NATURE

"To the solid ground
Of nature trusts the Mind that builds for aye."—Wordsworth

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CONTENTS

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PREPARING FOR A NEW WORLD ORDER

THE rapidity with which the march of events has thrown on Great Britain the main and almost the sole burden of the defence of the liberties and traditions of Western civilization, endows with something of prophetic vision the Prime Minister's declaration on June 4 of our determination to continue the struggle: "if necessary, for years, if necessary, alone". Under that burden we can have but one war aim—victory. Inexorably other discussion on war aims has for the time being to be thrust into the background, like the shattered solemn declaration of the Supreme War Council of March 28, with all the hopes it seemed to foreshadow of a new European order based on Anglo-French co-operation.

Such co-operation is for the time being impossible. On us now falls the material burden of staying the onslaught of aggression and barbarism and making safe for mankind those moral and spiritual values to which we owe all that is best in our civilization.

It is well that we should remember, however, that although the material burden is largely ours alone, we have the sympathy and often active support not only of those nations such as Czechoslovakia, Poland, Norway, Holland, Belgium whose liberation waits on the success of our arms, or of the great countries across the Atlantic, but also of many Frenchmen still in France. As regards those Frenchmen who have come to Great Britain, the memorandum of agreement recently made between the British Government and General de Gaulle provides for a French force of volunteers including naval, land and air units and scientific and technical personnel, who will fight and work for the Allied cause; further, such volunteers will be given special facilities for acquiring British nationality.

None the less, if we are to obtain in due course the full results of our efforts, for our allies and well-wishers as for ourselves, we must turn our attention to the history of the last twenty-five years, to probe the real causes of our failure twenty years ago to build a durable world-order, and to be ready to avoid the mistakes of the past when the opportunity to build again is vouchsafed us. As Sir Herbert Parsons points out in a letter in this issue of NATURE (p. 230), it is not too early to take steps to consider the future in the light of experience of the past two decades.

It is this point of view that gives topical interest to Prof. E. H. Carr's "The Twenty Years' Crisis" and to the more recent volumes of Dr. Maxwell Garnett and Mr. Arthur Bryant referred to below*. Prof. Carr attempts to analyse the underlying and significant, rather than the immediate and personal, causes of the present war, and he opens with a discussion of the science of international politics which should make a direct appeal to the man of science. None the less, the scientific worker who reads with keen appreciation Prof. Carr's opening chapter on the beginnings of the science of international politics, with its insistence on the relation between purpose and thought, its reminder that political thought itself is a form of political action, that political science is the science not only of what is, but of what ought to be, its warning about distinguishing the analysis of what

* The Twenty Years' Crisis, 1919–1939: an Introduction to the Study of International Relations. By Prof. Edward Hallett Carr. Pp. xv+313. (London: Macmillan and Co., Ltd., 1939.) 10*s*. 6*d*. net.

A Lasting Peace. By Dr. Maxwell Garnett. With some Chapters on the Basis of German Co-operation, by Dr. H. F. Koeppler. Pp. 288. (London: George Allen and Unwin, Ltd., 1940.) 7*s*. 6*d*. net.

Unfinished Victory. By Arthur Bryant. Pp. xxxvi+271. (London: Macmillan and Co., Ltd., 1940.) 8*s*. 6*d*. net.

is from aspiration about what should be, may yet put the whole book down with some sense of disappointment. Despite all his keen analysis of particular situations, his historian's impartiality and his shrewd comments, Prof. Carr appears to lead us nowhere. His concluding analysis of the prospects of a new international order lacks conviction and definition and offers little that is constructive.

The reason for this is easily found. Prof. Carr insists that Utopia and reality are the two facets of political science, and the whole book is largely an essay or commentary on the implications of the opposition between Utopia and reality in the light of the history of the past twenty years. Unfortunately, Prof. Carr does not carry his analysis of political objectives or ideals far enough. The distinction between reality and Utopia is never made clear to the reader. The two common meanings of Utopia are confused, and generally the analysis of terms, events or causes is not pushed far enough. Partly as a result of this, Prof. Carr's obvious desire for strict impartiality leads him to do something less than justice to the attempts to build a new world order, whether through the League of Nations, collective security, federation or the like. The opponents of world co-operation are invariably given the benefit of the doubt, despite a reminder that it is by no means certain that a direct appeal to the motive of sacrifice will always fail.

Prof. Carr, in fact, largely overlooks or underestimates psychological factors, and valuable as his work may be as a corrective to wishful thinking, or as a contribution to putting the factors of power and morality in their proper perspective in international politics, or for its analysis of the relations between law and change, it does not make the significant contribution to the science of international relations which might be hoped from its opening part. It should indeed be read with L. Woolf's stimulating essay "Utopia and Reality" in the *Political Quarterly* (April–June 1940)—itself essentially a thoughtful review of the book. None the less there are few recent books which are more worthy of attention from those who are attempting to think out the lines of the new world order.

Prof. Carr regards the fundamental difficulty of reconciling the good of the nation with the good of the world community as due to the breakdown both of the Darwinian doctrine which identifies the good of the whole with the good of the fittest and contemplates without repugnance the elimination of the unfit, and of the doctrine of a natural harmony of interests which, in his opinion, has lost such foundation in reality as it once had and becomes inevitably a cloak for the vested interests of the privileged. Our task of exploring the ruins of our international order and discovering on what fresh foundations we may hope to rebuild it must be considered from the point of view of power and of morality. The form of the future international order is closely bound up with the future of the group unit, and it may well be that the concept of sovereignty will become even more blurred and indistinct. The best hope of progress towards international conciliation seems to lie along the path of economic reconstruction.

L. Woolf dissents from Prof. Carr's view that the doctrine of harmony of interests has lost its validity. He points out that individuals as well as nations often fail to recognize their real interests, and that generally and in the long run common interests are more real politically than conflicting interests. The real international problem which confronts Europe and civilization to-day is not a choice between Utopia and reality but between the psychology of conflicting interests and the organization of power politics on one hand, and the psychology of common interests and the organization of international co-operation on the other. Woolf, however, is himself too legalistic. The transition to a durable peace and a more equitable social order must be in the sequence order, law and good government, as Sir Alfred Zimmern remarks, not law and then order. "No paper plan," insisted Lord Halifax, in a broadcast last autumn, "will endure that does not freely spring from the will of the people who alone can give it life."

Prof. Carr would doubtless concur that education is one of the essential tasks in the establishment of world order. That question is discussed in two of the most important chapters of Dr. Maxwell Garnett's book. The world commonwealth of the future can only be held together by a world loyalty and the invisible bond of ideals, and the problem of building world order on a lasting basis belongs in the long run no less to psychology and education than to politics and economics.

Dr. Garnett deals with the immediate causes of the present conflict and the breakdown of international co-operation. In some respects his analysis of the history of the last twenty-five years is more realistic than Prof. Carr's. In contrast to the latter's cool detachment, Dr. Garnett does not conceal the fact that he is on the side of the angels. He is concerned, however, to lay bare the causes of the

failure of the first experiment at international co-operation and world order through the League, and his survey and criticism cannot be dismissed as one-sided or superficial. The ordinary citizen will find his argument much easier to follow, if in some respects less profound, than that of Prof. Carr, and the book is a notable contribution to the educational work which must proceed, both during the War and after it, before we can achieve a lasting peace.

Dr. Garnett quotes the text of the Solemn Declaration of the Supreme War Council of March 28 and obviously visualizes the gradual development of the new international order out of that Anglo-French co-operation. Nor need we fear that the act of one French Government need compel the abandonment of all hope that that co-operation may yet prove the stepping-stone to such a new order when the menace of aggression and barbarism has been removed.

This factor gives special significance to the last part of the book, in which Dr. H. F. Koeppler, under the title "The Basis of German Co-operation", gives a succinct review of German history, particularly the unification of Germany, and discusses its bearing, as well as that of the rise of Nazism, on the establishment of a lasting peace. It is here, as in its stress on the importance of education, that the book touches common ground with Mr. Bryant's "Unfinished Victory", the finest in quality and most moving of the three. Writing with all the impartiality of the historian, Mr. Bryant gives us a study of Germany history from 1916 and an interpretation of Hitler and Nazism which can scarcely fail to facilitate the creation of an understanding between the British people and the Reich when the War has come to an end. The heart of the book is in the introductory "Historian's Testament", with its hope that the book may help in the right use of victory when it has been won for us by the valour and endurance of our race.

Mr. Bryant's sincerity and balance can scarcely fail of their purpose to make it a little easier for the people of Great Britain to understand the causes of the violence and aggression of our enemy, and as he points out, we can only achieve our end of freeing Europe from the effects of that violence and aggression when we have reached that understanding. But few who read the book will fail to be grateful also for the interpretation of the national spirit given in a passage written after the march to Prague. There is in these pages a quality of the spirit which is the surest token that victory won once again will this time not be unfinished or in vain.

These books are permanent evidence that in the midst of this struggle there are those who, recognizing all that it demands of us, are looking to what lies beyond. The reader may well find in their pages, not vain visions or castles in the air, but the quality of mind which will strengthen him to endure all that may be asked of him in the ordeal that lies immediately ahead ; and, when victory is won, to play his part in the travail out of which the new world order will be born. The three books together make no mean contribution to fundamental thinking on the enduring values of Western civilization for which we contend, and on their enthronement in a new order, social as well as international, from which, not change or evolution, but war has been eliminated. Such thought running ahead of realization, as A. N. Whitehead reminds us, is the condition of quick transition to new types of civilization. That it should proceed in the midst of so stern a struggle as that in which we are now engaged may indeed be the earnest of final victory.

ARE WE ALONE IN THE UNIVERSE?

Life on Other Worlds

By Dr. H. Spencer Jones. Pp. xiv+259+17 plates. (London : English Universities Press, Ltd., 1940.) 7*s*. 6*d*. net.

AS every professional astronomer knows, there is a vast population of laymen for whom the really exciting problems of astronomy are not those associated with the finiteness or supposed expansion of space, or the sources of stellar energy, but with the canals on Mars and the possibility of life on Mars. In this little book of 250 pages, the Astronomer Royal tells us of the findings of modern astronomy on these latter questions, and much besides, in a way that will not only interest the layman, but the professional scientist as well. It is a model of what such a book should be, popular and scientific at the same time, clear but concise

in its writing, with the main theme standing out unburdened by irrelevant details, and the conclusions stated with balance and fairness. If there are any inaccuracies of fact, or even of typography, the present writer has failed to notice them.

Yet the book is something more than a mere exposition of the accepted findings of modern astronomy; here and there the author adduces new arguments, and opens up new vistas of thought. These deserve the compliment of critical examination.

After giving us a thumb-nail "picture of the universe", the author explains why living matter on earth consists largely of compounds of carbon, and why it must probably do so wherever it appears. Life would thus seem to be restricted to a very narrow range of temperature, and this, in conjunction with other quite simple considerations, rules out all planets except the earth and Mars as possible abodes of life. The chapter on Mars, then, must contain the core of the discussion, and its title, "Mars—the Planet of Spent Life", informs us of its conclusions in advance.

We read first of Schiaparelli's discovery of the "canali" on Mars, and of Lowell's attempt to interpret them—in opposition to Schiaparelli's considered opinion—as canals built by intelligent beings to transport water, by a pumping system of 4,000 times the power of Niagara, from polar ice-caps to the equatorial regions. Dr. Spencer Jones rejects this interpretation *in toto*, and indeed he could do nothing else. For the supposed ice-caps are probably not ice at all, but clouds; and even if they were of ice, they could not be more than a few inches thick, otherwise they would not melt away and disappear, as they do, in the chilly Martian summer. Further, while the camera shows that some at least of the "canali" have a true objective existence, it shows them as rows of broken smudges rather than as continuous canal-like structures. Now it is known that the eye, straining to study such a row of dots or smudges in a poor light, will subjectively connect them up into a straight line; Greenwich schoolchildren, when told to copy a badly-lighted map of Mars, not only inserted the features that were on the map, but also systems of "canals" that were not there. Lowell saw many of the supposed canals doubled at distances of about 0·26″, although the resolving power of his telescope was limited to 1·0″. All this makes it clear that the problem must be attacked along other lines.

Mars is commonly supposed to have been formed from the outer layers of the sun, in which free oxygen is abundant, yet the spectroscope shows no trace of free oxygen in the Martian atmosphere. It is reasonable to suppose that the original oxygen has combined with other elements, Mars looks red, and many oxides are red, so that we may conjecture with Dr. Spencer Jones and many others that "Mars may be a planet where the weathering of the rocks, followed by their oxidation, has resulted in the almost complete depletion of oxygen from the atmosphere". But it is surely going too far to say that "the colour of the surface of Mars provides sure evidence of the presence of free oxygen, at any rate in the past", and still more so to continue, "The presence of free oxygen almost certainly demands the existence of vegetation". Surely the observations are most simply explained by supposing that the free oxygen which came from the sun has all, or nearly all, been absorbed by the rocks; the question of vegetation does not come in at all, except that if there were abundant vegetation, we should expect to find abundant free oxygen in the atmosphere, which we emphatically do not.

The author finds a further argument for the existence of vegetation in the seasonal colour-changes which occur on the surface of Mars, certain areas turning dark green, or at any rate dark, in the summer. Here he is again in company with many other astronomers. He rejects Arrhenius's suggestion that the areas in question may be covered with soluble or hygroscopic salts which change colour in rainy weather. He might have added that Lyot's recent careful studies of the reflecting and polarizing qualities of the surface of Mars seem to indicate that this consists of volcanic ash—like the moon.

Beyond the solar system the question of the existence of life becomes a matter for speculation controlled only vaguely by theory. If we are right in believing that planetary systems can only come into existence through the close meeting of two stars, then only a minute proportion of the stars can be accompanied by planets. Even so, there are so many stars in space that the total of planets must be large, and many of these must be in a condition to support life—if it comes. But will it come? Dr. Spencer Jones gives us little help here, telling us, on the first page of his preface, that he assumes life will come whenever the conditions are favourable; others may prefer to make the opposite assumption. Here is the question which, because of its philosophical and religious implications, interests the layman most, and the astronomer as such can give him but little guidance. We know of two, or at most three, planets on which the conditions are suitable for life. The earth falls out of any statistical discussion, because we should not be discussing the problem if life had not come to it. Venus is almost certainly too hot—and Mars? Clearly there is not yet adequate material for statistical discussion.

J. H. JEANS.

FRUITS OF THE RENAISSANCE IN ARCHÆOLOGY

The Prehistoric Foundations of Europe to the Mycenean Age

By C. F. C. Hawkes. Pp. xiv + 414 + 12 plates. (London: Methuen and Co., Ltd., 1940.) 21*s*. net.

THE past twenty years have seen an astonishing development in a broad field of historical study of which natural scientists have often been more aware than the majority of historians. Even the bare outlines of human history in Europe for more than nine-tenths of the total period of human occupation could not be indicated in 1920. The fruits of intensive work in prehistoric archæology at a multitude of sites revealing cultures separated in time by hundreds of thousands of years may to-day be co-ordinated securely enough, not merely to establish the outstanding phases of the culture history of Europe down to Classical times, but also to point with confidence to many of the physical and sociological conditions involved in the series of technical revolutions, migrations and territorial consolidations which occurred. The natural scientists have become acquainted with these remarkable achievements because their co-operation has been successfully sought in attacking a multitude of technical problems on which the delineation of this complex field of culture history has depended. To the anatomists and physical anthropologists have been referred problems of racial evidence for connexion and migration; the palæobotanists and geologists have provided techniques for the construction of prehistoric time scales, and have in their turn been aided by the archæologists, who have provided type fossils for their own problems of zoning. Mineralogists and chemists have made vital contributions to problems concerning the conditions and scenes of the decisive metallurgical and other technical advances of prehistoric times.

Mr. Hawkes's masterly survey of the greater part of this vast prehistoric field, the cultural development in Europe from the time of the first palæolithic occupants to the establishment of the 'cultural balance' of the Middle Bronze Age in the second millennium B.C., is from this point of view a repayment for these many contributions from the natural sciences, contributions the significance and importance of which are made clear in the course of his complex narrative.

The renaissance of European prehistory in Great Britain may be said to date from the publication of Crawford's "Man and His Past" (1921) and the first edition of Childe's "Dawn of European Civilisation" (1925). Before this prehistoric archæology was still very largely the grubby handmaiden of the conventional historian, the folklorist and the evolutionary technologist. Archæological data were too often conceived as useful merely for buttressing or refuting historical hypotheses based on literary records, legends or *a priori* theories of social and technological development. Flintwork and pottery, celts and swords were usually regarded only as the alleged, and often inadequately alleged, products of dimly conceived 'races' or stages of human development. The revolution in outlook consisted essentially in attempting to build up by every means possible, without reference to preconceived theories of origin, as full a picture as possible of the culture, time point and physical environment of the society whose members had used the artefacts discovered by chance or excavation. The amazing measure of success which has been achieved and the multitude of painstaking investigations which have contributed to the pictures Mr. Hawkes is able to present will be immediately clear to the reader of his book.

Archæology once obsessed by relics of lost 'races', by intimations of the 'pagan rites' of our 'ancestors', is now moving towards a position in which the historical geography, the sociology, economies and the religious systems of the human race may be adequately sketched from the ultimate dawn of history, the emergence of man. In the first phase of this advance there was a marked emphasis on environmental control of prehistoric cultures; later, under the stimulus of Prof. Childe's brilliant analyses, the economic revolutions of prehistoric times and their technological bases have formed the framework for classification and narrative. One of Mr. Hawkes's major contributions is to bring back into focus the sociological implications of culture contacts and in particular the rise and expansion of dominant groups and of their ritual systems. Some earlier studies have too often left one with an impression of prehistoric groups as pawns of the European forests and loess; the emphasis on economic forces, while never deterministic, has also on occasion obscured the fact that a society is never merely an economic organization that social values other than immediate economic advantage may be spurs to cultural change and, in particular, that there are indications of the effects of mystic zeal and the potency of religious symbolism in the culture spreads of prehistoric Europe. In his treatment of both the

Ægean cultures, of the role of the 'megalithic religion' in Atlantic lands and of the cultural unification imposed by the Warrior peoples of Central Europe, to cite but a few examples, Mr. Hawkes has restored the balance. He formulates hypotheses of social organization for every adequately documented culture and, while some may have to be revised in the future, the foundations of the social history of prehistoric Europe have been soundly laid.

In its plan and general organization this study follows broad lines which will be familiar to students of European prehistory. It is remarkable not only for the balanced and catholic treatment of the main trends, but also for the wealth of detail which Mr. Hawkes, revealing extraordinary command of the vast and scattered literature, has contrived to incorporate in his narrative. Making use of every stylistic device for compression he has been able to illustrate and discuss in some detail every cultural phase and problem. Nor is this only a compendium of current views ; quite often, as, for example, on the source of the Danish 'dolmens', on the introduction of cremation rites in northern Ireland and in disentangling the complexities of the ceramic tradition in Early Bronze Age Central Europe, new approaches and hypotheses are offered. It must be admitted that the compressed and parenthetic style make considerable demands on the reader's attention ; but his patience is rewarded by a full and critical treatment in extraordinarily small compass. The plates and assemblages of line drawings have been selected with great skill, and admirably document the text ; but the maps are less successful.

DARYLL FORDE.

GEOLOGICAL HISTORY AND MINERAL RESOURCES OF SOUTH AFRICA

The Geology of South Africa

By Dr. Alex. L. du Toit. Second edition, revised and enlarged. Pp. xii + 527 + 41 plates. (Edinburgh and London : Oliver and Boyd, 1939.) 28*s*. net.

SOUTH AFRICA, paradise of geologists, continues to bring forth its treasures. For many generations it has supplied the world with gold, diamonds, platinum and corundum, while in recent years the development of its resources in other essential minerals, such as tin and tungsten, has become increasingly important. In the realm of palæontology, it has furnished, from the rocks of the Karroo System, a wealth of well-preserved material for evolutionary studies in early reptiles, amphibians and fishes. Archæologists, too, have looked upon this region as a happy hunting ground, for within the last few decades it has yielded skeletal remains of early man and anthropoid apes, as well as a large series of primitive stone implements.

From the moment the visitor to South Africa sights Table Mountain his eye is arrested and his imagination fired by the peculiar and distinctive scenic types of the country ; he is held in wonder by the kopje landscapes, the great cliff of the Drakensberg, the desert wastes of the Kalahari, the granite weathering of the Matoppos, and the mysterious Great Dyke of Rhodesia. The geological pilgrim especially is impressed by the knowledge that, on not less than five (and possibly even more) occasions the country has undergone the vicissitudes of Ice Ages, all of great antiquity, occurring in pre-Cambrian, Cambrian (?), Devonian, and Carboniferous times. In some of these periods, the area may have been near the periphery of the great ice-sheets, so that it received only scratched pebbles and erratics dropped from melting icebergs or ice-sheets, but in late Carboniferous times, when the world-famous Dwyka deposits were formed, there was evidently a widespread glaciation that radiated westwards and southwards from the region that is now the Transvaal. The Dwyka deposits show beautifully preserved examples of glacial floors, pavements, roches moutonnées, disturbance, striæ, chatter-marks, varve-like clays and the like. So remarkable, indeed, are these phenomena, that the Union Government has wisely decreed that the Nooitgedacht Farm area, where they are exceptionally well exposed, shall be established as a natural reserve, just as the Glacier Garden of Lucerne is preserved as a testimony of the much more recent Pleistocene glaciation. (Curiously, Nooitgedacht has escaped mention in the index.)

These and many other equally interesting subjects are discussed in Dr. du Toit's book, now the standard work on the "Geology of South Africa". The volume appeared in its first edition in 1926 (reviewed in NATURE of May 7, 1927). In the second edition, the work has been revised throughout and, in consequence, somewhat enlarged. The accompanying coloured geological map has been corrected and brought up to date ; it includes

Southern but not Northern Rhodesia. Among the chapters that have been expanded are notably those dealing with the Witwatersrand gold-mining area, the economic resources of South Africa, the Ventersdorp volcanic series and the petrology and tectonics of the Vredefort Dome.

The results of recent geological investigations have been incorporated, as, for example, in the revised classification and subdivision of the "Primitive" or oldest Pre-Cambrian rocks, and in the account of the characters and distribution of the Nama System, a rock-group assigned to the Cambrian or latest pre-Cambrian on the evidence of its fossils, which appear to have affinities with the Archæocyathidæ, sponges and stromatoporoids. Similarly, in his account of the Vredefort "Dome" of granite, an extraordinary mushroom-shaped structure "of truly amazing character", the author has summarized the later work of Molengraaff and Hall, and of S. J. Shand.

The problem of the mode of origin of the gold emplacements in the Rand conglomerates (or bankets) is discussed at length, and, notwithstanding the recent attacks of Graton and others on the placer theory, Dr. du Toit expresses the opinion that the majority of geologists acquainted with the deposits adhere to the view that the gold is largely detrital in origin, while not denying that local enrichment has been caused by infiltration. In his extended account of the geology of the Rand the recent development of the Far East Rand and the West Rand is considered in relation to the parent area.

From his own observations in South America, the author is able to institute valuable comparisons between the Devono-Carboniferous stratigraphical succession, facies and structures on the two sides of the Atlantic, and to direct attention to the support that in his opinion these similarities give to the Wegener hypothesis of the drifting apart of the two continental masses.

Although the Great Ice Age as we know it in the northern hemisphere left no evidence of glacial and interglacial epochs in South Africa, a succession of early human industries resembling that in Europe has now been established. Much has still to be done before the stages of cultural development and the climatic oscillations (such as the three wet phases and an arid phase in the Vaal River Basin) can be regarded as satisfactorily correlated, but the valuable contributions to this end by C. van Riet Lowe and his colleagues are usefully summarized.

High praise was extended on the appearance of the first edition of this book. The second edition is even more praiseworthy. The volume is a masterly compilation, attractively written and well illustrated ; it will long be used with appreciation by all interested in South African geology.

P. G. H. BOSWELL.

SURVIVALS AND BELIEFS

English Folklore

By Christina Hole. Pp. viii+184+33 plates. (London : B. T. Batsford, Ltd., 1940.) 10*s.* 6*d.* net.

IN her introduction to this collection of English popular beliefs and customs, the author remarks on the relative poverty of the English tradition in this respect when compared with that of the Celtic-speaking peoples of Scotland, Wales and Ireland. This is in accord with the principle that such peripheral regions as a rule are found through their conditions to have afforded a favourable environment for the survival of the more primitive elements in a culture composed of diverse elements. The resistance of the Celtic-speaking elements in the British population to conquest has also fostered the preservation of tradition.

As a consequence, students of popular custom in Britain have shown a not unnatural tendency to direct their investigations to the richer material of the outlying regions, where the continuity of tradition, though not entirely free from outside influence, on the whole has suffered less dislocation than in England, which has not only been overrun by a succession of invasions by Saxons, Danes and Normans, but also in more recent times has been more completely subjected to the levelling influence of the contacts with outside peoples which has proceeded *pari passu* with the development of communications. Yet, as has frequently been pointed out, this makes of English folk-lore an interesting and at times informative field of cultural analysis.

Miss Hole has drawn her material in part from personal inquiry, in part from printed sources. Of these the more important and fruitful, almost inevitably, have been the invaluable volumes of county folk-lore published by the Folk-lore Society. The classification which she has adopted under the headings of "The World of Everyday", "The World of Nature" and "The World of Magic", has enabled her to cover systematically a field which from the very nature of its content invites inevitably to scrappy treatment. In the first

group of beliefs she deals with those which surround the individual from birth to the grave; the second illustrates the attitude of the individual to sun, moon and stars, birds and beasts, trees and plants, and water, wells and stones; and in the third division we have his relation with aspects of the unseen, the world of spirits, manifested in beliefs relating to witches and fairies.

While it is true that much of folk-lore custom died out before the nineteenth century came to an end, this applies more particularly to communal practices enshrining old and forgotten beliefs rather than those more personal survivals from which Miss Hole has drawn a rich selection. Of the more elaborate ceremonial customs, such as, for example, the Abbots Bromley horn dance, probably few would now survive had it not been for the efforts of Cecil Sharp and his colleagues and successors to preserve and revive folk-dance, song and drama. Yet notwithstanding the advance of education, beliefs affecting the individual survive in abundance. The reason is here made clear. It is fear, fear of ill-luck and the unknown. It is therefore not surprising that among the most recent examples quoted are measures to avert the evil influence of the witch. It is, however, interesting to find that Herne the Hunter, his blasted oak, and the white stag, portents of calamity, all appeared in Windsor Royal Forest before the economic crisis of 1931.

ULTRA-VIOLET LIGHT IN TECHNOLOGY

Fluorescence Analysis in Ultra-Violet Light

By J. A. Radley and Dr. Julius Grant. (Monographs on Applied Chemistry, Vol. 7.) Third edition. Pp. xvi + 424 + 34 plates. (London: Chapman and Hall, Ltd., 1939.) 22*s*. 6*d*. net.

THIS valuable work deserves the third edition which it has now attained in a little more than six years. It is twenty per cent larger than its predecessor in the text, in the number of references, and in five more large plates. These last include a photograph in ordinary light and a photograph in ultra-violet light of the faded writing in the Peniarth manuscript, which illustrate in striking degree the possible usefulness of the fluorescence method of examining such museum documents. An even more interesting instance, not illustrated by a plate, is the discovery of alterations in the concluding verse of St. John's Gospel in the "Codex Sinaiticus".

The final chapter (xx) on "The Dyestuffs Industries" is a very useful addition to the book. The general information is very meagre, but there is a wealth of data showing how fluorescence phenomena are influenced by solvents, temperature, inhibitors, decay, etc. on various colour agents. Unfortunately, a few of the paragraphs are borrowed from Chapters xiv on "Organic Chemistry" and xviii on "Textiles" in the last edition, where this part of the subject was then inadequately treated.

Chlorophyll, which came under the general heading "Identification of Colouring Matters" in the second edition, is bereft of any such association, having lost the companionship of "vegetable dyes", which now receive notice in the last chapter. Indeed, the "Identification of Colouring Matters" as a separate section ceases to exist; and the expression does not occur on p. 387, to which the index directs the reader.

Chapter iii deals at considerable length with the subject of "Filters", especially with glasses, and gives many details relative to the composition of glasses. Nevertheless, it appears to make no mention of the well-known didymium glasses, even though it pays tribute to the researches of Crookes in this field (p. 25). It is not clear why "Wood's glass" and the like (p. 33) should be included under "Filters other than Glass", away from "Glasses which Transmit Ultra-Violet Light" (p. 27). This has persisted from the first edition. Perhaps the most remarkable omission in these days of A.R.P. is that there is no mention of luminous paints, or of various fluorescent phenomena which have so long been utilized for advertising and similar purposes. A discussion on the technology of these subjects would be quite out of place in a work devoted to "Fluorescence Analysis", but surely there are analytical aspects which claim suitable notice.

As in the previous edition there are numerous inconsistencies in the text, some merely a matter of English, others technical. For example, on p. 27 one would welcome some comment or explanation by the authors on taking ordinary window glass as unity, even if on the authority of some other worker. Similarly, on p. 1, what was the quality of the glass plate 7 mm. thick which transmitted certain percentages of light at various wave-lengths?

However, the new edition marks a distinct advance on its predecessor, and bids fair to enhance its established reputation. S. J. L.

EFFECT OF NOISES OF WARFARE ON THE EAR

By Dr. T. S. Littler,
University of Manchester

THE rapid development of high-explosive weapons of destruction and attack accompanied by increased blast effects has necessitated increased protection against the possibility of physical injury. The dangers of destructive effects on the sense organs though less obvious have become increasingly serious, and of these impairment of the sense of hearing is of considerable importance. The disturbances likely to endanger the aural and nervous system during bombardments or air raids consist mainly of intense sudden noises of an explosive character. Much information is available on the effect on the ear of these intense noises, and to a certain extent it is possible to minimize or mitigate possible damage to the aural system. Less intense sounds of longer duration which are sometimes referred to as 'horrific noises' and which the enemy have recently introduced as a form of aerial warfare can of themselves produce no damage to the ear. Their panic effect is a psychological one and is calculated to be enhanced by surprise when used without regularity.

The human ear has an upper limit of acoustic pressure beyond which the sensation of sound is accompanied by a sensation of feeling or pain. This limit, known as the threshold of feeling, is a practical upper limit not only for sounds which can be sensed by the ear but near which prolonged exposure may cause damage and temporary or permanent loss of hearing acuity. The acoustic pressure required to attain this limit depends on the frequency of the sound. It is about 3,000 dynes per square centimetre for frequencies of the order of 30–100 cycles per second, but it is only about 600 dynes per square centimetre over the range 200–7,000 cycles per second[1]. Much work has been done on the effect on the ear of intense sounds at pressures approaching the threshold of feeling, and it has been found that such sounds produce definite aural fatiguing effects—effects which may remain for some hours if the sound is sufficiently intense and maintained for a sufficiently long period but from which the ear ultimately recovers. Subjects who have been in the presence of intense noise for very long periods are known to become permanently deaf to certain ranges of frequencies. In the majority of instances the deafness occurs for the upper audible frequencies and corresponds to an inner ear defect near the basal turn of the cochlea.

From experimental evidence it seems that in the case of complex sounds with different wave forms the peak excitation of the basilar membrane is nearer the basal turn of the cochlea the steeper the wave form[2]. It is to be expected, therefore, that greater peak pressures can be endured for slowly rising wave forms than for steeper wave forms. Although the blast pressure encountered during a high-explosive bomb explosion is probably of the order of 10^8 dynes per sq. cm. (100 atmospheres) at the point of explosion, the pressure dies rapidly to the order of 10^6 dynes per sq. cm. (1 atmosphere) a short distance away, after which the disturbance becomes a progressive wave of pulse form in which the pressure decreases linearly with distance from the source. The time interval during which the pressure rises from the undisturbed state to that of maximum condensation depends on the nature of the explosion, but in the case of the high-explosive bomb it is of the order of two or three milliseconds. It is apparently this sudden rise of pressure that produces the greatest

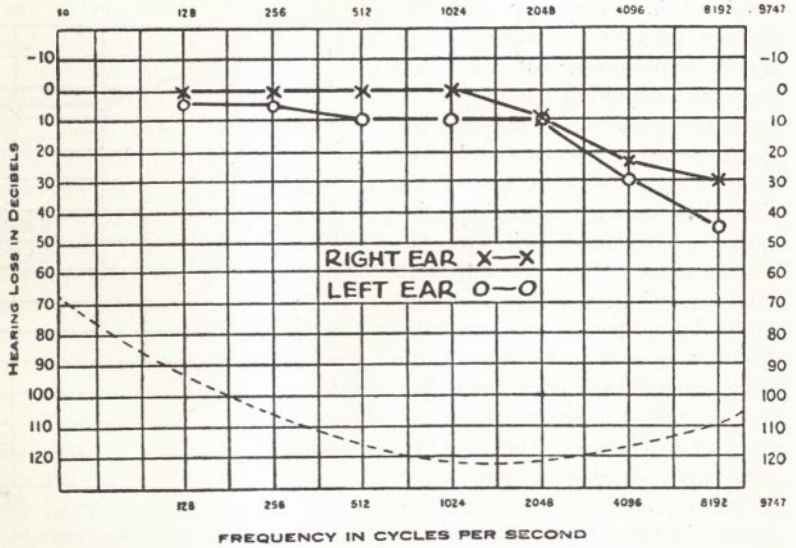

Fig. 1.

AUDIOGRAM OF PILOT AFTER FLIGHT OF ONE HOUR. EARS UNPROTECTED.

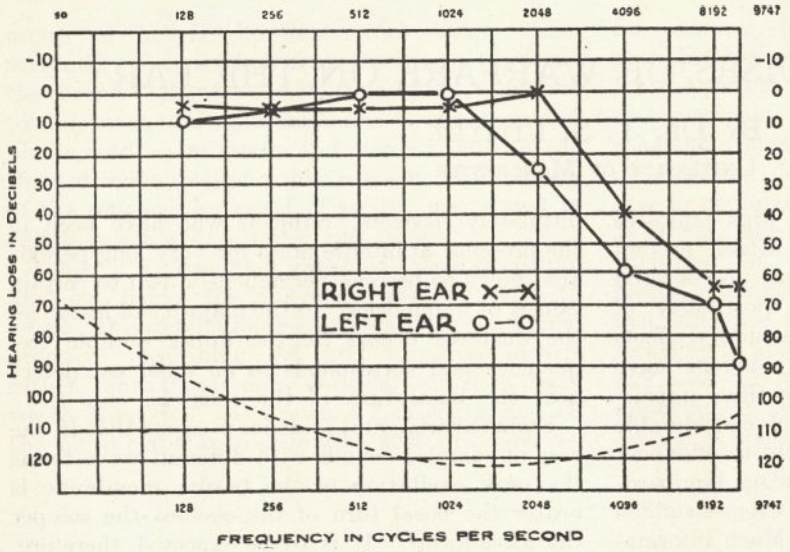

Fig. 2.

AUDIOGRAM OF PILOT SHOWING PERMANENT HIGH-FREQUENCY DEAFNESS PRODUCED WHEN THE EARS ARE UNPROTECTED.

damage to the aural system. This is observed in the case of exposure to gunfire, where it is found the smaller the gun the sharper and more distressing the sound.

Valuable information on the effect on the ear of intense sounds of steep wave front is obtained from hearing tests of aviators before and after certain periods of flying in aeroplanes where the peak acoustic pressure may reach or even exceed that corresponding to the threshold of feeling for pure tones[3]. It has been found that, after flights of one hour in modern types of aircraft, pilots show a severe hearing loss to frequencies in the upper register above 2,000 cycles if the ears are not protected in any way. This deafness is temporary and the subject recovers to normal after a certain period of rest, but if flying is continued for long periods without protection to the ears the deafness becomes permanent. The pilot is not always aware of the disability owing to the high frequencies involved affecting the clarity rather than the apparent loudness of speech received, but an audiometer test demonstrates the defect quite clearly. These results are illustrated in the audiograms of Fig. 1 showing the hearing loss produced in the case of a pilot after a flight of one hour. This temporary deafness does not occur if a helmet or a satisfactory earplug is worn. Fig. 2 shows the hearing curve representative of the type of permanent hearing loss produced after about 200 hours flying without any form of protection for the ears. Now hearing tests made on pilots who have always worn a flying helmet or protected their ears in some way show that hearing can be retained at normal level even after very long periods. For example, Fig. 3 shows the hearing curve of a pilot, representative of many others, who has had a total flying experience of several thousand hours, but has always worn a helmet or protected his ears. The acoustic insulating properties of a flying helmet and of a number of earplugs are given in the accompanying table, where it can be seen that although great insulation is produced for high frequencies the reduction of incident sound for frequencies below 500 cycles per second is very small. Since the main components in aeroplane noise are in the lower frequencies such plugs do not seriously reduce the peak pressure in the wave falling on the eardrum, but by virtue of their high insulating properties at high frequencies they reduce the steepness of the wave front appreciably, thus producing a less damaging sound on the ear.

In the case of explosive sounds the deafening effects are due to single blasts and are of the same nature as aviator's deafness. A detailed study of these has been made by Bunch[4]. In general, there

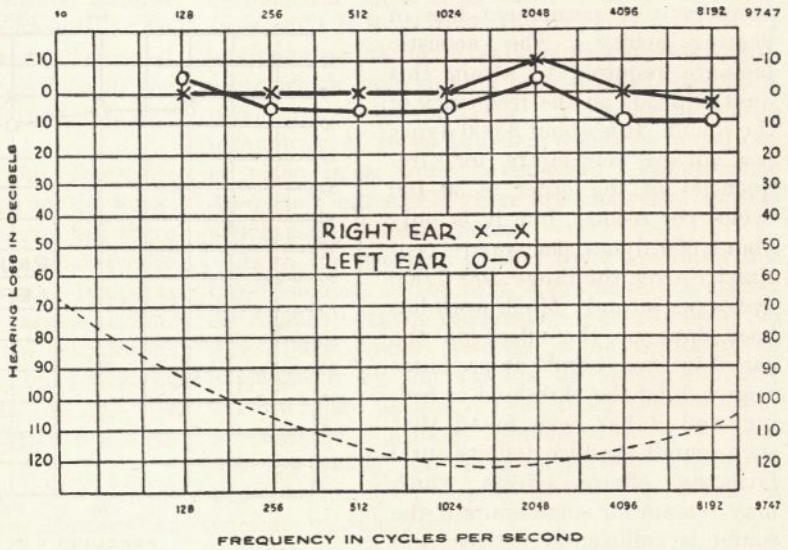

Fig. 3.

AUDIOGRAM OF PILOT WHO HAS ALWAYS PROTECTED HIS EARS.

TESTS OF METHODS OF EAR PROTECTION

Methods

1. Flying helmet firmly strapped so that the telephones and their holders closely seal the ears.
2. Ear defenders.
3. Finger tips in ear.
4. Cotton-wool saturated with 'Vaseline'.
5. Liquid paraffin and cotton-wool saturated with 'Vaseline'.
6. Liquid paraffin and cotton gauze saturated with 'Vaseline'.
7. Meatus packed with 'Plasticine'.

Protection stated as hearing loss in decibels.
(Measurements by air-conduction from a loud-speaker source.)

Frequency of test	Method	1	2*	3	4	5	6	7
	250	5	15	20	15	15	10	10
	500	—	10–30	—	15	20	15	10
	800	15	15–25	25	15	25	25	10
	2,000	25	15–40	25	15	25	40	20
	3,000	—	10–45	—	30	35	40	25
	4,000	35	25–55	35	30	50	50	35

* It proved impossible to fit defenders into the ears with equal tightness in successive tests because the material of which they were made was hard and failed to adjust itself to variations in the shape of the individual meatus.

seems to be no doubt that the parts of the cochlea near the basal turn corresponding to high frequencies are more exposed to shock excitation and the first to suffer any degenerative effects. Stevens and Davis[5] are of the opinion that violent stimulation causes disruptive effects which involve temporary or permanent damage to the hair cells. There are instances where explosive sounds actually produce a rupture of the tympanic membrane, but of itself this is not of a serious nature as the membrane heals rather rapidly—it is the inner ear with its sensitory contents that is so easily damaged. In addition to the effects referred to above, Yearsley[6] points out that true concussion of the labyrinth may occur as a result of a high-explosive wave and reports instances of deafness allied to hysteria after burial in earth thrown up by an explosive.

The methods of protection of the ears against explosive sounds are very simple. One of these, the earplug, has probably been in use for more than a century and has always been used extensively by gunners and others in the presence of intense noise. The other is the buffer, which is a wedge of rubber or resilient material held between the teeth. It is believed to prevent the full shock of an explosion from being conveyed through the bones of the skull. Relaxation of the face muscles, in reducing the rigidity of any exposed part, is an additional protection which reduces blast effects. The table gives some idea of the efficiency of simple plugs. A supply of these such as cotton-wool soaked in 'Vaseline' can easily be carried about the person as a precaution, and in the case of children pads strapped on the ears are an alternative. Earplugs made of hard material are not advisable as they are apt to produce irritation after long periods of use and they have little advantage over more resilient obstructions.

[1] Wegel, R. L., *Ann. Otol. Rhinol. and Laryngol.*, **41**, 740–779 (1932).
[2] Stevens, S. S., and Davis, H., "Hearing" (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 282–284 (1938).
[3] Dickson, E. D. D., Ewing, A. W. G., and Littler, T. S., *J. Laryngol. and Otol.*, **44**, No. 9, 531 (1939).
[4] Bunch, C. G., *Laryngoscope*, **47**, 615–691 (1937).
[5] Stevens, S. S., and Davis, H. H., *ibid.*, 322–27 and 257.
[6] Yearsley, M., *Daily Telegraph*, Correspondence, Oct. 29, 1939.

THE CELLULOSE PROBLEM IN WAR-TIME

By Dr. Julius Grant

FROM time to time I have discussed in NATURE[1] and elsewhere[2] some of the problems which face those in the paper, rayon and other industries which rely on fibrous cellulose as a basic raw material. Since some of the most important of these problems have always been subject to the balance of supply and demand, it is not surprising that under war-time conditions they should have acquired a new aspect. In the ten years prior to the War the production of cellulose pulp, particularly from wood, fluctuated uncertainly between a state of inflated prices to one of unprofitable over-production; immediately before the War, in fact, there were even 'scares' of a cellulose pulp shortage. These, however, were scares in the true sense; they did not bear a scientific survey of the cellulose resources of the world, particularly when alternatives to wood pulp were taken into account (see Grant[3]).

It is indeed an interesting reflection on the nature of a situation which aroused so much discussion at the time, that it should so soon have been forgotten. However, the war-time situation which confronts the cellulose-using industries may be summarized briefly as follows; incidentally, it is one of special interest to scientific workers, who rely on the printed word as an essential medium for the spread of information. The extension of the War to Scandinavia has cut off from Great Britain most of her supplies of wood pulp, which were drawn, in order of importance, from Finland, Sweden and Norway. Events in the Mediterranean may well render increasingly difficult the shipping of esparto grass from French African ports, thereby accounting for almost another fifth of our requirements. The only other direction to which are we able to turn is towards Canada, and increasing quantities from that source will no doubt provide

us with most of our really essential requirements ; the potential output of Canada certainly is equal to this.

On the other hand, Great Britain is not alone affected. The United States, for example, is by no means self-sufficient in wood pulp supplies, and they have had to rely in the past on Scandinavia for about 1,500,000 tons and on Canada for some 500,000 tons of wood pulp per annum ; with the loss of the former source they too are turning to Canada, and of course for several obvious reasons the latter is better placed to export to them than to us. The threatened wood pulp shortage, therefore, has at last materialized, although in a very acute and unexpected way, so that it is appropriate to review the situation once again in the light of these new events, and to assess the part which the scientific worker can play in dealing with it.

In the first place, the shortage is probably at its most acute stage now. Its severity has caught most consumers unawares, but assuming a long War, as time goes on the output of wood pulp in both Canada and the United States will increase, and the situation consequently will be eased. It may, nevertheless, be assumed with safety that if the War lasts, and if events take even the most favourable turn from the point of view of the supply of wood pulp to Great Britain, a serious shortage will still persist. It seems, therefore, that we must give some consideration to the production of cellulose pulp from such raw materials as are available in Great Britain.

At present these may be regarded as of three classes, namely, materials in use prior to the War, waste paper and new materials. The first category is comprised almost wholly of what are usually called 'rags', although they include materials as far apart as cotton linters and sacking. It is obvious that even under the most zealously organized system of salvage there is little likelihood of an increase of any real importance in the amounts of these available.

Much, too, has been heard on the subject of waste paper ; but here again, although a great deal has been done and much still remains to be done in the direction of salvage, it is evident that a system which brings no new grist to the mill cannot be a complete solution to the problem. Moreover, every time that the cellulose fibre undergoes processing for paper-making it is degraded in quality ; its length—an important factor in determining the response of the fibre to the processes of fibrillation which occur during beating—is decreased, and it loses its capacity for felting, with consequent detriment to the strength and character of the paper. Eventually, in fact, it behaves very much as an 'organic loading', contributing only weight and closeness of texture. A certain amount of virgin fibre must therefore be introduced into many papers in order to provide a 'skeleton', and the more often that a paper is re-used, the greater the proportion it requires ; or conversely, the poorer the grade of paper into which it can be incorporated. In addition, it must be borne in mind that as a result of the recent drastic restrictions in the use of paper the quantities coming back as waste will be correspondingly reduced.

In this connexion there is one aspect of the recovery of waste paper which deserves special attention, and this is the degree of degradation which takes place as the result of the fibre-recovery process itself, as distinct from the process of actual re-manufacture of the recovered fibre into paper. Recovery processes are numerous ; but they usually comprise two stages, namely, disintegration and purification. The former is mainly mechanical in nature, that is to say, the whole or shredded sheets of paper are agitated violently, usually with hot water which often contains free alkali, the purpose of which is to dissolve the resinous size which coats the fibres and helps to bind them together. It seems that this part of the process allows of little modification which might decrease the extent of the degradation of the fibre. The other stage of the process is, however, mainly chemical in nature, and varies according to the impurities present. The most important of these is usually ink, and the problem may differ considerably according to the nature of the ink. Thus, writing ink is removed with comparative ease with the aid of bleaching agents, and bleaching powder figures prominently among those used in spite of its adverse effect on the strength of the fibres.

Unfortunately, writing ink seldom occurs alone ; it is almost always accompanied by printing ink, and since most common printing inks are made up on a carbon basis, the question of removal becomes more difficult. The scientific basis of printing ink removal depends, first, on the destruction of the medium (usually an oil) in which the ink is compounded ; secondly, on the removal of the particles of the carbon from the fibre ; and thirdly, on the separation (after their removal from the fibres) of as many of these particles as possible, with a minimum loss of the fibres. The first requirement is easily satisfied by the use of alkali, so long as the oil is saponifiable, and it is assisted materially by the use of emulsifying and wetting-out agents. Newsprint inks, however, are made up with mineral oils, and are therefore an exception. Fortunately such oils have a relatively poor binding effect on the carbon, and this to some extent compensates for any difficulty in decomposing them. Owing to the chemical inertness of the carbon, however, its removal from the fibres depends

almost entirely on mechanical action. The mechanism underlying removal in this way is still imperfectly understood, and is proving a fruitful field of investigation; it seems, however, that under suitable conditions of combined rapid flow and agitation the individual fibres may be made to scour one another mechanically, and so to remove the particles of carbon on their surfaces. As might be expected, the presence at this stage of substances having detergent or wetting-out properties is again advantageous, and these are frequently used. This stage of the operation, therefore, need have little influence on the quality of the fibre.

The final stage, namely, separation of the particles of carbon, is the most difficult of all, because both the fibres and the carbon have dimensions and specific gravities of the same order, thereby eliminating to a great extent selective flotation or screening methods. In general, the greater the degree of cleanliness required the greater is the loss of yield at this stage owing to removal of fibre with the carbon. However, some degree of success has been achieved by the use of substances producing a froth which collects the carbon and so enables it to be skimmed off; froth-formation, unless it can be controlled, is, however, definitely objectionable. It is sounder to add an adsorbing agent such as china clay, or bentonite, or to precipitate an amphoteric oxide (for example, silica) *in situ*, as these fix the carbon by adsorption and later can be separated with it by means of a washing-drum. Where a final high quality is not of the first importance a compromise may be struck by separating most of the carbon (even at the expense of loss of yield), and dispersing the remainder in a very finely divided state throughout the bulk of the fibres. If this is done efficiently the particles of carbon cannot be seen as such; the final pulp is merely a shade more grey.

Devices of this nature have in common the reduction of damage to the fibres to a minimum. Nevertheless it is apparent that even under the most favourable technical and economic conditions, the re-use of waste is not a complete solution to the cellulose problem. There remains, therefore, the third alternative, namely, the utilization of home-produced raw materials. Numerous factors determine whether a particular material can be used in peace-time as a source of cellulose. In war-time some of these (and especially those which refer to cost) are of less importance, but the essential criteria remain. In order of importance these are: (1) availability (that is, regularity of supplies, quantities available, and ease of harvesting, collection, etc.); (2) yield; (3) ease with which the non-fibrous constituents may be removed (or quality of the final pulp); (4) suitability of existing plant for dealing with such raw materials; and (5) cost. In peace-time the order is different; cost and quality come nearer the head of the list, whilst the necessity to use existing plant is of less importance.

It should be pointed out at this stage that practically every vegetable material of a fibrous nature may be converted into cellulose pulp of one kind or another, and that ever since the shortage of rags which arose after the invention of paper-making by machine in the early nineteenth century, projects have been put forward for the utilization (for paper-making, at least) of every conceivable vegetable material from manure, peat and nettles to tree-wood. It is therefore highly significant that in spite of all this the cellulose requirements of Great Britain should have been derived solely from three raw materials of vegetable origin, namely, wood, esparto grass and 'rags'; indeed, the two latter account for only about 20 per cent of the total and are used only by virtue of special properties they possess. The position is much the same elsewhere in the world. Esparto is not used to any great extent, but in its place may be set various fibrous materials which, owing to local conditions, are favourably placed; straw in Holland, and bamboo in India are examples.

The reason for this is apparent if one applies the criteria of suitability set out above, because in almost every instance the question of cost proves to be the deciding factor. It has, in fact, ruled out everything except waste products (that is, materials for which there is no other use), and even then costs of collection and transport, combined possibly with poor yields, have brought the price of the final pulp to a figure which is not competitive with that of wood pulp. Since this is the case, under war-time shortage conditions one of the principal objections is removed, and the whole question may be reconsidered in this light. The result is that many home-produced raw materials which were previously rejected on the basis of the above criteria, now become interesting possibilities.

By far the most important of these is straw. It is a crop which is produced regularly and in large quantities; it can be collected and handled relatively easily, and its yield of bleached cellulose pulp (35–40 per cent), though on the low side compared with, say, esparto, may be regarded as satisfactory. There are, it is true, other uses for straw in the farming industry, but under modern conditions it is no longer essential for many of these, and it seems that the quantities available are adequate to safeguard a large proportion of our war-time cellulose requirements. Fortunately, too, straw may be processed in most of the existing plant previously used for rag and esparto; certain modifications are required, but these are of a minor

character, although owing to the bulky nature of the original straw and the difficulty of packing it into the digesters it is not possible to obtain the same output.

In Great Britain the only pulp plants available for such purposes are those operating an alkali process. The straw is then boiled in digesters under a pressure of 50–60 lb. per square inch with 15–20 per cent of its weight of caustic soda for some three hours. Under these conditions those constituents of the plant structure (such as lignins, pectins, gums, resins and carbohydrates) which serve to cement the cellulose fibres together, are rendered soluble, leaving free the skeleton of cellulose fibres. The cellulose is, however, not entirely unchanged, but undergoes a process the chemical nature of which is as yet imperfectly understood, although it appears to be allied to mercerization. The result is that the pulp acquires a greasy or gelatinous consistency which renders difficult the subsequent operation of removal of the soluble impurities by washing. Furthermore, the manufacture of paper from cellulose pulp is essentially a drainage process, and this, too, is retarded if the pulp is at all gelatinous. This is a characteristic of straw which makes it much more difficult to deal with than, say, esparto, and it presents a problem which may be attacked in two ways, namely, by improvements in methods of washing or by carrying out the digestion under less drastic conditions.

If the latter course is adopted the decomposition of the non-cellulose impurities may be less complete, and this applies particularly to those in the parts of the straw (such as the nodes) where the physical structure is more dense; it applies also to extraneous fibrous matter such as weeds. Certain of these (such as the dock) are far more resistant to attack by alkali than is straw itself, and when even a few of these partly digested particles are broken up in the subsequent operations, they appear in the final product as numerous small brown specks, known collectively as 'shive'.

In spite of this, however, the gelatinous character of straw pulp is such a serious drawback that further work on the elimination of shive becomes most desirable. One method of attack has been by means of a modified method of bleaching[2]. In the past the operations of digestion and washing have been followed by the addition of an excess of a solution of bleaching powder, the residual bleaching agent being washed out when the pulp has attained its maximum colour. One advance on this has been the bleaching of the pulp in two stages, about one half of the total quantity of bleaching agent required being first used; when this is exhausted the pulp is washed, and the remainder of the bleaching agent is added. The principal advantage of this method is the economy in bleaching agent which it effects; but it has also led the way towards further improvements (also along the lines of bleaching in stages) which have enabled more resistant materials such as weeds to be dealt with.

The most important of these is based on a principle similar to that of the original Cross and Bevan method of isolating cellulose, namely by chlorination. The first stage of the process, therefore, is treatment with chlorine, either as gas, as chlorine water or as an emulsion of the gas in water. If it is carried out under the correct conditions this stage has the effect of chlorinating the lignin almost selectively, with the formation of hydrochloric acid from the hydrogen atoms so displaced. If the pulp is then made alkaline, this acid is neutralized, and the chlorolignins are dissolved, so that after it has been washed the pulp is ready for the real bleaching operation, which is carried out with bleaching powder solution in one or more stages. Processes of this kind make possible the treatment of the more resistant plant materials, especially if these contain much lignin, and moreover the degradation in strength which inevitably accompanies the purification action of chemical reagents on cellulose is minimized. If, however, such processes are to be used to the best effect they require careful control; the influence of working conditions such as the concentrations of pulp and of bleaching agent, temperature, *p*H value and time are all of importance, and are the subject of active investigation.

So far special reference has been made to straw, partly because from the point of view of supplies it is the most promising source of cellulose available in Great Britain, and partly because elsewhere (and notably in Holland, Italy, and South America) it has already played an important part in supplementing or displacing wood pulp. There are, however, a number of likely though possibly less attractive alternatives available here, and experiments have already been made on materials such as Norfolk reeds, bracken, peat, potato and tomato haulms, sunflower stalks, linseed straw, hop waste and hop vines. These, however, vary considerably in their response to treatment, even by chlorination, and although it is possible to make cellulose pulp of a kind from each of them, when this is judged by the resultant criteria of yield, colour, strength and cleanliness, they do not equal weed-free straw; moreover, as a rule they are neither so plentiful nor so easily collected as straw. Nevertheless, they may well serve to supplement straw, particularly in war-time, and some of them by reason of their strength may suitably be used to reinforce straw pulps.

Finally, it may be pointed out that although this concentration on home-produced raw materials

is a direct result of war-time conditions, it may well prove to be the foundation of an attempt to render Great Britain permanently independent to a great extent of imported cellulose ; this would, in fact, be no more than to follow a precedent, already set in a similar way in Germany and Italy. If, however, this prospect is to mature, it seems to call for an organized attack on the many and various aspects of the problem involved. Not only are there the technical questions of pulp production outlined above, but bound up with these are matters such as the cultivation of straw containing the minimum quantities of weeds, and of straw which will give the maximum yield of cellulose fibre. The claims of the other uses to which straw is put at present will also have to be taken into account, and in fact the whole matter is obviously very closely bound up with the agricultural policy of the nation.

[1] Grant, J., NATURE, **139**, 867 (1937) ; **140**, 314 (1937).
[2] Grant, J., "Wood Pulp" (London : Wm. Dawson and Sons, 1938).
[3] *Chem. and Ind.*, **58**, 613 (1939).

OBITUARIES

Prof. William Frecheville

WILLIAM FRECHEVILLE, who died on July 30, was born in 1854 at Halifax, Nova Scotia, the son of R. R. F. Frecheville, barrister-at-law. Educated largely in England, he entered the Royal School of Mines in 1871, and in 1875 graduated in mining, metallurgy and geology. From that date until 1889 he held mining appointments abroad in different countries and in various capacities. With this experience he established himself as a consulting engineer in London, where his professional reports were greatly valued by reason of their sound recommendations and his uncompromising integrity. This work again took him to every land and to every sort of mine ; and in 1905 he was elected president of the Institution of Mining and Metallurgy.

It was not surprising, therefore, that in 1912 he was invited to allow his name to go forward for the then vacant chair of mining at the Royal School of Mines, Imperial College of Science and Technology. That he should have accepted this invitation to take up an academic appointment when he might well have continued a successful consulting practice or even have retired was in keeping with his inflexible will to work and his dauntless spirit. With nothing previously prepared and nothing to build upon except his own unassailable experience and his reading, he nevertheless set about and completed in time a series of systematic lectures on the mining subjects which fell to him as head of the department he took over. At the College his natural dignity and unfailing courtesy made him at once acceptable to his colleagues of the professoriate, by whom he was shortly afterwards elected as one of their representatives on the Governing Body.

In his own department Frecheville set himself the unpopular but cleansing task of putting down excessive coaching of students by members of the staff, permitting coaching only where there had been unavoidable absence from the adequate teaching which the College provided and for which the parents of students paid. Carrying on with a diminished staff, and fewer students, during the War of 1914–18, he was there to accommodate the influx of the large number which followed upon demobilization ; until in 1919, having by then a staff of his own selection and seeing one whom he could recommend to take his place, he resigned. In that same year the Institution of Mining and Metallurgy made him an honorary member in acknowledgment of his eminence in the profession and of the public spirit which prompted him to give students the benefit of his ripe experience ; in that year also he was made an emeritus professor of the Imperial College. Two years later he placed the sum of £2,000 at the disposal of the College for initiating research fellowships in mining and metallurgy, all of which was spent in useful awards for such work. Further distinction came when in 1926 he was awarded the Gold Medal of the Institution of Mining and Metallurgy ; and again in 1932 when he was made a fellow of the Imperial College—one of its first fellows.

In private life Prof. Frecheville was the courteous English gentleman. Married in 1890 to Helen, daughter of George Hamilton Penny of Sydenham, he celebrated earlier this year with his wife their golden wedding, the announcement being made in terms expressive of the swift but happy passage of time. Their one great grief was the loss of their only son, an officer in the Royal Engineers, who having fought through the War of 1914–18, went on to fight and to meet his death in Russia. Prof. Frecheville is survived by his widow, five daughters and grandchildren.

S. J. TRUSCOTT.

Major P. H. G. Powell-Cotton

WE regret to record the death of Major P. H. G. Powell-Cotton, zoologist, anthropologist, and one of the best known of big-game hunters in the world, which took place on June 26, at the age of seventy-three.

Percy Horace Gordon Powell-Cotton was born on September 20, 1866. He was educated privately and commissioned in the 5th Battalion the Northumberland Fusiliers, attaining the rank of major before his retirement. The greater part of his life, however, was devoted to travel, big-game hunting, and the collection of zoological specimens and ethnographical objects. The museum which he founded on his estate at Quex Park, Birchington, Kent, was one of

the finest private collections in Great Britain, and had he been able to carry out the extensions which he had planned before the outbreak of the War, would probably have been one of the most attractive exhibitions of big game in the world.

For nearly forty years Powell-Cotton was engaged almost continuously in conducting big-game hunting and collecting expeditions. Among the earliest scenes of his activities was Western Tibet, where he travelled on three occasions. In Africa there was scarcely a remote, and in his earlier days little-known, part of the continent which he had not visited. He crossed Somaliland ; and in a journey from Mombasa to the White Nile passed by way of Mount Kenya and Mount Elgon, and Turkana and Latuka, when these regions were indeed strange lands. Lado Enclave and Lake Edward were reached through the Ituri forest, and the Cameroons were visited three times ; while Tanganyika, Southern Angola and South-West Africa were some only of the scenes of his exploits.

Powell-Cotton's interests were not merely those of a big-game hunter. He was also keenly interested in zoological and anthropological science. In zoology many new species have been associated with his name ; and his collections exhibited in the public and private galleries of his museum at Birchington were readily placed at the disposal of students of zoological and ethnographical science. In anthropology, as was shown in his communications to the proceedings of the Royal Anthropological Institute, a profound sympathy with the point of view of the black man did much to compensate by accuracy of observation and understanding for a lack of systematic training. He was deeply interested in primitive arts and crafts and had brought together long series from almost every part of Africa, as well as from Tibet. At the same time he was a generous donor to the collections of the Ethnographical Department of the British Museum. In addition to communications in scientific periodicals, Powell-Cotton was the author of "A Sporting Trip through Abyssinia" and "In Unknown Africa".

CAPTAIN GUY DOLLMAN writes : "I have been a frequent visitor to the Powell-Cotton Museum during the last twenty or thirty years and have witnessed its growth and expansion from a comparatively small collection to the finest private museum in Great Britain ; in fact, it would not be an exaggeration to say that this museum is one of the foremost private museums in the world.

"Powell-Cotton specialized in presenting geographical groups of animals in his exhibition galleries and nearly all the specimens exhibited were close on record examples. With the exception of some specimens shot by Mrs. Powell-Cotton and others by the Misses Powell-Cotton, all the exhibits were personally collected by the Major. In the central gallery there is a magnificent group of African game animals, including the largest elephant which has ever been brought out of Africa, and the collection of elephant tusks contains some of the finest of specimens.

"Recently some new groups have been arranged in new galleries and some of these show a gradual transition from marshy surroundings to desert and mountainous environment. Here we have exhibited some of the Nyalas shot during Major Powell-Cotton's fairly recent expedition in south-east Africa. Among the desert animals is the new wild ass collected by Miss Diana Powell-Cotton, to which I gave her name when describing it. In the mountainous series are shown Barbary sheep and African ibex. There are also cases containing a fine group of Asiatic ibex, sheep and goats and others are filled with collections of apes and monkeys, the Cameroon gorilla group being especially noteworthy.

"In addition to the natural history specimens exhibited there is also a very extensive collection of ethnographical material, and quite apart from the exhibition branch of the museum there is a very large study collection which is available to students from all over the world. This has been consulted on many occasions by the principal mammalogists throughout Europe and America, and resulting from the work of these experts the Powell-Cotton Museum is extremely rich in type specimens.

"Of recent years the museum at Quex has become more and more a family affair. The Misses Powell-Cotton, in addition to accompanying their father on some of his trips to the Red Sea Province and Zululand, have also undertaken expeditions of their own into Angola, where considerable additions to the museum were obtained. Powell-Cotton's last two expeditions were to South-West Africa and Tanganyika Territory ; on the former trip he was accompanied by his son, and on the latter expedition Mrs. Powell-Cotton did much of the shooting."

WE regret to announce the following deaths :

Mr. W. C. Burnet, secretary to the Delegates of the Local Examinations, University of Oxford, on August 3, aged sixty-three.

Dr. R. Hanitsch, director of the Raffles Museum and Library, Singapore during 1895–1919, on August 11, aged seventy-nine.

Mr. A. H. Howell, senior biologist of the Bureau of Biological Survey of the U.S. Department of Agriculture, an authority on the geographical distribution of mammals and birds, on July 10, aged sixty-eight.

Sir George Macdonald, K.C.B., F.B.A., permanent secretary of the Scottish Education Department during 1922–28, an authority on numismatics and the history of Roman Britain, on August 9, aged seventy-eight.

Sir Daniel Thomas, known for his sociological, educational and antiquarian work in Wales, also for his work in the foundation of the National Library and the National Museum of Wales, on August 8, aged seventy-six.

Prof. N. T. M. Wilsmore, professor of chemistry in the University of Western Australia during 1913–37, formerly assistant professor in University College, London, on June 12, aged seventy-two.

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NEWS AND VIEWS

Element 85

IT is announced that Dr. W. Minder, of the University of Berne, has succeeded in isolating element 85. This, it is claimed, has been produced in small quantities from the decomposition of actinium, which is radioactive. Dr. Minder has named the new element 'helvetium' in honour of his country. It is hoped that further details of this claim will be available shortly. Commenting on this announcement in the *Evening News* (London) of August 13 is of such encouraging significance as to be worth placing on record. This newspaper says: "It is odd to learn to-day, in the midst of war, that a patient Swiss scientist has succeeded at last in isolating the elusive chemical element '85'. It is still odder to reflect that in the long view of history a discovery of that sort may rank above all the perils and victories of these days."

The Purchase Tax and Literature

IT was announced by the Chancellor of the Exchequer in the House of Commons on August 13 that newspapers, books and periodicals are to be exempt from the proposed purchase tax. He stated that he feels it would not be in the public interest at this time of war that there should be any decrease in the circulation of newspapers or any diminution of the services they provide for the public. This announcement will undoubtedly give satisfaction to all scientific workers. There is no doubt, however, as pointed out in the leading article entitled "Books in Wartime" in NATURE of May 11, p. 719, that this welcome decision is of much greater significance than would seem superficially. Sir Kingsley Wood added that books are to be exempt from the tax "at least for the present". It is to be hoped that, for the important reasons set out in the above-mentioned article, the future will not bring any significant change in this new policy.

The New World Order

IN his Cawthron lecture, 1939, "Some Problems of the New World Order" (Nelson, New Zealand: Cawthron Institute, 1939), Dr. G. H. Scholefield, pointing out that the raw material of political science is man in his organization for life, the family, the community and the nation, where the reactions of mankind are not so well known and precise as in biology or chemistry, gives a brief review of the sources of our liberty, the post-War revolutions and the rise of the dictatorships. Tracing the growth of German aggression, he emphasizes that with the destruction of dictatorship, the problem of settling Germany in a peaceful and prosperous state will remain and will involve some sacrifice. The great danger in such a war as this is that it may end before our leaders have fully studied how best to make peace and how to arrange international relations in future. This will involve attention to economic matters and the solution of problems of social organization.

Science and invention should alleviate man's labour, enable him to maintain himself by working shorter hours and to devote a greater proportion of his time to rest, to pleasure and to cultivating the arts. Failure of the social sciences to keep pace with the applied sciences has led to the position that the human race can produce all that is required for its material well-being with quite a light amount of personal labour while we have not devised means for all potential consumers to obtain possession legally of what they require. Neither Germany nor the democracies have solved the problem of absorbing unemployment and bringing mechanization under social control. Finally, Dr. Scholefield briefly touches on the possibilities of an international federation of States.

India's Future and the Constitution

ONCE again the British Government, notwithstanding the preoccupations of war, has turned aside to direct its attention to furthering the interests and promoting the welfare of a people for whom it accepts imperial responsibility. The statement of policy made by Lord Linlithgow, Viceroy of India, on August 9 and by Mr. L. S. Amery, Secretary of State for India, on the same day in the House of Commons was framed with the object of enabling the people of India to fulfil their anxious desire to contribute fully to the common cause in the present world struggle, and to ensure the triumph of our common ideals. In brief, the British Government proposes in the interests of Indian national unity, and notwithstanding the differences between parties which previous discussion has shown to be still unbridged, that the Viceroy's Council should now be expanded to include representatives of the political parties, and further that a consultative committee should be established which, as a war advisory council, will meet at regular intervals and will include representatives of the Indian States and of other interests in the national life of India as a whole. The statement of policy goes on to say that while it is clear that the present moment when the Commonwealth is engaged in a struggle for existence is not one in which fundamental constitutional issues can be decisively resolved, yet the British Government is prepared to undertake to set up at the close of the war a body representative of the principal elements of India's national life in order to devise the framework of a new constitution.

The state of tension between the various elements of the political situation in India at the present time is too well known to need stress. It has led to a deadlock, and lays it open to doubt whether the democratic idea has obtained a more than superficial acceptance in the minds of powerful sections of the

Indian population. The British Government is not blind to this aspect of the situation. While making it clear that Dominion status is its objective, it has laid it down without ambiguity in this statement of policy that the British Government cannot be a party to the coercion of any elements of India's national life into obedience to a system of government whose authority those elements do not accept. Secondly, it is declared categorically and insistently that the framework of the scheme for the future government of India should be primarily the responsibility of Indians themselves, and should originate from Indian conceptions of the social, economic, and political structure of Indian life. Subject to responsibilities from which His Majesty's Government cannot divest itself, it desires to see Indian conceptions given the fullest expression. This statement of policy made on behalf of His Majesty's Government is a bold and timely step forward to promote national unity among the Indian peoples. Its success or failure depends upon the people themselves. For while it embodies those principles of social justice which would submit the form of government to the determination of the peoples themselves, its translations into practical effect is clearly made to depend upon the display of that spirit of toleration, the exercise of that mutual co-operation, and that freedom from coercion which is the essence of the democratic ideal.

Colour-Blindness and Camouflage

THE chief characteristic which distinguishes colour-blind people from those with normal vision, is a reduced ability to distinguish colours that are normally quite distinct. Superficially, therefore, it would seem highly improbable that colour-blind persons could detect a camouflaged building that an ordinary observer would miss. This suggestion, however, which has come from the United States recently, is not wholly without foundation, as there are at least three ways in which certain colour-blind observers might see more than the ordinary person. For example, in a building camouflaged with large irregular patches of colour, the actual outline of the building may be lost in the jumble of these patterns. But the colour-blind person may be scarcely conscious of the variegated colours, so that to him the outline of the building may be almost unaffected by the camouflage. In the Ishihara test for colour-blindness, certain of the cards actually use this principle ; a faint blue figure is printed on a background of highly coloured dots of various hues. To the normal observer the blue figure is lost against the background, but the colour-blind person may spot it. Again, in the protanopic and protanomalous type of defect, reds and yellows appear darker than usual, and with certain colouring of building and background this could lead to an enhanced contrast and so give the colour-blind person his advantage.

That a third very hypothetical case is possible, is shown by the fact that, using a colorimeter, it is possible for a normal observer to make a colour match between two halves of a field that would not be a match for a defective observer of the anomalous trichromat type. It could therefore be argued that it might happen that a building matched its background for the normal person, yet, for the anomalous trichromat, the two would be distinct. But for every instance of this kind that might be suggested, there are innumerable examples in which the colour-blind observer is at a marked disadvantage, and in other ways would of course be a source of real danger. Moreover, if the normal person were provided with pieces of coloured glass, it would be most unlikely that the colour-blind person would ever be able to score off him.

University of London

THE report of the Principal on the Work of the University of London, 1939–40, gives a short account of the officially recommended dispersal of the various schools. The result was a heavy demand on those who received the evacuees, the Universities of Cambridge, Bristol and Wales in particular. The intensive air-raids which were expected not having yet arrived, Birkbeck College has re-opened for day and evening classes. The Imperial College of Science and Technology has remained open at South Kensington for several courses in chemistry, physics, and mining, and the London School of Economics with day teaching at Peterhouse has maintained evening classes in London. Bedford College went to Newnham, and Westfield to St. Peter's Hall, Oxford. The agricultural students at Wye went to Reading for the first term, but the College was re-opened for teaching last January. The British Postgraduate Medical School and the Lister Institute remained in London, and nearly all the other medical schools are now there again, and would plainly lose by dissociation from their special hospitals. The Government decision not to call up under the age of twenty led to some trouble in unexpected accommodation. At the end of August the Ministry of Information took over the Senate House, and the new wing designed for the Institute of Historical Research, when finished, will also be occupied by the Ministry. The University was due to receive a grant of £25,000 from the National Fitness Council towards the new Students' Union, but that was vetoed by the Treasury on the outbreak of War. Lord Nuffield gave twice as much, and on being asked if in the altered circumstances he would withdraw the gift, wished it to be retained for building in happier times.

It is good to learn that the work of the University goes on satisfactorily. Examinations have been held in eleven provincial centres, and there has been no lowering of standards. The University has had to provide for a large number of external students, and the Extension Department has made up for the falling off of its normal work by attending to the education of British and Canadian soldiers. The War will reduce the supply of students, though the numbers at present keep up rather well, so that the question of adequate financing will become urgent. The decision not to reduce the Government grant is important. That of the L.C.C. for this year is much

less, but other contributing bodies, we are glad to see, continue their support as usual. The Senate has wisely decided to retain its Publication Fund for works of science and learning on the scale which funds allow. Grants amounting to £1,583 were made last session. Among the benefactions we notice £25,000 in seven annual instalments for rebuilding at Queen Mary College from an anonymous donor, £2,660 from the Duke of Bedford for a fellowship in medical radiology at the Middlesex Hospital Medical School, a donation of £250 for one year from the Iraq Petroleum Company converted to twice as much for seven years, and £250 a year for seven years from the Gaekwar of Baroda to make a lectureship in Marathi a full-time post.

Pioneering in Educational Radio

DR. C. G. ABBOT, secretary of the Smithsonian Institution, has announced that a period of four years of pioneering in educational radio was completed on June 9 by the Institution. The object was to increase and diffuse knowledge among the people generally. The title of the popular series of broadcasts was "The World is Yours". In addition to science, the main theme of the series, the broadcasts dealt with exploration, history, engineering and invention, and art. A few recent titles will show the wide diversity of subjects treated: "Stars in the Sky", "The Indians who met Columbus", "Earthquakes", "Flying in Safety", "Cortez, the Conquistador", "Pompeii Lives Again", "Radium", "Dinosaurs". Since the programme was inaugurated on June 7, 1936, "The World is Yours" has expanded from its original 27 stations to a network of 82 stations covering the United States. The most recent, and the highest tribute paid to the series came last February when a leading American radio audience research service announced that the Smithsonian dramatizations received the highest rating of all serial programmes on the air. This followed from an analytical survey of all the programmes given on all networks.

To promote further this 'increase and diffusion of knowledge', the educational value of these programmes is preserved by the Educational Radio Script Exchange, U.S. Office of Education, Federal Security Agency. Hundreds of school and civic groups have used these scripts for production by radio and over sound systems. Another new radio service began last October with the inauguration of *The World is Yours Magazine*. Dedicated to the popular theme, "catch it by radio—fix it in print", these weekly magazines present a wide variety of articles by Smithsonian curators on historical, scientific, and engineering subjects for lay readers and schools. Some of the features of these new 'doors' to knowledge are dramatic scenes from the script, selected bibliographies for further study, recent news from the Smithsonian, and illustrations from rare drawings and photographs in the files of the Institution. Nearly 100,000 copies of these have been sold in the first half-year, the sales being on a non-profit basis. "The World is Yours" is produced for the Smithsonian Institution by the U.S. Office of Education with the co-operation of the National Broadcasting Company and with the assistance of the Work Projects Administration.

Regulation of the Upper Mississippi

THE Mississippi and Missouri, together, form the longest river system in the world, extending to a length of 4,502 miles. Above its junction with the Missouri, the Mississippi has a length of 1,170 miles and drains an area of 171,500 square miles. In an article in *Engineering* of July 19, a description is given of that part of the Upper Mississippi lying between the Missouri and the town of Minneapolis in Minnesota, 659 miles long. In 1907, a project was adopted for the regulation and improvement of the river from Missouri to Minneapolis in order to provide a 6-ft. channel at times of minimum flow. The work carried out consisted mainly of dredging and the construction of wing dams to restrict the width of the low-water channel. Twenty years later, the U.S. Congress directed that a survey of the river should be taken with the view of providing a low-water channel with a depth of nine feet. The project involved the construction of a series of locks and dams, and fairly extensive dredging. The work was completed last March at a cost of 170 million dollars. Twenty-five dams were required, and special Tainter and Roller gates were used for regulating the flow. The gates of later construction are designed so that they can be lowered several feet below the normal level of the pool, allowing even heavy ice to pass over the top.

The principal traffic on the Upper Mississippi River consists of fleets of barges, usually pushed by steamers of the stern-wheel or twin-screw type. The barges range in length from 100 ft. to 300 ft. and in beam from 24 ft. to 48 ft. The capacity varies from 500 to 3,000 tons. A tow of barges, practically filling one of the 110 ft. by 600 ft. locks, carries 6,000–8,000 tons of goods, and requires a 1,000 h.-p. steamer for its propulsion. In operation, it is possible to pass about fifty fleets of barges through the locks in twenty-four hours. The fifty-two over-bridges between Minneapolis and the Missouri River in general provide vertical clearances above high water in excess of 50 ft. and horizontal clearances varying from 106 ft. to 710 ft. Traffic on the river consists mainly of coal, petrol, fuel oil, steel-products and grain. The total tonnage handled between Minneapolis and the Missouri in 1936 was 2,300,000 tons.

Strengths of Indian Timbers

EVER since the inauguration of the Imperial Forest Institute at Dehra Dun, one of its branches has been engaged in testing out the strength and properties of indigenous timbers. Many timbers hitherto neglected or regarded as useless for practical commercial purposes are now coming under the tests of the research investigators. The Timber Testing Section of the Forest Research Institute has been studying the strength properties of Indian timbers for many years now, and more than 215 consignments of timber have been tested up to date. In *Indian Forest Records*,

(*Utilization*) 1, A (Govt. of India Press, New Delhi 1939), Mr. V. D. Limaye gives authentic information, on the possible uses and comparative strengths of thirty-six common Indian timbers and of six commonly imported timbers (three of which come from Burma) of different genera and species. This demonstrates the wealth of fine timbers there are in India. Yet three quarters of a century ago or less the bulk of the population in India, including the British, relied chiefly on three timbers only, according to situation—teak, sal (Shorea) and deodar.

Meteorology of the Australasian Antarctic Expedition

THE Australasian Antarctic Expedition of 1911–14 under the leadership of Sir Douglas Mawson seems an episode of the remote past, for so many better equipped expeditions have intervened. The latest of the scientific reports of this expedition is the fifth of the series and is in three parts (Australasian Antarctic Expedition, 1911–14. Scientific Reports. Series B, Vol. 5: Meteorology. Part 1: Records of the Queen Mary Land Station; Part 2: Meteorological Log of the S.Y. "Aurora"; Part 3: Sledge Journey Weather Records; Appendix, Macquarie Island Weather Notes for 1909–1910–1911. Pp. x+282+4 plates. Sydney: Government Printer, 1940. 40*s*.). It is concerned with meteorology. Part 1 of this volume deals with the records of the Queen Mary Land station—the 'Grottoes'—in latitude 66° S., longitude 95° E.; Part 2 covers the meteorological log of the S.Y. *Aurora*, and Part 3 the weather records of the sledge journeys; an appendix includes the daily weather records made at Macquarie Island by Otto Bauer's sealing party from August 1909 to July 25, 1910, and January 1 to December 12, 1911.

Although the report is largely statistical, there are some excellently reproduced photographs, at the end of the volume, of scenes of meteorological interest. Four of these show characteristic features of the edge of the Antarctic Continent that must, judging from the descriptions of others who have written about the same subject, be very typical. Thus, in Plate 4, Fig. 2, a canopy of strato-cumulus cloud is seen over Commonwealth Bay, with cloudless sky over the continent to the south. It is a scene of peace and beauty, the ripples in the sea showing that there was only a light westerly wind blowing. In Plate 3, Fig. 1, the sky is still partly cloud-free; but the clouds look like alto-cumulus and the horizon is a dark smudge indicating the approach of a blizzard. In Plate 4, Fig. 1, a sledging party on the plateau interior of Adelie Land appears to be preparing to weather a blizzard that is presaged by dense masses of cirrus cloud. The sequence is completed by Plate 2, Fig. 2, in which cumulo-nimbus clouds are breaking up just after a blizzard north of the Mertz Glacier Tongue. The bulk of the volume consists of undiscussed meteorological tables, but a footnote to p. 16 says that "Dr. E. Kidson has been engaged preparing two volumes analysing and discussing the Expedition's meteorological data. This will be published in due course".

Epidemiology in the Army

IN a recent article (*Ann. Int. Med.*, 13, 2229; 1940) Lieut.-Colonel J. S. Simmons, of the Medical Corps of the United States Army, divides the hazards of military life into three groups according as they arise in peace-time service, during mobilization or in actual warfare. In peace-time the soldier's life is as safe as, if not safer than, the civilian's, as he has been carefully selected, housed in modern barracks, fed on a balanced diet of wholesome food and forced to take adequate exercise. He is trained in physical hygiene, and his health is under medical supervision. During mobilization, though efforts are made to continue existing medical facilities, the rapid accumulation of susceptible recruits from all parts of the country frequently results in epidemics. In actual warfare, the soldier is not only faced with the risk of injury and death from battle, but is also exposed to infection. Between April 1917 and December 1919 when the United States Army was engaged in that War the casualties from all quarters were 50,000 deaths due to battle and 58,000 deaths caused by disease. The principal diseases to which the soldier is exposed during mobilization and war are wound infections, the morbidity and mortality of which have undergone a striking decrease since the introduction of antiseptic surgery, gastro-intestinal infections due to contaminated food and drink, including enteric fever, dysentery and cholera, venereal infections, the admission rate for which in the United States Army was 87 per 1,000, respiratory infections, including influenza, pneumonia, scarlet fever, diphtheria, measles, mumps and cerebrospinal fever, and insect-borne infections, such as malaria, yellow fever, typhus and plague.

History of Blood Transfusion

IN a recent thesis (*Thèse de Paris* 1940, No. 344) on this subject, Dr. Edmond Ecale states that the history of the transfusion of blood is intimately connected with the discovery of the circulation. Although even in the prehistoric period the idea of the operation had been conceived, it was in the country of Harvey that the first scientific attempts of transfusion were made, namely, by Christopher Wren in 1656 and Edmund King in 1667. Jean Denis was the first to carry out transfusion from an animal to man in 1667, and was followed a few months later by Richard Lower in England, Riva in Italy and Kaufmann in Germany. Transfusion of blood was prohibited by the Châtelet edict in 1668, and almost fell into oblivion for nearly a century and a half. The first successful transfusion of blood from man to man, which was carried out by the obstetrician James Blundell in 1825, marked an important progress in the history of the method, and was performed with a syringe containing defibrinated blood to prevent coagulation. The introduction, however, in 1879 of intravenous injection of normal saline which was a simpler and safer method interfered with the progress of transfusion of blood for some time. After the beginning of the twentieth century, transfusion of blood was again revived on the discovery of agglutinins,

iso-agglutinins, blood groups and blood incompatibilities, which enabled a correct choice to be made of donors and recipients, while the use of anti-coagulants, paraffined tubes and other refinements of technique led to the adoption of the perfected method employed at the present time.

The Long-term Prisoner

In a paper read before the ninety-fifth meeting of the American Psychiatric Association (*Amer. J. Psychiat.*, **96**, 1321 ; 1940) Dr. Marvin Sukov records his observations on thirty men completing life sentences in the Joliet-Stateville branch of the Illinois State Penitentiary. Their ages on admission ranged between 16 and 49, and their ages on examination were between 39 and 73. The study was conducted by means of a questionary in which each inmate was individually interviewed for a period averaging 1½ hours. Dr. Sukov's conclusions were as follows : (1) Imprisonment was accompanied by progressive social severance, shown by progressive diminution in visits and correspondence in every case. (2) The patients' basic interests with regard to religion, crime and intellectual sphere were little modified by years of imprisonment. None expressed a reduction in alertness except those advanced in age, who attributed it to that cause. (3) Twenty-five who admitted their guilt stated that they had deserved punishment but that their punishment was too severe. (4) While all had a desire for freedom, many had become resigned to life imprisonment and without help would probably be unable to make an extramural adjustment. (5) Nearly all after many years imprisonment showed no antagonism to society, but none could point to a single individual as a friend.

Cave Worship

In an interesting article in the April issue of the *Hibbert Journal*, Dr. R. R. Marett remarks that in addition to its mystic and religious associations the cave played no small part in early medicine, and suggests that it was primarily as a hydropathic establishment that the cave found so much favour with the sick. In the cave of Aesculapius, mentioned by Pausanias, for example, the healing waters gushed out from a rock, and at Elis in the cave of the Anigrid nymphs he states that a leper must sacrifice before bathing in the neighbouring river in order to leave his "shame" there. There were also caves mentioned by Pausanias of which the efficacy had possibly nothing to do with water, such as the cave of Aphrodite. Moreover, the famous Lemnian earth or terra sigillata which was supposed to provide an antidote to snake-poisoning was obtained from a cave.

The Government Museum, Madras

Under the superintendence of Dr. F. H. Gravely, an important extension to the Government Museum, Madras, has been completed and opened to the public, following the plans of the late R. Dann, consulting architect to that Government. The new building has provided accommodation for the staff of curators, the block which they formerly occupied being now given up to the zoological collections. But its main function is to give suitable expression to the evolution of the decorative motives of the architecture of the magnificent temples of South India. For the Tamil country, these changes form an interesting and logical sequence. The temples of other parts of India differ from those of Tamil origin, and although the development of their architecture is not yet fully understood, attempts have been made in the new building to indicate the succession of changes. A short account of these arrangements, based upon Dr. Gravely's address at the opening ceremony, which was performed by His Excellency the Governor of Madras, Lord Erskine, appears in the July number of the *Museums Journal* (**40**, 109 ; 1940).

Nematode Parasites of Plants

A catalogue of nematode parasites of plants, compiled by Dr. T. Goodey has been issued by the Imperial Bureau of Agricultural Parasitology, St. Albans, price 10*s*. The work consists of an alphabetical list of the scientific names of all plants which have been reported as hosts of nematodes, comprising more than 2,000 species and varieties of flowering plants, 78 ferns, 55 mosses, 5 liverworts and 3 seaweeds. In each case the appropriate parasite or parasites is stated, together with the name of the first recorder and the date of the record. For convenience, an alphabetical list of the popular plant names, with the scientific name appended, is also supplied, so that the reader can be sure of finding the information he requires by whichever plant name is the more familiar to him. The publication concludes with a list of references relevant to the records cited. Usually this is the earliest record obtainable, but in a few cases a more accessible reference has been deliberately selected.

Announcements

The Home Secretary has announced in the House of Commons that he is willing to consider steps to enable alien men of science who are not released to carry on their scientific activities or studies in internment.

The following appointments in the Colonial Service have recently been made : F. R. Bell, veterinary officer, Uganda ; J. H. Hughes, assistant conservator of forests, British Guiana ; R. M. Shackleton, geologist (temporary), Kenya.

A further step in the mobilization of the man-power of Great Britain is marked by the issue of the first industrial registration order made by the Minister of Labour. Registers have already been made of professional engineers, chemists and physicists and quantity surveyors. The new order requires the registration of skilled men more than twenty-one years old in certain specified occupations, mainly engineering, who are not employed on Government work. The five days of registration, to which also the test of full employment on Government work applies, are August 19–23.

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.

Planning the Peace

THE excellent series of articles which have been published in NATURE on the applications of science to social problems encourages me to suggest that specific efforts should be made for planning the peace. It may seem to be an inappropriate time to embark upon this project. I have no wish to distract the attention of those who are actively engaged in the prosecution of the War; but there are others who, by reason of age, physical infirmity, and so on, are doomed to relative inaction. Many such, by virtue of special training, experience, good judgment, and brilliant intellect, might well be encouraged to collaborate in drawing up some indications of the lines which should be followed in the light of their knowledge and appreciation of the grievous errors of the past. At the present time, feelings run high, and the irrational impulses of mob psychology are no sound guide to either the conduct of the War or the making of the peace. It is all the more desirable, therefore, that the restraining influence of level-headed advisers should be marshalled in the interests of sanity.

Presuming that Great Britain emerges successful from the contest, the War will be won; for the demagogic autocracies of Germany and Italy contain within them the seeds of their own destruction, and there can be little doubt that public opinion in the Americas is gradually becoming convinced that the security of the States and the survival of liberty depend upon the victory of Great Britain. It has indeed long been the opinion of many that the survival of civilization, that is, of a corporate life founded on a basis of mutual goodwill, freedom of thought, and Christian ethics, depends upon the co-operation of the English-speaking peoples.

The problems to be considered are of the greatest variety and complexity. The effects of the Treaty of Versailles and the drift into war have demonstrated the blindness of our statesmen to the most elementary facts of individual and social psychology. The psychologist with a biological training is best fitted to explain the causes of war, of which the most fundamental are unhappiness and a sense of grievance. There can be no doubt that there will be a profound change in economic conditions after the War. We may look forward with satisfaction to the abolition of gross disparities in individual incomes; but the levelling process demands the most minute care to avoid the dangers of a communistic revolution. The recent admirable broadcast by the Right Hon. R. A. Butler exemplifies the help which we may expect to receive from the historian and the diplomatist.

Probably the best method of attacking the problem at the present time would be by a series of articles by selected authorities to be published in NATURE or elsewhere.

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Identification and Determination of Aromatic Compounds in Mineral Oils

OUT of the many methods suggested[1] for the quantitative determination of the total of aromatic constituents in mineral oils, none is suitable for giving information about the nature of these constituents. In recent systematic research[2] on the aromatization of aliphatic compounds, the method of side-chain oxidation has been used, which, however, is only of value if the number of carbon atoms in the side-chains is known and is not applicable to the fundamental hydrocarbons like anthracene, phenanthrene, naphthalene or benzene.

Ultra-violet spectrography provides an easy method of identifying and determining quantitatively aromatic hydrocarbons in a mixture with substances which show no selective absorption at all, or at least not in the same region as the aromatic hydrocarbons. For the following fundamental hydrocarbons, absorption bands exist which are characteristic, and the intensity of which is directly proportional to the concentration of the hydrocarbons: benzene, toluene, xylene, naphthalene, phenanthrene, anthracene. The bands to be used for their identification are listed in Table 1. The method may be only of limited value in two instances: dialkylbenzenes with identical positions of the alkyl groups but substituted with different alkyls may be indistinguishable; and alkylated polycyclics may exhibit spectra practically identical with those of the parent hydrocarbons. Apart from this limitation, we have been able to identify all the absorption bands observed for those fractions of Iraq petroleum and of a shale-oil of Palestinian origin which distil up to 200° at 0·1 mm. pressure with the bands of the above six hydrocarbons, so that no other constituents of aromatic character are present.

For the quantitative determination of these hydrocarbons, the intensity of the characteristic absorption bands for a given sample is compared, visually or by means of a microphotometer, with the intensity of the same bands for the standard substances in known concentrations. For these comparisons, the substances are either used in solution in (non-absorbent) light petroleum or in the gas phase. With this method, the following figures have been found

TABLE 1.

Benzene	2433,2375 A.
Toluene	2700
Xylene	2713,2739
Naphthalene	3100
Phenanthrene	2932
Anthracene	3570,3760

TABLE 2 (Iraq petroleum).

Benzene content	0·02 per cent
Toluene	0·31
Xylene	0·52
Naphthalene	0·30
Phenanthrene	1·36
Anthracene	1·76

TABLE 3 (Shale-oil)

Benzene content	0·16 per cent
Toluene	0·18
Xylene	3·20
Naphthalene	4·60
Phenanthrene	1·80
Anthracene	1·60

in the case of Iraq petroleum (Table 2) and of the Palestinian shale-oil (Table 3).

The usefulness of the method is evident. It gave information about the interesting phenomenon of azeotropic distillation of aliphatic and aromatic hydrocarbons, which will be studied in greater detail at a later date, and about the aromatization involved in cracking experiments. It may also be noted that the spectrographic method may well contribute to the elucidation of the structure of lubricating oils, which are assumed to be alkylated and partly hydrogenated polycyclic ring-systems; in many cases, dehydrogenation previous to the spectrographic investigation, seems to be useful.

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V. HENRI.
ERNST BERGMANN.

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Rehovoth, Palestine.
Institute of Physical Chemistry,
University, Liége.

[1] Recently, new methods of the same type have been suggested by A. v. Grosse, *Ind. Eng. Chem.*, Analyt. Edition, **11**, 614 (1939), and by Jostes, *Oel, Kohle, Erdel, Teer*, **14**, 1012 (1938).

[2] Hoog, Verhuis and Zuiderweg, *Trans. Faraday Soc.*, **35**, 993, 1008 (1939).

A Patterson Analysis derived from the Cyclol C_2 Skeleton

I AM grateful to Dr. D. Wrinch for pointing out an error in my previous communication on this subject with Dr. Fankuchen[1]. A check of the calculations showed that our previous Fig. 3 was, in fact, derived from an arrangement of the cyclol molecules with a tilt of 36°, as Dr. Wrinch states[2], and not with a tilt of 6° as we had, by an unfortunate misunderstanding, assumed. This arose from a wrong choice of reference line to define the tilt, suggested, although certainly quite unjustifiably, by Dr. Wrinch's original packing diagram.

I have therefore recalculated numerically the Patterson map obtained by placing the cyclols in the insulin unit-cell with a tilt of 6°, and the essential part of the resulting contour diagram, namely, the triangle between origin peaks, is shown in Fig. 1. The only peak in the field is the large diffuse peak *A*, while *B* is a region of low density. The agreement with the experimentally derived basal Patterson projection of Crowfoot[3], which is reproduced in essentials in Fig. 2, is not very close. The low density region *B* compares with the region *C* in Crowfoot's diagram, but such a large central peak as *A* is not present in the latter case. The experimentally derived Patterson projection has a trigonal arrangement of three well-defined peaks (*B*) around the centre,

Fig. 1.

DERIVED PATTERSON MAP WITH CYCLOLS AT TILT OF 6°. CONTOURS AT ONE ARBITRARY UNIT APART. *A* IS A PEAK AND *B* IS A LOW DENSITY REGION.

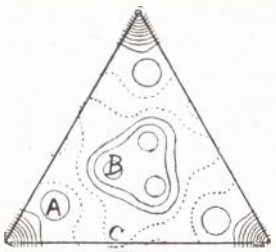

Fig. 2.

EXPERIMENTALLY DERIVED BASAL PATTERSON PROJECTION FOR INSULIN (AFTER CROWFOOT).

corresponding to interatomic vectors of 22 A. in this projection. In so far as the peak *A* in Fig. 1 be considered as compounded of three such 20 A. peaks, then it is clear from the calculation that these are due to vectors between the *sides* of the cyclol fabric, and do not arise from vectors between the 'slits' of the octahedron. Approximate working indicated that this central peak *A* would tend to be resolved with an arbitrary tilt of 10° or so. A calculation with $\alpha = 13°$ showed this resolution to be very small, and this tilt also destroys the *B* region of low density. Small deviations from the tilt of 6° therefore do not better the agreement with Crowfoot's projection, and the map obtained with an extreme tilt of 36° has already been discussed. Another unsatisfactory feature of Fig. 1 is the absence of a defined 10 A. peak corresponding to Crowfoot's peak *A*, and a strong 10 A. spacing is a characteristic property of most proteins. I therefore consider that this new derived Patterson analysis is not in nearly sufficient agreement with the experimental data for insulin to afford evidence in favour of the cyclol hypothesis.

In conclusion, I should like to point out that Dr. Fankuchen and myself have never claimed "to have disproved the structure C_2 predicted for the insulin molecule". We were concerned only with investigating the claims by Wrinch and Langmuir[4] of the confirmation of the cyclol hypothesis in the case of insulin by the X-ray data. The work done clearly showed that their primary assumption of approximating the cyclol C_2 molecule by an octahedral arrangement of scattering masses situated at the 'slits' of the cyclol fabric was not even approximately justified. Logically, therefore, their argument was invalidated even without Bernal's criticism[5] or without consideration of the second part of our previous paper or of this communication. I appreciate Dr. Wrinch's criticism of our work on the grounds that only the carbon and nitrogen atoms of the skeleton were considered. Reasons why this should not affect the general validity of the work were given in our paper. In circumstances other than those obtaining at present, it would undoubtedly be most desirable to recalculate the Patterson map having included the oxygen and C_β atoms, in order to settle the matter. In the meanwhile, I would enter a plea for this detailed type of working in comparing any proposed models of protein molecules with the X-ray data, otherwise it is often difficult to separate evidence from speculation.

DENNIS RILEY.

Department of Mineralogy,
Oxford. July 24.

[1] NATURE, **143**, 648 (1939).
[2] NATURE, **145**, 1018 (1940).
[3] *Proc. Roy. Soc.*, A, **164**, 580 (1938).
[4] *J. Amer. Chem. Soc.*, **60**, 2247 (1938).
[5] NATURE, **143**, 74 (1939).

The Generalized Kaleidoscope

A RECENT communication from Sidney Melmore[1] has refuted my statement[2] "that a kaleidoscope cannot have more than six mirrors". The statement should be "that any kaleidoscope is effectively equivalent to one having at most six mirrors". In the case of Melmore's octahedral kaleidoscope, every pattern produced is symmetrical about either of the planes which bisects the dihedral angles of 120°. Hence two extra mirrors may be placed in those positions without affecting the pattern. Six of the eight original mirrors then become superfluous, and we are left with the four faces of the tetragonal bisphenoid[3] $AB'CD'$. The rectangle $BB'D'D$ is one half of the common base of Melmore's two square pyramids, with apices A and C; hence E (the mid-point of AC) is the point-object which gives rise to the solid tessellation of cuboctahedra and octahedra.

H. S. M. COXETER.

Department of Mathematics,
University of Toronto.
June 7.

Melmore, S., NATURE, **145**, 778 (1940).
[2] Ball, W. W. R., "Mathematical Recreations and Essays", 160 (1939).
[3] *Op. cit.*, 159.

I AGREE with Prof. Coxeter's conclusion that no more than six mirrors need be used to produce the solid tessellations. It is now clear that two of his tetragonal bisphenoids, interpenetrating, bear the same relation to my octahedron which two interpenetrating regular tetrahedra bear to the regular octahedron.

SIDNEY MELMORE.

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June 24.

Growth of Aggregates in Suspensions

ON reading through the D.S.I.R. report of the Water Pollution Research Board for the year ended June 30, 1938, I was much interested to notice the account of the settling of silt in estuarial waters of the River Mersey. In the course of a study of the effect of sewage upon the rate of sedimentation of mud, it was found (p. 49) that sedimentation occurred only at slack water. The scour during the ebb and flow of the tide erodes fine particles from the bottom so that they disperse more or less uniformly in the water. During slack water, practically the whole of the suspended matter is deposited. It was found that large, fragile aggregates form and then settle at a rate of about 0·011 ft. per sec.

I find that this is approximately the maximum velocity at which these particles obey Stokes's law, that is to say, the settling occurs at the point at which the flow round the aggregate ceases to be wholly streamline. Thus it appears that the mechanism of such settling is that the aggregates continue to grow until their falling speed increases to the point at which the flow becomes turbulent. This prevents further increase of size, so that when full grown their falling speed will be substantially constant.

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July 11.

Radiation and 'Stuffiness'

IN discussing the spectral transmission of human stratum corneum[1], Messrs. Yarnold and Kirkpatrick have overlooked the measurements of Pearson and Norris[2] which show only a very faint suggestion of the absorption band at 4·1–4·2 μ to which they refer.

In connexion with Yarnold and Kirkpatrick's work on the effect of spectral distribution on the comfort of radiant heat, I may mention that some years ago I measured the time of tolerance of radiation of a fixed intensity falling on a given area of the hand, arm or face, for six subjects. In every case the emission from a 'bright' source such as an ordinary gas fire was tolerated considerably longer than an equal intensity from a box kept at barely visible red heat and filled with coal gas flame.

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Winfrith,
White Knowle Road,
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July 13.

[1] NATURE, **146**, 62 (1940).
[2] *Brit. J. Radiology*, **6**, 480 (1933).

Depression of Neuro-Muscular Transmission in a Crab by Phenothiazine

SINCE phenothiazine is a new and valuable vermifuge, its effect on animal tissues is of some general interest. Its effect on crustacean neuro-muscular function can readily be observed in the shore crab (*Carcinus mœnas*), from which the nerve-muscle preparation is one of the most readily obtainable among invertebrates.

The transmission of excitation from nerve to muscle in the walking leg of the shore crab is characterized by the existence of a natural 'block' at the

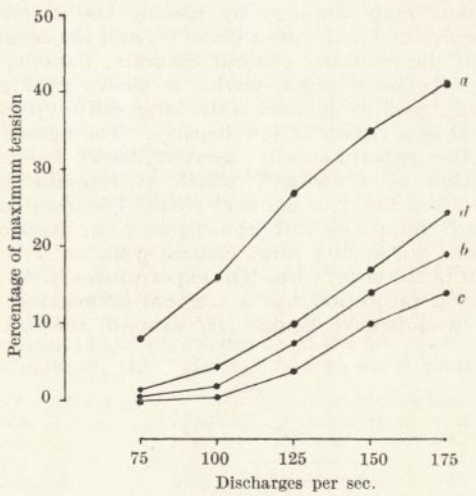


Fig. 1.

PERCENTAGE OF MAXIMUM ISOMETRIC TENSION DEVELOPED AT GIVEN FREQUENCIES. CONSTANT STIMULUS DURATION OF 0·4 SEC.
a, Perfusion with crab's Ringer; *b*, 18 min. after perfusion with 1 part in 5,000,000 phenothiazine; *c*, 11 min. after perfusion with 1 part in 2,000,000 phenothiazine; *d*, 35 min. after return to crab's Ringer.

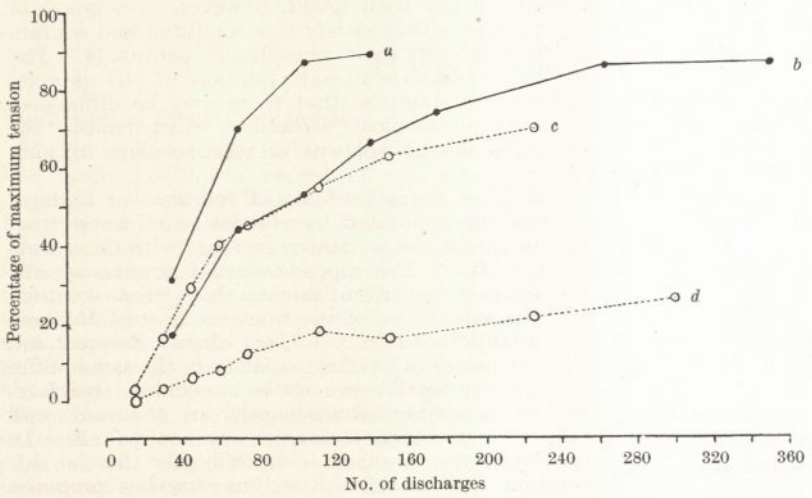


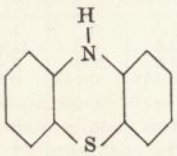
Fig. 2.

PERCENTAGE OF MAXIMUM ISOMETRIC TENSION DEVELOPED AFTER A GIVEN NUMBER OF SHOCKS.

a, perfused with crab's Ringer; 175 shocks per sec.: *b*, perfused with 1 in 1,500,000 phenothiazine; 175 shocks per sec.: *c*, perfused with crab's Ringer; 75 shocks per sec.: *d*, perfused with 1 in 1,500,000 phenothiazine; 75 shocks per sec.

junction, which can be overcome by the summation of nerve impulses arriving there. A just visible contraction of the flexor muscle of the dactylopodite of the walking leg is observed when impulses arrive at the nerve-muscle junction at a frequency of about 10 per sec., while a maximal contraction is obtained at a frequency of about 300 impulses per sec.[1]

Katz has reported that curare does not prevent transmission across the nerve-muscle junction of Carcinus[2]. Increase of junctional 'block' can, however, be effected by concentrations as low as 1 part in 10,000,000 of the vermifuge phenothiazine:



The extent to which junctional transmission is depressed after treatment with a drug can be assessed from several characteristics of the preparation. In the experiments reported here, the nerve was stimulated with a series of brief condenser discharges through a neon lamp. A number of different frequencies of stimulation ranging between 75 and 175 discharges per sec. were employed and the stimulation was applied for measured periods of time. The tensions developed by the muscle were recorded by a spring lever. An indication of the extent to which junctional transmission is depressed after perfusion of the limb with phenothiazine in comparison with the condition when the limb is perfused with crab's Ringer solution can be obtained from a study of the tensions of muscular response at each frequency and duration of stimulation. If neuro-muscular function in the isolated walking leg of Carcinus perfused with low concentrations of phenothiazine (1 part in 1,500,000 to 1 part in 10,000,000) is compared with that in the limb perfused with crab's Ringer solution, it is found that:

(1) The threshold potential for excitation of the nerve is raised.

(2) The maximum tension obtainable from the flexor muscle of the dactylopodite by stimulation of the nerve at high frequency for an indefinite period is little reduced.

(3) Junctional transmission is depressed. If the stimulation is applied for a constant period of time then, during perfusion with solutions containing phenothiazine, a higher frequency of condenser discharge is required to evoke a given tension of muscular response (Fig. 1). If the frequency of discharge is kept constant, then a greater number of discharges is required to evoke a given tension (Fig. 2). The relative extent to which tension is reduced by phenothiazine, moreover, declines as the range of frequencies is ascended (Figs. 1 and 2). The effect of phenothiazine on junctional transmission is partially reversible.

The sample of phenothiazine was kindly given to me by Imperial Chemical Industries, Ltd.

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July 3.

[1] Pantin, C. F. A. (1936), *J. Exp. Biol.*, **13**, 111.
[2] Katz, B. (1936), *J. Physiol.*, **86**, 14*P*.

Mixed Radioactive Indicators in Physiological Experiments

OBJECTIONS have been raised against the use of radioactive indicators in physiology, suggesting two sources of error, namely, a discriminating effect for isotopic atoms, and a change in the behaviour of organic material through irradiation[1]. Although one has good theoretical reasons to believe that the radioactive tracer atoms and their non-active isotopes show the same physico-chemical behaviour[2], and that effects of irradiation could be neglected so long as the specimens are not too active[3], it has been emphasized[2] that doubts about the tracer method can only be removed by experimental evidence.

The property of biological material of discriminating between the radioactive and non-active isotopic atoms represents only a special case of the separation effect of ordinary isotopes in biological tissue[4,5]. This question could be easily examined, in some cases at least, by the use of two or more active isotopes of the same element. If the proportion of these before and after the experiment were the same, then no isotope separation can have taken place. On the other hand, any differentiation can be measured quantitatively. This is only possible with some elements, and is unfortunately not possible with the biologically important phosphorus and sodium, but the general question of biological separation could

be accurately investigated with such elements as calcium, iodine, bromine, silver, etc.[6]

The effect of irradiation on tissues could be examined by observation of the amounts absorbed of a solution activated with a suitable tracer element, before and after exposure to the same solution 'tagged' with a different active isotope.

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Birmingham, 15.
July 19.

[1] Barnett, A., *Phys. Rev.*, **56**, 963 (1939).
[2] Crane, H. R., *ibid.*, **56**, 1234 (1939).
[3] Mullins, Lorin J., *ibid.*, **56**, 1244 (1939), Hevesy, G., *ibid.*, **57**, 240 (1940).
[4] Brewer, A. Keith, *Ind. and Eng. Chem.*, **30**, 893 (1938).
[5] Lasnitzki, A., and Brewer, A. K., NATURE, **142**, 538 (1938).
[6] Livingood, J. J., and Seaborg, G. T., *Rev. Mod. Phys.*, **12**, 30 (1940).

Influence of Combined Phosphoric Acid on the Swelling of Granular Starch

IN some starches phosphorus occurs in combination as a salt of an amylomonophosphoric ester[1], $St-O-PO\langle^{OR_1}_{OR_2}$, where St is a glucose unit in the polysaccharide chain and R_1 and R_2 are metal or hydrogen atoms; in others the phosphorus is not combined with the starch, and part of the phosphorus-containing impurity can be removed by extraction with methanol or cold dilute mineral acid. Potato and wheat starch are representative of the two classes[1].

correlation has been found, however, in a group of eight starches that satisfy this condition and contain 0·145–0·232 per cent phosphorus pentoxide. The swelling capacities in salt solution of the samples differ considerably so that there may be differences in sub-microscopical structure which mask the effect of the phosphorus on the swelling in pure water.

The phosphorus contents of fractions of uniform granule size separated by elutriation in water from one sample of potato starch increase with decreasing mean radius. The copper-reducing powers, specific viscosities in 30 per cent calcium thiocyanate solution, and the solubilities of the fractions in 0·01 *M* phosphate buffer solution, *p*H 7, are almost identical and the differences in swelling capacity in the same buffer solution are small; it may be concluded, therefore, that their average chain-lengths are the same and that the structure factor is common to all. In distilled water, swelling is much higher than in salt solution, and among the sodium starches prepared from the different fractions the swelling increases three-fold as the phosphorus pentoxide content increases from 0·148 to 0·254 per cent (see accompanying table). These differences in swelling are not due to differences in the ratio volume/surface area of the granules[4], since fractions 1 and 2, differing in average radius but nearly equal in phosphorus content, swell equally.

On the other hand the swelling of the fractions from a wheat starch is independent of granule size, phosphorus content, the salt used in washing, or the presence of salt during swelling. It is therefore evident that esterified phosphoric acid does facilitate the swelling of starch granules to an extent dependent upon its amount, but the effect is manifest only in the absence of free electrolyte and when the average chain-length and the structure of the granules are the same.

	Potato Starch						Wheat Starch		
Fraction	1	2	3	4	5	6	1	2	3
Percentage by weight	0·7	7·1	39·4	12·4	32·5	6·8	18·5	64·0	17·5
Average radius * of the granules (cm. × 10^4)	5·9	8·5	13·8	19·1	25·5	29·3	3·8	8·1	11·1
P_2O_5 per cent	0·254	0·244	0·195	0·169	0·153	0·148	0·130	0·114	0·115
Swelling capacity † at 70° (potato) or 85° (wheat). c.c. water/gm. of undissolved starch:									
Na starch	150	151	104	68	62	55	16	19	16
Ca starch	49	52	54	48	40	47	15	19	16
Na or Ca starch in salt solution	25	24	23	20	20	19	16	17	16

* by a photographic method.
† determined by centrifuging a 0·3 per cent suspension under standard conditions after attainment of equilibrium.

The metal combined with the phosphorus in potato starch can be varied by washing with appropriate salt solutions and then with water until the filtrate is free from electrolyte[2]. The properties of the washed starch vary with the identity and amount of the combined metal; for example, the swelling capacity of the granules in hot water and the viscosity of the hot 3 per cent paste of a sodium starch are greater than those of the corresponding calcium starch. The difference is not observed in presence of salt and is probably due to the greater tendency of the sodium to ionize and diffuse into the surrounding water. It was expected that after washing with the same salt solution the swelling behaviour of potato starches would be related to their phosphorus contents provided that their average molecular chain-lengths[3] were the same. No simple

Enhanced swelling has also been observed when carboxylic acid groups have been introduced by oxidation into a granular starch of low phosphorus content.

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July 22.

[1] Posternak, *Helv. chim. Acta*, **18**, 1351 (1935).
[2] Tryller, *Chem. Z.*, **44**, 833, 845 (1920).
[3] Richardson, Higginbotham and Farrow, *J. Text. Inst.*, **27**, T131 (1936).
[4] Alsberg, *Ind. Eng. Chem.*, **18**, 190 (1926).

RESEARCH ITEMS

South African Stone Bead Industry

THE relative scarcity of the stone bead throughout the world justifies a record of the discovery of serpentine beads by Harold S. Harger on sites in the western Transvaal (*Trans. Roy. Soc. South Africa*, **38**, 2; 1940). From the collection as a whole it has been possible to describe the entire process of manufacture from beginning to end. The prime factor in the establishment of the industry was the occurrence of a serpentine dyke midway between the factories on Nooitgedacht and Winkelhaak. This region affords abundant evidence of settlements of primitive man of pre-Bantu times. The serpentine beads were found in cleared spaces where native kraals at one time had existed. Old furnace slags, an iron hammer, ornamental stone pendants, gold beads, a steatite mould, pottery, etc., combine to indicate that the industry was established by an early Bantu tribe in pre-European times. The greater part of the material consisted of 108 cylinders ready for boring, 15 were finished ready for use; and 15 beads of copper and 2 of gold were also found, the occurrence of the last named indicating a Bantu origin. Some much-corroded pieces of iron found on Winkelhaak, when fresh, might have been thin enough to perform the boring. One bead had been bent to take the palm of the hand and facilitate vertical pressure. The procedure adopted in manufacture was to trim the material into cylindrical shape and then saw it in sections—a method followed by Cro-Magnon man in the manufacture of stone beads. The segments were then drilled and smoothed, the ends being ground smooth on a stone to make them lie close. To avoid waste of labour owing to splitting in drilling, stones were sometimes drilled before shaping. While the industry is early and pre-European, it is Bantu and not, properly speaking, Stone Age, as usually understood.

The Fishing Heron

CONSIDERABLE controversy over the heron's diet has long passed between anglers and fish conservators on one hand, who claimed the large proportion of fish in the bird's menu, and bird protectionists on the other, who brought forward the results of pellet and other investigations which showed a preponderance of frogs, voles and other small waterside vertebrates. The argument will now probably be cleared up following the work of Miss A. Hibert-Ware, of Hilary, Girton, Cambridge, who, with the help of others, has collected 270 pellets from Norfolk, Carmarthenshire, Surrey and Cambridgeshire, and found numerous remains of small vertebrates and insects in them, but only remains of the dace among fish, despite the observations on the abundance of eels and coarse fish brought to the heronry nests. Subsequent studies of the digestion of the heron (*Ibis*, July 1940) suggested that fish figure more prominently in the diet than previous food investigations show, and the strong digestive juices and the soft, non-grinding nature of the gizzard leave little opportunity for remains to be ejected in the food pellets. These pellets were found to be strongly acid when fresh. The chief remains noted in the pellets were moles, water voles and Dyticus and Colymbetes insects. Mammalian food also included small specimens of rabbit, water-shrew, and brown rat; bird remains included starling, redbreast, moorhen, coot, mallard, wood-pigeon and poultry chicks; reptiles included slow-worm, grass snake and adder; frog was the only amphibian; there were also remains of the water-boatman bugs (Corixa and Notonecta) and the water-beetle Hydrophilus; but a few remains of earwig, grasshopper, wood-lice, spiders and carabids or ground-beetles suggest that these were taken in the other prey consumed.

Birds on St. Kilda

ST. KILDA was evacuated in 1931, and, except for the summer visits of a few of its former inhabitants, has run wild since that time. With the deliberate intention of founding a basis on which future comparisons might be based, T. H. Harrisson and David Lack made in 1931 a census of the birds on the island, and a new census by E. M. Nicholson and J. Fisher made in 1939 offers the first comment on changes induced by the absence of man (*British Birds*, **34**, 29; 1940). The majority of the birds, land or sea, show no significant change, a specially noteworthy fact in the case of the gannet and fulmar petrel, considering the allegations that have been made regarding the destructiveness of man in relation to these birds. The black guillemot seems to be disappearing, only one individual having been seen in 1939, whereas six pairs were noted eight years before. On the other hand, shags and razorbills have increased, as has also the meadow-pipit. Striking additions to numbers were observed in the case of starlings, attributed to the supply of undisturbed nesting sites in the deserted houses and to the abundance of sheep; of eider duck, attributed to the freedom from egg-robbing; and of the common snipe, which curiously enough have colonized the enclosed dry fields about the village and were more frequent there than in the marshy haunts of the island, their normal habitat.

Indian Chalcid Wasps

MISCELLANEOUS BULLETIN 30 of the Imperial Council of Agricultural Research (India), by Hem Singh Pruthi and M. S. Mani, contains biological notes on Indian parasitic Chalcidoidea. It is in the main a host list referring to 175 species of these insects—the phytophagous forms of Chalcids, it may be added, are not included in this bulletin. Some fifty-six of the species dealt with are figured on the accompanying plates. From the list at the end of the bulletin it will be gathered that the Rhynchota feature as the most frequent hosts for these parasites, the Lepidoptera coming second in this respect. The insect collections in the Laboratory of the Imperial Entomologist contain a large amount of material, with data, concerning insect parasites. Information derived from this and other sources is being worked up and made available to workers in India and other countries. It is intended to publish the data so obtained, taking one group of parasites at a time. The series has been started with the present host-parasite account of the Indian Chalcids, concerning which no information has been available in comprehensive form at present.

Crinoids from the "Discovery" Expedition

D. DILWYN JOHN has beautiful material to describe, consisting entirely of Comatulids from the "Discovery" expedition (Crinoidea, *Discovery Rep.*, **18**, 121–222; 1938). There are 326 specimens, mostly from depths between 100 and 600 m., 269 from the Antarctic region, the majority from the South American sector, a small number from the Ross Sea. 54 are from the Burdwood Bank and the Patagonian Shelf and are all of one species, *Isometra vivipara*, common to that region and to the Antarctic. The other 3, all *Comatula novæzealandiæ*, are from New Zealand. 9 species of the family Antedonidæ are new. A feature of the collection is the number of species which care for the brood and are viviparous. Most Comatulids shed their eggs directly into the sea and only 3 viviparous species were previously known, 8 more are now added, 6 belonging to new species and a new variety, and 2 which were not before recognized as being viviparous, making 11 viviparous Comatulids now recorded, 8 of which have only been obtained from the Antarctic. Out of 19 species known from the Antarctic 50 per cent are viviparous. A gradual series is shown in the methods of brood protection, from those with numerous eggs and larvæ with ciliated bands presumably emerging in the free-swimming stage to those with very few eggs which retain the young in the brood-pouch until the Pentacrinoid stage or, in one case, even as far as the young Comatulid. In all the viviparous species there is in the female a brood-pouch beside each ovary.

Maternal Constitution and Infant Mortality

AN extensive analysis of the morphology of mothers and the mortality of their infants up to one year old has been made by H. C. Seibert (*Human Biol.*, **12**, 232–246; 1940). Those mothers whose infant had died were significantly shorter in mean stature at exterior auditory canal, at suprasternal notch, and at lower costal margin and in mean sitting height, but not in mean trunk height. Body weight, span, head-length and -breadth, mean biachromal, bi-iliac hip and sagittal chest diameters were not significantly different in mothers with and without infant mortality. Several physiological phenomena were found to be uncorrelated with infant mortality.

Genetics of the Fowl

F. B. Hutt and W. F. Lamoreux (*J. Hered.*, **31** 231–235; 1940) publish a map of the chromosomes of the fowl, involving six linkage groups and 21 mutant genes. With the exception of the sex chromosome, it is as yet unknown which of the 40 chromosomes bear these linkage groups.

Structural Changes in the Chromosomes of Drosophila

H. J. MULLER (*J. Genetics*, **40**, 1–66; 1940) has made an intensive analysis of the phenomenon giving rise to structural changes in the chromosomes of Drosophila. The genetically observed rearrangements are secondary effects to the primary changes brought about by irradiation. The frequency of these observed effects varies as the 3/2 power of the total dose for the range 1,000 r.–4,000 r. At lower doses the observed exponent rises nearly to the square, indicating that nearly all the rearrangements represent combinations of independent primary changes. There is little effect of temperature, wave-length or duration and intensity upon the frequency change brought about by irradiation. Therefore, change is caused by individual ion-effects which act separately. The 3/2 power relationship is accounted for by the survival value of the secondary changes and by the occurrence of unidentifiable multiple rearrangements. The author therefore brings forward strong evidence that 'breakage followed by union' as distinct from 'previous contact' is the phenomenon which gives rise to the observed chromosome rearrangements and other chromosome mosaics. Related work and theories are discussed.

Crystallization of Olivine-basalt

THE Hat Creek basalt flow, north of Lassen Peak, California, has been described by C. A. Anderson (*Amer. J. Sci.*, 477–492; 1940). The lava was erupted along a line of north-south fissures, probably within the last two thousand years, and although it is holocrystalline for the most part, with an ophitic to sub-ophitic texture, it possesses many characters indicating marked fluidity at the time of eruption, for example, lava tubes, ropy pahoehoe surfaces, pressure ridges and slump scarps. It is shown that the Hat Creek basalt is of essentially the same composition and texture as the widespread Pliocene Warner basalt which covers a large area of north-eastern California, where it forms the major part of the Modoc lava plateau. The rock is rich in alumina and magnesia, and the history of crystallization is shown to be simultaneous separation of olivine and plagioclase, followed by pigeonitic pyroxene, plagioclase and iron ores. If chilling is rapid, hyalopilitic, intersertal or intergranular textures result from basaltic magmas of this composition, but with slower cooling, sub-ophitic textures develop with local areas of ophitic (poikilitic) texture. On the other hand, in plateau basalts of tholeiite type olivine is absent or rare and the lower amount of alumina results in a smaller proportion of felspar, so that the magma begins to crystallize near the boundary surface of the pyroxene and plagioclase fields and simultaneous crystallization of these minerals soon follows after the initiation of crystallization.

Upper Palæozoic Floras and Climates of South America

AT the Eighth American Scientific Congress held in May 1940, several papers were presented dealing with the floras and climates of South America in Upper Palæozoic times. C. B. Read well summarizes present knowledge of the floras. The little that is known of the Devonian floras suggests identity with those of the northern hemisphere. Similarly, the Lower Carboniferous assemblages known from Peru and Bolivia show a very striking relationship to those of certain stages in the Mississippian of North America and the Lower Carboniferous of Europe, as well as to those of the Kuttung series of Australia and the Po series of India. The occurrence of Glossopteris floras and their relationships to tillites in the Falkland Islands, Argentina and Brazil is discussed. The general succession appears to be one in which the earliest floras are few in genera and species and completely austral. This is followed by larger associations in which distinct boreal elements appear. There appears to be a considerable body of evidence favouring a Carboniferous rather than a Permian age for these older Glossopteris floras and, in consequence, for the subjacent 'Gondwana' tillites.

M. de Oliveira Roxo discusses the habitat of the plant remains found in the coal-bearing deposits of South Brazil. He arrives at the conclusion that the plants flourished in a climate similar to that of the southern part of New Zealand at the present day, a climate that favoured the growth of a mixed flora with both cosmopolitan and 'Gondwana' types. In another paper the same author states that 17 species of 'Gondwana' plants, 8 of which are peculiar to Brazil, and 12 species of cosmopolitan plants have so far been identified.

A Seismograph for Microseisms

WITH the aid of a small research fund given by friends in St. Louis, U.S.A., it has been possible for the Department of Geophysics of St. Louis University to build a comparatively simple and relatively inexpensive seismograph especially for the study of microseisms. The instrument was designed by Rev. J. B. Macelwane, S.J., and built by W. F. Sprengnether (*Trans. Amer. Geophys. Union*, 1938). The design chosen was a small horizontal pendulum with tension-hinge supports, induction transducer, and electromagnetic damping. The relatively small dimensions and slight moving mass of only about two and one half pounds make the instrument readily portable. The boom of aluminium tubing carries a brass frame into which is set a brass box containing the two coils wound with a large number of turns of fine wire. This coil box is supported in the field of a strong horse-shoe magnet of Alnico alloy, and the wires are led back through the hollow boom to binding posts on the frame. At the outer end of the boom is a copper damping vane which moves in the fields of four opposing pairs of small commercial Alnico magnets, the separation of which may be adjusted to secure critical damping at any period desired. The current from the coils of the transducer is led to a Leeds and Northrup type *R* galvanometer of seven seconds period, the critical resistance of which is that of the coils in series. The period of the pendulum is adjusted to seven seconds, so that the whole system is in resonance with the microseisms that are to be studied. The results have been very gratifying, and excellent records are obtained with the magnification adjusted to about five thousand.

Reactions between Dry Salts

REACTIONS between the alkali halides in the solid state have been studied by H. L. Link and L. J. Wood (*J. Amer. Chem. Soc.*, **62**, 766; 1940), mixtures of salt pairs being heated for long periods of time below the fusion point and the resulting mixtures analysed by the X-ray method. If the pair of salts containing the heavy cation united with the heavy anion and the light cation united with the light anion is called the stable pair, and the other mixture the reciprocal pair, then evidence for the partial or complete conversion of the reciprocal to the stable pair was obtained for forty out of forty-two reactions examined. Except in the mixtures containing lithium salts but no fluorides, no tendency for reversal of the stable to the reciprocal pairs was noticed. It was found in general that there was very little reaction in the solid state if the reaction temperature was more than 200° below the melting range, and that there was likely to be considerable reaction if the reaction temperature was within 100° of the melting range.

Organic Compounds of Tungsten

VARIOUS attempts have already been made to prepare organic compounds of tungsten, but with little success. The possibility of the existence of such compounds was, however, rendered very likely by the preparation of organic compounds of chromium, and later of molybdenum. Bearing in mind the types of chromium and molybdenum salts which were used in the successful preparation of their organic compounds, F. Hein and E. Nebe have now obtained similar compounds of tungsten (*Naturwiss.*, **28**, 93; 1940). The best starting materials are non-electrolytic complexes of the type $[MeX_3A_3]$ and pseudo-salts of the type $[MeX_n]$. Tungsten hexaphenate, described by Funk (1936), was found to combine readily with phenyl magnesium bromide, forming a brown substance. This resembled in appearance the organic molybdenum compounds. Analogous compounds were obtained by the reaction of tungsten hexachloride and Grignard reagents or lithium phenyl. $(C_6H_5W)_2O_7H_4$ and $(C_6H_5)_3W_2O_8H_7$ have been isolated. In colour and reactions they resemble the corresponding molybdenum compounds. Like them, they are less stable than the organic chromium salts.

Apparent Places of Fundamental Stars

IT was recommended at the International Astronomical Union held in Paris in 1935 that the apparent places of stars in all astronomical ephemerides should be based on the mean places of the Third Fundamental Catalogue of the "Berliner Astronomisches Jahrbuch", known as FK3. It was further recommended that, from the date of the adoption of the star places of the FK3, the apparent places of the 1,535 stars in the FK3 and its supplement should be published annually in a single volume, under the auspices of the I.A.U. The first volume is now available (London: H.M. Stationery Office. 30*s*. net). Its preparation has been shared by the co-operation of the national almanac offices in Berlin, Paris, San Fernando, Washington and London. The computations of the apparent places of the stars have been shared by the first four, while Great Britain has been responsible for the collation and preparation of copy, independent checks and proof reading, and the British Government has borne the cost of printing. The 1,535 stars for which mean and apparent places are given consist of 853 10-day and 20 circumpolar Auwers' stars, and also 630 10-day and 32 circumpolar additional stars. In the reductions to apparent place, the constants of precession, nutation and aberration involved are those adopted by the Conférence Internationale des Étoiles Fondamentales, which met in Paris in 1896. The details relating to the numerical values and methods of reduction are given in each of the five almanacs issued by the countries participating in the work. The introduction is printed in English, French, German and Spanish, and full explanations are afforded of the various sections under mean places of stars, apparent places of stars, short-period terms of nutation, etc. There is an index to apparent places of stars which enables the page upon which the apparent place of any star is tabulated to be found from a knowledge of the star's name alone, and all names given to stars in the work are included in the index, which is, therefore, very complete. It is satisfactory to know that the recommendation of the I.A.U. regarding co-operation in the production of this volume has proved possible.

GRAIN DESTRUCTION BY INSECTS

BY DR. A. D. IMMS, F.R.S.

THE Department of Scientific and Industrial Research has recently published a report* dealing with the infestation of stored grain by insect pests. The survey which it describes was undertaken at the request of the grain trade and with its help and assistance towards the cost. The survey was carried out by the Department of Zoology and Applied Entomology of the Imperial College of Science under the direction of Prof. J. W. Munro. In order to maintain proper liaison with industrial concerns a Standing Conference was set up, under the chairmanship of Mr. W. McA. Gracie of the L.N.E.R. Co., to act as a consultative body. A Technical Consultative Panel, representative of many aspects of the problem, also established to make this knowledge available for the benefit of the investigation. Also, in order to assist the scientific workers engaged on the survey, a Grain Infestation Survey Committee was set up under the chairmanship of Sir Edwin Butler.

The field work of the survey has lasted about a year. Its most important result is the demonstration that infestation occurs throughout all the industries producing, housing, transporting, trading in, manufacturing, or using cereals and cereal products. No single industry, therefore, is in a position to accuse another as being the source of the prevailing evil. Compared with the elaborate series of processes used for the cleaning, conditioning and refining of flour, the prevailing methods of storage are almost crude.

The major problems appear to be the regulation of humidity and temperature. Until the causes of the rise in these two factors, as affecting stored grain, are better understood, effective regulation is not attainable. This aspect of the subject is a complex one and one which involves time for its solution. Meanwhile palliative measures for reducing and controlling infestation need to be considered. The survey has proved its value in recognizing and defining the main problems that need to be tackled.

* "Report on a Survey of the Infestation of Grain by Insects" (London: H.M. Stationery Office, 1940). 1*s.* 3*d.*

Good ventilation, general cleanliness, segregation of infested consignments and other simple methods of control have yielded results of value. Hygienic measures alone, however, will not provide sufficient control while heavily infested imported cereals and cereal products are brought into Great Britain.

The problem of insecticidal treatment comes to the fore; but there are real difficulties and disadvantages involved by their application. The importation of infested grain, as is continually going on, offers little encouragement to the dock authorities to provide modern hygienic transit vehicles and storage capacity. Also, unless these conditions are available it is unreasonable to expect the exporters to ensure freedom of their cargoes from infestation. In other industries the question whether the importing or exporting parties shall take first action has resulted in a stalemate except in one section of the dried-fruits industry. Timely measures by the Board concerned have resulted in a wholly negligible infestation of Australian dried fruits on the home market during the past five years. The way is thus pointed towards the reduction of one of the major evils of grain infestation.

The insects infesting grain are not natives of the British Isles: they cannot live and breed in our climate in the open, but only in barns, granaries, warehouses, mills, etc. The links in the chain of distributing infestation begin with the arrival of vessels from overseas and go from them to dock premises, vehicles and containers, and so to mills, merchants, breweries, maltings, farms, etc. The report has done good service in stressing the risks and formulating the problems that have to be met at a time when food conservation is of paramount importance. Also, as a beginning, the recognition of proper cleanliness and the separation of infested from clean grain are steps in the right direction. Since there is a whole chain of circumstances requiring control we have to bear the burden of neglect of applied biology at a time when the nation is facing its greatest crisis.

EARLY EXPLORERS OF SOUTHERN SOUTH AMERICA FROM THE UNITED STATES*

BY COLONEL LAWRENCE MARTIN,
DIVISION OF MAPS, LIBRARY OF CONGRESS

IN October 1829, Capt. Nathaniel Brown Palmer, who had discovered the mainland of Antarctica nine years earlier, sailed from New York in the brig *Annawan* and Capt. Benjamin Pendleton sailed from Stongington, Connecticut, in the brig *Seraph*. With them travelled five scientific investigators, Dr. James Eights of Albany, N.Y., Dr. John Frampton Watson of Philadelphia, Pa., Mr. Jerimiah N. Reynolds of Wilmington, Ohio, and two associates whose names are not known. These five were, as it seems, the first persons from the United States of America who carried out scientific investigations and inland explorations on the continent of South America. The captains of the two brigs independently explored the waters, largely uncharted, between South America and Antarctica.

* Abstract of a paper presented to Section VIII (History and Geography) of the Eighth American Scientific Congress.

Eights of Albany is the great name in the group. He was a physician and an accomplished naturalist, being well equipped in geology including glaciology, and highly competent in botany and zoology as well. The scientific investigations by Eights commenced in the south-east of the Argentine, where he landed at several places on the east coast of Patagonia in January 1830. He collected, *inter alia*, a crustacean, which he called *Brogniartia trilobitoides* and which is now known as *Serolis trilobitoides* (Eights), and also a plant afterwards identified as *Adesmia candida* by Hooker.

In the Isla de los Estados, or Staten Island, south-east of the Straits of Magellan, Eights continued scientific collecting. Here the botanical results included the plants *Viola Magellanica*, *Stellaria debilis*, *Galium Antarcticum*, *Senecio Eightsii*, *Clarionia Magellanica*, and *Pratia repens*. Doubtless some of these names have been modified in modern botanical practice.

In extreme southern Chile, upon islands near Cape Horn, Eights pursued his botanical and zoological studies shortly after January 22, 1830. A previously unidentified isopod, described as being found in unusual abundance in pools left by receding tides, was *Sphæroma bumastiformis*.

Eights' principal geological studies were carried out in the South Shetland Islands, an archipelago much nearer to Antarctica than to South America. Here he spent the month of February 1830. He was the first professional geologist to say "let [Antarctica] rocks their silence break". He showed that the South Shetlands were underlain by argillaceous conglomerate and sandstone, dipping south-east at angles of 12°–20°, intruded by basalt, and with carbonized wood in the conglomerate. Among recent plants, he found *Usnea fasciata*, *Aira Antarctica*, some species of Polytrichum and of Avena, one or two lichens, and a marine Fucus.

The sea life included two new species, *Glyptonotus Antarcticus*, and *Decolopoda Australis*, a 10-legged red sea spider, to say nothing of the more familiar fur seals, elephant seals, sea leopards, whales, porpoises, etc. Eights identified at least sixteen species of South Shetland birds besides five species of penguins. He worked out the regime of the South Shetland tides, finding only one ebb and flow every twenty-four hours in most localities, and studied the ocean bottom deposits.

The substantial geographical contribution of Captains Palmer and Pendleton in 1829–31, aside from taking the investigators to the places where they worked in the Argentine, the South Shetland Islands, and Chile, was their demonstration that no oceanic islands are to be found south-west of South America along the particular courses independently traversed by the two brigs. A logbook in the Library of Congress, that of the schooner *Penguin*, a consort of the *Annawan* during the voyage from Staten Island to the South Shetlands and on to the Island of Mocha in Chile, contributes to meteorology, oceanography, and ornithology by indicating (1) directions and forces of the wind day by day, (2) days when there was rain or sleet, (3) presence or absence of icebergs and other sea ice, and of floating kelp, (4) distribution of penguins and other oceanic birds. During the six weeks voyage of Capt. N. B. Palmer and his brother Alexander in the South Pacific, they sailed some 3,500 miles between February 20 and April 3, 1821, starting from Potter's Cove in the South Shetlands, continuing to a point in the ocean near lat. 58° 01′ S. and long. 103° 03′ W., and ending at the Island of Mocha south of Concepción, Chile. Watson and Reynolds sailed westward on the *Annawan* with Capt. Palmer.

Eights anticipated Charles Darwin by some nine years in observing glacial boulders carried in or left by floating icebergs and deducing from them the geology of unvisited lands poleward from the points of observation in the South Pacific Ocean and in the Shetland Islands. He probably sailed from this archipelago about March 1, 1830, in the *Seraph* with Pendleton and reached Chile early in May, after exploring south-westward and westward from the South Shetland archipelago in the waters between lat. 60° and lat. 70° S. and long. 54° and long. 101° W. By convincing deductions from two months of collecting meteorological, oceanographical, zoological, and botanical data, including facts about the prevailing winds, the fogs, snow, sea ice, icebergs with rocks in them, ocean currents, kelp, penguins, terns, and so on, he established the existence of a long stretch of unseen land. He thought it to be insular, that is an extensive chain of islands, but it was actually a portion of the antarctic mainland west of the Palmer Peninsula, a part of the *terra incognita* which Admiral Richard E. Byrd mapped by aeroplane flights from the *Bear* in 1940.

In Southern Chile, where the *Seraph* and the *Annawan* operated together during 1830–31, Eights presumably continued his geological, botanical, and zoological studies, chiefly in the lands adjacent to the Chonos Archipelago, the Gulfs of Ancud and Corovado, the Island of Chiloe, and adjacent islands and waters. Reynolds and Watson, landed by Pendleton and Palmer at the mouth of the River Arauco on July 23, 1830, spent four months or more in the interior of the so-called Araucania, exploring the lands, investigating the resources, and studying the native people. They brought back thirteen chests of scientific specimens which were placed in the Lyceum of Natural History at New York City, and two chests which were given to an institution at Philadelphia, Pa. Reynolds presented to the Boston Society of Natural History in Massachusetts a substantial collection of ornithological, botanical, marine, and mineralogical specimens, not only from the South Shetlands and Chile but also from Peru and the Galapagos Islands as well. Fragments of Eights' herbaria are in the State Herbarium at Albany, N.Y., other portions being with the collections of Sir Joseph Dalton Hooker in England. His geological and zoological specimens, and his field notebooks, have not been discovered.

These explorations and scientific studies in the southern parts of the Argentine and Chile, and in adjacent islands and waters, resulted indirectly from a message which John Quincy Adams, President of the United States of America, sent to the Senate and House of Representatives on December 6, 1825, only five years after the discovery of the antarctic mainland by Palmer. If Pendleton and Palmer had not taken Eights and Watson and Reynolds in 1829–31 to the localities alluded to above, there might never have been a United States Exploring Expedition of 1838–42 under Admiral Charles Wilkes. Eights' field-work in Patagonia and Isla de los Estados in the Argentine, and near Cape Horn in Chile, is one of the very early professional scientific investigations in the coastal regions of South America, as well as in the South Shetland Islands and South Pacific Ocean not far north of Antarctica, by a technically qualified scholar from North America.

TAXONOMY IN THE JUNGLE

By PROF. JAMES RITCHIE

THE naming of species and their subordinate groups in laboratories and museums is a familiar process; indeed, it is the process by which the vast majority of animals have been named from the time of Linnæus onwards; and it has performed with reasonable success its two main objects, of labelling for convenience the population of the world, and at the same time of expressing degrees of natural relationship. But the demand for more precise methods of delimiting species is often made, and this demand takes two distinct trends, both influenced by the knowledge that species are not self-contained units but are composed of individuals the characters of which intergrade with those of related species. On one hand there is the plea for a statistical analysis of the morphological characters of populations before the risk is taken of dubbing a new species, as in Ginsburg's 'arithmetical definition' which expresses numerically intergradation or divergence. On the other hand there is a growing tendency to interpret characters in relation to environment, so that relatively small morphological differences which are constant throughout a habitat are regarded as of taxonomic significance.

There is no reason why the two methods should not be combined, each making its contribution to the validity of the final definition; but it must be recognized that for a vast part of the animal kingdom, as it is named, both methods would have been impracticable, the first because it demands large series of closely related forms, the second because it requires intimate knowledge of habits and restricted habitats. Had the *Challenger* collections awaited such refined tests, the systematic zoology of the ocean would have lost a foundation which on the whole has turned out to be solid and reliable.

On land the method of ecological taxonomy is more easy to apply than in the sea, unless it be on the shore and in the region between tides, and a close analysis of vegetation zones and of the peculiar characteristics of their inhabitants is bound to reveal unexpected affinities. A good example of this kind of analysis is Ivan T. Sanderson's account of "The Mammals of the North Cameroons Forest Area"[1]. It is true that the author minimizes the amount of study already done on these lines, for it is scarcely accurate to say that "within areas that may be defined as zoogeographical provinces little work has been done upon the distribution of animals" (p. 630) when one considers—to mention a few—the investigations of Beebe, Hingston and others in the Amazon region, of Grinnell and Storer in California, the many American contributions to zonal distribution published particularly by the American Museum of Natural History (including one dealing with an area not far distant from Mr. Sanderson's chosen spot, Chapin's "Birds of the Belgian Congo", part 1 of which ran to 900 pages), and that even the knowledge of the animals of our own islands has been closely linked with habitats. But the author enters with the zest of a pioneer upon his inquiry, and has carried it out with such thoroughness that it will serve as a model for the zoologist in the tropical forest.

The place selected was the Mamfe Division, inland from Calabar, containing one of the largest remaining areas of unaltered primary rain forest in the whole of West Africa and including many contrasting ecological situations. The method of collecting was unusual: first a map-survey of the whole territory was made; then specimens collected in any ecological unit of the survey were examined and their appearance in the flesh recorded, with no attempt to name them by orthodox taxonomic standards. Indeed, instead of 'museum' characters, stress was naturally laid upon fresh colour variation, the distribution and shape of foot-pads, colour of iris, comparative measurements, and so on.

The general result was to reveal that "almost every variation, however slight, tallied with some recognizable alteration either of habitat or of conditions in the habitat" (p. 628), and that "most species were confined to a single vegetational zone . . . some extended over two such zones, but in only one case was an animal taken from more than a few paces beyond the edge of its zone or zones" (p. 631).

The minute analysis to which specimens were subjected brought out several interesting points bearing upon taxonomic characters. Colour, for example, was found to be unreliable, sometimes because it faded in different degrees according to the method of preserving the pelt—the skins of a maroon-coloured rat, *Malacomys longipes*, turned out grey, dark brown or bright reddish-brown, according to whether they were dried in a closed container, in shade or in bright sunlight. Some cases of local orange or red coloration appeared to be due to staining by a food plant, since the colour could be washed out. The dorsal bright green of four arboreal species is attributed either to the presence of minute algæ or to refraction (the unconvincing reason given for the latter suggestion being that the colour fades rapidly after death); but a minute examination of the hairs should have decided the matter once and for all.

Sometimes the field characters pointed to conclusions regarding classification which could not be deduced from museum skins, as when they indicated two or more divergent groups the evidence for which was lost in the preserved material, or when specimens "rather homogeneous in life" presented characters, in their preserved state, which might have warranted the creation of sub-species.

The author set out deliberately to test by his own thorough methods the validity of the criteria upon which systematics are based, and his conclusion encourages belief in the long-established technique, for when the field determinations were compared with recognized classification "the two sets of identifications coincided exactly as regards genera", and "in the majority of cases, also, species as defined in the field corresponded to species as recognized and recorded in current literature". In the matter of the finer subdivisions, however, difficulties presented themselves, and it was found to be difficult to equate the field subspecific types with the named subspecies.

Many interesting observations were made in the course of the exploration, such as that of the spherical

hanging nests inhabited and said to have been built by *Cercopithecus preussi*, or of the giant and dwarf races of shrews here attributed to the abundance or scarcity of food available in different places, or of the cats (*Felis catus*) run wild in farmland and secondary forest which all had pale blue eyes, whereas in the village cats the iris varied between green and yellow.

Men of science, like Government Departments, are often pilloried for their misuse of the English language. Here there is a tendency to 'excessiveness'—"most forest animals tend to be excessively confined in their distribution"; two related species of Cercopithecus are "totally different"; "true constancy is exceptional". But the merit of this field monograph and of the author's drawings, coloured and uncoloured, of many species deserves the highest praise. If a word of advice may be given it is that a scientific paper, instead of indicating subtle colours in vague terms which convey different impressions to different people, would better describe them by reference to accepted colour standards such as those in Ridgway's well-known book on the subject.

[1] *Trans. Zool. Soc. Lond.*, **24**, Pt. 7, 623–725 (1940).

ASPECTS OF THE TOTALITARIAN STATE

A SYMPOSIUM on the totalitarian State from the points of view of history, political science, economics and sociology has recently appeared (*Proc. Amer. Phil. Soc.*, **82**, No. 1; 1940). Discussing totalitarian politics, F. M. Marx points out that totalitarianism and constitutionally safeguarded individual rights are incompatible. The corporative order is essentially an effort to interlock the entire occupational and social structure with the centrally controlled political hierarchy, and it cannot respect the difference between persuasion and brutal force. Totalitarianism is essentially anti-intellectual, but its character is dynamic and it would never have gained hold if it did not satisfy a human need not otherwise met. Its corporative features may well change the structure of the nation State so as to set a new international standard, and freedom of choice will only be retained by dealing effectively with those domestic conditions which cry out for redress.

Prof. Thomas Woody deals with the principles of totalitarian education, which he characterizes as aristocracy, anti-pluralism, anti-rationalism, collectivism and activism, the last-named differing from the liberal interpretation in permitting and encouraging only controlled activity, limited to the attainment of pre-determined goals. These principles constitute the basic educational framework of societies that look for stability and perpetuity on the basis of strict regimentation of the individual's capacities rather than through free development. They rest on the conviction that liberalism failed to show that men, if they had freedom, would use it for the common good.

Prof. H. Kohn, discussing the totalitarian philosophy of war, points out that in totalitarian philosophy war is the normal and welcome concomitant of all life, the supreme manifestation of vitality and virtue, an unalterable and dominating part of the whole system, whereas in the liberal conception wars exist only as a result of the shortcomings of the political and social order and may be overcome by the rational efforts of man. Ultimately, these two concepts of war rest on different concepts of the nature and destiny of man. Prof. C. R. Whittlesey, in reviewing the relation of totalitarianism to international trade and finance, suggests that the most significant feature of the economic policies of totalitarian States is their disregard of cost as the term is customarily understood, and from this fact arise most of the problems confronting countries competing with totalitarian States.

The totalitarian States, however, differ among themselves, as Mr. M. J. Bonn points out, as to the place of economics in the affairs of the world. In Italy and Germany, economics are only means which society needs for the pursuit of its main purpose, 'power', in order to dominate other societies and grow at their expense in accordance with the law of Nature which makes weaker and less numerous societies the prey of their stronger rivals. The pursuit of life, liberty and happiness for individuals as objectives of policy is senseless; they can only be reached as by-products of national welfare.

Communism, however, not only accepted but even stressed the rationalist doctrines of liberalism that growth and welfare of societies are regulated by immutable economic laws, the discovery of which enables man to develop a more or less perfect human society. It differs from its predecessors as to the proper nature of these laws, but they can be used to speed up development when they have been properly recognized. On the assumption that communists are in full possession of these laws, their dictatorial acts are not arbitrary. They merely impose the laws of the universe on those unable to discern them. Fascism and nazism are thus opposed to communism, because of its basis on reason and deduction and because it represents an impersonal scientific approach to objective truth by way of the intelligence and not through the emotions.

Discussing the novelty of totalitarianism in the history of Western civilization, Prof. C. J. H. Hayes considers that this novelty lies in the fact that dictatorial totalitarianism is really totalitarian, monopolizing all powers, subordinating all institutions and groupings, leaving no room for the free play of individual wills and recognizing no utility in free inquiry. Secondly, it commands and rests upon mass-support, and is not the affair of an aristocratic class or military caste. Thirdly, it is maintained, and its overthrow rendered unusually difficult, by novel and marvellously effective agencies of popular education and propaganda. It also possesses an allure through the emotional and essentially religious spirit which its leading apostles have infused into it. It has evolved a new pattern of methods and techniques, and in its exaltation of might and force as an end in itself is another novelty. It is essentially a revolt against the whole historic civilization of the West, but as an antidote to undue pessimism Prof. Hayes points to the improbability of a novelty of the last two decades outlasting what has long endured, and secondly to the resourcefulness of man, which has as often brought him liberty and fraternity as his inertia and submission have brought him dictatorship and slavery.

INDUSTRIAL INJURIES IN WAR-TIME

A REPORT by Prof. H. Levy on "War and Industrial Injuries" which has been issued by the Fabian Society (Tract Series No. 253) emphasizes the importance in the war effort of the fitness of the army of industrial workers behind the soldier, and directs attention to the cost of industrial accidents not only in sums paid for compensation but also in the loss of working time, both direct and indirect. In present circumstances it is emphasized that we must use to the full every ounce of man-power we possess that can be employed on production and that the present arrangements for preventing accidents and still more for the treatment of injuries and of industrial disease result in a very great and unnecessary waste of man-power—a wastage which is likely to be enormously increased under war conditions.

Prof. Levy therefore urges that one of the most important single contributions to the war effort would be the immediate introduction of expedients designed both to minimize the occurrence of accidents and to improve the facilities for treating the injuries resulting from them. The proposals put forward are essentially intended for the consideration of the Royal Commission on Workmen's Compensation, as any final solution involves drastic reform both of the law of workmen's compensation and the system of National Health Insurance. The main purpose, however, of any immediate proposals should be to create throughout the industry of this country institutions charged with the continuous and positive duty of preventing accidents so far as possible, and, where accidents occur, of providing for rapid and effective treatment of the victim. The changes now being made in factory administration, and the establishment under the chairmanship of Mr. Ernest Bevin of a new Factory and Welfare Advisory Board, provide a unique opportunity to use the new powers of the Ministry of Labour to extend and develop this type of organization over the whole of industry.

With regard to organization, the essential is that for a well-established industry of any size those who are vitally concerned in the running of the industry and who understand its problems should be entrusted with the task of preserving its man-power. Where joint standing committees do not exist, associations of employers and employees should be asked to form committees and compulsion brought to bear if this is not done voluntarily within a limited period of time. For small, scattered or ill-organized industries or occupations the Ministry should itself set up a welfare and safety organization partly of official members and partly of representatives of those engaged in the trade or occupation. To function effectively, such committees must be given really wide powers, including the right to visit any plant in the industry with which they are concerned, to inspect its safety provisions, make additional suggestions and under prescribed regulations inflict fines for the non-observance of safety provisions. The committees should be under an obligation to provide medical treatment for injured workers where the injury is serious, the treatment to be arranged so as not to interfere with existing arrangements, which at present are sketchy and inadequate. The committee would also be able to arrange far more efficiently than any centralized board for special attention to the particular problems of its own industry.

APPOINTMENTS VACANT

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

SUPERVISOR OF DOMESTIC SCIENCE TRAINING in Jamaica—The Secretary (I.P.R.), Board of Education, Kingsway, W.C.2 (August 26).

PROFESSOR OF GEOGRAPHY at the Higher Teachers' College, Baghdad—The Secretary (I.P.R.), Board of Education, Kingsway, W.C.2 (August 26).

TEACHER (MAN) OF ENGINEERING SUBJECTS in the South Dorset Technical College, Weymouth—The County Education Officer, County Education Office, Colliton House, Dorchester, Dorset (August 26).

PROFESSOR OF HOME SCIENCE in the University of Otago—The High Commissioner for New Zealand, 415 Strand, W.C.2 (August 31).

LECTURER IN BIOCHEMISTRY in University College, Dundee—The Secretary, The University, St. Andrews (August 31).

GRADE II (C) LECTURER IN THE DEPARTMENT OF MECHANICAL ENGINEERING—The Secretary, The University, Birmingham 3 (August 31).

REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

University of Reading: National Institute for Research in Dairying. Annual Report for the Year ending 30th September 1939. Pp. 90. (Reading: National Institute for Research in Dairying.) [68

Experimental Researches and Reports published by the Department of Glass Technology, The University, Sheffield. Vol. 22, 1939. Pp. iii+248. (Sheffield: The University.) 7*s*. 6*d*. [68

Witherite (Natural Barium Carbonate) and its Industrial Uses. Issued jointly by the Holmside and South Moor Collieries, Ltd., and the Owners of Settlingstones Mines, Ltd. Pp. 56. (Stanley, Co. Durham: Holmside and South Moor Collieries, Ltd.) [88

Other Countries

Proceedings of the United States National Museum. Vol. 88, No. 3091: A Prehistoric Roulette from Wyandotte County, Kansas. By Waldo R. Wedel and Harry M. Trowbridge. Pp. 581–586. Vol. 89, No. 3092: A Revision of the West Indian Beetles of the Scarabaeid Sub-family *Aphodiinae*. By Edward A. Chapin. Pp. 42. (Washington, D.C.: Government Printing Office.) [297

Newfoundland Government. Research Bulletin No. 8: Lobster Tagging on the West Coast of Newfoundland, 1938. Dr. Dr. W. Templeman. Pp. 16. (St. John's: Department of Natural Resources.) [297

Madras Fisheries Department. Fish Statistics for 1928–29, 1929–30 and 1930–31. Edited by Dr. B. Sundara Raj. (Reports 2, 3 and 4 of 1937, Madras Fisheries Bulletin, Vol. 27.) Pp. iv+71–264. (Madras: Government Press.) 2.14 rupees. [297

India Meteorological Department. Scientific Notes, Vol. 8, No. 88: A Historical Note on the Standard for the Measurement of Atmospheric Pressure in India. By J. M. Sil. Pp. 47–66. (Delhi: Manager of Publications.) 10 annas; 1*s*. [307

Proceedings of the American Academy of Arts and Sciences. Vol. 73, No. 11: Interatomic Forces and Helium in Rocks. By Norman B. Keevil. Pp. 311–360. 1.50 dollars. Vol. 73, No. 12: Some Physical Constants of a Few Hydrocarbons and their Structural Isomers. By Mieczyslaw Wojciechowski. Pp. 361–370. 35 cents. (Boston, Mass.: American Academy of Arts and Sciences.) [317

Astrographic Catalogue 1900·0. Sydney Section, Dec. −51° to −65°. From Photographs taken at the Sydney Observatory, New South Wales, Australia. Vol. 22: R.A. 6h to 12h, Dec. −56° to −58°. Plate Centres Dec. −57°. Pp. 98. (Sydney: Government Printer.) [317

De Tuberculine Reactie. Door Injo Beng Liong. Pp. viii+203. (Batavia: Medical College.) [18

Instituto Nacional de Tecnologia (Ministerio do Trabalho, Industria e Comercio). Estudos sobre o tratamento de agua por coagulação. Por Eros Orosco, E. Frias Rocha e E. Goulart de Andrade. Pp. 28. Gordura de Bati: considerações para o estudo do problema da oblenção em bases industriais. Pelo Jayme Sta. Rosa. Pp. 26. Papoula de São Francisco. Pelo Waimir A. Teixeira de Carvalho. Pp. 48. Metrologia (métodos óticos nas medidas de comprimento de alta precisão). Pelo J. Costa Ribiero. Pp. 28+4 plates. A Mandioca: sua industrialização, seu valor econômico. Pelos Ruben Descartes de G. Paula e José Luiz Rangel. Pp. 60+4 plates. (Rio de Janeiro: Instituto Nacional de Tecnologia.) [18

Commonwealth of Australia: Council for Scientific and Industrial Research. Pamphlet No. 96: Further Investigations on Copper Deficiency in Plants in South Africa. By D. S. Riceman, C. M. Donald and S. T. Evans. Pp. 44+10 plates. (Melbourne: Government Printer.) [68

Newfoundland Government. Research Bulletin No. 9: A Preliminary Study of Newfoundland Trout. By Nancy Frost. Pp. 30. (St. John's: Department of Natural Resources.) [68

Catalogues

Rapid Testing applied to Foods, Chemicals, etc., in Industrial and Scientific Research, by Fluorescence with the Hanovia Analytic Lamp. Pp. 20. (Slough: Hanovia, Ltd.)

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A Catalogue of Important Books, including Americana, English Literature, Music, Ornithology, and Important New Books. (No. 578.) Pp. 40. (London: Bernard Quaritch, Ltd.).

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ANDREW BENNETT,
Secretary of the University.

The University,
St. Andrews, 1940.

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C. G. BURTON,
Secretary.

The University,
Birmingham, 3.
August 1940.

UNIVERSITY OF LONDON

The Senate invite applications for the University Chair of Anatomy tenable at St. Mary's Hospital Medical School. Salary £1,000 a year. Applications (ten copies) must be received not later than first post on Wednesday, September 11, 1940, by the Academic Registrar, University of London, Royal Holloway College, Englefield Green, Surrey, from whom further particulars should be obtained.

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