central Europe forced themselves into the country, a movement also apparent all over Europe, caused a greater

break in the continuity of culture than the various advances in metallurgy. In a recent work, Hawkes has suggested that the first period of the development of culture in Europe closed with the fall of the Palace of Knossos. A second grain-growing period may conveniently be regarded as ending with the coming of the Romans. There is much, however, to be said for the suggestion that prehistoric times came to an end with the introduction of Christianity and written documents, or even continued to the middle of the eleventh century.

These changes, omissions, and additions in the recent development of prehistoric studies require a revision of nomenclature which might as a starting-point be based upon the distinction marked by Elliot Smith between Palæanthropic and Neanthropic man. While the former epoch is at present in a state of flux which precludes further subdivision, the latter falls naturally into two phases: the hunting and collecting age, and the second a cultivating age or the corn age, which is in turn divisible into four main periods. The first is conspicuous for the spread of cultivation, the second was a period of invasions, the third, the medieval period or age of faith, and the last the modern period or the machine age.

Stratigraphy, typology, the study of the distribution of cultural elements, more especially with the aid of distribution maps, each by its appropriate method and argument, has made and will continue to make specific contributions to prehistoric studies.

In the past, archæologists were wont to focus their attention on flints, potsherds or works of art —always on material objects, regardless of the men who made them. Younger investigators, and some of the veterans too, are now realizing that the human element is all-important. We are engaged in fitting together a gigantic jig-saw puzzle, of which many of the pieces are missing. To solve this gigantic puzzle—not one puzzle only, but a series—a picture of each succeeding age is needed, and ultimately an absolutely continuous series, like a roll of film, giving a moving picture of the progress of mankind. Then, if even only a part of our considerable task has been performed, we shall be in a better position to achieve that new orientation in world affairs for which many of the greatest thinkers of to-day are striving.

THE CENTRAL REGISTER

READERS of NATURE will recall several references during the past year or so to the work of the Central Register set up by the Ministry of Labour and National Service. A survey of the position of the Register as a whole appeared in NATURE of February 3, 1940, p. 176.

The Central Register has now been working for more than a year, and up to the end of October had made 9,016 placings of persons from the Register in Government Departments and other organizations engaged on work of national importance. The number of placings of scientific men of all kinds, including industrial chemists but not engineers, is 1,469.

In June last, the Select Committee on National Expenditure examined the Central Register and issued a report upon it. The report emphasized that the Central Register was an essential part of the organization of the national effort and was not, as was often supposed, an employment-finding agency; its function, as the Committee expressed it, was not to find jobs for men but to find men for jobs. The Committee noted that the chief use of the Register had been by Government departments and such bodies as Chatham House and the British Council, and that little use had been made of the Register by industry. The Committee recommended, therefore, that steps should be taken to encourage employers in the vital war industries to make greater use of the Register. The Committee referred to a widespread belief that Government Departments had not followed the Government's declared policy that the Central Register should normally be the sole medium for the recruitment of temporary staff of the standard of the Central Register. It declared that this belief was mistaken, and that departments in general had used the Central Register, exceptions to the rule being confined to the most part to the earlier stages of the War.

At the same time, the Committee expressed strongly its conviction that the position of the Central Register as the sole agent for recruiting higher personnel to Government Departments should be fully maintained, except where the urgency of any requirement of special qualifications justified an exception to the rule. The Committee further examined the criticism that there was delay in filling appointments through the Central Register, and stated in its report that this criticism had been examined and found unjustified. Some orders had been filled within a few hours, while the average time taken by the Register in making submission was between

six and eight days. This period included, generally, consultation with the appropriate panel and inquiring whether the volunteer was available and willing to be considered for the post in question and whether his existing employer had any observations to offer. The Committee stated that it had visited the Register and was of the opinion that the present staff should be adequate to cope with the much greater use of the then 97,000 names on the Register which it desired. The Committee also placed on record the appreciation of the amount of voluntary effort which leading members of the professions had given to the Central Register.

Shortly after the report of the Parliamentary Economy Committee had been published, steps were taken for the compulsory registration of certain categories of persons on the Central Register where the demand was considerable. The Specified Classes of Persons (Registration) Order required qualified engineers, engineering scientists, chemists and physicists to enrol with the Central Register if they had not already done so. The result of this compulsory registration order has been to bring the total of names on the Central Register to nearly 200,000. The number of chemists who were registered as a result of the compulsory order was 5,954, the number of physicists 1,175, and the number of engineering scientists 226. These numbers are, of course, additional to those already enrolled on the Register.

Of special interest is the re-organization of the Central Register Branch which took place about this time under the control of Mr. O. V. Guy, who has been temporarily seconded from the Cambridge University Appointments Board to become an Assistant Secretary at the Ministry of Labour and National Service. The increase in the pace of the war effort, the wide powers given to the Minister of Labour and National Service under the Emergency Powers Act, and the compulsory registration of persons with technical qualifications referred to above had put additional responsibilities on the Central Register, and it was thought desirable to secure a greater understanding of the demands of the ordering Departments on one hand, and on the other hand to have a greater degree of specialization in the work of selecting candidates and handling problems of the best utilization of people on the Register. With this in mind a number of qualified scientific and technical officers were added to the staff of the Central Register. It was further thought necessary to bring the Register into closer relation with the general employment policy of the Ministry.

As a result of these considerations the Central Register was attached to the Employment Department of the Ministry of Labour and National Service, and arrangements were made for Mr. Guy to attend regularly the sittings of the Labour Supply Board. The Register was divided into seven sections, two non-technical and five technical sections. The five technical sections were placed in the charge of qualified technical men as follows: civil engineers, architects and surveyors under Mr. G. E. Forward (recently on the staff of Messrs. Howard Humphreys and Sons); mechanical engineers under Mr. J. C. Orkney (seconded from his post as lecturer in engineering at the University of Aberdeen); electrical engineers under Mr. A. L. Fielding (seconded from the post of advisory and inspecting engineer with the Agent General for the Government of New South Wales); chemists, industrial and pure, under Prof. W. Wardlaw (seconded from his post as professor of physical chemistry at Birkbeck College); all other scientific workers, including mathematicians, under Dr. C. P. Snow, fellow and tutor of Christ's College, Cambridge). Among the duties of Dr. Snow will be that of examining means of utilizing on branches of scientific work in which war-time demands are great, the services of men whose secondary rather than their primary qualification fits them for such work. Thus a number of biologists have been appointed recently to posts making use of their aptitude for physics. The seven sections are co-ordinated by Mr. H. R. Whiteman, a deputy divisional controller of the Ministry, who has been transferred to the Central Register to replace Mr. F. Gent on his retirement.

The new organization has already shown an improvement on the old. The technical heads of sections make better contact with the Service and Supply Departments from their more intimate knowledge of the problems at issue. This allows orders to be handled with a greater understanding than before. Meantime, the advisory machinery has continued to operate fully, and questions concerning the age of reservation, and supply and demand of qualified technical people of all kinds have come before the committees.

It is worth noting also that, of the members of the Scientific Advisory Committee under the chairmanship of Lord Hankey, all but one are members of the advisory machinery of the Central Register. This arrangement will avoid any overlapping of function between Lord Hankey's Committee and the Central Register, and enable the problem of supplying the requisite personnel for research to be closely linked with the development of research, and with the problems of the application of science to the war effort which Lord Hankey's Committee is considering.

In conclusion, it may be of interest to refer to the Central Register of Aliens, which at present contains 3,400 names of qualified professional men

such as engineers, many of whom are immediately suitable for employment. In connexion with the steps being taken by the Government to secure that use is made where possible of the services of friendly disposed aliens in the prosecution of the War, Mr. Bevin set up an International Labour Branch to co-ordinate questions of the employment of aliens. The Central Register of Aliens has accordingly been transferred from the Central Register to the International Labour Branch, where in common with other problems of the employment of aliens it will be in the charge of Mr. T. T. Scott, late of the International Labour Office at Geneva. Prof. J. A. Davies, of King's College, University of London, has joined the International Labour Branch as a technical officer appointed to assist in finding ways for the utilization of the services of aliens.

Security restrictions have so far hampered the placing of friendly aliens in employment, but with the increasing demands of war industry, and the encouragement by the Government of the employment of approved aliens, a wider use of this Register can be expected.

KINETICS OF CONTACT CATALYSTS AND THE INDUSTRIAL BACKGROUND*

By Prof. Hugh Stott Taylor, F.R.S.,
Princeton University

IT is a tragedy of the efforts of the student of chemical reactions at surfaces, in these closing decades of the two centuries of service to culture and civilization that the University of Pennsylvania is now celebrating, that the finest flowers of the effort should have synchronized with, and been made subservient to, the international tragedy of 1914–1918 and that which now burdens the human race. It was not mere accident that, in the decade preceding the first Great War, out of the fundamental researches of Sabatier on the capacity of nickel and other metals to induce the combination of hydrogen with unsaturated substances, there emerged the answer to the famous query of Napoleon to Frenchmen of science one hundred years earlier as to the possibility, in a blockaded country, of converting liquid fats into the solid fats necessary for the production of margarine and of soaps. It was a proud boast of an English technician in 1919 that success had been attained in converting fifth-grade whale oil into edible fats in the last years of the first World War. It cannot be chance alone that the industrialization of Haber's researches on the fixation of atmospheric nitrogen and the production of the ammonia necessary for fertilizers and explosives should have been achieved on the eve of that same war which found Germany cut off, by British sea-power, from the only hitherto available source of fixed nitrogen, the nitrate deposits of Chile. These processes demanded in their turn cheaper sources of hydrogen. This was achieved by new processes of formation at catalytic surfaces, and put to use for the filling of those now archaic 'sausage balloons' that served as observation posts in the battle lines of Flanders. To-day the hydrogen is used in 'barrage balloons' employed in defence against the attacks of invading bombers.

Two decades of 'progress' demanded the solution of new problems for the coming new war. The mechanization of transport has profoundly modified the technique of modern warfare. The present distribution of sea-power compelled a blockaded country to ensure for herself either accessibility to the necessary raw materials of transport such as oil and rubber, or alternatively so to shape her technical development as to ensure the production of such materials synthetically from raw materials available within the blockaded area. Within Germany during the last years there have been developed, by means of reactions at surfaces, methods of converting coal into high-quality aviation gasoline and synthetic rubber materials which have gone far towards making that country independent of supplies from abroad. Similarly, her need for fats, mitigated in part by her conquests of the present year, demanded the replacement of the fats used in soap manufacture by synthetic detergents and the development of methods for the conversion of available raw materials into synthetic fatty acids. Marked progress has been achieved in these directions.

Even in the case of countries open to the available resources of Nature, it has been found that Nature does not always produce the most highly desirable forms of the materials to be consumed. Petroleum supplies an excellent example of such a situation. In the early days of the automobile,

* A paper at a symposium on "Chemical Kinetics" delivered on September 17 during the Bicentennial Conference of the University of Pennsylvania.

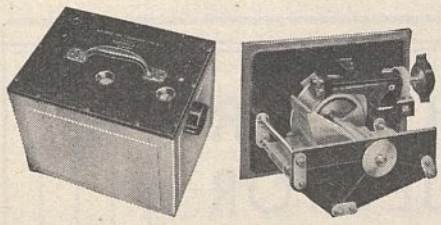
LAWFUL PREY

"There is hardly anything in the world that some man cannot make a little worse and sell a little cheaper; and the people who consider price only are this man's lawful prey."

MR. JOHN RUSKIN is, of course, the author of this oft-quoted statement, and although it has the familiar Ruskin air of rather sniffy disapproval, there is yet a great deal of sound sense in it.

Not that one disapproves of low prices in themselves. To make things a little cheaper is an admirable achievement; and for many purposes it does not even matter if the cheapness involves some loss of efficiency. "Good enough for its purpose" is a perfectly reasonable phrase, condescendingly though it is so often used.

So far as we are concerned, we tend rather to the reverse. Most of the work we produce is "a little better and a little dearer," and our lawful "prey" is the man who wants something produced of unusual quality, precision and accuracy. We are staffed and equipped to produce fine work and so we do not pretend to compete for jobs in which cutting to the last tenth of a penny is the vital consideration.



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adequate fuels could be obtained by simple distillation of crude oil. Improvements were demanded by increasing fuel requirements, which led to the development of cracking processes for increasing gasoline fraction from a given barrel crude. The demand for increased power in the automobile, stimulated further by progress in aviation, led to the realization that certain types of gasoline molecules, notably *iso*-octane, possess fuel characteristics that far exceed those of other molecules within the range of volatility demanded by the engines in question. New problems were thus presented to the chemist; the conversion of low-grade natural products into the more valuable high-grade fuels. In the solution of these problems the catalytic chemist has made notable contributions. Catalytic methods have been developed for cracking complex petroleum molecules into simpler high-grade automobile and aviation fuels, for polymerizing or putting together the simpler hydrocarbon molecules to form molecules of high anti-knock value in the gasoline range, for adding simpler saturated molecules to unsaturated molecules to form valuable fuels, the so-called processes of catalytic alkylation; catalytic isomerization, the changing of molecules of a given configuration to other configurations more powerful in fuel characteristics; catalytic dehydrogenation, which coupled with catalytic processes of ring formation, led to the formation of aromatic fuels containing benzene, toluene and xylene. As a by-product of these latter new processes of dehydro-aromatization the petroleum industry is becoming an active competitor of the by-product coke-oven industry upon which, hitherto, we have been dependent entirely for the raw materials of the dyestuff industry, explosives and many pharmaceutical preparations.

Paralleling in intensity these developments with the more complex units of petroleum raw materials, a series of efforts has evaluated the lighter constituents of petroleum, natural gas and the cracked gases of refinery operations. Catalytic processes have been developed for the direct oxidation of ethylene at metal surfaces, notably silver surfaces, to yield ethylene oxide, itself a reagent of great value in a series of synthetic processes and the intermediate in the production of ethylene glycol, a product now required on a tonnage basis for anti-freeze solutions. Propylene, the next higher unsaturated olefinic hydrocarbon, is, by reason of a newly developed process, the raw material for synthetic production of glycerine available at any moment when the by-product glycerine of soap manufacture becomes inadequate to meet the demands. Butene, a four-carbon atom olefine, yields by further catalytic removal of hydrogen the butadiene which is the starting material for the synthetic rubbers of the 'Buna'-types developed in Germany. There, due to lack of petroleum, coal is the raw material and the production of butadiene occurs via the formation of calcium carbide and acetylene. That butadiene, under the influence of metallic sodium, would polymerize to a rubber-like material has been known since the end of the last century. It was such materials which were employed as rubber substitutes by the Germans in the latter phases of the War of 1914–18.

The progress achieved in the recent researches on these materials arises from the discovery that 'cross-polymerization', the introduction of other molecules into the growing unit, rubber, like the plastics, cellulose, starch, etc., is 'macro-molecular', that is, composed of large numbers of constituent units combined with each other into a structural pattern conferring on the mass its particular characteristics. The newer synthetic rubbers build into the growing butadiene polymer such other materials as styrene and acrylic nitrile, with the result that products having abrasion characteristics and resistance to oxidation, and therefore to deterioration, from 5 to 30 per cent better than the best natural rubbers have been produced. Superior characteristics over the natural products also obtain in the case of such special products as 'neo-rene' and 'thiokol' which, in addition to their carbon and hydrogen constituents, contain also chlorine and sulphur respectively, thus deviating markedly in constitution from the natural product, and possessing properties which for certain purposes render them more valuable than the natural product.

In the field of plastics also the chemistry of reactions at surfaces is making notable contributions. These materials have almost endless uses and possibilities, alike for peace-time and war. They can be used as substitutes for metals and for glass. Optical instruments, aeroplane parts, possibly even as impregnating material for plywood aeroplane wings, are among their immediate uses in the era of defence now upon the United States. Solvents for plastics, ethers, alcohols and esters are allied materials that the catalytic chemist is contributing. From these researches also come the newer synthetic fibres of which 'nylon', as a material superior in many characteristics to silk, is now in large-scale production. The raw materials from which they are made, coal, limestone, petroleum, water and air, require the chemistry of reactions at surfaces for the transformations that ultimately yield the desired products.

Side by side with the intensive industrial developments here outlined, there has grown up also in industrial research, Government and

university laboratories a broad programme of theoretical study in this field. Upon the pioneering investigations of Langmuir has been built a body of theoretical fundamental knowledge, the major contributions to which have come from American laboratories, and with the aid of which a more rapid and certain approach to the solution of problems of industry can be achieved. Langmuir recognized that the seat of chemical change at surfaces was a layer of absorbed gas one molecule thick associated with the surface by chemical forces. The heterogeneity of catalytic surfaces was then recognized and its importance in the interpretation of the great sensitivity of surfaces to poisons became understood. This concept led also to an understanding of the phenomenon of promoter action, whereby with suitable added material the efficiency of a given quantity of catalyst material could be enormously enhanced. The quantitative extent of the surface could be increased and its quality multiplied. Later researches revealed that two types of association of a gas with a surface, one physical and the other chemical, could obtain, and that the operating temperatures determined which type of interaction occurred. With different surfaces, different temperature ranges could be employed. The range of catalytic materials and the temperature ranges in which they operate were correspondingly expanded. With the advent of isotope separations, signalized by Urey's discovery of heavy hydrogen, followed by heavy oxygen, carbon, nitrogen and sulphur, new tools became available for the study of the associations with surfaces involved in catalytic changes.

To-day the analysis is going yet deeper. With the modern tools of X-ray and electron diffraction, the catalytic chemist is examining the activities of individual faces of crystals and is demonstrating that the geometrical configurations characteristic of particular faces are more favourable to the activation of reactants than are other faces. As a consequence, methods can be developed to produce the desired crystal faces in preponderant amount. Twenty-five years ago, the science of catalysis was almost purely empirical, dependent entirely on trial and error; it has now become a highly refined scientific study, rich in possibilities for applied science and in joyous endeavour for the fundamental scientist.

OBITUARY

Prof. H. Rosenberg

PROF. H. ROSENBERG, director of the University Observatory at Istanbul, Turkey, whose death has just been announced, was one of the pioneer workers in modern astrophysics.

It was in 1914 that Rosenberg completed a fundamental paper on the photographic investigation of the intensity distribution in star spectra. Using Planck's law, and for calibration the standard star α Aquilæ and the sun, he was led to a preliminary series of seventy stellar temperatures; it was the first of its kind, as previous temperature work by Wilsing–Scheiner–Muench was carried out exclusively by visual spectrophotometry. The comparative study of the differences between these two series later gave rise to a number of fruitful investigations concerning the deviations of stellar radiations from black body radiation.

In August 1913 Rosenberg announced at the Hamburg meeting of the Astronomische Gesellschaft the successful introduction of the potassium photocell into stellar photometry. At the same time as Rosenberg, but independently, work along similar lines was carried out by P. Guthnick, while the selenium cell has been used most skilfully by J. Stebbins in America. In view of the prominent part which both spectrophotometry and photo-electric photometry play in modern researches, Rosenberg's influence will not be under-estimated, even without going into detail of all his other notable contributions to astronomy. These were concerned mainly with variable stars, the formation of photographic star images, the scale of effective wave-lengths, the removal of instrumental errors; furthermore, the successful construction of a new polarization photometer and its application to surface brightness measurements on the moon (1921), of an electro-microphotometer (1925), and of a photographic double filter giving simultaneously two close star images, in blue and yellow (1936).

Most of his earlier work was carried out by Rosenberg at his private observatory at Oesterberg near the University of Tübingen, where he held a chair before his appointment, in 1925, as director of the Kiel Observatory, in succession to P. Harzer. When the Nazi regime commenced, Rosenberg was forced for 'racial reasons' to resign; he worked for two years in the United States under Prof. Otto Struve at the Yerkes Observatory at Williams Bay, and three years ago became the new director of the Observatory at Istanbul, succeeding Prof. E. F. Freundlich. The breakdown of scientific culture in Nazi-Germany prevented him from completing some of his plans; one of these has already been discussed by the present writer in NATURE (**142**, 496; 1938); it was the planning of a new astrophysical handbook which, in 1938 (after Rosenberg's departure but mainly with the team of his selected collaborators) was edited in a masterly way by Prof. Bengt Strömgren of Copenhagen.

NEWS AND VIEWS

Dr. F. M. Lea

The administrators of the Beilby Memorial Fund have announced an award of a hundred guineas to Dr. Frederick Measham Lea in recognition of his researches on the constitution of silicate systems and the chemistry of cement in its physico-chemical aspects. Dr. Lea was educated at King Edward VI School, Birmingham, and after war service during 1918–19, entered the University of Birmingham, where he gained the Frankland Prize for practical chemistry, and graduated B.Sc. with first class honours in 1921, proceeding to M.Sc. in 1922 and D.Sc. in 1935. He was elected an associate of the Institute of Chemistry in 1922 and a fellow in 1936. During 1922–25, Dr. Lea was attached to the Admiralty Engineering Laboratory. Since 1925, except during 1928–29 when he was guest research associate at the Bureau of Standards, Washington, he has been a member of the staff of the Building Research Station, Department of Scientific and Industrial Research, where he now holds the position of principal scientific officer. Dr. Lea was a member of the Official British Delegation to the World Power Conference and Second International Congress on Large Dams held at Washington in 1936 and has also been a British representative on the International Committee on Special Cements, and honorary secretary of the corresponding British Committee. He has also served on a number of sub-committees of the Research Committee of the Institution of Civil Engineers and is at the present time chairman of the Roads and Building Materials Group of the Society of Chemical Industry.

Total War and Spiritual Values

As winter draws on, the 'New Order' of the Nazi régime relentlessly imposes upon the subjugated peoples of Europe conditions comparable only with those of the Middle Ages, when the peasantry had famine and pestilence ever imminent at their doors, following in the train of the wars waged by their overlords. The aims and methods of the Nazis are a grim commentary on the glorious renaissance in arts, science and letters which in Germany followed the close of the Napoleonic Wars, when a united and freedom-loving German people had helped to throw off the yoke of another dictator. Whatever may be the loss of life and property inflicted by recent activities of the Nazi air arm, nothing so clearly reveals the intention with which the Nazis have entered upon this War as the gutted Bristol Museum and shattered great hall of the University of Bristol, or the ruins of St. Michael's, the great cathedral church which for centuries has been the centre and a symbol of the corporate life of the city of Coventry. In destroying these and other edifices of a like character throughout Britain, their aim is not to secure military or material advantage, but to strike a deliberate blow at vital sources of spiritual and intellectual freedom.

That acts such as those mentioned above have their place in settled policy and are not the random and inevitable consequences of warfare from the air is made clearer as the concomitants of the political and economic 'New Order' are disclosed. Since the establishment of the customs and monetary union between the Reich and the Protectorates of Bohemia and Moravia, it is reported in *The Times*, persecution of the Czechs has been intensified. Nearly four hundred Catholic priests have been arrested, while the dismissal of the rectors and deans of the Czech universities is, not unreasonably, taken as an indication that it is not intended to reopen these institutions, which last year were ordered to close for a period of three years. The purpose of this action was indeed revealed by the Secretary of State, K. H. Frank, who when asked by a deputation to reopen the universities, replied that in the event of a German victory "elementary schools will be enough for you". The intention of completely subordinating all intellectual activity to the expression of views officially approved is even more nakedly exposed in the exhortations addressed to Czech authors to support the 'New Order' and to earn handsome royalties. They are, it is said, free to write what they will, so long as they undertake not to offend Germany. In like manner in Holland, all text-books containing any criticism of Germany are suppressed ; and now the universities themselves are threatened with closures on account of the attitude of their students.

Malayan Nature Society and Journal

A Malayan Nature Society has recently been inaugurated. Although the calling of an opening general meeting was found impracticable, officers have already been elected, in order to secure the inception of the Society. They are : *President*, Mr. E. O. Shebbeare, Game Department, Kuala Lumpur ; *Secretary and Treasurer*, Mr. A. T. Edgar, Suffolk Estate, Sitiawan, Perak ; *Editor*, Mrs. G. Le Mare, 254 Upper Stephens Road, Taiping. There is a number of keen naturalists in Malaya, and these should form a sound nucleus for the Society, which will doubtless do much towards promoting the study of the natural history of such a rich area and encouraging new arrivals to Malaya. The Society hopes later to inaugurate informal State or Settlement branches—a sound scheme in an area where natural history, anthropology and ethnology, etc., offer such diverse fields of study and observation.

The first number of the *Malayan Nature Journal* (1, No. 1, 1–27 ; August 1940) has just reached us. It is well printed on good paper, and attractively illustrated by three full-page, twenty-two half-page, and six quarter-page photographs. An article by E. J. H. Berwick on the long-tailed tailor-bird contains some beautiful illustrations of the male and female and of their uncommon type of nest. In the same paper is described an unusual shama's nest. Observations from a 'hide' are described and details of the structure of

the nest are given. R. O. Noone describes caves and some cave formations, and submits eight photographs of unusual interest, especially one of strange calcite growths which are even now not satisfactorily explained. The president, E. O. Shebbeare, gives a short but interesting account of an elephant trek. In a paper on Malayan bears, A. H. Fetherstonhaugh describes chiefly two bears in captivity. The illustrations of these are particularly fascinating. A few observations are also made on bears in their native jungles. G. S. Ogilvie presents a descriptive account of the 'Che Wong', a little-known primitive tribe from an area well known for its diversity of primitive peoples. This account is also supported by well-produced photographs. The *Journal* has certainly made a good start, and we wish it success and much support. The annual subscription is six dollars (single numbers, two dollars). A few spare copies of the first number are available at Malaya House (Mr. G. E. Cator), 57 Trafalgar Square, London, W.C.2.

Dried Onions

THE trade in dried onions developed after the War of 1914–18, and there is now a big demand for this material on the Continent (*Bull. Imp. Inst.*, 38, No. 3 ; 1940). In Great Britain the quantity used in 1939 was only about 400 tons, but in view of the scarcity of the fresh vegetable an increase may be expected. Hitherto, supplies to Great Britain have come from southern Europe ; but as these are no longer available it is suggested that Empire sources be developed. The method of preparing the onions is briefly as follows : The bulbs are peeled by hand and cut into thin slices which may then be immersed in a 5 per cent salt solution for 3–5 minutes to prevent discoloration. Drying is carried out on trays in tunnel driers for about 5–10 hours, the slices being kept turned to hasten the process. The temperature should not be allowed to rise above 140° F., or flavour is lost and the slices darken.

The finished material should be dry and crisp with a moisture content of 5–7 per cent. Sun drying is said to give less satisfactory results than artificial drying. The dried product is usually shipped in tin-lined cases of 1 or 2 cwt. each, the material fetching between 65–70 shillings per cwt. before the War, but by August 1940 it was worth 150 shillings per cwt. in London. On an average, one ton of the dried material represents about 10 tons of fresh onions. The Imperial Institute, London, would be glad to receive samples of dried onions from Empire sources with the view of submitting them to the trade for a report on their market possibilities.

Mineral Products of the British Empire and U.S.A.

THE possibility of a joint control of essential minerals and other natural products by the United States and the British Empire as a means of preventing future wars or of curtailing their duration is raised again by Dr. William Cullen in a paper contributed to *Chemistry and Industry* of November 30. Dr. Cullen suggests that the great distance which public opinion in the United States and elsewhere has travelled in the past few months brings a mineral sanction within the bounds of possibility. He points out that apart from food the two most essential materials in modern warfare are steel and oil. Good steel cannot be made without manganese, and in all Europe there is no appreciable amount of manganese. Even with Poland and Rumania, Europe is very badly off for mineral oil. The United States of America and the British Commonwealth control 75 per cent of the world's reserves of economic minerals, and if the United States and the British agreed by treaty that no aggressor nation should be supplied with essential metals and minerals, and that during peace, steps should be taken to prevent the accumulation of reserves by any other nation, it would be impossible for any aggressors to carry on a war for any lengthened period. With the pronounced change in American opinion, Sir Thomas Holland may see the fruition of all his labours in this field.

New World Populations and the Future

IN another column of this issue of NATURE (see p. 783), certain figures are extracted from a comparative study by Prof. Raymond Pearl of the populations of the New World and the Old. After making allowance for any inaccuracies and uncertainties in the data upon which his study is based, he arrives at the conclusion that, when they are examined in respect of certain criteria, such as density of population in a given unit of space, rate of growth, age distribution and the like, the populations of the New World, as contrasted with those of the Old, have in a biological sense all the characteristics of a young and vigorous organism, and that this fact carries with it certain social and psychological implications. Thus he points out that the relatively low figure for the density of population implies freedom of movement and expansion in settlement, the vigour indicated by the rate of increase of population and a higher birth-rate affords freer play for the forces of natural selection and the production of a virile and healthy stock, while the higher proportion of the population of pre-reproductive age holds out promise of a bold and enterprising outlook as against the pessimistic and despondent attitude of mind in a community such as that of the Old World, in which no less than one fifth of the whole has passed the active age of production.

Taken on the basis of an abstraction, Prof. Pearl's analysis is impressive ; but it has the weakness of all abstractions that it presents only a certain aspect, or certain aspects of reality. This he admits when he feels constrained to pass by the criterion of 'quality', on the ground that it is difficult or impossible to apply with scientific accuracy. He finds that quality, however, as the eugenist would maintain, does open the way in one direction at least in which Old World populations may seek to redress the balance against them. Prof. Pearl himself, indeed, directs attention to certain dangers in the future of the post-War world to which his figures point as arising out of the very advantages which America enjoys. While,

he holds, the populations of the western hemisphere are in a relatively much more favourable position biologically and demographically than are those of the eastern hemisphere, the close of the War will bring such pressure on the Americans to take in migrants as has never before been exerted. Their countries will be asked to share those acres that are still so sparsely populated. Before that happens, Prof. Pearl maintains that sound population policies scientifically conceived and administered, "should determine the relationship . . . between the numbers of the people and the area of the good earth on which they live, upon which prosperity and happiness finally depend". On the assumption that Prof. Pearl's forecast will be justified by the event, the question is one upon which the decision of the people of America, as most intimately and vitally concerned, will be final; but the problem opens up a vast field for joint investigation and effective co-operation for the general good of mankind between the peoples of the Old World and the New.

Sir Theodore Turquet de Mayerne

IN a richly documented paper (*Proc. Huguenot Soc. Lond.*, **16**, 301; 1940) on Sir Theodore Turquet de Mayerne, royal physician and writer, Miss Irene Scoloudi states that he was born at Geneva on September 28, 1573. He received his medical education at Heidelberg and Montpellier, where he studied under Riverius, who became physician to the Court of Henri IV, and qualified in 1596. He afterwards moved to Paris, where he soon became well known. In 1600 he was appointed district physician of Paris and physician in ordinary to Henri IV. Six years later he was invited to England, where he received the honorary degree of M.D. from the University of Oxford and was made physician to the wife of James I. In 1616 he was elected fellow of the Royal College of Physicians, and next year played a part in the formation of the Society of Apothecaries. In 1618 he was deputed by the College to write the dedication of the first Pharmacopœia to the King, by whom he was knighted in 1624. Although in his official capacity or as a medical witness he was connected with several scandals and lawsuits, such as the Overbury and Gaultier cases, he came out unscathed. He died on March 22, 1655. Mayerne is now chiefly remembered for his case reports by which he founded the practice of careful case taking. He published only two works composed entirely by himself, one being a pamphlet in reply to the French physicians with whom he quarrelled, and the other on a tour in France, Germany, Italy and Spain, which was one of the first extant French itineraries, and passed through several editions. In collaboration with Moffett he brought out a work on insects and also helped to compile a book of recipes for the Distillers' Company.

Public Health in India

ACCORDING to the annual report for 1939 of the Public Health Commission in India, the outstanding feature in that year was the large decrease in the incidence of cholera. Whereas in 1938 deaths from the disease in the Punjab numbered 5,670, in 1939 they were only 19. Improved sanitation of the villages and towns through which pilgrims pass is the most effective method of prevention, but is a slow process, and in the meantime the best practical method is anti-cholera inoculation, its compulsory enforcement being the best practical measure. Of the annual six million deaths in India a fifth or a quarter is attributed to malaria, to outbreaks of which India is everywhere subject, except in areas 5,000 ft. above sea-level and a few widely separated regions. In the large cities such as Bombay and Delhi control measures are being successfully carried out, but rural malaria is a difficult problem. The general policy of provincial authorities is to provide an adequate supply of quinine or cinchona febrifuge to popularize the use of these drugs and to provide for their distribution by travelling dispensaries. The greatest sources of danger from yellow fever lies in the air-traffic passing through infected areas in Africa. Under Government rules any person who has been in a yellow fever area is forbidden to enter British India until nine days after exposure, unless he has been inoculated or is protected by a previous attack.

Fuel Analytical Methods

THE analysis of solid fuels, as befitting its technical importance, is described widely in technical literature. The treatment, usually confined to the proximate analysis, is so familiar as to give an appearance of simplicity which is not in fact warranted. Many pitfalls occur, especially when somewhat abnormal fuels are in question. This emphasizes the need for specification when commercial transactions are involved and has led to the production of British Standard Specifications. Even these can only prescribe methods to secure uniformity of procedure, and there is a need for a critical treatment of fuel analytical methods.

The Fuel Research Board is well qualified to undertake this task because in the physical and chemical survey of coal its staff examines every kind of coal found in Great Britain, and many elsewhere. Its experience is embodied in "Methods of Analysis of Coal and Coke" Paper No. 44 of the Physical and Chemical Survey of Coal Resources (H.M. Stationery Office). The methods given are not always identical with those in the B.S.I. Specification and at times include refinements unlikely to be used in technical practice. These elaborations may, however, at any time be required. Most of the possible components of coal are mentioned. It is worthy of comment that in a book of this character it is still considered sufficient to limit the treatment of 'ash' to a determination of the residue on ignition—composition, fusibility, physical structure and density being ignored.

Beetle Pests of Furniture

UNDER the title of "Beetles Injurious to Timber and Furniture" a bulletin was issued in October last by the Department of Scientific and Industrial Research which gives an account of the damage and losses caused by these insects. It is based on the

text of Bulletin 9 of the Forestry Commission by Prof. J. W. Munro, which is now out of print. The new bulletin, which is a revision and amplification of its predecessor, has been written by Dr. R. C. Fisher in consultation with Prof. Munro and includes the results of recent investigation. The longhorn and pinhole borers are essentially forest insects: they attack recently felled timber, but abandon it during the drying and seasoning. The powder-post and furniture beetles are enemies of seasoned woods, the former abounding in timber yards and the latter attacking antique furniture and the structural timbers of old buildings. The losses occasioned by these different classes of beetles are often very great, and the present bulletin gives a clear and well-illustrated account of how to avoid or reduce the damage by the adoption of preventive and remedial measures. The publication, which is Forest Products Research Bulletin No. 19, is obtainable from His Majesty's Stationery Office, or through any bookseller, price 1*s*. 6*d*. net.

Evolution of Weapon Types and Design

IN the *Journal of the Franklin Institute* of October, Brigadier-General Earl McFarland, of the United States, has published a paper on the trend in weapon types and design. He first gives a sketch of the story of man's effort to adapt scientific principles to self-defence. Each of the great civilizations of history developed something new in the art of warfare. The epoch-making invention of gunpowder by the Chinese is placed first in the list. The period since the Napoleonic wars has seen the introduction of steel and its application to gun manufacture and projectiles. The development of chemistry has led to the manufacture of propellants and explosives exceeding by many times the effectiveness of the cruder preparations of a century ago. The development of military weapons during the last three generations has been greater than during the entire previous period of recorded history. The invention of the petrol engine had a revolutionary effect vastly increasing both the tactical and strategic mobility on the ground and in the air.

The United States Congress in 1794 passed an Act which provided for the establishment of a system of Government-owned shops for the manufacture of muskets. At the Springfield Armory, Massachusetts, the musket or rifle has been produced continuously for 144 years. The Frankford Arsenal, organized only twenty years later than Springfield Armory, has carried on without interruption, in war and in peace, the manufacture of ball, armour-piercing and tracer ammunition for rifles and machine-guns; it is now manufacturing the mechanical time fuse. American troops are being armed with the semi-automatic shoulder rifle, officially known as U.S. Rifle, Calibre ·30 Ml., but often referred to as the Garand rifle, from J. C. Garand, an ordnance engineer of Springfield Armory, who was mainly responsible for its design and development. The trend in rifle design is toward the type which demands the least time of training and which gives the greatest number of aimed shots per minute with the minimum fatigue to the firer. At the present moment, a contest is going on between the anti-tank gun and tank armour. The gun is sure to win in the long run.

Interior Lighting and Decoration by Fluorescence

NEW effects in interior decoration have been obtained recently by using fluorescent paints and ultra-violet lamps. In the Hawaii Theatre opened in the early summer in Hollywood the whole of the walls and ceilings have been covered with fluorescent paint. When cinema pictures are shown the ultra-violet lamps are switched on, but no other illumination is used. The whole auditorium then seems to be bathed in 'shadowless moonlight' and the walls appear to have receded. The audience has the impression of sitting under a deeply luminous blue Hawaiian night sky with brightly glowing stars. In earlier attempts at interior decoration by fluorescence, blues and greens preponderated to give only a limited range of colours. A sufficient number of paints, twelve in all, has now been developed so that landscapes can be painted on the walls. A panel of Mount Manua Loa spouting fire and smoke gives the impression of many miles in distance. The fluorescent materials can be had as either solid paints or transparent varnishes. White fluorescence is obtained by applying two complementary colours, such as a red and a green, so that at a distance from the surface the light mixes well enough to give an effect of white light. The transparent varnishes are invisible in ordinary light.

Advertising signs have been made to give one picture in natural light and a second picture in filtered ultra-violet—'black light'. Carpets have also been impregnated with fluorescent substances. Details of all the products can be had from Conti-Glo Paint, Continental Lithograph Corp., 952 East 72nd Street, Cleveland, Ohio. The literature supplied is concerned with the decorative and third-dimensional effects. As, however, the use of ultra-violet light is an essential part of the scheme it would appear that, by extending the range of the ultra-violet sources, air sterilization could also be combined with the new decorative effects. In hospitals at night, where low-level illumination is needed, the patients could have the beneficial effects of air sterilization together with rest under a "deeply luminous blue Hawaiian night sky".

Testing Steel Rails

A DESCRIPTION is given in the *Electrical Review* of November 22 of the method developed by Sperry Products, Inc., Hoboken, New Jersey, U.S.A., for examining steel running rails of railways *in situ* for internal defects. A recording car is used, and operation is based on the fact that any internal discontinuity in a metal bar creates an area of high resistance to the flow of direct current; consequently a difference of potential will occur at the site of the internal flaw. Indicating currents are conveyed to the track rails by brush holders attached behind the front bogie and underneath the frame of the rear bogie of the

coach. A current of about 1,500 amp. up to 8 volts is injected for pre-energizing the rails to ensure uniformity of molecular arrangement prior to the introduction of the detecting current just in front of the two pairs of searching coils. This precaution is necessary because running rails are generally magnetized by the normal effect of the earth's field, augmented by vibration due to the pounding of passing train wheels.

The magnetic poles strongly formed in this way are of two kinds; the effects of the superficial ones on the surface of the rail can be avoided by the use of suitable brush gear for conveying the test current to the rails, while those within the railhead can be overcome by raising the detective current density to 275 amp. per sq. in., which means feeding 4,000 amp. to each rail at up to 4 volts. The testing currents are furnished by a petrol engine with gear-box and multiple belt pulley which drives the main current (8,000 amp.) and auxiliary (pre-energizing) generators and a 200-volt exciter mounted together in the car. The recording tape moves at 0·025 in. per ft. of car travel; the recording car travels at seven miles per hour when fault detecting. It is reported that in seven months this year 597,000 miles of track, tested in this way, revealed 304,000 defective rails.

Movable Electric Generating Stations

THE Commissariat of the Building Industry of the U.S.S.R. is constructing 1,000 movable electric generating stations for use in timber camps and on railway construction jobs. The movable generating stations will be of various capacities, beginning with the smallest, of 2·5 kw., which will be used by railway maintenance men. Generators of this capacity will be installed on hand-carts and moved about from place to place as required. Electric generating stations of 30 kw. capacity will be fitted on the running-boards of automobiles and worked by the motor engine. A novel feature of the electric power stations of 50 kw. capacity will be a gas generator, instead of the ordinary Diesel engine, which will effect a considerable saving of fuel.

New Seismographs for Boulder Dam

AN ambitious, though necessary, seismological programme is being undertaken in the neighbourhood of the Great Boulder Dam (*Earthquake Notes*, **22**, Nos. 1 and 2, September 1940). A Wood-Anderson seismograph has been operating for several years at Boulder City, and two Neumann-Labarre vibration meters are temporarily installed at Overton, Nevada. The seismograph buildings at Pierce Ferry on Lake Mead are almost ready to house the temporary Coast and Geodetic Survey vibration meters. The construction of permanent Benioff instruments recording on 35-mm. motion picture film for all three stations is nearing completion. Four records, two horizontal, one vertical and one 'time record', will be made simultaneously on one drum. The 'time record' will be a film on which radio time signals will be recorded at regular intervals several times each day in addition to the regular chronometer time marks. Through the use of a reading microscope with two-way micrometer control, it will be possible to read time from the record to the nearest hundredth of a second and to measure amplitude to corresponding precision. Another feature of the seismographs is a second vertical seismometer used to control relays for intensifying the recording light at times of recording strong seismic disturbances.

Earthquake in Chile

ON the basis of instrumental reports from fourteen seismographic observatories, the United States Coast and Geodetic Survey, in co-operation with Science Service and the Jesuit Seismological Association, has determined the epicentre of the earthquake of October 11, 1940, to be provisionally at latitude 45° S., longitude 73° W. This is on the mainland of Chile opposite the Chanos Archipelago and north of Taitao Peninsula. It has been the scene of many small earthquakes and earth tremors in the past.

Announcements

PROF. HUGO ILTIS, formerly director of the Mendel Museum in Brno, has been appointed professor of biology in Mary Washington College, Fredericksburg, Virginia.

PROF. TH. DOBZHANSKY, formerly professor of genetics in the California Institute of Technology, Pasadena, has been appointed professor of zoology in Columbia University, New York.

DR. A. C. SMITH, formerly associate curator of the Herbarium, New York Botanical Garden, has been appointed curator of the Herbarium of the Arnold Arboretum, of Harvard University.

THE following appointments in the Colonial Service have recently been made: J. E. Hardy, chief plant protection officer, Palestine; J. K. H. Wilde, veterinary research officer, Tanganyika.

AT a Congregation of the Senate of the University of Cambridge on December 9, degrees of M.A. *honoris causa* were conferred on Prof. A. M. Carr-Saunders, director of the London School of Economics and Political Science; Prof. F. L. Hopwood, professor of physics in the University of London (St. Bartholomew's Hospital Medical College); and Prof. A. E. Richardson, professor of architecture in University College, London.

THE British Museum (Natural History) has recently published three additions to the series of "Economic Leaflets". These are No. 4, "Psocids, Book Lice, Dust Lice, etc."; No. 5, "Crickets"; and No. 6, "Plaster Beetles". Each type of insect dealt with is clearly illustrated and an account is given of its habits, the injuries that it may cause and the best means of controlling it. The leaflets are sold at the British Museum, Cromwell Road, London, S.W.7, price 1*d*. each for Nos. 5 and 6, and ½*d*. for No. 4.

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.

Collisions of Neutrons with Deuterons and the Nature of Nuclear Forces

ATTEMPTS to decide the nature of the forces between elementary nuclear particles by investigation of the distribution in angle of protons projected by neutrons have so far proved fruitless. This is because the only source of neutrons, homogeneous in velocity, at present available is the D – D reaction, which yields neutrons of 2·2 mv. energy. The wave-length of these neutrons is so long compared with the range of the neutron – proton forces that only those particles which make head-on collisions are effective in the scattering. These particles give an isotropic distribution of the scattered intensity in relative co-ordinates independent of the nature of the neutron – proton force.

To obtain information more sensitive to the nature of the forces it is necessary to investigate collisions of neutrons with simple nuclear structures of dimensions comparable with the wave-length of 2·2 mv. neutrons. We have therefore carried out a detailed theoretical investigation of the collisions of neutrons with the simplest of such structures, namely, deuterons.

The interaction energy between any two nuclear particles, ij, was taken to be of the form

$$-\left[mM+hH+\left\{\tfrac{1}{2}(1-x)-h\right\}B+\tfrac{1}{2}(1+x)-m\right]Ae^{-\alpha r_{ij}},$$

where M, H, B are the Majorana, Heisenberg and Bartlett exchange operators. x is the ratio of the force between particles of opposite spin to that between particles with the same spin and has the known value 0·6. The constants A and α were taken to be those given by Present and Rarita[1] as the ones which lead to binding energies of H^3, He^3, He^4 in best agreement with that observed. Three distinct sets of values of m and h were taken for detailed calculation :

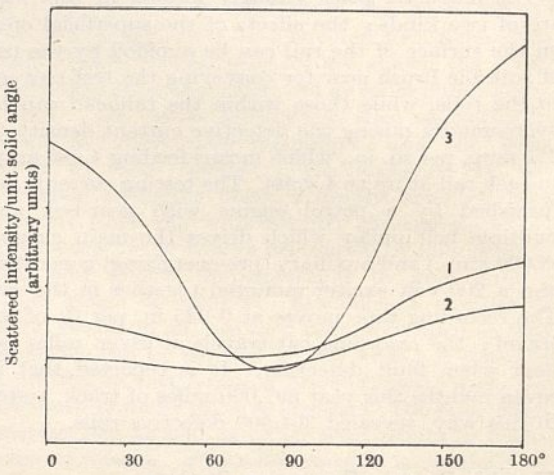
(1) Mixed exchange force.
$m = \frac{1}{3}(1 + 3x)$, $h = \frac{1}{3}(1 - 3x)$.

(2) Majorana-Heisenberg exchange force.
$m = \frac{1}{2}(1 + x)$, $h = \frac{1}{2}(1 - x)$.

(3) Ordinary force.
$m = 0$, $h = 0$.

The method employed in calculating the scattering follows that of resonating group structure introduced by Wheeler[2]. Exchange of particles is taken into account but the polarization of the deuteron by the incident neutron is neglected. The integro-differential equations involved were solved by numerical methods.

In Fig. 1 the calculated angular distribution, in relative co-ordinates, for the scattering of 1·85 mv. neutrons by deuterons is illustrated for each of the assumed types of force (1), (2) and (3). It will be seen that curve 3, corresponding to ordinary forces (case (3)), shows a much more marked variation of scattering with angle than either of the other two. The recent experiments of Barschall and Kanner[3] indicate that there is little variation in scattered intensity in the angular range of their observations (70–135°). This suggests that the fundamental nuclear forces are really of exchange type approximating to (1) or (2).



CALCULATED ANGULAR DISTRIBUTION (IN RELATIVE CO-ORDINATES) OF NEUTRONS OF 1·85 MV. ENERGY SCATTERED BY DEUTERONS.

Curve 1, assuming 'mixed' exchange forces.
,, 2, ,, Majorana-Heisenberg exchange forces.
,, 3, ,, 'ordinary' forces.

The evidence from the total collision area Q also points the same way. The measurements of Aoki[4] give $Q = 2{\cdot}2 \times 10^{-24}$ cm.^{2} for D–D neutrons. We find for cases (1), (2) and (3) respectively 2·25, 1·79 and $3{\cdot}37 \times 10^{-24}$ cm.^{2}, strongly favouring (1).

It thus appears that very useful evidence regarding nuclear forces can be obtained by a detailed study of neutron – deuteron collisions. It is hoped that further experimental evidence will be forthcoming.

A detailed account of the theory will be published in the *Proceedings of the Royal Society*. It would not have proved possible to complete the numerical solution of the equations involved but for a grant from the Government Grants Committee of the Royal Society, which enabled us to employ the professional services of the Scientific Computing Service.

H. S. W. MASSEY.
R. A. BUCKINGHAM.

University College,
London.
Nov. 19.

[1] *Phys. Rev.*, **51**, 788 (1937).
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The Possibility of Detecting a Doubly-Charged Proton by the Photographic Method

BHABHA[1] has recently shown, on theoretical grounds, that there probably exists a proton having a double charge. Such a particle might be expected to occur in the nuclear explosions produced by cosmic rays, and it has been suggested that the most likely way of detecting it would be by examining the tracks which are found in photographic plates exposed at a high altitude.

We have here a number of Ilford 'R' plates which, by the kindness of the Rev. W. Asboe of Leh, Kashmir, we were able to place at a height of more than 18,000 ft. in the Himalayas. A full study of these plates has yet to be made, but at the suggestion of Dr. Bhabha we have examined some areas to see whether they furnish any evidence for the existence of the doubly-charged proton. The plates show large numbers of tracks, many of which are doubtless due to protons, and some hundreds of them have been measured. We conclude, however, that the resolving power of the method is insufficient to reveal the new particle, for reasons which we will briefly indicate.

In general, there are two criteria for classifying tracks of unknown origin : (*a*) total length, (*b*) mean grain spacing, *s*. The first criterion is here of little use, for we can seldom be sure that the whole path of a particle is fully recorded in the emulsion. Other causes of uncertainty in length measurements have been discussed elsewhere[2,3]. Some workers[4] have based important conclusions on the distribution of track lengths, claiming a fairly high resolving power, but this is only in special types of experiment, under controlled conditions, where the tracks are produced by known ionizing particles of one kind.

The second criterion has also been previously discussed[2,3]. The *s*-value depends on the ionizing power of the particle producing the track. It has a minimum value for α-particle tracks, since an α-particle ionizes sufficiently strongly to affect practically every grain it encounters. (Heitler[5] reports a track with three times the grain density of an α-particle track, which he interprets as due to a heavy particle of very high effective charge. This conclusion is difficult to understand, for the implication that the α-particles affect only one grain in three is contrary to previous results.) The *s*-value enables us to distinguish proton from α-particle tracks with certainty when the tracks are long, but for short tracks there is uncertainty, since the distribution curves for *s* overlap. Bhabha[1] has shown that the doubly-charged proton would have a mean ionization, for the same range, about twice that of a proton, so we may expect the mean grain spacing, in tracks of these particles, to be intermediate between the values for α-particle and proton tracks. If therefore the distribution curve of *s*, for a large number of measured tracks, were to show three well-defined peaks, it would be legitimate to interpret the middle one as evidence of the doubly-charged proton. Even in the ideal case, however, with plates containing only the tracks concerned, and free from background grains, such a group could not be distinguished unless it contained a relatively large number of tracks. The overlapping of the two end groups would entirely mask a small intermediate group.

In the present experiments the ideal conditions are far from being realized. After four months exposure to penetrating radiation, the plates contain tracks due to all kinds of ionizing particle, and the number of background grains is naturally very much greater than on unexposed plates. These grains seriously interfere with the measurements. One can seldom be confident that the end grains of a track have been correctly located, and the number of grains to be assigned to a track is often doubtful. These uncertainties necessarily decrease the resolving power. Moreover, it is to be expected that the doubly-charged proton will be relatively infrequent, so that only a small proportion of the tracks will be due to this particle. Under these conditions, it is not surprising that our values of *s* for the measured tracks are distributed almost uniformly between 1·5 μ and 4·5 μ, and give no indication of different groups of particles.

It is possible that half-tone or process plates, which have been used by some workers, may have a somewhat different resolving power, but as 'R' plates are specifically designed to have the most suitable characteristics for track recording, it is improbable that a different choice of plate would give an appreciably better result. In this particular type of experiment the lack of resolving power seems unavoidable. There are undoubtedly problems to which the method of the photographic plate can be advantageously applied; but we think it unlikely that a definite decision regarding the existence of the doubly-charged proton can be reached by this method.

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Sept. 28.

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South African Senecio Alkaloids

Manske[1] and Barger and Blackie[2] isolated from *Senecio retrorsus* of South African origin the alkaloid retrorsine, $C_{18}H_{25}O_6N$. Chemical investigations by me have since led to the isolation from the same species also of isatidine, $C_{18}H_{25}O_7N$, and a new alkaloid, possibly $C_{18}H_{25}O_8N$. The latter two alkaloids are water-soluble but insoluble in chloroform, and have a peroxide nature.

Catalytic hydrogenation of isatidine leads to the consumption of four molecules of hydrogen per molecule of alkaloid. Three molecules of hydrogen saturate three ethylenic linkages (two in the basic fission product and one in the acidic fission product). A fourth molecule of hydrogen combines with one peroxygen atom, which is present in the acidic portion of the molecule and which is then removed as one molecule of water. The hexahydro-desoxyisatidine ($C_{18}H_{31}O_6N$) so formed is crystalline.

The dibasic isatinecic acid, $C_{10}H_{16}O_6$, and the base isatinecine, $C_8H_{13}O_3N$, are obtained by hydrolysing isatidine with barium hydrate. Isatinecic acid has

one ordinary carboxylic group and one percarboxylic group (R$\begin{smallmatrix}\text{COOH}\\\text{CO.O.OH}\end{smallmatrix}$) which readily lactonizes to form a monolactonic monobasic acid, $C_{10}H_{14}O_5$, which is no longer a peracid, but contains the peroxygen atom in the lactone ring.

From *S. rosmarinifolius* Linn. a new alkaloid rosmarinine, $C_{18}H_{27}O_6$, has been isolated which yields on hydrolysis a new base rosmarinecine, $C_8H_{15}I_3N$, and senecic acid, $C_{10}H_{14}O_4$. Rosmarinine has one double bond only, that is, the one present in senecic acid and which can be hydrogenated catalytically to the saturated dihydrosenecic acid.

S. pterophorus D.C. contains besides retrorsine a new alkaloid pterophine, $C_{18}H_{23}O_5N$, which can be hydrolysed to retronecine, $C_8H_{13}O_2N$, and pterophnecic lactone, $C_{10}H_{16}O_6$.

The Senecio species responsible for 'bread-poisoning' in human beings in the Cape south-western districts, namely, *S. ilicifolius* Thunb., contains three toxic alkaloids, senecionine, pterophine and retrorsine.

These alkaloids are all physiologically active and contain the pyrrole nucleus typical of other Senecio alkaloids. Details of these results will be published in the *Onderstepoort Journal* in due course.

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Oct. 22.

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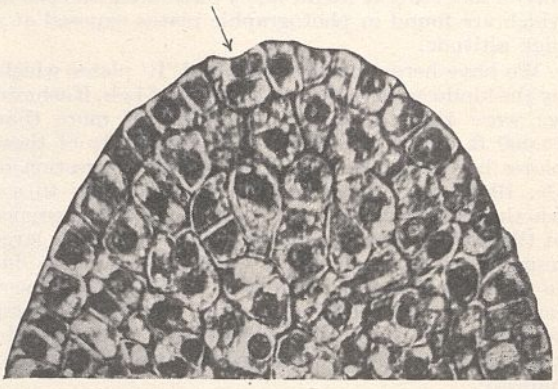
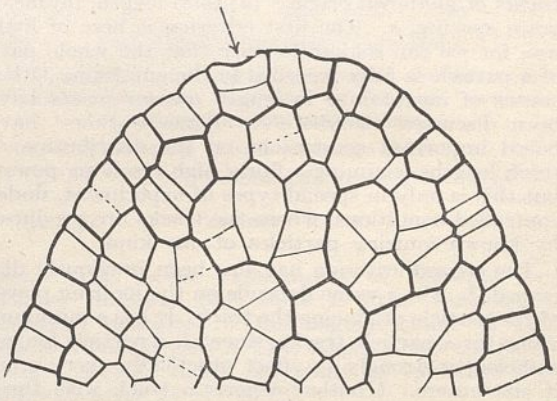
A Periclinal Division in the 'Dermatogen' at the Tip of the Maize Growing Point

THE accompanying photomicrograph and the cell-wall drawing show the periclinal division of a single isolated cell in the 'dermatogen' of a maize growing point (L.S.). In the more primitive vascular plants it has long been recognized that the outer layer of cells contributes to the central tissues of the apex by periclinal divisions. Recent workers have confirmed this for Lycopodium[1], and a number of Gymnosperms[2,3,4,5]. The above case shows that even in the Angiosperms, and even at the extreme apex in these, periclinal divisions sometimes occur in the outermost cell layer.

In the case of the cell concerned, its general shape, its position high up on the apex, the well-vacuolated cytoplasm of the daughter cells and the lack of rapid anticlinal divisions in the cells on either side, clearly indicate that the division is an isolated one and is not in any way foreshadowing the initiation of a leaf primordium. Examination of the series (cut at 5 μ) showed traces of the single division, at the same point in the cell, in at least three sections.

It is now generally agreed that there does not exist a dermatogen in the strict sense of the term as originated by Hanstein, since the outer layer often undergoes periclinal division during leaf formation. In the Dicotyledons it may be involved in the production of the leaf edge, while in the Monocotyledons it is frequently concerned in the initiation of the leaves and often contributes considerably to their inner tissues (Alstroemeria[6], Orchis[7], Dactylis[8], Triticum[9], Avena[10], and Tradescantia[11]). In more than twenty species of grasses (that is, in every one I have so far studied) periclinal 'dermatogen' divisions play their part in leaf primordia initiation. So far, however, there does not seem to be any case recorded of the 'dermatogen' contributing to the inner tissues of the apex. The case illustrated shows that it does sometimes occur in Angiosperms: perhaps future observations will throw more light on this point.





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RESEARCH ITEMS

Carbonic Anhydrase

THE physiological significance of zinc in the organism has been demonstrated for the first time by Keilin and Mann (*Biochem. J.*, **34**, 1163 ; 1940) who show that carbonic anhydrase is a zinc protein compound. This enzyme, which catalyses both phases of the reversible reaction $H_2CO_3 \rightleftarrows CO_2 + H_2O$, was discovered in 1933 by Meldrum and Roughton and was obtained as a colourless substance free from hæmatin and other known enzymes, stable within *p*H 3–12, thermolabile and very sensitive to KCN, H_2S, NaN_3 and to several heavy metals. The enzyme has now been prepared in pure or almost pure condition, having a catalytic activity 150 times that of the red blood corpuscle. As prepared from erythrocytes of ox and sheep by different methods, the enzyme has a constant zinc content of 0·33 per cent and contains no other metal. Also the enzyme activities of different fractions from erythrocytes and gastric mucosa run parallel to their zinc content. In the Tiselius cataphoresis apparatus the enzyme behaves like a homogeneous protein. Ultracentrifugal studies show that the enzyme has a size approximately half that of the hæmoglobin molecule, and hence each molecule contains two atoms of zinc. 100 ml. of erythrocytes contain about 0·21 gm. carbonic anhydrase, 0·06 gm. hæmocuprein and 28 gm. hæmoglobin. It is pointed out that carbonic anhydrase is the only known zinc compound which has characteristic catalytic properties, in contrast to zinc porphyrin, zinc insulin and zinc protein compounds of serum and tissues. Iron and copper are able to form compounds with different proteins, either acting as carriers of molecular oxygen or capable of catalysing a series of completely different reactions. The fact that the distribution of zinc in Nature is so much wider than that of carbonic anhydrase only shows that zinc, like iron and copper, forms with protein, compounds having different properties and functions.

Translocation of Minerals in Cotton

THERE seems to be quite general agreement as to the tissues responsible for the movement of sugars and water in the higher plant, but the position with regard to mineral nutrients still remains somewhat obscure. Another attempt to solve this latter problem has recently been made by Phillis and Mason, using as indicators of translocation, calcium (immobile in phloem) and phosphorus (mobile in phloem) (*Ann. Bot.*, N.S. **4**, 635 ; 1940), and bromine (*loc. cit.*, p. 651). Sea Island cotton plants were used, and in the first investigation was confined to roots, stem, and two branches by judicious removal of developing buds. In this work, one set of plants were ringed at the base of one branch. There was an initial collection of normal plants and three subsequent collections of ringed and normal plants over a period of fourteen days. Ringing caused a slight reduction of both calcium and potassium uptake in the plant as a whole, but the ringed branch itself was found to contain more potassium and less calcium than either the unringed branch or the branches of the normal group. The results are in harmony with the view that the bulk of the solutes move upwards in the wood and, provided they are mobile in the phloem, are re-exported down the stem in this tissue. Phosphorus is trapped by the ring and therefore accumulates. The effect of transpiration on mineral uptake is the subject of the second paper. The authors point out that previous attempts to separate the effects of transpiration and assimilation (leading to transport of sugars to the roots and a possible change in uptake) have been largely unsuccessful; they therefore observed plants in which the roots are isolated by a phloem ring at the cotyledonary node. After two hours exposure to light both normal and ringed plants had absorbed bromine rapidly. While the presence of the ring had depressed slightly the uptake of bromine by the roots (below the ring) no appreciable difference was observed between the tops of the two series. Subsequent determinations on ringed plants in light and in darkness established the fact that transpiration increases uptake of bromine. It is suggested that transpiration affects uptake by altering the concentration in the absorbing region of the root (and possibly also by oxygenating the root), while assimilation is active by altering the solvent capacity of the root. Mineral nutrients thus appear to travel up the stem in the wood ; whether, in normal plants, a proportion also ascends in the phloem is not yet clear.

Diseases of Pasture Grasses

THE age-long practice of grassland farming is now enlarged to include the finer aspects of its technique. 'Winter burn' is a significant condition of poor yield which scarcely troubled our grandfathers, but is now recognized as worthy of investigation. Kathleen Sampson and J. H. Western, in a study of possible mycological contributions to this state, have described two grass diseases new to Britain (*Trans. Brit. Mycol. Soc.*, **24**, Pt. 2, 255–263 ; 1940). These are caused by the fungi *Helminthosporium siccans* and *H. vagans*. The former produces oval chocolate-brown spots upon the leaves of rye grass and meadow fescue ; the latter induces dark purplish-red lesions upon the foliage of smooth-stalked meadow grass. *H. vagans* appears to attack from infested soil, whilst *H. siccans* seems to depend more upon aerial methods of spore dispersal. Neither disease is severe of itself, but their possible contribution to a general condition of low yield warrants their study by mycologists in this disease-conscious age.

Rust Fungi Attacking the Thistle

SEVERAL species of thistle are subject to attack by various rust fungi, the taxonomy of which has been somewhat confused. Dr. Malcolm Wilson has investigated this subject (*Trans. Brit. Mycol. Soc.*, **24**, Pt. 2, 244–250 ; 1940) and has found that the greatest discrepancy lies in the identification of *Puccinia Syngenesiarum* on *Cnicus palustris*, which is usually *P. Cirsii-palustris* (*P. Le Monnieriana*) on that host. *P. Cardui* and *P. Circii-oleracei* are often wrongly recorded upon *Cnicus lanceolatus* as host, for they appear to confine their parasitism to other species of the host genus.

Foliage Blight of the Bulbous Iris

THE growth of bulbous Irises upon a commercial scale in the south-west of England has accentuated several maladies such as ink disease and leaf spot. Still another parasite has been discovered in a Phytophthora blight of the foliage, recently described by Gordon W. Gibson and P. H. Gregory (*Trans. Brit. Mycol. Soc.*, **24**, Pt. 2, 251–254; 1940). This fungus, which is possibly related to *P. Cyperi-rotundati*, causes the appearance of ill-defined whitish lesions upon the leaves. Spore characters are described, but the fungus has hitherto defied artificial culture. Suggested control measures are based upon methods of plant sanitation.

Standard Disks in the Strain Testing of Glass

A PAPER on this subject was read by E. J. Gooding at a meeting on November 20 of the Society of Glass Technology. Glass disks with standardized degrees of strain (described shortly as standard strain-disks) have been used at eleven bottle factories and one other glass factory. The results and comments of the observers were correlated by the author. Four different types of strain-viewer have been used, and a large variety of glassware has been examined in respect to its weight, thickness and contents capacity. The method is most easily employed in conjunction with a strain-viewer which has a large, uniformly illuminated field of view, with uniform polarization over a relatively large area. In general it is agreed that the strain disk method of comparison is simple and trustworthy, is useful for training personnel, and that good agreement between different observers is obtained. When the degree of strain is small, observers rarely disagreed by more than one disk, colourless or pale green bottles being used; but when it is greater than normal, agreement between observers is not so good. The disks are not particularly suitable for use with amber or dark green bottles unless a suitable colour tint plate can be superimposed on them. It is agreed that for bottle examination no revision of the degree of strain of the disks is necessary. Only about 1·5 per cent of the ware examined has a strain grading greater than three disks.

Sydney Observatory Astrographic Catalogue

THE section of the sky assigned for purposes of the Astrographic Catalogue to the Sydney Observatory lies between − 51° and − 65° declination. Of the fifty-two Catalogue volumes which publication of this work will necessitate, seventeen have now been issued. The latest (22. Sydney, 1940) covers − 56° to − 58°, 6–12 hr. in right ascension. It gives, in the usual way, rectangular co-ordinates and diameters of the star images. The latter, however, are not linear measures, but indicate the grade of the image according to a calibrated scale of comparison images used in the micrometer. Plate constants have not yet been computed, but space is left for their insertion when available, in the appropriate positions in the catalogue.

Variation of Faint Fraunhofer Lines

M. G. ADAM showed in 1938 (*Mon. Not. Roy. Astro. Soc.*, **98**, 112; 1938) that there was an anomalous behaviour of faint Fraunhofer lines towards the limb of the sun, for the region λ 5100. From absolute measurements at centre and limb it was shown that the equivalent widths of strong lines decreased to the limb, in accordance with theoretical considerations, but that faint lines showed a marked strengthening for which no explanation could be given by the usual theories of line formation. The latter phenomenon was finally ascribed to reduced re-emission in faint-line frequencies, which was interpreted as interlocking. The possibility of interlocking does not exist for all faint lines, and the correctness of the interlocking hypothesis has now been tested by the method described by Adam (*Mon. Not. Roy. Astro. Soc.*, **100**, 8–9; June 1940). The term 'rare-element faint lines' is applied to the Fraunhofer line which may be faint because it originates from an oscillator of low relative abundance, and the term 'abundant element faint lines' is used if the line originates from a transition of low probability in an abundant oscillator. Equivalent widths at centre and limb of the sun were obtained for twenty-three rare-element faint lines and seventeen abundant-element faint lines in the region λ 4100, and for both classes a marked increase in equivalent width at the limb was established. The abundant-element faint lines showed a slightly greater increase than the rare-element faint lines. An examination is made of the existing theories of absorption-line formation, the two types of atmospheric models being considered, the Schuster pure scattering atmosphere model and Eddington's model, in which the continuous spectrum is formed all the way up in the atmosphere. The conclusion is that the strengthening of faint lines is due to an anomalous temperature distribution in the outer layers of the solar atmosphere.

Distribution of Sunspots Over the Sun's Disk

G. H. A. ARCHENHOLD has discussed the distribution of sunspots as a function of longitude from the central meridian (*Mon. Not. Roy. Astro. Soc.*, **100**, 8–9; June 1940). The material utilized was taken from the Greenwich Photoheliographic Results, and the daily results up to the year 1915 give the details of the position and area of single spots and also of the more important individual spots composing the groups. There is evidence that the area of a sunspot, which has already been corrected for geometrical foreshortening, is also affected by physical foreshortening, which increases from centre to limb and also slightly from small to large spots. At long. 65° the physical foreshortening amounts to about 10 units of area, and at long. 80° it amounts to about 50 units (a unit is the millionth of the sun's visible hemisphere). The physical foreshortening, implying that a sunspot appears smaller if looked at from a greater angle of observation even when its area is corrected for the geometrical foreshortening, suggests a structural feature of sunspots. If a sunspot has the shape of a flat dish or funnel, it should show an increase in corrected area as it approaches the limb, because, with increasing inclination to the line of sight, the depth to which an observer can look into the sun decreases. From the observational facts given in the paper it is evident, however, that the cross-section of a sunspot decreases in the higher levels of the sun's surface, and this view is confirmed by certain theories of spots advocated by Minnaert and Wanders about eight years ago. Among other matters discussed is the Maunder effect, which amounts to an eastern excess of 7·5 ± 1·4 per cent (mean error) for groups in the period 1888–1915, the physical cause of which can be found in the slope of the axes and the preponderance of faculæ on the eastern side of sunspots.

BRITISH RHEOLOGISTS' CLUB

INAUGURAL MEETING

AT the inaugural meeting of the British Rheologists' Club held at the University of Reading on November 16, a discussion on "Rheology in Industry" was introduced by Mr. J. Pryce Jones. In the unavoidable absence of the president, Prof. G. I. Taylor, the chair was taken by Prof. J. A. Crowther.

Rheology is defined as the 'science of the deformation and flow of matter', and Mr. Pryce Jones stressed the diversity of materials and of the properties of materials which the rheologist has to study. He went on to propose that the Club, or a committee appointed within it, should attempt to make a classification of the essential rheological properties of a number of industrial materials so as to construct a rheological table such as was recently proposed and attempted on a limited scale by Scott Blair (*J. Sci. Inst.*, **17**, 169; 1940). But first it is essential to define the terminology to be used. Such a term as 'thixotropy' is used by different workers in very different senses, and even when the original definition of Freundlich is referred to, definitions of the terms 'sol' and 'gel' are by no means standardized.

Mr. Pryce Jones went on to discuss the property of *Spinnbarkeit*, and gave some interesting demonstrations of both this and thixotropy, but the main part of his paper was concerned with a description of an extremely ingenious new viscometer especially designed for the study of anomalous liquids. This instrument, shortly to be described in the literature, consists of two Couette units rigidly attached to one another and rotated at the same speed in opposite directions. One of these contains an oil or other true fluid of known viscosity, and in the other is placed the materials to be investigated. The speed at which the couettes rotate can be varied, but if both contain true fluids, the frame connecting the two does not rotate so long as the speed of both is the same. If one of the couettes contains a material the viscosity of which varies with rate of shear, a deflection is observed and can be measured.

Mr. Pryce Jones concluded by discussing the connexion between anomalous viscosity and elastic recoil.

Mr. F. D. Farrow urged the importance of a careful scrutiny of the way in which rheological data are published. Since the methods of analysing such data are still in many cases tentative, it is important that the experimental figures should be given in their original form. The definitions of the term 'sol' and 'gel', 'solid' and 'liquid' were much discussed, Mr. Pryce Jones proposing that any system showing elastic recoil should be classed as a gel, and asking whether anomalous viscosity need be in all cases associated with elastic recoil. Dr. P. Halton and Dr. P. White also spoke on this point, the latter suggesting that, if we regard truly elastic behaviour as analogous to bright sunlight, and truly viscous behaviour to complete darkness, most industrial materials would fall in the twilight zone, and that consequently the distinction between 'sol' and 'gel', though convenient in practice, may be illusory in theory.

Dr. G. W. Scott Blair congratulated Mr. Pryce Jones on his most interesting new viscometer (as did several other speakers) but questioned the advisability of his definition of 'gel', which would include many quite dilute sols such as ammonium oleate (see Hatschek and Jane, *Koll. Z.*, **40**, 53; 1926).

It was generally agreed that the closer co-operation which the new Club can make possible between rheologists working in different industries will be extremely valuable. That this was appreciated was shown by the fact that the Club already has a membership of sixty-five, and that in spite of the difficulties of the present time, about twenty-five were present at the meeting.

ELECTRICAL DEVELOPMENT IN THAILAND (SIAM)

A SERIES of useful articles are being published in the *Electrician* which will prove helpful to electrical manufacturers looking for export markets. In the issue dated November 15, the export market to Thailand (formerly Siam) is discussed.

During the past few years Thailand has developed a sound constructive policy, including the promotion of land, water and air transport and communications. This widespread plan, which as well as including road making, also provides for the improvement of harbour facilities at Bangkok.

Under its scheme of development, the Government spent 370,000 ticals (11 ticals = £1) on its wireless broadcasting station during the period April 1, 1938—March 31, 1939 (year of the Buddhist Era 2481), 2·2 million ticals on the Post Office, 4 million ticals on transport and development at the port of Bangkok, and 103,000 ticals on turbines for the Samsen power station. Over a period of four years there has been a steady increase in the demand for electrical goods, apparatus and machinery. This followed naturally from the development of municipal amenities. The figures for 1937–38 show electrical imports of 2,575 thousand kilograms, valued at more than 3 million ticals.

Analysing these figures, the United States led with imports valued at 823,000 ticals; Germany took second place with a value of 553,000 ticals; from the

United Kingdom the imports were valued at 405,000 ticals. Japanese competition was confined mainly to cheap electrical goods, including lamps, and was responsible for a total of 330,000 ticals.

Comparing these figures with those for 1936–37, during which period Thailand imported nearly 2½ million ticals worth of electrical goods and apparatus, it is possible from the figures given to gauge to some extent the growth of the market. Figures for the total of all imports show that in 1936–37, the United Kingdom supplied goods to the value of more than 11 million ticals; Germany nearly 6 million ticals, and Japan more than 28 million ticals. For 1937–38 they show that the total of goods supplied were more than 13 million for the United Kingdom, nearly 7 million from Germany, and 22 million from Japan. This reflects a slackening of the Japanese competition.

Bangkok, the principal city, is developing rapidly. Up-to-date electric tramways are in operation. The first public wireless service between Thailand and foreign countries was inaugurated in 1929, and to-day Bangkok is in direct communication with eleven foreign stations—Berlin, London, Paris, Tokyo, Hong Kong, Manila, Saigong, Bandoeng (Netherlands East Indies), Calcutta, Penang and Rangoon.

There is in operation a wireless telephone service between Thailand and Europe, as well as a radio picture telegraphic service and radio service for air and marine navigation. For internal wireless communications, stations have been established at various centres. In 1937 a medium wave transmitter of 10 kw., working on a wave-length of 400 metres, was added. Work has now been begun on the erection of a more powerful transmitter near Bangkok. It will be rated at 100 kw. Six studios and three announcers' booths are to be installed in a new General Post Office building included in the scheme.

The language problem should not prove a bar to trade, for English is widely used commercially, and it is only in bazaar work that a knowledge of the national tongue is necessary. While, by comparison with other overseas markets, Thailand is as yet only small when considered from the electrical exporter's point of view, it is a market which will undoubtedly expand in the next few years.

FREEZING AND COLD STORAGE OF FISH

A REPORT from the California State Fisheries Laboratory* claims that the problem of preserving tuna on fishing voyages of several weeks duration, in good condition for canning, has been solved—at least on a small scale—by the application of freezing and cold storage. This announcement may serve as a reminder that the problem of so improving the preservation of fish at sea as to reap the full benefit of the ever wider extension of fishing made possible by the construction of larger, more speedy and generally more efficient catching vessels, is also a pressing one in Europe, and that its solution by freezing and cold storage has been repeatedly advocated of recent years by the Food Investigation Board on the basis of work done at the Torry Research Station, Aberdeen.

While most modern British fishing vessels successfully undertake voyages lasting three weeks or even longer, some reaching to well within the Arctic Circle, the universally employed means of preserving the fish, namely, storage in crushed ice, have in such circumstances proved inadequate, with the result that a considerable proportion of the total catch is landed in poor condition. Ice, in fact, will normally preserve white fish in really fresh condition for little more than one week. Freezing, on the other hand, promised not only to avoid staleness in long-distance fishing but also, if cold storage were continued on shore, to steady available supplies of the various food fishes independently of seasons and circumstances. Research has clearly shown that fish of all sorts can be kept in a condition practically as good as freshly caught for several months—even for much longer in the case of most white fish—if certain technical principles are observed. The fish must be frozen while strictly fresh and stored at temperatures in the range −20° to −30° C. In addition, freezing to these temperatures should preferably be completed within two or three hours. Only by employing such low temperatures is it possible sufficiently to retard various types of deteriorative change affecting odour, flavour and texture†.

The poor quality of the relatively small amount of fish frozen annually in the past must be held responsible for such prejudice against frozen fish as now exists. There appears to be little doubt that these fish were frequently frozen when already stale, and they were certainly stored at much too high temperatures, for example, −6° to −10° C., besides being as a rule very slowly frozen.

Unless a shore station can be established very near abundant fishing grounds, as, for example, in eastern Canada or Iceland, or in Great Britain with respect to the herring fishery, it is necessary to freeze the fish on board ship. A large factory ship with an attendant flotilla of small catching vessels could range remote seas for months at a time; alternatively, a super-trawler fitted to freeze and store as well as catch fish could operate nearer home for periods of some weeks. The former scheme has already been tested by British enterprise and the latter by French; and with return to peace conditions it is to be hoped that these pioneer attempts will be followed up, and that eventually Great Britain may be assured at all times of a steady supply of all kinds of fish of uniformly high quality. It is of present interest to note that part of the shortage in the home supply occasioned by the War is being met by the import of frozen fish; but it is well also to remember that at such a time considerable difficulties may frequently stand in the way of treating the fish in the best possible manner.

GEO. A. REAY.

* The Refrigeration of Tuna. Progress Report No. 2. (California State Fisheries Laboratory, Terminal Island, California.)

† See Reay, G. A., "The Freezing and Cold Storage of Fish", *Modern Refrigeration*, July 18, 1940.

RESPIRATION IN THE HIGHER PLANT

AEROBIC breakdown of sugars can conveniently be studied in two stages—glycolysis followed by oxidative processes. Both phases have been discussed recently (*New Phyt.*, **39**; 1940). James and James (*loc. cit.*, p. 266), continuing the work on pyruvic acid metabolism, have shown that inactivation of carboxylases in barley, either by acetaldehyde or by one of a number of aromatic sulphonic acids, leads to accumulation of pyruvic acid in amounts which enable the isolation of identifiable hydrazones. The position of pyruvic acid in the aerobic respiration of barley is now considered sufficiently clear by James and his collaborators to allow the statement of a chain of reactions involving ascorbic acid oxidase:

hexose $\xrightarrow{1}$ hexosediphosphate $\xrightarrow{2}$ triosephosphate $\xrightarrow{3}$ phosphoglycerate

$\downarrow$

pyruvic acid.

Reaction 3 involves the oxidase. Pyruvic acid is metabolized to acetaldehyde and carbon dioxide in the usual way, though it is considered that the former may not be respired directly in young tissues, but may rather be concerned with synthesis (Report of Soc. for Exp. Biol., *loc. cit.*, p. 335). The oxidative stage in plant respiration involves one or more of a series of enzymes.

In a review of the various possibilities Boswell and Whiting (*New Phyt.*, **39**, 241; 1940) discuss the three principal oxidase systems and also other systems of less importance. They base their study on the observation of Szent Györgyi that only catechol compounds, ascorbic acid, and dihydroxymaleic acid give a pronounced violet coloration with ferrous salts in neutral solution. For example, in catechol, an iron-catechol complex is formed, and this, by electronic interchange between Fe^{++}, $C_6H_4O_2^{--}$ and Fe^{+++}, eventually releases free orthoquinone. Catechol oxidase is considered to act simply as a copper compound effecting oxidation by such complex formation, oxygen addition, and electron transfer. The importance of the three compounds listed above seems to lie in the fact that each carries a dihydroxy grouping. Oxidases may thus be regarded as protein plus firmly attached metal plus loosely attached prosthetic group or coenzyme containing a dihydroxy group. The chemical possibilities underlying oxidation by catechol oxidase, dihydroxymaleic oxidase, and ascorbic oxidase are discussed in some detail.

There is, however, no clear evidence that these last two are widely operative in plants. The more important catechol oxidase contains no peroxidase; it produces quinones, which act as hydrogen acceptors, and perhaps also hydrogen peroxide which is removed either by catalase or peroxidase. Among other iron complexes, the iron-porphyrins cytochrome and peroxidase receive most attention. The latter is stated to catalyse oxidations in the presence of hydrogen peroxide only. It may thus play a part in the catechol oxidase system by increasing the production of quinones. It is suggested that the respiratory chromogens of Palladin may be prosthetic groups loosely attached to unknown proteins.

NEW WORLD POPULATIONS

RAYMOND PEARL has examined statistics of the populations of the western hemisphere, the New World, in relation to corresponding figures for the Old World, so far as available, and taking certain bases of comparison as indexes of 'youthfulness' or the reverse in the populations compared (*Human Biology*, **12**, 3; 1940). Five of six attributes of populations generally regarded as of primary importance have been taken, the sixth quality being omitted on account of the difficulty of scientific appraisement.

(1) *Density of aggregation per unit of land area.* Central America, 37 persons per sq. mile; North America, 17 per sq. mile; South America, 12·8 per sq. mile, as against Europe, 189·5 per sq. mile; Asia, 108·6 per sq. mile (U.S.S.R. territory being omitted in both these). Broadly speaking, a relatively low density implies a comparatively youthful and vigorous stage of population.

(2) *Net percentage rate of growth per unit of time.* The comparative levels of population growth-rates may be taken as the clearest and least equivocal expressions of innate physical vigour, combining the forces of natality and mortality. The higher birth-rates are found among the biologically more vigorous, whereas in enfeebled populations the death-rates tend to be low. In such figures as are available from 1900 until 1935, the most impressive result is a well-nigh universal decline, but even so the population of the New World is growing at a much faster rate than that of Europe. The figures available are: Europe, 1900–10, 0·95 per cent; 1910–20, 0·22 per cent; 1920–35, 0·81 per cent. Western hemisphere, 1900–10, 2·24 per cent; 1910–20, 1·72 per cent; 1920–35, 1·68 per cent.

(3) *The natural rate of increase by excess of births over deaths.* This gives insight into the capacity for growth and general biological healthiness of a population at a given time. Figures for 116 countries are considered and again confirm the general biological healthiness of New World populations. The average vital index for the western hemisphere is 175·72 as against Europe 151, Asia (sampled) 152, Africa (sampled) 162, or a grand average for the eastern hemisphere of 152·38.

(4). *Age composition.* This attribute is of vital importance as reflecting the mass outlook on life and the psychology generally, as populations containing a relatively high proportion of young people are apt to display progressive and hopeful attitudes and to be aggressive in social and economic pioneering. Taking the life-cycle as falling into three divisions, the figures for the western hemisphere are: pre-reproductive, 39·0 per cent; reproductive, 50·6 per cent; post-reproductive, 10·4 per cent. For Europe, pre-reproductive, 27·9 per cent; reproductive, 52 per cent; post-reproductive, 20·1 per cent.

(5) *Racial composition.* As applied to the western hemisphere, just under 65 per cent of the combined total population is classified or regarded as white without other racial admixture.

RESISTANCE WELDING

WHAT may seem at first sight unlikely subjects can often be treated by resistance welding by carefully anticipating the conditions. Each welding possibility must be considered on its merits and not crippled by attempts to improvise a solution from a standard machine not suited to the special requirements of the case, and the advice of manufacturers should be sought.

The *Electrical Review* of November 15 shows what can be done in this way in a description of the Metrovick "A S P" heavy-duty spot welder; this machine is flexible enough to deal with light work also, and can be adapted for projection welding by changing the electrodes, which are bolted to top and bottom platens, for contact blocks. A 12-in. diameter double-acting cylinder provides a maximum pressure between platens of 9,000 lb. from air supplied at 80 lb. per sq. in. from reservoirs built into the top of the frame. Within the frame is a 250 kva. welding transformer having a secondary winding consisting of copper tube of square section brazed into cast copper headers through which the cooling water circulates. The primary has five tappings and a series-parallel connexion, all taken to a double-unit tapping switch on the frame giving a wide range of welding currents.

For straightforward projection welding, a contactor and timing device for controlling the duration of the weld have been found quite satisfactory. For more involved work, especially spot welding of heavy sections, the interrupted current method offers advantages. This method with 'woodpecker' control depends upon the employment of synchronous timing devices that allow instantaneous switching of heavy currents, as there is no inertia due to the moving parts, and permits the application of repeated and predetermined current impulses by a single operation. The use of interrupted current greatly lengthens the life of the electrodes when spot welding heavy sections, and so greater thickness of metal can be dealt with by any one machine. It is of advantage also on jobs that tend to 'flash' or blow out weld metal during the passage of the current. When spot welding thick pieces of steel together, the heat generated, combined with the high pressure applied to the electrode tips, tends to cause the material to anneal and the tips to 'mushroom' out and fuse to the steel. While the time between impulses allows the water flowing to the electrodes to control the temperature of their tips, the interval is insufficient for appreciable heat to be lost from the inside surfaces of the plates where the weld is being formed.

The control consists of an ignition panel for determining the welding current, and a small panel mounted on its side housing two thyratron-controlled relays for regulating the time at which set-up pressure is applied and the length of the forging period. The latter is the time of pressure 'dwell' after the weld is completed and before the electrodes are allowed to separate. A differential pressure is obtainable by electrically operated air valves, and the air can be exhausted underneath the piston at any desired stage of the cycle by means of the thyratron relay in order to apply a sudden pressure increase to the electrodes. This upset pressure is of considerable value in consolidating welds made in the thicker sheets and in obtaining a flush joint on projection welded assemblies.

FORTHCOMING EVENTS

Monday, December 16

ROYAL GEOGRAPHICAL SOCIETY (at Kensington Gore, London, S.W.7), at 3 p.m.—Mr. E. A. Gunther: "Sierras of Venezuela".

Tuesday, December 17

INSTITUTION OF CIVIL ENGINEERS (at Great George Street, London, S.W.1), at 1.30 p.m.—Mr. Alec George Vaughan-Lee: "The Mohammad Aly Barrages, Egypt."

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (in the Literary and Philosophical Society's Lecture Theatre, Newcastle-upon-Tyne), at 6 p.m.—Sir Stephen J. Pigott: "The Engining of Highly Powered Ships" (Sir Charles Parsons Memorial Lecture).

APPOINTMENTS VACANT

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

LECTURER IN THE DEPARTMENT OF PHYSICS AND APPLIED PHYSICS of the Technical College, Cardiff—The Director of Education, City Hall, Cardiff (December 20).

LECTURER IN ELECTRICAL ENGINEERING at the Constantine Technical College, Middlesbrough—The Director of Education, Education Offices, Woodlands Road, Middlesbrough (December 28).

REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Department of Scientific and Industrial Research. Report of the Fuel Research Board for the Year ended 31st March 1939, with Report of the Director of Fuel Research. Pp. iv+206. (London: H.M. Stationery Office.) 3*s*. 6*d*. net. [1311

Other Countries

Egyptian Government: Ministry of Public Works. Annual Report for the Year 1930–1931. Part 1. Pp. ix+163. (Cairo: Government Press.) P.T.30. [511

Commonwealth of Australia: Council for Scientific and Industrial Research. Fisheries Circular No. 2: The Canning of Fish and Fish Products in Australia. By E. J. Ferguson Wood. Pp. 56. Pamphlet No. 100: Studies on the Marketing of Fresh Fish in Eastern Australia. Part 2: The Bacteriology of Spoilage of Marine Fish. By E. J. Ferguson Wood. Pp. 92. (Melbourne: Government Printer.) [511

Commonwealth of Australia: Council for Scientific and Industrial Research. Bulletin No. 133: A Soil Survey of the Mildura Irrigation Settlement, Victoria. By F. Penman, G. D. Hubble, J. K. Taylor and P. D. Hooper. Pp. 76. (Melbourne: Government Printer.) [611

U.S. Office of Education: Federal Security Agency. Leaflet No. 28: Education in the Union of Soviet Socialist Republics and in Imperial Russia—Selected References. Compiled by Severin K. Turosienski. Pp. ii+16. (Washington, D.C.: Government Printing Office.) 5 cents. [711

Proceedings of the United States National Museum. Vol. 89, No. 3093: Two New Anuran Amphibians from Mexico. By Edward H. Taylor. Pp. 43–48+3 plates. (Washington, D.C.: Government Printing Office.) [711

Proceedings of the United States National Museum. Vol. 88, No. 3090: Seven New Species and One New Genus of Hydroids, mostly from the Atlantic Coast. By C. McLean Fraser. Pp. 575–580+plates 32–33. (Washington, D.C.: Government Printing Office.) [1111

Field Museum of Natural History. Anthropological Series, Vol. 27, No. 2: Notes on Skidi Pawnee Society. By George A. Dorsey and James R. Murie. Pp. 65–120. 40 cents. Botanical Series, Vol. 22, No. 3: Studies of American Plants, XI. By Paul C. Standley. Pp. 131–218. 50 cents. (Chicago: Field Museum of Natural History.) [1211

Publications of the Observatory of the University of Michigan. Vol. 8, No. 3: A Self-Recording Direct-Intensity Microphotometer. By Robley C. Williams. Pp. 45–56. (Ann Arbor, Mich.: University of Michigan.) [1311

Rubber Research Institute of Malaya. Annual Report, 1939. Pp. 278. (Kuala Lumpur: Rubber Research Institute of Malaya.) 1 dollar. [1311

Publications of the Dominion Observatory, Ottawa. Vol. 13: Bibliography of Seismology. No. 6: Items 4770–4868, April, May, June 1940. By Ernest A. Hodgson. Pp. 89–104. (Ottawa: King's Printer.) 25 cents. [1411

U.S. Department of Agriculture. Farmers' Bulletin No. 1850: The Armyworm and its Control. By W. R. Walton and C. M. Packard. Pp. ii+12. (Washington, D.C.: Government Printing Office.) 5 cents. [1511

OFFICIAL ANNOUNCEMENTS

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(Founded 1177) (Incorporated by Royal Charter, 1885)

APPOINTMENTS REGISTER

A Register of Chemists (Fellows, Associates and Senior Registered Students) who are available for appointments or who are seeking to improve their positions, is kept at the office of the Institute. The facilities afforded by this Register are available (free) to Companies and Firms requiring the services of chemists, and to Universities, Colleges and Technical Schools requiring Teachers of Chemistry and Technology. A list of Laboratory Assistants is also available.

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W. J. WILLIAMS,
Director of Education.

City Hall,
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Applications are invited for a temporary appointment, for the duration of the war, of a Keeper (man or woman) of the Department of Botany. Candidates required preferably with some experience of work in botanical gardens. Applications stating age, experience and full particulars, together with copies of recent testimonials, should be addressed to the undersigned not later than December 28, 1940. Remuneration according to qualifications.

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Further particulars and forms of application may be obtained by sending a stamped addressed envelope to the Director of Education, Education Office, Chapel Street, Salford 3, Lancs, and must be returned by December 31, 1940. Canvassing, direct or indirect, will disqualify a candidate.

H. H. TOMSON,
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Wanted. Used Measuring Microscope, sound condition, scales approximately 300 mm. by 75 mm., with Vernier adjustments in both directions reading to 0.01 mm., preferably with goniometer eyepiece.—Particulars and price to Box 751, T. G. SCOTT & SON, LTD., 63 Ludgate Hill, London, E.C.4.

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