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NATURE

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WORLD MAGNA CHARTA

THERE could scarcely be higher tribute to the dramatic instinct and imaginative insight which led Mr. Churchill and President Roosevelt to choose the Atlantic for their historic declaration of peace aims than the fact that German commentators have already recognized and sought to minimize the parallel with the Fourteen Points. They at least have seen that this is no mere declaration of peace aims. It is a moral offensive which strikes Germany in one of her fundamental weaknesses—the dread and certainty of impending disaster.

Unsatisfactory as have been some of the recent debates on propaganda or political warfare, and slight the evidence that the Government was really alive to the value of the 'fifth arm' and prepared to integrate it into the general stragegy of the War, this master-stroke of the meeting and Declaration of the Atlantic provides convincing evidence that the important contribution to British defence and British strategy made by the Prime Minister in his speeches and broadcasts is now recognized. As a statement of peace aims, more could not be expected than is contained in the Declaration ; less would scarcely have satisfied the bulk of those who were demanding a declaration of peace aims. Much more important, this clear enunciation of principles derived directly from the President's formula of the four freedoms is the starting-point for a moral and political offensive that will lead to the accelerated disintegration of Nazism. The peace offensive and initiative have passed into Anglo-American hands.

There have indeed already been welcome signs in recent speeches by Mr. Eden that in the field of political warfare Great Britain is no longer to remain on the defensive. In his speech at Leeds on July 6, Mr. Eden declared emphatically that the Government is not in any circumstances prepared to negotiate with Hitler at any time or on any subject. We would intensify our war effort until he and all he stood for was utterly destroyed. In the House of Commons a month later, on August 6, Mr. Eden reiterated the distinction between the military and the economic treatment of Germany. Every recourse that can be devised must be taken to see that Germany does not for a sixth time plunge Europe into war. There could be no wavering on that point although it would be to our disadvantage and to Europe's disadvantage that Germany should be economically ruined after the War. Mr. Eden went on to indicate that the Government had made certain changes in the work

for the co-ordination and for the operation of our political warfare, and that we were entering on a period of greater opportunities in this field.

The eight points of the Declaration made by the President of the United States and Mr. Churchill, representing His Majesty's Government in the United Kingdom, are as follows :

First, their countries seek no aggrandizement, territorial or other.

Second, they desire to see no territorial changes that do not accord with the freely expressed wishes of the peoples concerned.

Third, they respect the right of all peoples to choose the form of Government under which they will live ; and they wish to see sovereign rights and self-government restored to those who have been forcibly deprived of them.

Fourth, they will endeavour, with due respect for their existing obligations, to further enjoyment by all States, great or small, victor or vanquished, of access, on equal terms, to the trade and to the raw materials of the world which are needed for their economic prosperity.

Fifth, they desire to bring about the fullest collaboration between all nations in the economic field, with the object of securing for all improved labour standards, economic advancement and social security.

Sixth, after the final destruction of Nazi tyranny, they hope to see established a peace which will afford to all nations the means of dwelling in safety within their own boundaries, and which will afford assurance that all the men in all the lands may live out their lives in freedom from fear and want.

Seventh, such a peace should enable all men to traverse the high seas and oceans without hindrance.

Eighth, they believe all of the nations of the world, for realistic as well as spiritual reasons, must come to the abandonment of the use of force. Since no future peace can be maintained if land, sea, or air armaments continue to be employed by nations which threaten, or may threaten, aggression outside of their frontiers, they believe, pending the establishment of a wider and permanent system of general security, that the disarmament of such nations is essential. They will likewise aid and encourage all other practicable measures which will lighten for peace-loving peoples the crushing burden of armament.

This unequivocal declaration regarding Nazism deals the first blow in the political offensive for which Sebastian Haffner calls in his book "Offensive against Germany". While waging war with all our strength, we are giving it a purpose which makes resistance on the enemy's part superfluous and impossible. The most cursory reading of the Declaration of Mr. Churchill and President Roosevelt, with its reference to the final destruction of Nazi tyranny and the pledge to endeavour, with due respect for existing obligations, to further the enjoyment by all States, great or small, victor or vanquished, of access on equal terms to the trade and raw materials of the world, which are needed for their economic prosperity, indicates how well the opportunity has been grasped.

Here at long last Anglo-American co-operation is fashioning weapons for a moral offensive, perfecting the technique and tactics of effective propaganda. Here is the break with the wavering policy of the last ten years, and the creation of a policy giving full power to propaganda, confronting the misery and slavery of the Nazi New Order with an equally tangible but nobler New Order. Here is the formulation of our cause in terms which should make it an irresistible moral weapon.

No better answer could indeed be given than the Declaration of the Atlantic to Nazi and Fascist attempts to represent the War as a conflict between the large and proper ambitions of young and vigorous races and the unimaginative selfishness of two democracies that have lost the capacity for leadership. The dramatic setting is well calculated to carry the generous spirit of the principles embodied in the Declaration across the frontiers and into the hands of every country that lies under the Nazi yoke. Here is the testimony that Great Britain has accepted the formula of President Roosevelt, that it has turned its back on the world of 1939 and is prepared to make the sacrifices involved in the establishment of the four freedoms and the pursuit of the constructive economic policy by which alone the world can be made free from fear and free from want.

The Declaration does not propose to set up a world in which a man will have a privileged position because he is British or American. On the contrary, in the world contemplated he may be asked to make real sacrifices of national interest or prestige, and from this fact alone the declaration derives immense value, both for the prosecution of the War and for the settlement of the world thereafter. There is nothing in the terms of the document which has not already figured in the speeches of British and American statesmen. President Roosevelt's great speech upholding the four freedoms is not more pertinent in this connexion than the Prime Minister's refusal even in our darkest hour last summer to abate one jot of our commitments to restore liberty to those peoples who have been deprived of it, or Mr. Eden's recent insistence that peace must not bring destitution even to the guilty. It is the formal recognition of such aims and principles, the assumption by the United States and the British Empire of a joint responsibility for all that is implied in the establishment of such a peace, and the definite association with those aims and principles of the destruction of Nazi oppression and the disarmament of the

aggressor nations, and the enactment of measures to secure peace and order while leading ultimately to collective disarmament, which give the declaration the force of high explosive in the hands of friends of liberty in all the oppressed countries.

"Here in Britain," said Mr. Eden, on July 6, "we must lay the foundations of a new Europe, at meetings of the Allied Governments", and the forthcoming meeting will acquire fresh inspiration and value from this demonstration not merely of American association with that task, but also that the Government is imaginatively alive to the possibilities and opportunities of fashioning the future of men's hopes amid the sights and sounds of war. On the wide waters of the Atlantic and this free soil of Britain, the forces of freedom are being marshalled, and the Declaration affords reasonable assurance that the future peace settlement will not fail because it either lacks large and bold economic imagination, or makes too little provision for safeguarding Europe from another outburst of aggression. Not again can Britain and the United States take too lightly their duties of order and peace.

The eight clauses of the Declaration deserve and should receive the closest study. Even at a first glance, their resemblance to principles already enunciated by many responsible studies of the central problem of Germany and European order—as, for example, the conclusions of the recent broadsheet issued by Political and Economic Planning (P E P) on "The Future of Germany"—is as remarkable as the harmony of the whole circumstances in which the Declaration was made with the conditions of a moral offensive, as indicated by Sebastian Haffner, or by Mr. Wickham Steed in recent letters in *The Times*. The hopes the Declaration will inspire in Europe are well founded, because here at last is clear recognition of the twin and inescapable conditions of any true peace—the provision of real incentives to observe it and real deterrents against breaking it.

It has been clear for months past that both in Great Britain and in the United States it is increasingly recognized that the economic foundations of peace are as important as the political, that vanquished and victors will have to live together in the world of to-morrow, and that a rising standard of living, such as a well-ordered world can furnish, will be one of the indispensable guarantees of security and the permanent answer to the more specious elements of the Nazi and Fascist appeal. That is the fundamental conception which has inspired the work of the Leith-Ross Committee, the Willingdon Commission or the agreements in regard to shortages and surpluses concluded last June between the United Kingdom and the Dominions of Australia and New Zealand. Its embodiment in this Declaration, the establishment of freedom from fear and want as a world objective, should give fresh purpose and incentive to all such efforts and movements.

No less emphatic is the fifth clause, affirming the desire to "bring about the fullest collaboration between all nations in the economic field with the object of securing for all improved labour standards, economic advancement, and social security". That affirmation should give fresh heart to the many already concerned in dealing with the technical problems involved, and should lend fresh purpose to the meeting of the International Labour Organisation already contemplated this autumn. The solemn exclusion of arbitrary territorial changes and of territorial and material ambitions from our war aims is reaffirmed, and recognition of the right of all peoples to choose the form of government under which they will live is repeated, as well as the affirmation of our desire to see sovereign rights and self-government restored to those who have been deprived of them.

The means by which these principles are to be translated into practice have still to be worked out, but already much machinery lies to our hand for the task. The Declaration, as already suggested, gives new importance to the meetings of the Allied Governments in London. In that embryonic conception of a free united Europe, of a European cabinet, must be worked out the mechanism by which the choice of form of government for the occupied and enemy territories must be devised, so that the suppression of liberties in one country is never again allowed to threaten the liberties of others. The addition to those meetings of free German representatives from among the many distinguished German émigrés already to be found in Great Britain, parallel with the Free French representatives, might well supply the vital touch, particularly in the formulation of the strategy and tactics of political warfare on the increasingly offensive scale which the Declaration should rightly inspire.

These are but a few of the consequences which should follow from this historic meeting and Declaration. Gratitude to President Roosevelt for suggesting the meeting and to Mr. Churchill for his instant response, and admiration for the dramatic sense and timing of both meeting and Declaration, will not be the less for the further indication it affords of growing Anglo-American co-operation, and of readiness to accept the full responsibilities of world leadership and all that such responsibilities involve. The courage and imagination which have been displayed are the best assurance that the world will not look in vain to Great Britain and America to provide the leadership and resources adequate to establish the world order outlined in this historic Declaration.

BERTRAND RUSSELL ON MEANING AND TRUTH

An Inquiry into Meaning and Truth
By Bertrand Russell. Pp. 352. (London : George Allen and Unwin, Ltd., 1940). 12*s.* 6*d.* net.

BERTRAND RUSSELL is the Picasso of modern philosophy. He has expressed himself very differently at different periods ; and in each period he has exerted deservedly great influence and aroused extravagant hostility. That his works have always produced so strong a reaction is partly due to the sharpness and clarity with which they have been written. But this, unfortunately, does not hold good of his latest book, which differs not so much in its subject matter as in its style from anything that he has written before. It deals in a comprehensive, if unsystematic, way with the class of philosophical problems that are conventionally brought under the heading of the theory of knowledge. Many interesting questions are raised by it and ingenious answers suggested. But the argument as a whole suffers from a hesitancy and discursiveness which make it unexpectedly difficult to follow.

Though he is inclined to drop hints about the limitations of empiricism, Russell still in the main approaches his problem from an empiricist point of view. He says that he is, "as regards method, more in sympathy with the logical positivists than with any other existing school," but he rightly rejects the formalist view, which Carnap and others of them have put forward, that no more is ever necessary for the specification of a language than an account of its syntactical rules. He recognizes that if we are to make statements which can be empirically true or false, we require not merely the formal rules which correlate symbols with one another, but also rules of meaning, which correlate symbols with observable facts. His way of making this point is to take, as what he calls his language of lowest type, "a language consisting wholly of 'object words', where 'object words' are defined, logically, as words having meaning in isolation, and, psychologically, as words which have been learnt without its being necessary to have previously learnt any other words." That he is thinking here of words that are defined ostensively is shown by his further explanation that "an object word is a class of similar noises or utterances such that, from habit, they have become associated with a class of mutually similar occurrences frequently experienced at the same time as one of the noises or utterances in question." At the outset he claims for his object language only that it is one among a number of possible languages of lowest type ; but this must not be taken to imply that he conceives himself to be engaged merely in a game of language building. For sentences of the object language are apparently supposed to express what he calls basic propositions, where, by a basic proposition, he means one that "arises on occasion of a perception which is the evidence for its truth" ; and he holds that these basic propositions constitute the indispensable foundation of all empirical knowledge. They fulfil this function in virtue of their connexion "with certain non-verbal occurrences which may be called experiences" ; and the nature of this connexion is, for Russell, "one of the fundamental questions of epistemology". He implies, indeed, that it is for him the essence of the problem both of meaning and of truth.

In the case of meaning Russell falls into confusion through taking it for granted that meaning is a relation which somehow connects a symbol with some sort of object. Thus he assumes that "when a sentence is significant, there is something that it signifies" ; but "since a significant sentence may be false, it is clear that the signification of a sentence cannot be the fact that makes it true (or false). It must therefore," he concludes, "be something in the person who believes the sentence, not in the object to which the sentence refers." This "something" he chooses to call a proposition, defining propositions as "psychological occurrences of certain sorts, complex images, expectations, etc." But this whole line of reasoning is surely mistaken. To ask what a symbol signifies is legitimate if what is required is an explanation of the way in which it is used. In the case of any given sentence such explanations may take the form of translating it into other sentences, the meaning of which is assumed to be known, or of describing the sort of situations to which it is conventionally applied. But this course cannot be followed when the question about the meaning of symbols is completely generalized, for the reason that there is no general usage to explain. There is no one thing that all symbols mean.

It is true that the assertion of sentences may be accompanied by complex images, expectations and so on : but it is very misleading to say that these are in any sense what the sentence means. Similarly, it is true that the expression of a symbol which describes a sensible occurrence is usually in some way an effect of the occurrence in question. But this does not justify one's defining the meaning of the symbol in terms of the causal relation, as

Russell is inclined to do. It is an old philosophical fallacy to suppose that a symbol must have some natural connexion with that which it symbolizes, apart from the conventional rules by which its use is determined. The establishment of these rules does, no doubt, depend on physical and psychological factors, which can be investigated; but these factors do not enter into the definition of the rules themselves.

In the case of truth, Russell hesitates between two versions of the correspondence theory, the 'logical' version, according to which propositions are required to correspond with 'facts', and the 'epistemological' version, according to which they are required to correspond with 'experience'. He eventually decides in favour of the logical version, principally upon the ground that it makes it possible to retain the law of excluded middle, whereas he thinks that, according to the epistemological version, propositions which there is no practical means of verifying must be regarded as neither true nor false. Unfortunately he does not make it at all clear what he intends us to understand by 'fact' as opposed to 'experience'. It depends upon his theory of perception, of which no clear or consistent account is given in the book. In the main, he seems to adhere to a causal theory, according to which sense-data, which are absurdly described, in one place, as "states of ourselves", and in another, as being "inside the percipient's head", are conceived to be the effects of physical events which are themselves unobservable. But he does not try to meet the main objection to all theories of this type, which is that the notion of causality has no significant application outside the field of possible experience. Throughout the whole book, indeed, he makes use of causal relations in a surprisingly uncritical way.

The fact is that, while Russell appears to start from an empiricist position, he does not consistently adhere to it. This is shown, among other things, by his analysis of the use of words like 'this' and 'I', which he calls egocentric particulars. His view is that their peculiarity lies not in their meaning but in their causation, inasmuch as the expression of them is the effect of a "minimal causal chain", which, "in this connection, is the shortest possible chain from a stimulus outside the brain to a verbal response". He concludes that words of this kind are "not needed for a complete description of the world", whatever that may be. But this is to assume that the public physical world is in some mysterious way impersonally 'given', and that the question is to fit the egocentric particulars in; whereas in fact it is just the other way round. Epistemologically, it is necessary to start with the individual's private experience, in the description of which egocentric particulars cannot be dispensed with. Russell does indeed recognize this in the case of "our knowledge of other minds", which he treats as a problem of explaining one's knowledge of events that one cannot oneself directly verify. He takes as an example the proposition "you are hot", which he says is roughly equivalent to, "there is a hotness related to my percept of your body as, when I am hot, the hotness of me is related to my percept of my body". He then remarks that whereas "when I am hot, I can give a proper name to my hotness; when you are hot, your hotness, to me, is a hypothetical value of an apparent variable." But this, according to him, is simply a matter of the insufficiency of my vocabulary. "It is a merely empirical fact that I have not sufficient proper names for this purpose."

I believe this answer to be along the right lines, but it will scarcely do as it stands. For if the fact that I cannot directly verify statements about other people's experiences is simply due to the accidental limitation of my vocabulary, what is there to prevent me from removing this limitation simply by inventing new proper names? The answer is that, however inventive I am, the proper names that I add to my vocabulary will always refer to elements of my own and not of anybody else's experience. For the fact that each person's experience is private to himself is logically necessary. It is so, however, only in the sense that it depends upon the conventions that we have chosen to adopt in speaking about people's experiences; and the facts which make it useful to adhere to such conventions are indeed empirical. As we now use words, it is impossible, even in principle, for one person literally to share another's experiences; but it is not difficult to imagine circumstances in which we should find it convenient to adopt a different verbal usage.

Perhaps it is considerations of this kind that lead Russell to say, at the end of his book, that he believes it possible to make inferences "from the structure of language as to the structure of the world". He tells us indeed that the proof of this possibility "has been in a sense the goal of all our discussions". But if he intends this to be taken seriously, he seems to me to be setting too low a value on his book. For if he means only that the development of a language is partly conditioned by the nature of the facts which it is used to describe, his conclusion, though true, is not one that it would take a lengthy book to prove; while if he is referring to some more mysterious affinity between language and the 'world', it does not appear to have been established by anything that he has previously said.

A. J. AYER.

THE MAKING OF THE 'MARITIMES'

The Cod Fisheries

The History of an International Economy. By Harold A. Innis. (The Relations of Canada and the United States: a Series of Studies prepared under the direction of the Carnegie Endowment for International Peace, Division of Economics and History.) Pp. xx+520. (New Haven, Conn.: Yale University Press; Toronto: The Ryerson Press; London: Oxford University Press, 1940.) 21*s*. 6*d*.

THIS is an important book (as well as a large one) about the great fisheries of the maritime provinces of North America, including New England, tracing their history from the days of Cabot's discovery of Newfoundland to the recent inglorious submission of that island to administration by British civil servants.

The book is one of a series designed to promote the mutual understanding of Canada and the United States. It is also introduced as a challenge to the imagination and insight of the reader, which it undoubtedly is, and Canadian and American students who master it may well have a fellow-feeling based on survival of the same ordeal, for it is uncommonly hard reading.

Yet the book is saved by its very pedestrianism. It is a long and tedious tale of petty greed and sectional interests, in which it is usually the reader who has to contribute the thought that these men were venturing their all, or their lives, on arduous fishing in comfortless places, and in far voyaging with the catch to West Indies and Mediterranean; but there is a fascination in the record of commercial facts which passes across the pages with the precision and inevitability of the tape-machine: "Colonial shipping grew in importance with colonial trade. In 1763 St. John's shipped fish totalling 56,365 quintals. Of this, vessels from Philadelphia carried 2,967 quintals"; etc.; or, from a footnote: "Planters increased from 346 men in 1736 to 690 in 1747, and to 1,250 in 1764; servants from 3,727", etc.

There is another and greater virtue in the book, in that it does attempt to make sense of all this, to show the historical trends that have resulted in the present state of affairs in the Maritimes. Despite the long record of apparently unimportant detail, the author does establish his right to draw sweeping and important conclusions. Having traced the failure of the chartered company system, then the dominance of the English West Country Merchant Adventurers, whose power was destroyed by the multitude of small settlers, and the rise of their commerce, essentially a maritime decentralized economy, he shows how this in its turn has fallen.

"The transition from dependence on a maritime economy to dependence on a continental economy has been slow, painful, and disastrous. The tremendous initiative which characterised commercialism based on the fishing industry could be measured in the collapse of West Country company control over trade and the fishery, in the history of Newfoundland and New England, the defeat of France and the breakdown of the colonial system, the disappearance of the Navigation Acts, and even the rise of responsible government and the establishment of Confederation. This is an initiative which cannot be suddenly replaced. The effects of the tragedy of the replacement of commercialism by capitalism call for a long period of expensive adjustment and restoration, and this cannot take place without policies which foster the revival of initiative under responsible governments."

Those are Prof. Innis's closing words. As English I found the passage difficult, but unless I am much mistaken it is history of the most useful kind—that understands the past in order to forgive the present, and prepare for the future.

MICHAEL GRAHAM.

ANIMALS AND PLANTS AT HOME

The Open Book of Wild Life

An Introduction to Nature Study. By Richard Morse. Pp. 240+48 plates. (London: Adam and Charles Black, Ltd., 1941.) 8*s*. 6*d*. net.

MR. MORSE's book is meant primarily for younger readers, but it is not likely that many adults will begin reading it without being caught by its irresistible charm—the charm of the wild life of the British countryside and the charm of the writer's style. The book is based on sound scientific principles, and compresses an enormous amount of knowledge in a comparatively small compass. In fact, everybody can learn something from what one can only describe as a delightful book. It is not a text-book. It comprises the

observation and thoughts of a true lover of Nature. There is no evidence of any attempt on the part of the author to teach natural history (much less biology) to his readers. He proves himself here to be a literary "Zoo-man" or "Romany", telling his readers, as David Seth-Smith writes in his foreword, "in simple language, what to look for, and how to make one's country walks much more interesting than they have ever been before".

Thus he tells his readers a great deal that they will not find in their more formal text-books, and, indeed, he tells much that the text-book does not even explain, which is all to the good. It will set an enthusiastic reader wondering, and, above all, verifying by practical observation.

Even so, though the author does not attempt to teach biology in the formal way, his own style of presentation brings out the main biological principles almost surreptitiously. For example, after a fascinating account of the behaviour of the adult and young cuckoo (where he introduces the concept of instinct) he finishes:

"As soon as any plant or animal begins to steal from others instead of working for itself, it begins to lose some of its organs or some of its powers. It begins, in other words, to degenerate. Now the cuckoo affords a striking illustration of the working of that law, for it is quite plainly a degenerate bird. It is, for example, very unsociable—just the opposite of the highly intelligent rooks Then again, the mother cuckoo, as we have already seen, cares nothing at all for her children, and she is herself a terrible glutton. How amazingly different she is from the pair of little blue-tits who brought home two thousand grubs and caterpillars for their young ones in a single day—a task which meant at least sixteen hours of almost continuous labour!

Exactly how the cuckoos first came to start their life of indolence and plunder nobody knows, but it is quite evident that they are birds that are going downhill. Their eggs are peculiarly small; their internal organs are always in an unhealthy condition; and they are hated and despised by vast numbers of their hard-working fellow-birds."

Few other books of this standard would put it like that.

Mr. R. Morse, Mr. Eric J. Hosking, Miss C. von Wyss, Mr. W. S. Berridge, Mr. D. Ferguson and Mr. C. A. Hall are all well-known nature photographers, and there are nearly fifty of their photographic studies reproduced here, together with some others. The fifty beautiful line drawings are by such well-known nature artists as Miss Doris Roger, Miss C. von Wyss and Mr. Roland Green. Some of the sixteen colour plates are particularly attractive, especially Roland Green's "Ruler of a Kingdom" (robins at home) and V. R. Balfour-Browne's "Our Largest Wild Animal" (red deer).

If this book achieves the success that it so richly deserves, it will be more to the advantage of its young and adult readers than to the author, who is deserving of praise and congratulation for such a charming and valuable contribution to popular scientific literature.

FARMING AND NATIONAL LIFE

England and the Farmer

A Symposium by Viscount Lymington, Sir Albert Howard, C. Henry Warren, Adrian Bell, Rolf Gardiner, Dr. L. J. Picton and Prof. Sir George Stapledon. Collected and edited, with an Introduction, by H. J. Massingham. Pp. vi+154+81 plates. (London: B. T. Batsford, Ltd., 1941.) 10*s*. 6*d*. net.

IN this book Mr. Massingham has collected a series of essays by well-known agricultural writers mostly belonging to the same school of thought, and he thus gives them an opportunity of restating their views on farming in relation to national life in Britain. In the main, they support what he calls the "Rule of Return", that is, the rehabilitation of the small yeoman farmer, the return of all waste products to the land, the avoidance of imports and the elimination of 'big business'; and it is recognized that this involves a "return to smaller units of social economic life and the splitting up of the swollen topheavy communities squeezed into huge towns".

The advantages of small-scale general farming on our own soil, it is claimed, are so overwhelming that one wonders why it has not prospered here. Lord Lymington criticizes our present methods and states that "subnormality in health and degenerative disease are the average in this country" and this can only be cured by a general return to the land. Sir Albert Howard's solution is a more widespread adoption of the Indore method of making compost, which is based on the wisdom of the East: "in the Orient a fertile soil always means healthy crops"; we should, he says,

retrace our steps and discard the use of artificial fertilizers "which history will condemn as one of the greatest misfortunes which has befallen agriculture and mankind". Facing this page is a good photograph showing the application of artificial manures in preparation for wheat on what looks like a very well-run farm.

Mr. Warren recognizes that we must continue to import corn but must also continue to grow it, and he argues in favour of a subsidy for keeping land in good heart rather than for particular crops. Mr. Rolf Gardiner gives a spirited account of the self-contained estate, which is a better unit than the self-contained farm, being larger and more comprehensive ; but he cites no example that he can commend although several landowners have actually tried this method. Sir George Stapledon makes some calculations showing what might be achieved if the grassland of Great Britain were fully improved. Mr. Adrian Bell claims that the small family farm maintains the highest standard of fertility, yet admits that the sons try to get away from it.

That brings us at once to the crux of the problem. You may argue as much as you like with a young countryman about the joys of a peasant's life (which you are obviously not leading yourself), of the delight of working in the field from morning until night, of walking behind the plough, of swinging the scythe, etc. He is not interested. His idea, if he stays on the land at all, is to drive a tractor and let *that* do the work, to have a short day and abundance of leisure. It is unfair to blame the system of education for this ; the responsibility is with the motor-cycle and the motor-bus, that take the young countryman into the town and show him how the machine and the scientific appliance can shorten the day's labour and at the same time increase the day's output. This has been the direction in which our agriculture has moved, thanks to science and engineering, and it has given our farm workers a higher output, better remuneration and easier conditions of life and labour than any others in Europe.

But the picture has another side ; the output per acre in Britain has been low. In a general way there is often an inverse relation between output per man and output per acre, but this is not essential ; and the great problem confronting British agriculture now is to raise the output per acre while maintaining or increasing the output per man, and it should be possible to do this without going back to peasant conditions.

E. J. RUSSELL.

SUGAR REFINING

Technology for Sugar Refinery Workers

By Oliver Lyle. Pp. 401. (London : Chapman and Hall, Ltd., 1941.) 15*s*. net.

THIS book gives a comprehensive account of the manufacture of refined from raw sugar. The author apologizes for his frequent reference to the refinery at Plaistow Wharf, but the apology is unnecessary since the author's experience at that factory gives him the opportunity of tracing the development of the industry during many years.

Short chapters are devoted to chemistry and physics in so far as these subjects are related to sugar refining. Full descriptions are given of steam boilers, electrical plant, pumps, evaporators and vacuum pans used in the refinery and there are detailed accounts of the successive stages of refining—filtration, char treatment, evaporation, boiling to grain, etc.—and of the methods of systematic control of the factory efficiency. In the refining process as carried out at the Plaistow Refinery, the total loss of sugar during a recent six-months period was only 0·7 per cent, a figure which speaks volumes for the efficiency of modern refining especially in view of the fact that most of the sugar is turned out as refined sugar of 99·9 or 99·95 per cent purity. The technical part is followed by an account of the transactions involved in the buying of raw sugar and sale of the refined article.

Very few mistakes have been noted in the text and only two are serious enough to warrant mention. On p. 72 it is stated that of the two rays into which light is separated by Iceland spar, one is plane-polarized and the other is ordinary light ; actually, of course, both rays are plane-polarized at right angles. On p. 106 it is stated, in effect, that coal differs from wood and vegetation only in having undergone compression !

The author makes a very justifiable protest against the claim that glucose is preferable to sucrose as a food ; this claim, developed in the first instance by advertisment, has unfortunately been accepted by many medical men.

The book is well printed and the illustrations are numerous and excellent.

LEWIS EYNON.

Bainbridge and Menzies' Essentials of Physiology

Ninth edition, edited and revised by Prof. H. Hartridge. Pp. x+687. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1940.) 16*s*. net.

"BAINBRIDGE AND MENZIES" first appeared in the early days of the War of 1914–18. It rapidly made headway and now rightly holds place as one of the standard text-books for the teaching of physiology. This, the ninth, is the fourth edition for which the present editor has been responsible.

Although this new edition has not demanded the extensive changes in subject-matter apparent in the last, the introduction of a considerable amount of new material has still been necessary. Nevertheless Prof. Hartridge has retained the same limits of length and size, a task which must have entailed laborious detail in revision. He has, further, continued the same plain method of presentation in distribution of content, in paragraphing, in type of illustration and in make-up generally, laid down by the original authors.

The book suffers from the defects of its title; indeed it always has. For the limits of its mere length impose mechanical restrictions calling for careful selection in the compression of material and in the proportionate balance given the different chapters. This is, of course, a problem which all technical writers, and in particular, teachers, have to face. In the present instance the aim of keeping "Bainbridge and Menzies" within the imposed limits has been carried too far. Both the standing and purpose of the book would well justify an expansion sufficient to allow a better balance and freer discussion. Physiology to-day is a different thing from what it was in 1914; it is scarcely reasonable to expect a volume of the same size to contain the subject as completely.

The Anatomy of the Eye and Orbit

Including the Central Connections, Development, and Comparative Anatomy of the Visual Apparatus. By Eugene Wolff. Second edition. Pp. x+374. (London: H. K. Lewis and Co., Ltd., 1940.) 31*s*. 6*d*. net.

THIS book makes a bid for a unique position both in ophthalmology and anatomy; it is easy to understand why a second edition has so soon been called for.

The subject-matter apparent in the title is fully and generously covered, the bony orbit and the eyeball, the appendages and the musculature, the vessels and the visual pathway. Mr. Wolff adds to the value of his book by his chapters on development and comparative anatomy; the latter is indeed, if choice may be expressed, one of the most attractive in the book.

The text is clearly and concisely written, seeking always a simple statement of fact, a property too often lacking in technical books; the account, for example, of the development of the iris and of the knotty problems concerned with that of the vitreous could scarcely be bettered. The neurological descriptions may also be remarked on.

Many of the numerous illustrations are original and some are really admirable; the drawings by A. K. Maxwell from sections by the author of Verhoeff's membrane may be cited as an example.

References are full and complete, and the book is well indexed.

The Calculation and Design of Electrical Apparatus

By Dr. W. Wilson. Third edition, revised. Pp. xv+240. (London: Chapman and Hall, Ltd., 1941.) 10*s*. 6*d*. net.

NO author could have had better press notices of a book than has Dr. Wilson of the earlier editions of this one and, as a natural corollary, one might say that the book has deserved every word of them.

The new edition contains additional matter and is not simply a reprint of the previous one. The two chapters on heating and fusing and on the calculation of heavy conductors have received most attention in the revision, more complete data being given on the calculation of convection and radiation losses, temperature conversion factors, time-constants, short-time ratings and conductor emissivities. In the chapter on system short-circuits a method is now given of finding the asymmetric factor and the duration of the D.C. component of asymmetric waves.

So far as heavy conductors are concerned, additional charts are included for the estimation of skin and proximity factors for bars, rods and cables, and the sizes of rectangular single and laminated bus-bars can now be ascertained by rational calculation instead of by semi-empirical methods.

Other miscellaneous data and worked examples are provided, all of which increase the value of this very acceptable book. S. A. S.

General Biology

By Prof. James Watt Mavor. Revised Edition. Pp. xxx+897. (New York: The Macmillan Company, 1941.) 4 dollars.

THE absence of a really coherent course in biology for students of general degree standard in Great Britain is probably one of the reasons for the dearth of good British text-books as compared with a large number of different American texts of which the book now before us is one of the best examples. It can be strongly recommended for the keenest students of Higher School Certificate standard, but more so should it be brought to the notice of all teachers of biology, no matter of what standard.

The book was published in 1936 and was such a success that it was necessary to reprint it five times; but the present edition is a totally new one. The pages have been increased in size and their number has been advanced by about one-sixth, with a corresponding increase in number of illustrations. The latter increase is due largely to the incorporation of a number of excellent photographs.

The author also presents a suggested schedule for a thirty-week course of practical laboratory work for the use of teachers, who are often sadly in need of guidance and who usually lack enough initiative to depart from the deadly 'type' system imposed by the prevailing examination system.

Introduction to Algebraic Theories

By A. Adrian Albert. Pp. viii+137. (Chicago: University of Chicago Press; Cambridge: At the University Press, 1941.) 10*s*. 6*d*. net.

PROF. A. ADRIAN ALBERT is well known for his outstanding research in algebra and, in particular, the structure of non-commutative algebras. His "Modern Higher Algebra", published in 1938, presented the first English text of modern algebraic theories on a purely abstract basis. In the meantime, he has been concerned with the obviously serious gap existing in the mode of thought between the intuitive treatment of the theory of equations and the essentially rigorous and abstract methods of the "Modern Higher Algebra". In spite of the attempt to bridge the gulf by the publication of several more abstract presentations of the theory of equations, Prof. Albert felt that the only satisfactory course was to provide a new introduction to algebraic theories, and the present volume is the result.

The text begins with polynomials and then passes to a full discussion of the theory of matrices with simple modern proofs. The six chapters are written with great clarity and are well illustrated by many new types of numerical exercises. The last chapter—on fundamental concepts—is a noteworthy and illuminating introduction to the study of abstract algebra. Any student who has a good knowledge of the usual theory of equations and of determinants will be able to follow the course without difficulty. To those interested in the application of the theory of matrices to statistics, economics and psychology, this book should also be very useful.

Embryology of Insects and Myriapods

The Developmental History of Insects, Centipedes and Millepedes from Egg Deposition to Hatching. By Prof. Oskar A. Johannsen and Ferdinand H. Butt. (McGraw-Hill Publications in the Zoological Sciences.) Pp. xi+462. (New York and London: McGraw-Hill Book Co. Inc., 1941.) 35*s*.

WITH the growth and rise of the modern subject of experimental embryology, renewed interest has asserted itself in regard to the 'normal' developmental phases of animals. The resulting demand is likely to be for more exact studies of the development of individual organs and parts. In this connexion the re-investigation of their intimate origins, cell by cell, seems likely to be called for. In so far as insects are concerned, the experimental aspects of their development have not, as yet, progressed very far, and at this stage a stock-taking of the position as regards the general embryology of these animals is opportune. This has been provided for in the new book by Messrs. Johannsen and Butt, who have restated the modern position of the subject in a clear and readily understandable style. Both authors have published original researches in embryology which qualify them for this task. Their work is one of judicious compilation and the unbiased assessment of conflicting views: in both these respects it has been ably accomplished.

The book is divided into two parts, of which Part I is a general comparative account of the development of insects and myriapods. This part also includes a useful chapter on experimental embryology, based on a review of the subject by Richards and Miller, published in 1937. Short chapters on polyembryony and parthenogenesis and on micro-organisms in the egg are also included. In Part II the embryology of leading types of the different orders is described. Thus, for the Orthoptera the work of Roonwal on Locusta is freely drawn upon both for figures and textual matter. For the Coleoptera the junior author's account of the weevil Brachyrhinus forms the basis, and for Scolopendra, Heymon's well-known memoir provides the necessary data. These several accounts contain very adequate illustrations and at the end of the book there is a bibliography of more than 700 references.

The letterpress is well up to date, and it is pleasing to see so much attention paid to the findings of recent research. By way of criticism certain features require mention. The account of the Myriopoda is disappointing on the whole, especially with reference to the Diplopoda. Also, the authors' attention is invited to their use of unfamiliar group names such as Oligoentomata, Aptilota and Oligonephridia, which are left undefined and are likely to confuse the student. These are minor blemishes in a thoroughly sound text-book.

A. D. IMMS.

The Tutorial Algebra

By Dr. William Briggs and Prof. G. H. Bryan. Fifth edition, revised and re-written by Dr. George Walker. Vol. 1: Intermediate Course. Pp. xv+457. (London: University Tutorial Press, Ltd., 1940.) 7*s*. 6*d*.

THIS is the fifth edition of a well-known book written originally as a text-book for students taking the London intermediate and degree examinations. In consequence of the many changes which have taken place in the mathematical syllabuses prescribed for these examinations, as well as the improvement in teaching methods, it became necessary to revise completely and extend the scope of this work. It has thus been expanded into two volumes of which the book under notice is volume 1.

This covers all the algebra required for the London intermediate examinations except that for economics. It begins with the theory of indices and elementary ideas of complex numbers. The usual course is then followed up to the binomial theorem, interest and annuities. The sections devoted to equations are especially noteworthy and comprehensive. Particular stress is rightly laid on the functional notation and attention is early directed to the properties of partial fractions. Exercises in abundance, with answers, are supplied for the student's practice, and many of these have been taken from recent examination papers. Special emphasis has been laid on the diversity of types of examples, and a large number have been fully worked in illustration of the text.

The book is very attractively bound and the printing is very clear. It should prove very useful to students of algebra whether reading for the relevant examinations or not.

DEVELOPMENT OF HEAVIER-THAN-AIR CRAFT

By The Right Hon. J. T. C. Moore-Brabazon, P.C., M.P.
Minister of Aircraft Production

GLIDING flight, so patent to all watchers of Nature, seems to have been neglected through all the ages. There was little reason why efficient gliders could not have been constructed with the materials at the hand of many preceding generations, and had this been pursued with vigour the high-efficiency glider might well have come into use and the motive power required deduced therefrom to get sustained flight. The early pioneers of gliding flight never reached a glide of one in ten, but Lilienthal, Chanute and others were getting near that angle when the Wright brothers with their flexible biplane, controlled fore and aft aerodynamically instead of by transference of weight, showed a real advance in stability and the possibility of the introduction of an engine.

December 17, 1903, marks indeed a very great day in human progress and no credit is too high to pay the two Wright brothers for the tremendous concentration that they must have devoted to the construction of this machine, for not only did they construct the actual machine but also in fact, built an engine—no mean feat—which after gearing down by chains to two large-sized propellers, gave the necessary propulsive power to sustain flight. It is interesting to note that in the Wrights' patent their claim was for lateral stability. By gliding experiments they had found that putting extra warping on the depressed wing did not restore the aeroplane or glider to horizontal unless it was accompanied by rudder to force it to maintain its speed. The control for this was complicated, the rudder and side control being put on one lever, which was soon, however, found inconvenient. What is remarkable is the hiatus between the original experiments at Kitty Hawk and the demonstration of sustained flight which the Wright brothers gave in the United States and in Europe as late as 1908—five years. This latter machine, judged by the original which is now in the Science Museum, had become more robust, the under-carriage stronger and the engine more powerful, but generally the same scheme was adopted with the tiresome launching by virtue of reposing the machine upon—so to speak—a type of sleeper on roller skates which ran down a single rail pointed in the direction from which the wind was coming. Acceleration down this rail was accentuated by a weight hoisted in a pylon falling, it being attached round the end of the rail through a pulley and back to the machine. Acceleration to about 45 m.p.h. was obtained in 90 ft. by virtue of the kinetic energy of the weight and push of the propellers.

Analogous experiments had been proceeding in Europe. Santos Dumont had obtained a flight of about 100 metres with a vast dihedral biplane with no lateral control, of a very big box type with control in pitch for'ard. This flight took place in 1906. The propelling power was a very remarkable engine built by Levavasseur, a genius in design. The propeller was coupled to the engine shaft, but the engine was very remarkable for those days. It was an eight-cylinder V type. It had copper-deposited water jackets and fuel injection—an engine in fact twenty years ahead of its time. It was with this engine, however, that Farman in Paris with a biplane built by Voisin, again with no side control but with a stabilizing tail and single horizontal rudder in front, won the Archdeacon prize for a sustained flight of a kilometre in 1908. I flew several of this type ; they were unstable in pitch and laterally uncontrolled.

The only outstanding aeroplane in those days from an aerodynamic point of view was the Antoinette, which was flown by Latham. Here again Levavasseur designed not only the engine but also the aeroplane, introducing steam cooling, a thing we have not yet reached in modern practice. This machine in its day was, I think, the most graceful, being a centrally winged monoplane, and it was a pity that it did not go down in history as the first machine to cross the Channel, as twice Latham failed by a matter of a few hundred yards.

There was a general attack upon flight in Europe by a succession of more and more powerful engines on singularly inefficient aircraft ; exception might perhaps be made to the Bleriot, a light type of monoplane with warping wings, open fuselage and tractor screw. This historical craft that crossed the Channel was driven by an Anzani three-cylinder engine, but never again did this engine or one of similar type run for such a long period as when crossing the Channel, the reason being that it was kept cool and avoided overheating by virtue of a rain-storm which cooled it !

The next important contribution along the lines of excessive power rather than aerodynamic efficiency was the introduction of the radial engine of a rotating type, not the non-rotating radial as we see to-day. This was the famous Gnome engine. It had seven cylinders, exhaust valve on the top, and gave roughly about 40 h.p.

at 1,100 revs. per min. At first the amount of lubricating oil that was wasted by escaping centrifugally through the exhaust valve made the consumption of lubricating oil almost equal to that of the petrol. Somebody cleverly suggested the use of castor oil, which has the peculiarity of getting stickier the hotter it gets, and from that moment there existed an engine which was certainly comparatively reliable and successful.

Many remarkable flights were made with this engine, including the first London to Manchester by Paulhan and the glorious failure by Graham-White in the same competition. This was a great engine which contributed very much towards flight in Europe. Speeds, of course, had increased by now—and I am referring to 1910–11—from about 45 m.p.h. to 60 and 70 m.p.h. and the general trend was towards the monoplane type of construction in order to avoid parasitic drag. Seaplanes had come in by now and the Schneider Cup —the blue ribbon of seaplane racing—was won by that type of machine. The monoplane fetish was, however, completely upset by Tommy Sopwith's attack on the Schneider Cup, when he appeared with a biplane (1914) and had at least thirty-five miles up his sleeve. Again we were back to biplanes.

No great advance from the point of view of use—apart from exhibition—had been made until the outbreak of the War of 1914–18 when there was a tremendous concentration, regardless of economy or anything else except the war outlook, on aircraft in general. Some very remarkable machines and engines were constructed under pressure during that War. Machines jumped in horse-power from 50 to nearly 500, and they were exceeding 120 m.p.h. towards the end with regularity. The outstanding machines of the War were the Bristol Fighter, a biplane fighter—reconnaissance machine as we would call it now, two-seater, with engine, a Rolls, rather high up between the two planes; the Handley Page big bomber; and among fighters, the S.E.5, Sopwith Pup and the Camel. It is interesting to note that the 'pusher' type of machine was still favoured by some. The general trend of engine design on the British side at any rate was the multi-cylindered type, whilst the Germans concentrated on big six-cylinder units in line. The mushroom growth of aviation forced upon the world by war caused a very great reaction afterwards. Great Britain threw away her predominance in the air, and there was not very much imagination shown towards the possibility of joining the Empire closer together in time by virtue of flight.

Holt Thomas certainly had vision but no machines. He endeavoured to run a service to Paris and elsewhere on the Continent with old war machines, but the enterprise failed. But the idea that civil aviation had a future was born never to be killed. Generally it was realized, however, that civil aviation could not, in the words of the present Prime Minister speaking at that time "fly by itself", and subsidies throughout the world were started in order to foster civil aviation. But most nations spoke with their tongue in their cheek because fostering civil aviation meant, in fact, fostering an aviation industry built to make war machines. In fact some countries deliberately used war machines for civil purposes in order to find a use for them. Germany developed a very intensive internal non-economical commercial service in that they were not allowed war machines, but they were potential war machines. Great Britain started building two-engined heavy machines, but of vast surface with light wing loading—notably the Heracles built by Handley Page, slow, but a reliable money-making attempt at civil aviation.

However much various governments strove to get advanced with the ideal bomber, the real advance in aviation and especially in civil aviation came from the intense local competition which was being waged in the United States—a country ideally situated for long-distance air transport—among the various companies operating there in conjunction with manufacturing units.

Just as the Mercedes car suddenly emerged upon the motoring world five years ahead of anything else, so in aviation the Douglas machine marks an epoch in development. Here for the first time we had a machine completely clear of extraneous speed-reducing impediments. It was a skin-stressed machine, twin engine, tractor, of beautiful lines and of great comfort, and had three outstanding aerodynamic advantages: first of all the variable pitch propeller, which enabled it to get off with little run by virtue of low gearing the propellers and after attaining height increasing the pitch. It had a retractable under-carriage which in the realms of 200 m.p.h. meant a very great saving in drag and increased the speed for power. It had flaps which enabled the machine when they were depressed to take up a very coarse gliding angle, and allowed a machine so beautifully faired to come to rest in quite a small field, without running on. This machine was built ostensibly to serve the world, but is to-day the prototype for every long-range bomber. It is indeed a tragedy that a machine designed entirely for civil purposes should turn out in fact to be the ideal long-range bomber.

The radial engine and the liquid-cooled still continued to fight their battle for supremacy. The horse-power now is in the range of 2,000 and weights round about a pound per horse-power. Liquid coolers have the advantage of small frontal area; radials are simpler by virtue of air cooling. Height has now become a necessary part of engine

design, and here we find that it is not a function of power alone but of maintaining power at height by boost. Various boosts have been introduced on engines varying between the two-stage, two-speed blower, to the exhaust-driven turbine type.

I suggest that the future economical cruising stratum will be in the neighbourhood of 35,000 ft. If that is to be the right level then passengers cannot be asked to put up with the barometer at less than 6 in., so that pressurized cabins suitably heated and pressed will become the standard order of the commercial machine.

Long-range bombers have drifted into the four-engined type of great reliability with speeds up to 300 m.p.h., but they are voracious petrol eaters. Single-seater fighters with engines of 2,000 horse-power with wings not too heavily loaded, so that manœuvrability is not impaired, exceed the 400 m.p.h. mark. That is where we are to-day.

How all this is to be exploited for the benefit of inter-communication afterwards is difficult at present to say, and it is not clear how loads can in fact yet pay. We have perhaps come to the definite end of a type again, and it is not certain whether the tractor will eventually survive against the pusher, or whether present power units, with their big disk area propellers, are the end of the story. Aeronautics is now a science and development will not stop. There are great possibilities looming ahead, revolutionary in character ; but the present situation may be prolonged by a great increase in wing loading with assisted take off.

Here is a brief résumé of the results of those first experiments by the Wrights. (Mr. Orville Wright celebrated his seventieth birthday on August 19. See NATURE of August 16, p. 191.) It is indeed the duty of man to see that what the Wrights first introduced—one of the greatest inventions and contributions to mechanical science—is eventually used for the benefit of the world and not for the destruction of civilization. We cannot blame the Wright brothers for the prostitution of their invention that has taken place. Those of us who knew the two brothers will always cherish affection for them and the memory of two remarkably quiet, charming people. It will be for succeeding generations to prove that they introduced into the world, not a curse, but a means of transport which will eventually bind nations together on a basis of mutual understanding and goodwill.

CROP DAMAGE BY AIR ATTACK

By Sir John Russell, F.R.S.
Rothamsted Experimental Station

TWO possibilities of damage to crops by enemy action are now so near that warnings have been issued along with instructions showing what is to be done should the necessity for action arise. The Ministries of Home Security and of Agriculture have sent out to farmers three leaflets giving simple but precise methods for coping with attempts to destroy our crops either by fire or by poison gas.

In regard to fire, the problem is an old one in Australia and in Canada, so that a certain amount of experience is already available. In both countries the prairie or bush regions are liable to become very dry during periods of drought, and a spark or even a cigarette end may start a conflagration that races over miles of country, causing havoc wherever it goes. I shall never forget the Australian bush fires in the summer of 1938–39 (December and January) ; they were impressive beyond words, and one marvelled at the skill and courage of the Australians in facing up to what seemed irresistible devastation, gradually limiting and finally subduing it. In Great Britain experience is far more limited, and except for occasional fires started by picnickers or campers in young forestry plantations, the only fires ever seen in British fields are those caused by sparks from railway engines. But, small as it is, this experience is invaluable at the present time, and has clearly been drawn upon in the preparation of these pamphlets.

The reason so few field or forest fires are seen in Great Britain is, of course, the unsuitability of the climate. Occasionally, it is true, we get a summer where crops and grass dry up and look as if they would burn easily. 1940 was an example, and it is fortunate for us that the Germans made no large-scale attacks then. 1941 has been much wetter, and nothing could have fired the crops this summer. In spite of this, however, the Ministries are taking no risks, and are issuing instructions should the case arise.

Greenleaf crops are obviously exempt from risk, and the only danger might come to cereals. Oats are usually cut before they are dead ripe, and they normally still contain so much sap as to be non-combustible ; no danger arises from railway-engine sparks, and it may be assumed that incendiary

leaves or bombs would be harmless. Wheat is left longer and dries out more: it does not usually, however, become dry enough to burn easily, and railway-engine sparks rarely set a wheat field on fire. Barley, however, is generally left until it is dead ripe, and becomes drier than any other of the cereals, hence it is most likely to catch fire. Even so, barley fires are not very common, considering the number of barley fields in the country, and the total loss of standing corn is not great. As barley fields are scattered in among oat, root and grass fields, the danger of spreading, even if a fire should start, is only small.

The most serious risk is on the stubbles, if very dry weather should set in after the harvest. The short residual straw easily dries sufficiently to become inflammable, and if a fire starts it creeps over the field. There is no harm in that, so long as the fire keeps to the stubble; even some good may result if the heat is sufficient to kill insects and their eggs, and to destroy fungi and weed seeds; also the heating of the soil liberates plant food. But if sheaves of corn are still standing out, or if a stack of corn or of hay has been built up in the field, then there is danger that it may be set on fire.

Fortunately, Australian and Canadian experience shows how to give protection: the stubble should be ploughed up as speedily as possible, or if that be impracticable, then strips must be ploughed so as to divide the field into compartments; if a fire starts in one of them it can go no farther. Stacks must be well isolated from each other and from the stubble; they are best put in grass or root fields, but if they must be in a cereal field they should be surrounded by a belt of ploughed land.

Hedges also are liable to catch fire, especially if they contain much dry material at the bottom, as not infrequently happens. The precaution here is to keep the hedge well cut back and well cleaned.

In view of the fact that most of our grain is grown in the dry parts of England, the amount of water available for putting out a fire may not be great. Methods are indicated in the leaflets for organizing water supplies, and making such arrangements as are possible beforehand for facilitating action when the fire comes. Beating is effective, and although many parts of the country-side are familiar enough with the simple form of this operation that suffices for dealing with gorse and heather fires, a serious field fire would need more elaborate precautions, and these are duly described.

This fire danger has attracted the attention of a number of the farmers' organizations. The Hampshire Branch of the National Farmers' Union has issued recommendations which include such important details as the cutting and ploughing up of fire breaks through standing crops across the direction of the prevailing wind, but emphasizes the need for organizing groups of fire watchers and helpers, since the first minutes are always the most important.

The danger from gas is more oppressive because it lies right outside the countryman's experience, and every untested danger seems terrifying until it has actually come. It might not come at all, and if it does, it might prove relatively harmless. Certainly, the bombs that caused so much fear in the country-side before they arrived were treated with scant respect once it was seen how little damage they do in a field: a hole that is quickly filled in, or a fence that is soon mended, and all signs are removed. Many farm-workers have spoken contemptuously of the bombs: "They didn't even kill a rabbit" was a common phrase, and there was great relief at finding that the much-vaunted terror had so little substance. There is, of course, a world of difference between an open field and a crowded city.

It is possible that gas bombs in the fields would be equally innocuous, but the Ministry has set out instructions as to what should be done if they come. As the instructions cannot cover every possible case, the first and chief one is to get in touch promptly with the gas identification officer of the local authority.

Only persistent gases are considered likely to do serious harm, and of these the blister gases are the most important, especially mustard gas; but it is stated that still further caution would be needed against lewisite, on account of the risk of arsenic poisoning. Two modes of distribution are dealt with: by bombs and by spraying; bombs cause intensive contamination over a small area, and spraying a less intense contamination over a larger area. The crops become discoloured or scorched in appearance, and some of the liquid may remain either on the plant or on the soil; mustard gas has a faint, rather onion-like smell, while lewisite sometimes, but not always, has a smell of geraniums. The instructions to the farmer are quite simple: he must keep human beings and animals out of the affected areas, and get in touch with the local A.R.P. authorities, who will presumably have access to experts able to give fuller advice. Visibly damaged crops should not be fed to animals, though if grain crops survive and continue to grow, the expert might advise that they could be used as seed.

Stored crops usually present less difficulty. The usual protective agents, clamps, thatch, barns, and tarpaulins are said to be adequate against blister gas, and nothing more than prolonged airing is needed to overcome the trouble. Concrete silos

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(Founded 1877)

(Incorporated by Royal Charter, 1885)

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Applications are invited for the post of Head of the Electrical Engineering Department. Candidates must be University Graduates in Engineering and have had thorough practical training in Electrical Engineering and experience in lecturing. Salary scale £600 to £650 per annum. The salary covers service in both Day and Evening Classes.

The Engineering Department of the College co-operates with the University of Aberdeen in providing Degree Courses in Engineering. The occupant of the post is normally a part-time lecturer in the Department of Engineering of that University.

Ten copies of letter of application and ten copies of not more than three recent testimonials should be lodged not later than Saturday, August 30, 1941.

JAMES McKENZIE,
Secretary and Registrar.

IMPERIAL BUREAU OF ANIMAL BREEDING AND GENETICS, EDINBURGH

ASSISTANTS REQUIRED

One on £300-£15-£390. Graduate in agricultural or veterinary science, or zoology, or physiology, with special knowledge of animal genetics and physiology and knowledge of some European languages.

One on £250-£12 10s.-£300. European languages, especially Russian and Eastern, with some scientific knowledge of animal genetics or physiology.

In both cases some experience in abstracting an advantage.

Applications, giving qualifications, experience, and references, to be sent by September 15 to the Deputy Director, Imperial Bureau of Animal Breeding and Genetics, King's Buildings, West Mains Road, Edinburgh, 9, from whom further information can be obtained. Appointments end September-October.

UNIVERSITY OF BIRMINGHAM

Appointment of Grade II(b) Lecturer in the Department of Mechanical Engineering

Applications are invited for the post of Grade II (b) Lecturer. Stipend £400 per annum. Duties to begin October 1, 1941.

Four copies of application, together with four copies of not less than three testimonials, must be sent on or before September 6, to the undersigned, from whom further particulars may be obtained.

C. G. BURTON,
Secretary.

The University,
Edmund Street,
Birmingham, 3.
August 1941.

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Principal: Dr. J. W. Whitaker, F.I.C.

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Applications are invited from graduates or candidates with equivalent qualifications for Research Scholarships tenable for two or more years. The scholarships vary in value from £75 to £150 per annum and are tenable in the Department of Coal Tar Colour Chemistry and/or other Departments of the College. The scholarships are open to candidates of either sex.

Further particulars may be obtained on application to the Principal.

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Applications are invited for the post of physicist to undertake work on stereotyping flongs in which problems connected with elasticity and plasticity are involved. Initial salary £252-£325 according to experience and qualifications. Participation in Federated Superannuation System for Universities.—Applications, giving particulars of age, qualifications, experience, etc., to Director of Research, 101 Princes Gardens, London, W.3.

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J. CAMERON SMAIL,
Principal.

UNIVERSITY OF MANCHESTER

PHYSICS DEPARTMENT

Full particulars of the Lectures and Laboratory Courses in Physics, preparing for both the Ordinary and Honours Degrees, will be forwarded on application to the REGISTRAR.

The SESSION COMMENCES on THURSDAY, SEPTEMBER 25.

UNIVERSITY OF MANCHESTER

CHEMISTRY COURSES

A Prospectus containing full particulars of the LECTURES and LABORATORY COURSES qualifying for the Degrees in Chemistry will be forwarded on application to the REGISTRAR. Applications for admission to the Research Laboratories should be made to the DIRECTOR of the Chemical Laboratories.

The Session commences on Thursday, Sept. 25.

R.A.F. EDUCATIONAL SERVICE

Vacancies exist for men graduates aged 32-50 with substantial qualifications in Mathematics or Geography. It is not desired that men over the age of 35, who are already engaged in full-time teaching service, or men below that age whose calling up under the National Service (Armed Forces) Acts has been deferred to enable them to continue in full-time teaching service, should apply for these vacancies. Candidates appointed will be given commissions in the R.A.F.V.R. and will wear uniform. They will, however, be on civilian conditions of service. Those whose names are not included on the Central Register, Ministry of Labour and National Service, should apply on a *POST-CARD* for particulars to:—The Under-Secretary of State, Air Ministry (E.S.1), Dept. Q.J., London. Those whose names are on the Central Register should apply through the Central Register (Section G.), 41 Tothill Street, London, S.W.1.

The Association of Scientific Workers

announces an

OPEN MEETING on

"SCIENCE & THE SOVIET UNION"

Speakers:
DR. JOSEPH NEEDHAM
DR. MARTIN RUHEMANN
and others.

FRIDAY, AUGUST 29, 6.30 p.m.

CONWAY HALL, Red Lion Square, W.C.1.

Metallurgical Interpreters required by Foundry Engineers in South-East London to interpret features observed in radiographs of light alloy castings and the correlation of these observations with variations in foundry practice. Candidates must be educated up to Inter B.Sc. standard and have a general knowledge of metallurgy or foundry work. Actual experience of X-Ray technique not essential. Salary £4 10s. per week.—Apply in writing, stating if registered at any office of the Ministry of Labour and National Service, to the Supplementary Register, 4 Gt. Marlborough Street, London, W.1, quoting order M385.

Imperial Chemical Industries Ltd. (Dyestuffs Group) require an experienced Rubber Physicist for research work in their Manchester Laboratories. Candidates, who must be of British nationality, should apply in writing to the Staff Section, Hexagon House, Blackley, with full particulars of qualifications, experience and salary required.

Abderhalden's Handbuch der Biologischen Arbeitsmethoden: INDEX BIOLOGARIUM: BEILSTEIN'S HANDBUCH: MELLOR'S TREATISE; 16 vols.: CHALLENGER EXPEDITION REPORTS.—Complete Sets wanted by the MUSEUM BOOK STORE, LTD., 45 Museum Street, London, W.C.1.

Wanted: Abbé Appertometer and Test Plate. Good price given.—Vaughan, M.P.S., 56 Bexhill Road, S.E.4.

Diffraction Grating wanted in Speculum or Glass. Please state size, lines per m.m. and price.—S., 16 Southfields Road, Eastbourne.

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give complete protection, so long as the top is closed, but wire and paper silos may not always prove adequate, and a certain amount of dismantling and cutting out may have to be done. Stack or clamp silos afford no protection, and any part that has been splashed or sprayed must be removed and destroyed. Running water is safe, and need cause no anxiety, but water in shallow ponds or storage tanks, if contaminated with blister gas, may remain dangerous for long periods.

Naturally, one hopes that these particular dangers may never arise, but it is comforting to realize that if they should the Ministries of Agriculture and Home Security are alive to the possibilities, and that farmers have been forewarned and advised as to what steps they should take.

DRUG PLANTS NATIVE TO GREAT BRITAIN

By Dr. W. O. James

Botany Department, University of Oxford

APART from herbalist simples, there are some half-dozen or so plants of Europe and the British Isles which yield drugs of first-class medical importance. The annual consumption of Great Britain runs into hundreds of tons of crude dried material, almost the whole of which normally comes from the Continent, particularly from Belgium, Germany, the U.S.S.R. and the Balkans. Consumption is not limited to the requirements of the people of Great Britain. A re-export trade of refined drugs exists on a considerable scale and, since this largely goes to the western hemisphere, and is economical in its demands on cargo space, there is point in trying to keep it alive at the present time.

First, however, must come home needs. The Ministry of Health has issued several pronouncements stressing the importance and urgency of the question of supply and, through its Vegetable Drugs Committee, has reviewed the situation and made certain cautious recommendations.

Serious shortage already exists of some of the drugs in question, a situation which had its parallel in the War of 1914–18. The steps taken then were only partially successful, but should afford some useful background of experience now, though it is too early yet to say whether the implied lessons have been learnt.

The steps open to us include collection of wild plants and increased cultivation. Each is very narrowly restricted both by botanical and economic causes and will require skilful and determined handling if anything useful is to be achieved. The Ministry of Health has ruled that war-time production must remain on a commercial basis. Strictly speaking, this is impossible. It is true that the produce is being handled through the usual trade channels, but collection depends upon volunteers who can receive nothing commensurate with any normal valuation of their time and labour. This end of the effort is essentially a gift to the country—a commendable if indirect war-service—and should be recognized as such. It is being undertaken by women's institutes, women's voluntary services, boy scouts, girl guides and some schools.

Government assistance has not been lacking. The Ministry of Health has sought to give a lead, and has provided machinery for co-ordination and advice. In hard cash, grants have been given to certain famous and well-established firms to enable them to extend their drying-plant and, on a smaller scale, to the Oxford Medicinal Plants Scheme, which has been called into existence to make selections from the native wild plants, combining trials with a limited scale of present production.

It has been officially recommended by the Ministry of Health and the Medical Research Council that effort be concentrated on *belladonna*, colchicum, *foxglove*, male fern, *henbane*, sphagnum, *stramonium*, dandelion-root and valerian, with special emphasis on the four italicized. This recommendation does not seem to have received all the attention it deserves. Besides these plants of well-established therapeutic value, the flora of Great Britain contains many more which are normal articles of the drug trade, but the value of which no responsible medical man would put in the same category. Bluntly speaking, nobody is going to die prematurely or suffer great pain for lack of them, as many might suffer or die for lack of belladonna or foxglove. By no effort of the will can the harvesting of such inessentials be made to appear a significant contribution to the war effort. Nevertheless, judging from the inquiries and literature I have received, there seems to be a real danger of anxious and willing help

being dissipated upon them. Nor does it appear an adequate argument that there are districts where none of the important drug plants are to be found. In such places, which are, of course, numerous, effort would be better directed to something else; the much-besought women's institute member might better be left at her preserving-centre and her husband on his allotment.

Cultivation is limited to the 'big four', with some valerian. It has its own special difficulties and seed is not easy to come by. Moreover, the market could very easily become over-supplied if cultivation were begun by numerous growers on a large scale. It is clearly undesirable to stimulate a demand for such plants artificially, and for these reasons growing by amateurs and farmers, other than the already established specialists, has not been encouraged. The latter, however, have somewhat expanded their normal acreage.

The appeal for public assistance is concerned with collection. Within my own experience landowners have usually proved helpful and co-operative. A few wish to sell, especially where belladonna is concerned, and there have been very rare refusals of help or permission to collect.

The real crux, however, lies in the question of drying. Fresh herb as collected cannot be transported over any considerable distance both on account of prohibitive cost and of damage by bruising the leaves. Ten or fifteen miles is an extreme range and the latter figure is probably beyond it. It follows that the really worth-while effort is to get drying-sheds established in the centre of a zone thickly populated by the plant required. This puts foxglove into a class by itself. Valerian root may be collected in some swampy districts; henbane is rare in quantities large enough for commercial gathering though I have received reports of "fields full" here and there. We are able to collect a small amount of belladonna in Oxfordshire and the adjacent counties, but other resources are slender. Colchicum and male fern are locally abundant and worthy of serious attention in the west. Stramonium is only an occasional escape and inhabitant of waste-tips. The collection of dandelion root is a formidable undertaking and its use for the relief of dyspepsia, valuable though it is, is not to be compared with the irreplaceable role of digitalis as a cardiac stimulant. Foxglove, moreover, exists in abundance over wide areas which are still largely untapped. Initial results obtained by the Oxford Medicinal Plants Scheme, with the co-operation of the Botany Department at Bangor, suggest that the foxglove on the Welsh hills has an unusually high digitalis potency. An exceptional effort towards its gathering would seem to be indicated.

Everyone is agreed that drying-plant must be of a makeshift kind. There is no guarantee of a certain market for these products after the War; in fact they are more than likely to be displaced again by cheap imports from the Continent. Capital sunk in permanent drying-sheds would be sunk indeed. The temporary use of hop-kilns has been suggested; but very considerable additions of shelf-area are needed since drug plants are wetter and need much thinner spreading than hops. Consultation with a firm near Oxford made it clear that the attempt was likely to involve serious financial loss. Forced-air systems with their relatively high running costs appear to be out of the question. Occasionally, institutions are willing to allow the use of large airing-rooms with central heating. Since there is then no further outlay for fuel or shelving, this plan works to admiration. The only method of general application is that of the handyman who can knock up shelves of wood and netting in some available outhouse. When allowance is made for putting in the essential stove, the most modest attempt involves an expenditure of ten or fifteen pounds. Ten pounds is the market value of about 2 cwt. of dried foxglove leaf, or getting on for a ton of leaf as gathered—far more than such a shed could handle in a single season, and this is making no allowance for coke and other costs of operation. There is also implied a great deal of active gathering by a considerable number of women or supervised children in the field and a great deal of uncomfortably hot and tiring work spreading and turning the leaf in the driers.

Each drying-centre, small though it may be, needs the constant supervision of a man or woman of untiring and persuasive nature to keep it actively in operation. A modicum of expert knowledge is also needed, and there is much greater scope and need for the help of botanists on the spot than has yet been realized. Botanists are often exercised at the present time as to how they can turn their special training to the public good. Those of a practical turn could find something valuable and patriotically useful to do in building up and running such drying-centres. It need not be at all a routine job. Very little seems to be known about the best methods of drying, a purely empirical judgment of colour being a common basis of values. There is need for the collection of numerous data both for direct technical and more academic purposes. This amounts to a good deal more than spare-time work and can probably only be achieved as a recognized activity for a botany department. In my view, the help of many more such institutions and their personnel is essential if this war-time emergency work is to be carried out with full success.

PHYTIC ACID AND THE PREPARATION OF FOOD

By E. M. WIDDOWSON,
DEPARTMENT OF MEDICINE, UNIVERSITY OF CAMBRIDGE

NOW that something definite is known about phytic acid metabolism and about the extent to which this compound interferes with the absorption of calcium, the quantities in our daily food have become almost as important a nutritional counter as the amounts of calcium. In fact, following Harrison and Mellanby's work on dogs[1], and the experiments on men and women which have been carried out in this Department[2], it has become clear that the phytic acid/calcium ratio determines whether a diet will promote the absorption of calcium or facilitate the production of rickets. Foods have been analysed for calcium and for phytic acid, but there is another aspect of the matter which has not yet received the attention it deserves. It is known that the rat possesses a digestive enzyme which will hydrolyse phytic acid[3]. It is thought that other animals have not; and consequently it is generally assumed in human nutrition that the phytic acid in wheat and other natural foodstuffs can be broken down only by the bacteria in the intestine. There is, however, a phytase in wheat, and the purpose of this note is to show that this enzyme is active in commercial flours, and that it may destroy phytic acid during the accepted cooking processes.

Phytic acid in wheat is located chiefly in the bran, and consequently the more bran included with the flour, the greater the amount of phytic acid in it. Representative figures may be taken to be as follows:

		Phytic acid mgm./100 gm.
White flour	70% extraction	51
National Wheatmeal	85% extraction	127
Wheatmeal	92% extraction	214

The table opposite shows the destruction of phytic acid which has been found to follow the conversion of these raw materials into food. It will be seen that baking with yeast led to considerable hydrolysis, and the more refined the flour, the greater the percentage destruction. In fact, the phytic acid in white flour was very largely removed by this process. 'National' bread also contained much less than the flour from which it was made. 92 per cent flour not only contained most phytic acid, but also the percentage destruction on baking was the least.

There was very much less destruction when baking powder replaced the yeast, and there were probably two reasons for this. First, when the yeast dough was set to rise, it afforded the enzyme an opportunity to act upon its substrate before it was itself inactivated by the rise of temperature in the oven. In baking with sodium bicarbonate and cream of tartar the doughs were put into a hot oven as soon as they were mixed and the temperature was rapidly raised to a point at which the enzyme was destroyed. Secondly, the optimum *p*H of wheat phytase is in the region of 5·5[4]. The enzyme is never given a chance to act at this reaction in the usual cooking processes, but the hydrogen ion concentration of a yeast dough is much more favourable to the activity of the phytase than that of a baking powder dough. As might have been expected from the results with bread, there was some destruction of phytic acid during the preparation of a steamed pudding. This was cooked in the usual way in a pudding basin, and was of a size suitable for five or six persons, so that the temperature of its centre probably rose quite slowly. There was no destruction of phytic acid in the baking of wholemeal pastry. This was made with a dry dough and heated very rapidly.

DESTRUCTION OF PHYTIC ACID ON COOKING

Nature of flour	*Cooked product*	*% destruction of phytic acid*
White (70%)	Yeast bread	85
National Wheatmeal (85%)	"	69
Wheatmeal (92%)	"	31
" "	Baking-powder bread	5
" "	Steamed pudding	16
" "	Pastry	0
White (70%) with added sodium phytate	Baking-powder bread	15
" "	Steamed pudding	60
" "	Pastry	15

The table also shows the destruction of organic phosphorus which took place when enough sodium phytate was added to white flour to make its concentration equal to that in 92 per cent flour. More phytic acid was destroyed in baking and cooking with this product than with 92 per cent flour. This may have been because sodium phytate is more soluble than the phytates naturally occurring in the wheat, but in any event there was evidently an active phytase in the 70 per cent flour. Hence, either the enzyme is naturally more dispersed than its substrate through the endosperm, or it becomes separated from its substrate by the milling processes.

The cheapest and most effective way of frustrating the noxious action of phytic acid is unquestionably to add calcium to flour, but something can evidently be done by cooking in a suitable manner. It is hoped that these observations—in the present emergency or later—may find some application to the service of man.

Miss B. Alington prepared most of these foods. The expenses were covered by a grant from the Medical Research Council, and the author is in the whole-time service of the Council.

[1] Harrison and Mellanby, *Biochem. J.*, 33, 1660 (1939).
[2] McCance and Widdowson, Spec. Rep. Ser. Med. Res. Coun. (1941). In the press.
[3] Patwardhan, *Biochem. J.*, 31, 560 (1937).
[4] Kolobkowa, *Biochimia*, 1, 512 (1936).

A CLASSIFICATION OF THE EOLITHIC INDUSTRIES OF ENGLAND

By J. Reid Moir, F.R.S.

IN view of the considerable number of discoveries made in England of eolithic implements of various kinds, it seems desirable to attempt a classification of these artefacts, as a first step towards that which has been made of the later palæolithic industries. There is no doubt that the original classification of these implements was of great value as enabling us to visualize the main stages of palæolithic man's existence, and the great length of time absorbed during the ebb and flow of his material advancement. Though the late Prof. Rutot of Brussels published, many years ago, a classification of the eolithic industries found in Belgium and France, no attempt has, hitherto, been made to classify the English eoliths—the study of which remains in the unsatisfactory state of the palæolithic artefacts in pre-classification days.

It is necessary, however, to point out that the classification of the English eoliths must differ in an important manner from that which has been formulated for the palæolithic industries. In the case of the latter many actual 'floors', or sites of occupation, have been found resting upon, and covered by well-known deposits of which the geological age has been ascertained. Though very ancient, the palæolithic races lived near enough to our own time to make it possible for some of the beds in which certain of the land surfaces on which they lived, were embedded, to survive the intense, destructive geological agencies which have operated since these beds were accumulated. Thus it has been found possible to fix, with considerable accuracy, the geological age of certain palæolithic 'floors' in England. But, in the case of the eoliths, the passage of time since they were made has been so extended that the deposits in which they were originally embedded have, in England, long since been destroyed, and the eolithic artefacts are now found only in beds composed of the wreckage of these older deposits.

The Suffolk Bone Bed, beneath the Red Crag, is a typical example of such a *remanié* accumulation, and contains, in addition to the bones and teeth of land mammals of late Miocene and Pliocene age, together with certain pieces of fossil bone artificially shaped, no less than five groups of flint implements which, by their differing patinations, and re-worked examples, can be recognized as of different ages[1]. As these remote relics of man are found, almost exclusively, as derivatives in the Suffolk Bone Bed, of Upper Pliocene age, it follows that their makers must have lived in some at present unspecified period, or periods, prior to that in which this bed was accumulated. There would appear to be six eolithic stages represented in England—though more may eventually come to light—and these are as follows :

(1) *Kentian.*—The Kentian specimens were first found by Benjamin Harrison in and upon the high plateau gravel of Kent. They are made, chiefly, from naturally produced pieces of flint of tabular form, which have been modified by steep flaking along their edges, causing them to assume the shapes of points, borers and scrapers of more than one type. For many years after their discovery the age of the Kentian eoliths, though regarded as, in all probability, very great, remained unknown, but it is now apparent that another series of eoliths, the Cantalian, found at Aurillac, Cantal, in central France, resembles the Kentian artefacts so closely that it is reasonable to suppose they are of the same age[2]. The geological deposit, a gravel, in which the Cantalian eoliths occur, is fortunately known, and referable to the Upper Miocene period. The following five groups of eoliths were found in the Suffolk Bone Bed beneath the Red Crag.

(2) *Bramfordian.* The Bramfordian specimens were discovered, most frequently, in Coe's pits, Bramford, near Ipswich. The colour of the majority of the flints is a peculiar archaic-looking, washed out yellow, while they exhibit signs of

much rolling by water action and heavy striation. The Kentian tradition is very clearly marked in these specimens, which, however, show an advance in technique as they are often made from primitive flake implements exhibiting steep edge-flaking. Rostro-carinates are present in this group.

(3) *Boltonian.* The Boltonian specimens occurred most freely in Bolton and Co.'s brick-field, Ipswich. The prevailing colour of the flints is a rich chestnut brown carrying a well-marked gloss, and they show considerably less signs of rolling and striation than the Bramfordian series. The implemental types are also much more varied and advanced than those of the latter specimens, and comprise rostro-carinates, points, racloirs, scrapers, cores, etc.

(4) *Whittonian.* The Whittonian specimens are a small group, found chiefly in Coe's pits, Bramford, and Bolton and Co.'s brick-field, Whitton, Ipswich. The colour of the majority of the flints is an unusual speckled yellow, and they exhibit very slight signs of rolling and striation. A few rostro-carinates are present in this group, but the greater proportion of the artefacts are racloirs, with one or two scrapers.

(5) *Thoringtonian.* The Thoringtonian specimens equal, approximately, the Boltonian in number, and are found chiefly in the pit at Thorington Hall, Wherstead, near Ipswich, and in the cliffs at Bawdsey, Suffolk. The prevailing colour of the flints is a dense white, or cream, while some of the specimens are patinated blue. The majority of the flints are only slightly rolled and striated, while some are unabraded. Rostro-carinates are rare, while the greater number of the artefacts, which exhibit considerable skill in their manufacture, comprise points, racloirs and scrapers.

(6) *Henleyan.* The Henleyan specimens are a very small group of unpatinated, unabraded, and non-striated artefacts, found chiefly in Bolton and Co.'s brick-field, Ipswich. The predominant type is a skilfully made racloir, and from the condition of these specimens it is legitimate to infer that they were actually made at the site of discovery. No rostro-carinates are present. The titles I have given to these various eolithic industries are based upon the names of the actual pits where the specimens were found, or upon those of the immediate neighbourhood of the excavations, and it is to be hoped that they will pass into general use as have those given to the palæolithic cultures—Chellean, Acheulean, Mousterian, and so on. An examination of the groups of English eoliths must impress unbiased and competent observers as representing a slow but definite evolution of flint implements, and as forming the probable and necessary background to the earliest palæolithic cultures. It has been shown[3] that the eolithic points of the Kentian industry developed into the rostro-carinates, and these into the earliest palæolithic hand axes, and it may well be that the Stone Bed beneath the Norwich Crag in which the latter are found is the geological successor in Norfolk to the Suffolk Bone Bed in which the eoliths occur. The chronological succession of the industries from beneath the Red Crag is irrefutably established by the evidence afforded by the re-flaked specimens, while the difference in technique employed in the various pre-Crag periods seems manifest. I do not think it desirable to place the artefacts found at two superposed occupation-levels in the Red Crag at Foxhall, Suffolk, in the eolithic period. The Crag itself, as distinct from the Suffolk Bone Bed beneath it, is, I think, best regarded as of Early Pleistocene age, and it is possible that the Foxhall specimens are of the same period as those of Group 5 from the base of the Cromer Forest Bed[4] and referable, therefore, to the beginning of lower palæolithic times.

[1] *J. Roy. Anthr. Inst.*, **65** (1935).
[2] I hope to publish a special monograph on the Cantalian industry in the near future.
[3] "The Antiquity of Man in East Anglia" (Camb. Univ. Press).
[4] NATURE, **147**, 530 (1941).

OBITUARIES

Prof. E. Barnes

PROF. EDWARD BARNES, professor of chemistry at the Madras Christian College, died suddenly at the end of May 1941 at the early age of forty-nine. During the past twenty years Barnes had developed a passion for botany and utilized every opportunity for the pursuit of his hobby. He spent most of his holidays making extensive tours in the hills of South India, and even during a stay of a few days in Ceylon, when returning from leave in England, he managed to find a new species of Arisæma. Assisted by his wife, he made a close study of the vegetation in the vicinity of his camps, and this assiduous research led to the discovery of a number of new species of herbaceous plants, all of which were described in either the *Kew Bulletin* or the "Icones Plantarum".

While collecting the majority of the species he encountered, he devoted particular attention to the genera Arisæma (Araceæ), Impatiens (Balsaminaceæ)

and Sonerila (Melastomaceæ). Especially in connexion with the first-named he recorded many observations of interest, including some with reference to their relation to the insects that effect their cross fertilization. Some of his conclusions were published in the *Journal of the Natural History Society of Bombay*.

His herbarium specimens (a considerable number of which, including all the type-specimens, were presented to and are lodged in the Kew Herbarium) are particularly well selected and preserved; many retain their natural colours and some are so prepared that all the floral parts can be seen without further dissection.

Barnes's friends, besides feeling the loss of a good companion, are convinced that botanical science has been robbed of one who would have brought much further knowledge of plant life to light.

C. E. C. FISCHER.

WE regret to announce the following deaths:

Dr. John Ball, technical counsellor to the Survey of Egypt.

Mr. Claude Hutchinson, C.I.E., formerly Imperial bacteriologist, Pusa, lately chief scientific adviser in India to Imperial Chemical Industries, Ltd., on August 2, aged seventy-two.

Mr. C. Pendlebury, senior mathematical master at St. Paul's School during 1877–1910, honorary secretary of the Mathematical Association during 1886–1936, on August 18, aged eighty-seven.

NEWS AND VIEWS

Comenius Tercentenary Commemoration

JAN AMOS KOMENSKY (COMENIUS), the great Czech educational pioneer, author of the "Janua Linguarum", "Didactica Magna", and many other books, paid a visit to England in 1641. His resolute internationalism and his plan of a "Pansophic College" for co-operative scientific research were among the influences leading to the formation of the Royal Society, which, in its first form, the Invisible College, began its meetings in 1649. Unfortunately, the Civil War, and his failure to find in any other country a patron able and willing to carry out his schemes, postponed the realization of his ideas, which he never lived to see.

On October 24, a meeting will be held in the Senate House of the University of Cambridge at which the following discourses will be delivered: President Benes, "Comenius's Plans for Peace Leagues and his Place in History as a Great European"; Mr. Jan Masaryk (Foreign Minister of Czechoslovakia), "Comenius as an Educational Pioneer"; Prof. J. D. Bernal, "Comenius's Visit to England and the Foundation of the Royal Society"; Prof. Ernest Barker, "The Debt of Europe to Comenius and to Czechoslovakia". These, together with contributions from other distinguished scholars, will afterwards appear in the form of a small commemoration volume. Official representatives will, it is expected, be present on behalf of the embassies and Governments o Czechoslovakia, the U.S.S.R., Poland and Yugoslavia, the Board of Education, the Royal Society, the British Council, the Moravian Church (of which Comenius was a bishop), etc. The Tercentenary Committee consists of the Vice-Chancellor of the University of Cambridge, Mr. H. Butterfield, Prof. G. Haloun, Sir William Dampier, Prof. G. R. Owst, Mr. B. W. Downs and Dr. J. Needham, to the last-named of whom, at Caius College, any communications regarding the tercentenary should be addressed.

Photo-Electric Devices for Detecting Incendiary Bombs

THE British Standard Specification (A.R.P. Series) for the performance of photo-electric devices for the detection of incendiary bombs forms one of a series of standards prepared by the British Standards Institution at the request of the Ministry of Home Security (*BS/ARP* 60. British Standards Institution, 28 Victoria Street, London, S.W.1, 6*d*., post paid 8*d*). The alarm is normally intended to be given within or near the premises so equipped for the purpose of warning fire-watcher parties, and is not primarily designed to call the public fire-fighting services or to bring automatic fire-extinguishing equipment into action. The photo-electric devices may be of various types incorporating light-sensitive cells, including (*a*) photo-conductive cells, (*b*) photo-emissive cells, and (*c*) photo-voltaic cells. The alarm device must be battery operated and give an audible signal which may, if desired, be supplemented by a visual signal. The power supply to the alarm circuit must be obtained from a battery the nominal voltage of which shall not be less than 3, and this battery must be used exclusively for the alarm circuit. The methods of carrying out type tests, routine tests and the test after installation are described.

An appendix deals with the photo-electric cells commonly in use, namely, the selenium cell, the alkali cell and the rectifier cell. The term 'photo-electric cell' is sometimes used as a generic term to embrace these three main types of cell, together with all other devices capable of producing changes in an electric circuit by the action of light. It is preferable, however, to distinguish more clearly between the three main types. The selenium cell is the most common example of a class of semi-conductor the ohmic resistance of which is a function of the illumination to which the cell is exposed. Such cells are termed 'photo-conductive cells'. In the alkali cell there is an electron emission across a vacuum or gas-filled space, and such cells are termed 'photo-emissive cells'. When the term 'photo-electric cell' is used in a restricted sense, it usually relates to the photo-emissive class of cell. The rectifier cell belongs to a class which is termed photo-voltaic. Such cells consist of a contact between a metal and a semi-conductor, and one of the most efficient semi-

conductors for use in rectifier cells is selenium. Such cells must not be confused with selenium cells in the photo-conductive class.

Myths of Sun Snaring

In a recent paper ("Oceanic, American Indian, and African Myths of Snaring the Sun", by Katharine Luomola, Bernice P. Bishop Museum, Bull. 168; 1940) the author has made an exhaustive study of myths and magical practices for sun snaring which she has collated and analysed. In each section the stories and processes are given in full and then compared with each other and with those of the other sections, and by this method possible centres of diffusion have been determined. There are striking similarities in some of the myths, for example, in the use of a woman's hair as a snare, which tale, with variations, seems to have diffused in Polynesia from the Society Islands, and in North America from the Lake Superior Ojibwa and the Menominee.

Other myths show less resemblance and could easily have arisen independently, and on the whole the author's conclusion is that the evidence is not sufficient to show a common origin for these two areas. Similarly with the African myths and magical processes; although there are parallels between the Nandi and the Melanesians in knotting grass to retard the sun, this alone can scarcely be sufficient evidence of contact. As regards cat's-cradles, the author is mistaken in her statement that these are forbidden by the Iglulik during the winter; according to Jenness, this is the season at which they are allowed. There are two distribution maps, numerous authorities are quoted and the paper forms a useful addition to the study of sun myths.

Canadian Aerial Forestry for Burma

In the *Indian Forest Records* (Silviculture (New Series), 4, No. 1; Govt. of India Press, New Delhi, 1940), Mr. J. D. Braithwaite of the Burma Forest Service discusses the great advance which has been made in discovering comparatively cheap methods of applying aerial survey to solve forestry problems, and considers that these methods should be applicable to Burma. Burma started before India in making use of the aeroplane in connexion with the forests, for during 1924–25 the Delta and the Heinze Basin were both surveyed from the air with good results. Mr. Braithwaite relates that immense strides have been made in Canada in air work in the last ten to twelve years—strides which were to a great extent unknown even to the United States alongside. Their chief importance is their practical nature and cheapness as compared with methods in force in England, or, to quote an example given by the author, Germany, where he remarks "the scientists have got hold of both the photographic and mapping operations to such an extent that a very expensive and highly trained staff is needed to work the very delicate and costly machinery that has been painstakingly developed".

Obviously this would be as useless as impossible for the great areas of the Empire forests. It is in this simplification and cheapening of methods to which Canadian investigators have directed themselves, and Mr. Braithwaite during a visit to Canada for the purpose was able to study the work with thoroughness, as his monograph well displays. Some of the forestry problems of chief importance in which aerial survey can give the greatest assistance are (1) the problem of mapping small plantations; (2) the thinning of young plantations and an examination of the degree of stocking; (3) stockmapping, and the distinguishing of individual species in a mixed forest, from the air.

Horticulture of the Amaryllidaceae

The title of the periodical *Herbertia*, though somewhat concealing to the uninitiated, covers a concentrated scientific approach to the horticulture of the Amaryllidaceæ. It appears as the yearbook of the American Amaryllis Society (from the Editor, Dr. H. P. Traub, Orlando, Florida, U.S.A.). Vol. 7 for 1940 announces the description of two new species, *Amaryllis aglaiæ* and *Zephyranthes Fosteri*; it discusses the phylogenetic position of several groups within the natural order, and acts as a genetic record for the origins of many hybrid introductions. The first part of a large-scale review of the breeding and testing of day-lilies (Hemerocallis) further indicates the sources of various characters which have been combined to form clones of proved horticultural excellence.

A paper by Dr. A. B. Stout correlates the vigour of shoot growth with the origin of a clone, and W. M. James outlines briefly the methods of growing Alstroemerias from seed. Germination is optimum when the seed has been subjected to a temperature of 77° F. for two months, followed by one month at 50° F. The same author has also a short paper on the best conditions for harvesting and storage of amaryllid bulbs. A method of preserving herbarium specimens in their natural colours by drying in sand is described by Dr. H. P. Traub. *Herbertia* ministers to the practical cultivation of its particular group of plants; it also maintains a welcome personal character, for the pioneers of Amaryllid culture are described in biography. The volume is withal an excellent example of what yearbooks should be.

Celluloid for Cycle Accessories

One of the most interesting features in the development of the British bicycle industry during the past sixty years has been the growth of a group of specialist manufacturers whose products have had a great deal to do with the success of the modern British lightweight bicycle in the markets of the world. The *Export Trader* of August says that by careful experiment, continuous research and insistence on high quality they have produced components, parts and accessories for bicycles in steel, rubber, celluloid and other materials which, because of their lightness combined with their strength and durability, have enabled British cycle manufacturers

to turn out machines better than those of any other country.

Among this group of specialist manufacturers is the firm of Bluemel Bros., Ltd., Woolston, near Coventry. At an early stage in the firm's history the brothers Bluemel realized the advantages of the application of celluloid with its inherent lightness and freedom from dust to bicycle design, and now a large number of the accessories which the firm manufactures are made of this material. The celluloid type tyre inflator was a great success from the start. It was able to withstand the rough and tumble of every-day usage without becoming dented and thus put out of service. Its smooth and easy action is also another commendable feature. Later the Company started to produce celluloid chain covers for cycles. Celluloid mudguards have also been very successful. Quickly detachable fittings of light construction enable the rider to attach or remove them without interfering with the wheels. Celluloid cycle handles are coated with strong adhesive and only require moistening before placing on the handlebars. The 'Cushion Grip' rubber handle is very comfortable to use, although, unlike sponge rubber, it does not absorb moisture.

Recent Earthquakes

TWENTY well-established earthquakes were registered at the Swiss observatories in March 1941, and nineteen in April 1941, according to the bulletins just received. Some of these were distant earthquakes mentioned previously in NATURE, but some were local. On March 12 an earthquake was felt with intensity 4 on the Rossi-Forel scale at Lokalstoss in Andermatt. On March 28 an earthquake with intensity 3–4 was felt in Canton Graubunden, its epicentre probably being south-east of the Ortlergruppe. On March 29 an earthquake with its epicentre near Oberwallis was felt in Visp with intensity 4. The only local shock in April was apparently on April 6 and had an epicentre near Val d'Anniviers and was felt in Vissoie with intensity 5.

THE Jesuit Seismological Association of St. Louis has recently determined the epicentres of two strong earthquakes. The first shock was on January 5, 1941, with tentative calculated epicentre 2·0° S., 123·7° E. and T_0 18h. 46m. 44s. G.M.T. The depth of focus was considered somewhat deeper than normal, and this is not surprising since earthquakes from this region are often from a deeper than normal focus. The epicentre is near the centre of the island of Celebes in the Dutch East Indies. The second was on February 9, 1941, and was felt at Eureka, California. The tentative epicentre was calculated to be at 41·1° N., 125·5° W. with T_0 9h. 44m. 5s. G.M.T. and depth of focus probably near normal. It probably had the same epicentre as the earthquake of January 31, 1922, which has been described by J. B. Macelwane, S.J. (*Bull. Seis. Soc. Amer.*, 13, 13; 1923). For both earthquakes complete readings of seismograms from several American observatories are given.

Theodor Kocher (1841–1917)

PROF. THEODOR KOCHER, one of the most famous of recent scientific surgeons, was born on August 25, 1841, at Bern, where he received his medical education and qualified in 1865. After a postgraduate tour abroad he returned to Bern, where he served as Lueck's assistant and succeeded him as professor of surgery in 1872. Though there is scarcely a branch of surgery to which he did not make some valuable contribution, he is best known for his work on the thyroid gland, for which he was awarded the Nobel Prize in 1911. In 1878 he was the first to excise this organ for goitre, and afterwards performed this operation on more than two thousand cases. At an early stage of his career he recognized the value of antiseptic methods, which he was the first to introduce into Switzerland. He was one of the founders of abdominal surgery, especially as regards operations on the stomach, gall-bladder and rectum. His name has been given to a method of reducing dislocation of the humerus, an operation for inguinal hernia and numerous instruments. Throughout his life he paid constant attention to anatomy and operations on the cadaver.

Kocher's principal publications were the "Operationslehre", which was translated into English, French, Italian, Spanish and Russian, lectures on surgical infections and forms of fracture. He was also the author of works on diseases of the testis and on gunshot wounds, as well as of numerous contributions to periodical literature. He received many honours in his own country, including the presidency of the Bern Medical Society, the Swiss Medical Committee and the Swiss Society of Pathology, as well as foreign distinctions such as the honorary fellowship of the Royal College of Surgeons of England and the presidency of the German Society of Surgery and of the International Congress of Surgery held at Brussels in 1905. In 1912 in honour of the fortieth anniversary of his appointment as professor he was the recipient of a *Festschrift* which formed the 116th volume of the *Deutsche Zeitschrift für Chirurgie*. He died after an abdominal operation on July 27, 1917.

Announcements

THE following appointments and promotions in the Colonial Service have recently been made: R. W. Ford, veterinary officer, Gold Coast; T. T. Threlkeld, veterinary officer, Jamaica; B. D. Evans (assistant director), director, Royal Observatory, Hong Kong.

FIVE hundred bottles of blood serum prepared at the University of Toronto in a laboratory furnished by the Canadian Government are being sent to the National Institute for Medical Research, London, for the treatment of air-raid casualties.

BY an Order of the Committee of Privy Council, made after consultation with the Medical Research Council and with the president of the Royal Society, Mr. E. Rock Carling (senior surgeon to the Westminster Hospital) and Prof. S. P. Bedson (professor of bacteriology in the University of London) are appointed members of the Medical Research Council, in succession to Prof. G. E. Gask and Prof. W. W. C. Topley, who retire on September 30.

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.*

Terminology of Relative Growth-Rates

IT is generally agreed that the study of the rates of growth of parts of organisms in relation to the rates of growth of the wholes or of other parts is one of the most fruitful ways of advancing our knowledge of ontogenetic development. But these biological processes have stable end-results. Organisms differ among themselves in size, weight, proportions, etc., when at corresponding stages of their life-cycles. These differences are often expressible by the same, or similar, relations to those which describe developmental relative growth. Their study is one of the most fruitful ways of advancing our knowledge of phylogenetic development.

Satisfactory and generally accepted terminology for these comparisons has not yet been quite achieved. Some time ago, in these columns, Needham and Lerner[1] proposed that for ontogenetic relative growth the term *heterauxesis* should be used, with *isauxesis*, *tachyauxesis* and *bradyauxesis* to denote the cases where the growth of the part is at the same rate, or faster, or slower, than that of the body as a whole. The older term *allometry* was suggested for comparisons of phylogenetic character. It seems, however, that it is in the opinion of many desirable to have a covering term for both these comparisons, and this being so, we wish to suggest here that *allometry* be the covering term, and *allomorphosis* the term for phylogenetic comparisons. This indicates that all these differences are quantitative, but that on one hand they concern differing rates of growth in the individual, and on the other they concern different (morphological or chemical) patterns brought about by previous heterauxetic growth in the completed individual of different groups.

The following definitions may therefore be given:

(1) *Heterauxesis*, the relation of the growth-rate of a part of a developing organism (whether morphological or chemical) to the growth-rate of the whole or of another part; a comparison between organisms of the same group but of different ages and hence sizes.

(2) *Allomorphosis*, the relation of parts of organisms at some definite age to wholes or parts also at some definite age, but of different groups (races, varieties, species, genera), for example, egg-size or hatching-weight to adult size or weight.

(3) *Allometry*, ontogenetic heterauxesis and phylogenetic allomorphosis.

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[1] NATURE, 146, 618 (1940).

Ultra-violet Rays and Their Variations

WIRELESS operators have observed that the strength of signals received by them from distant stations varies from time to time. There is a secular variation which Sir Edward Appleton has shown coincides in general with the solar cycle[1]; there is an annual variation depending on the season; and there is a daily variation in which sunrise and sunset play a prominent part. These variations are, with high probability, effects of the ionization of the upper atmosphere and this ionization is, in its turn, produced by the ultra-violet rays from the sun. Observations of ultra-violet rays are of considerable interest in this connexion and have been carried on in one or two places for a number of years.

In order to allow for the effects of the lower atmosphere in absorbing radiation, Dr. Pettit's method[2] has been adopted in the following way.

Two groups of rays have been observed, one in the ultra-violet of wave-length around 3600 A., and the other in the visible region around 4500 A., and by taking the *ratio* of these the influence of the lower atmosphere may be neglected as a first approximation.

It has been found that there is a variation of this ratio which is in sympathy with the solar cycle[3]. There is also a variation in which there are high values in winter and lower values in summer; and now recent observations made daily, every three hours, show a variation of the ratio in which values are high at sunrise and sunset and low at midday. Curves of these seasonal and daily ratios of ultra-violet and daylight rays agree closely with each other both in form and magnitude.

Experiments on the reflexion of electromagnetic waves from the upper atmosphere show that the Kennelly-Heaviside ionized layer increases in density from winter to summer and decreases from summer to winter; in the same way there is an increase of density from sunrise to midday and a decrease from midday to sunset. These variations readily explain the fluctuations of ultra-violet rays treated as a percentage of the daylight rays. Thus, of the ultra-violet rays supplied by the sun, a part of their energy will be absorbed in the process of ionization, and the remaining part will pass on to the surface of the earth, while the visible rays which do not ionize the air pass to the surface of the earth without losing energy in this way. Now ionization by the ultra-violet rays will be approximately proportional to the altitude of the sun, and when this is high as it is in summer, or at midday, the absorption of ultra-violet rays in ionizing will be a maximum, and consequently at these times the percentage of ultra-violet radiation reaching the surface of the earth will be a minimum. Similarly, when the solar altitude is least, the percentage of ultra-violet radiation reaching the earth will be largest. This is in agreement with observation.

Thus the behaviour of ultra-violet rays and the behaviour of electromagnetic waves both yield, although in different ways, evidence of ionization in the upper atmosphere.

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July 24.

[1] Appleton, *Phil. Mag.*, Ser. 7, **27**, 144 (1939).
[2] Pettit, E., *Astro. J.*, **75**, 185 (1932).
[3] Ashworth, *Proc. Manchester Lit. and Phil. Soc.*, **83**, 81 (1939); and Pettit, *loc. cit.*

After-burning of Carbon Monoxide: Spectroscopic Evidence for Abnormal Dissociation

IN recent papers[1,2] I have discussed the cause of the after-burning and latent energy of the carbon monoxide flame in relation to the flame spectrum, and have given estimates of the lives of the vibrationally activated molecules which are formed. It was also suggested that the high vibrational energy of the newly formed molecules might result in a large amount of dissociation. Since I communicated these papers, David, Leah and Pugh[3] have published some experiments on latent energy and dissociation in flame gases which give striking support to my suggestion.

The theory of the later stages of the combustion of carbon monoxide may be summarized as follows:

(*a*) Since the dissociation products of a normal carbon dioxide molecule are not normal $CO(^1\Sigma) + O(^3P)$, but electronically excited CO $(^3\Omega) + O(^3P)$, the formation of normal carbon dioxide from normal carbon monoxide and oxygen must require an electronic rearrangement in the newly formed carbon dioxide molecule.

(*b*) The excited state of carbon dioxide, before the electronic rearrangement, is probably triangular, while the normal carbon dioxide molecule is known to be linear. Hence the electronic rearrangement, whether occurring by radiation or on collision, will result in the newly formed molecule acquiring a large amount of vibrational energy owing to the sudden change in shape.

(*c*) This excess vibrational energy will, if the gases are pure, persist for an appreciable fraction of a second. In the presence of moisture, however, the excess energy will be quickly transformed into thermal energy.

(*d*) For the carbon dioxide molecule the transverse vibration ν_2 and the symmetrical vibration ν_1 have frequencies which satisfy the relation $\nu_1 = 2\nu_2$ to a very close approximation. This degeneracy may result in resonance between the two vibrations and transfer of energy from one form to another, and thus may result in dissociation of the molecule if its vibrational energy content is sufficiently high.

This theory appears to explain many of the peculiarities of the combustion of carbon monoxide, such as the effect of moisture on flame speed and flame temperature, the effect of drying in increasing the infra-red radiation[4] from explosions, and the failure to observe the infra-red band at 14·9 μ.

In the recent experiments by David and his colleagues it has been shown that temperature measurements of flames made with wires coated with quartz indicate an abnormally high dissociation of the CO_2 molecules, this being greatly in excess of the dissociation expected at the flame temperature. If the newly formed carbon dioxide molecules are vibrationally activated, as indicated by the theory above, they may be regarded as having a very high effective vibrational temperature, this being much greater than their effective translational temperature. Since it is the vibrational temperature which determines the dissociation of the molecules, it is to be expected that the vibrationally excited molecules formed by the combustion will show an abnormally high dissociation.

The afterglow of carbon dioxide in a discharge tube[5] and the after-burning should both be regarded as manifestations of this dissociation, the usual flame spectrum being emitted during the recombination processes following the dissociation. The emission of light during the after-burning or afterglow should not be regarded as due to emission from activated (metastable) molecules, which have not sufficient energy to give a spectrum in the ultra-violet[6], but as due to the flame of gases which are recombining following the abnormal dissociation. Increase of pressure will increase the light emission from the after-burning gases by altering the dissociation equilibrium; Prof. A. C. G. Egerton points out that this is supported by observations of the increased luminosity at the centre during explosions in closed vessels when the pressure wave travels back through the burnt gases.

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[1] Gaydon, A. G., *Proc. Roy. Soc.*, A. **176**, 505 (1940).
[2] Gaydon, A. G., *Proc. Roy. Soc.*, A. **178**, 61 (1941).
[3] David, W. T., Leah, A. S., and Pugh, B., *Phil. Mag.*, **31**, 156 (1941).
[4] Garner, W. E., Johnson, C. H., and Saunders, S. W., NATURE, **117**, 790 (1926).
[5] Fowler, A., and Gaydon, A. G., *Proc. Roy. Soc.*, A. **142**, 362 (1933).
[6] Egerton, A., and Ubbelohde, A. R., NATURE, **134**, 848 (1934).

"White Horses"

THE behaviour of secondary waves riding on the larger primary ones does not seem to have been taken into account in the theory of wind-formed sea waves. From the geometry of trochoids, surface water particles at the troughs on either side of the crest of a secondary wave will close up when this wave is riding on the crest of a primary one, and open out at its trough. The energy of the secondary wave will squeeze up and disperse accordingly; and height, and so steepness, will be affected not only on that account, but also because the relationship of height to energy will change owing to the vertical acceleration of the water caused by the primary wave.

Thus, if L, H, S, E denote length, height, steepness and energy per sq. ft. of water surface of the primary wave, S being taken as $H \div L$, and l, h, s, e apply to the secondary wave, l will range from $l \times (1 - \pi S)$ at crest, to $l \times (1 \times \pi S)$ at trough; e from $e \div (1 - \pi S)$ to $e \div (1 + \pi S)$; and W from $64 \times (1 - \pi S)$ to $64 \times (1 + \pi S)$ lb. per cu. ft. Therefore, as $e = W.h^2 \div 8$, h will range from $h \div (1 - \pi S)$ to $h \div (1 + \pi S)$, and s from $s \div (1 - \pi S)^2$ to $s \div (1 + \pi S)^2$. It will be noticed that this deformation is independent of the steepness of the secondary wave, and of whether that wave is moving with or against the primary one.

It is commonly assumed that 'white horses' are due to the wind blowing off the tops of the primary waves, and that may be partly true. But they are apt to persist for some time after the wind has completely dropped, so must also be accounted for by the steepening, and consequent breaking, of secondary waves when the crests of the primary ones are passing under them. To reduce the problem to figures, let L, H, S be 200 ft., 5 ft. and 0·025, and let l, h, s be 20 ft., 2 ft. and 0·10, on the average. s will increase from that average value to almost 0·12, which is not far off Wilton's theoretical limit[1] of 0·13, a figure which may not necessarily always be attained, for waves have but a small margin of stability as they approach breaking point.

Further, it seems to be common experience that a nasty lop gets up with great rapidity when wind starts to blow against a swell, and this may be accounted for by the effect described.

The above applies to deep water. When the primary waves run into shoal water, the horizontal movement of the water particles is increased, and so the length and height of secondary waves, when they are riding on primary crests, are respectively decreased and increased to greater extents than before. There will only be secondary waves when there is an onshore wind, and then these waves will break more easily after the primary ones feel the bottom than they did before; and when they do break they will create disturbances which may initiate the breaking of the primary waves. This may be an explanation of the conclusion arrived at by Gaillard[2], who made many observations to determine the ratio of D (depth of water) to H necessary to cause breaking. He found that "for a given locality and given slope [of bottom] variations in the ratio of D to H appeared to be due almost entirely to the direction and force of the wind", and that while with a strong onshore wind the ratio might be 1·25, an offshore wind reduced the figure to 0·72.

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[1] *Phil. Mag.*, (6) 28, 1055 (1913).
[2] Gaillard, "Wave Action in relation to Engineering Structures", p. 120.

Transmission of *Leishmania tropica* by the Bite of *Phlebotomus papatasii*

SANDFLIES *Phlebotomus papatasii* ♀ were infected with *Leishmania tropica* by feeding through a membrane on a suspension of flagellates in 3 parts of 2·7 per cent saline and 1 part inactivated defibrinated rabbit blood.

They were afterwards refed on eight human volunteers, of whom five have so far become infected with cutaneous leishmaniasis as a result of bites from twenty-six infected sandflies. Twenty-six infected sandflies produced twenty-eight individual lesions, of which twenty-seven were produced by eleven sandflies only.

This experiment differed from previous negative experiments only in that the sandflies were kept at a temperature of 30° C. and that they were infected by feeding on a suspension containing 2·7 per cent saline instead of normal physiological saline. Full details will be published elsewhere.

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Evolution in the Genus Pæonia

THE genus Pæonia has three main centres of distribution and diversity: in the Mediterranean and Black Sea basins, in the Far East from Tibet to Japan, and in North America. From my own and previous chromosome studies[1,2,3], I find that in these separate regions it has undergone three different methods of species formation, all the time working with the same haploid set of five chromosomes.

In the Mediterranean area are a group of small-range diploids ($2n = 10$). Most of these diploids, apparently by simple doubling, have given rise to large-range tetraploids ($2n = 20$) usually lying to the north of their progenitors. Three of these large-range tetraploids, namely, *arietina* and *peregrina* in the Balkans and Asia Minor, and *coriacea* in southern Spain and Morocco, have no nearly related diploids; apparently their ancestors have failed to survive (see accompanying table).

SPECIES IN PÆONIA

	2x	4x
Europe	*Mlokosewitchii* (Caucasus)	*Witmanniana* and varieties (Caucasus)
	daurica (Crimea, etc.)	*mascula* (scattered)
	Clusii (Crete)	*officinalis*, *humilis* and (N. Mediterranean) vars.
	Cambessedesii (Balearics)	*Russii* and vars. (Western islands of Mediterranean)
	2 other localized species in Mediterranean 1 widespread in Ukraine	3 other widespread species unrelated to any surviving diploids
Asia	*japonica* (Japan)	*obovata* and varieties (E. Asia)
	8 other widespread diploids	No other tetraploids
N. America	2 diploids	No tetraploids

It thus seems that the advancing ice had driven the diploid species into Mediterranean peninsulas and islands, and from these isolated fragments of pre-glacial species Europe was afterwards recolonized by more vigorous, or perhaps more adaptable, tetraploids as the ice retreated. The kind of adaptability is shown in some cases to consist in stronger tuber development.

In Asia, on the other hand, there has been no such impassable barrier to movement back and forth, and we find a number of diploid species—some covering a large range, for example, *P. lactiflora* and *P. anomala*—and only one tetraploid, *P. obovata*. This species again is in the north (Manchuria and eastern Siberia), but it seems that the diploids, never having been restricted in population and variation, have themselves been able to meet the opportunity of colonization and to follow the retreating ice northwards.

In the smaller territory of California and Oregon a smaller population shows yet another system of variation. Only two species are recognized, and both of them are true-breeding diploid hybrids of the kind known in Œnothera. Instead of having five bivalents at meiosis they have rings of six, eight or ten chromosomes[3].

Thus in the three regions Nature seems to have carried out an experiment in variation and selection which helps us to understand how different conditions, partly external and partly perhaps internal, can lead to different methods of evolution in members of one genus.

I wish to thank Major F. C. Stern for much of the material on which this investigation was made. All the details of the geographical distribution will be found in his forthcoming monograph[4].

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July 23.

[1] Dark, S. O. S., *J. Genet.*, **32**, 353 (1936).
[2] Sinoto, Y., *Cytologia*, **9**, 254 (1938).
[3] Stebbins, J. L., and Ellerton, S., *J. Genet.*, **38**, 134 (1939).
[4] Stern, F. C., "The Genus Pæonia", Roy. Hort. Soc. Monographs (in the press).

Defence of Source of Food by Bees

IT is well known that worker bees defend their hives against individuals from other stocks. So far, however, there seem to be no reports of bees defending their feeding grounds. The following observations indicate such behaviour. Light pure Italians from a particular stock were fed on a training-table and marked individually according to von Frisch's[1] methods. The food was cane sugar dissolved in twice its weight of water and was poured on sand in a Petri dish. After several days no food was offered for one day. Great numbers of marked bees were observed digging eagerly and persistently in the dry sand and searching the neighbourhood for many hours. Scouting black Caucasians which might have had an occasional drop of syrup on the previous day frequently approached the Petri dish, but although they appeared to be of heavier build, they were invariably attacked and driven away. Of the 217 encounters observed, not a single one was won by the Caucasians. One particular Italian bee which had been treated with hydrocyanic acid the previous day attacked twenty-six times, generally carrying the Caucasians away and stinging at least three of them. Another Italian won twelve duels. If food is offered the pugnacity of the bees is much reduced, but intruders are still chased away.

From a second experiment it appeared that Caucasians similarly trained and marked could equally well defend their feeding-place against I alian intruders. It was remarkable that the same marked Italian bees, which had previously defended their dish so well, were invariably driven away by the Caucasians. It seems that the different smell and the uncertain behaviour of the newcomers arouses the pugnacity of the other group when food becomes scarce. It is possible to train Italian and Caucasian bees simultaneously at the same dish of food. As long as there is plenty of syrup nothing much happens, but when the sand becomes dry a general battle ensues.

In a third experiment Italians from two hives were fed on the same dish and marked differently. When the food became scarce occasional encounters between workers of the two groups were observed, but the fighting was far less intense, and some bees from both hives could be seen digging in the sand side by side for a considerable time. At the same time Caucasian intruders were fiercely driven away, sometimes by the combined efforts of the Italians from different hives. Caucasians from different hives also do not fight one another very intensely. It seems therefore that, in contrast to the defence of the hive, which is defended against all intruders, a bigger racial difference between bees is necessary to induce fighting for the source of food on a large scale. It would be interesting to investigate the behaviour of the offspring of crosses of the two bee races.

Thus collecting bees from a hive take possession of a particular feeding ground and defend it in the circumstances mentioned above against intruders, especially when of a different race, in a way similar to that described for fish, birds[2] and other animals. This result should be borne in mind by anybody attempting to compare the collecting habits of workers of different bee races.

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[1] Frisch. K. V., "Abderhaldens Hdb.", Abt. 5, 365 (1921).
[2] Howard, E., "Territory in Bird Life", John Murray, London (1920).

Discovery of *Mysis relicta* in Ennerdale

ON June 19 a single living specimen of *Mysis relicta* was found in Ennerdale Water accidentally trapped in one of a series of funnels which are suspended at various depths to catch the sediment from the overlying water. Although this 'relict' crustacean has been recorded from Loughs Neagh, Erne and Derg in Ireland, this is the first time it has been recorded from Great Britain. It is particularly noteworthy also that it should have been taken in Ennerdale Water as this lake is the only known British locality for another 'relict' crustacean, namely, the copepod *Limnocalanus macrurus* Sars. That there was just a possibility of the occurrence of Mysis in the lake had been realized ever since the discovery of Limnocalanus, but all attempts to obtain specimens had been unsuccessful. The intriguing problems of modification, distribution and geology raised by the occurrence of Limnocalanus in Ennerdale Water have been discussed by Dr. Gurney in his papers on "The Crustacean Plankton of the Lake District"[1], and on "Ennerdale Water : A Problem for Geologists"[2], and the same problems, of course, are still further emphasized by the discovery of Mysis in the lake.

Outside the British Isles these two crustaceans occur, very often together, in many lakes of the Baltic region and in the region of the great lakes of North America, and it seems certain that they have been modified from the marine species *Limnocalanus grimaldi* (De Guerne) and *Mysis oculata* Fabricius since the close of the glacial epoch. Their occurrence, therefore, in Ennerdale Water, some 360 ft. above sea-level, evidently calls for renewed consideration by both zoologists and geologists. It is proposed to endeavour, as soon as practicable under present conditions, to obtain further specimens of Mysis from Ennerdale especially with the view of finding out whether the animals there have developed any distinctive racial characters as compared with other representatives of the species in Ireland and elsewhere.

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[1] *J. Linnean Soc.*, Zool., **35**, 411–447 (1923).
[2] *Discovery*, **9** (December, 1928).

DEUTERON-INDUCED FISSION*

MECHANISM OF DEUTERON-INDUCED FISSION

By Prof. N. Bohr, For.Mem.R.S.

Institute of Theoretical Physics, University of Copenhagen, May 8

IN nuclear transformations initiated by deuteron impact, two types of processes are, as well known, to be taken into consideration. In the process of the first type (process I), the intermediate state is formed by the capture of the whole deuteron by the nucleus ; in the process of the second type (process II), the deuteron breaks up during the impact with the result that the proton escapes and only the neutron is taken up in the compound nucleus. As originally pointed out by Oppenheimer and Phillips[1] and more closely discussed by Bethe[2], the cross-section for the formation of the compound system may, in certain circumstances, be considerably larger in process II than in process I. Still, a clear discrimination between the two types of processes by means of ordinary nuclear transformations seems so far to have met with difficulties, and it may, therefore, be of interest to point out that the study of deuteron-induced fission of heavy nuclei offers new possibilities for such a discrimination.

Not only is fission easily distinguished from other possible transformations but, in particular, a certain critical excitation energy different for different nuclei is necessary for fission to occur. Just as regards the excitation of the compound nucleus, the processes I and II differ essentially. While the excitation obtained by process I will be far greater than the neutron binding energy for all nuclei concerned, it will, in process II, on the average be smaller than this energy. Since, for the abundant uranium isotope, as well as for thorium, the critical fission energy is higher than the neutron binding energy, it was concluded[3] that a considerable output of nuclear fission in thorium and uranium could only be expected in processes of type I. Even if, in certain deuteron energy regions, processes of type II should be more probable, they would almost entirely result in a permanent capture of a neutron with formation of radioactive uranium and thorium isotopes with well-known periods.

One of the possibilities of testing these arguments is offered by a comparison between the fission yields in uranium and thorium. This is possible because the probability of fission of the compound nucleus in process I may be estimated with a high degree of approximation. In fact, the excitation energy in process I will not only be sufficient for fission to occur in competition with neutron escape, but even the excitation of the residual nucleus left after the escape of a neutron will be large enough to make a fission quite probable. The total probability for fission of the compound nucleus in such successive transformations was thus estimated[4] to be nearly 1 for uranium and about 0·8 for thorium. These expectations seemed confirmed by the experiments reported by Jacobsen and Lassen[5] who found that the ratio of the fission cross-sections in uranium and thorium at 9-Mev. deuteron energy was approximately 0·7.

In a later discussion of these experiments[6], however, it has been realized that the cross-section for the formation of the compound system in process I, because of the smaller nuclear charge, must be expected to be 25 per cent greater in thorium than in uranium. If the whole fission effect in both elements was due to processes of this type, the theoretically estimated ratio of the fission yields in thorium and uranium should, consequently, instead of 0 8, be about 1·0. The difference between this last figure and the measured value 0·7 seems too great to be explained, unless it is assumed that a considerable part of the effect, at any rate in uranium, is due to processes of type II. A support of this conclusion is also offered by a closer comparison of the fission effects in thorium and uranium for smaller deuteron energies. Thus, in the experiments of Jacobsen and Lassen the fission cross-section for deuteron energies about 8 Mev. is relatively higher in uranium than in thorium, as would be expected if a part of the effect in uranium sets in for lower energy values.

A contribution of process II to the fission effects which is relatively greater in uranium than in thorium may be expected from the fact that the critical fission energy of the compound nucleus for thorium is almost 2 Mev. higher than the neutron binding energy, while, for the abundant uranium isotope (238), the difference is smaller than 1 Mev. Moreover, in the energy region concerned, where the fission cross-section is less than 1 per cent of the geometrical nuclear cross-section, it is possible that a not inconsiderable contribution is due to the lighter rare uranium isotope (235). Since, for this isotope, the critical fission energy of the compound nucleus in process II is about 1 Mev. lower than the neutron binding energy, the probability of fission may, for the low excitations obtained by such a process, be far greater than for the heavy isotope.

To clear up the different questions raised, it would be very desirable that experiments on deuteron-induced fission be extended to a region of greater deuteron energies, and, especially, that such experiments be performed with separated uranium isotopes and with protactinium, for which the critical fission energy of the compound nucleus is nearly equal to the neutron binding energy[7].

*Reprinted from the *Physical Review* (**59**, No. 12, 1042–1043 ; June 15, 1941).

[1] Oppenheimer, J. R., and Phillips, M., *Phys. Rev.*, **48**, 500 (1935).
[2] Bethe, H. A., *Phys. Rev.*, **53**, 39 (1938).
[3] Bohr, N., and Wheeler, J. A., *Phys. Rev.*, **56**, 449 (1939).
[4] Bohr, N., *Phys. Rev.*, **58**, 864 (1940).
[5] Jacobsen, J. C., and Lassen, N. O., *Phys. Rev.*, **58**, 867 (1940).
[6] Jacobsen, J. C., and Lassen, N. O., Det Kgl. Danske Vidensk. Selsk. Math.-fys. Medd. (Math.-phys. Comm., Acad. Sci. Copenhagen), in print.
[7] Wheeler, J. A., and Bohr, N., *Phys. Rev.*, **56**, 1065 (1939).

FISSION CROSS-SECTION IN URANIUM AND THORIUM FOR DEUTERON IMPACT

By J. C. JACOBSEN AND N. O. LASSEN

Institute of Theoretical Physics, University of Copenhagen. May 8

As reported in a previous note[1], experiments have been carried out with the cyclotron in this institute to investigate the cross-section for fission in thorium and uranium produced by impact of deuterons with different energies. The fission outputs were determined by collecting the radioactive fragments on aluminum foils facing the targets and screened from the deuteron beam. Because of the difficulty of estimating the number of fission processes from the β-radioactivity of these foils, a considerable uncertainty, however, was involved in the determination of the absolute value of the fission cross-section.

In continued experiments, this uncertainty has been reduced by a calibrating procedure in which two thin uranium targets were exposed to neutron impact. One of the targets was placed in a small ionization chamber and the number of fission particles emitted from this target counted by a linear amplifier. The fission particles from the second target were collected on a thin lead foil; the distance between the two targets was sufficiently small to ensure that the neutron intensity was very nearly the same. By measuring the activity of the collecting foil with the same counting arrangement as in the experiments with deuterons, the ratio between the foil activity and the number of fission particles emitted during the irradiation could thus be determined.

Instead of the preliminary value of $0{\cdot}5 \times 10^{-26}$ cm^2 given in the previous note, the measurements thus calibrated gave now the value $(2{\cdot}2 \pm 1) \times 10^{-26}$ cm.^{2} for the fission cross-section in uranium at 9-Mev. deuteron energy. The results found for the variation of the cross-section with deuteron energy and the ratio between the cross-sections in thorium and uranium given in the note remain, of course, unaltered. From the value 0·7 for the last ratio, which agrees with the independent determination by Krishnan and Banks[2], we obtain in consequence $(1{\cdot}5 \pm 0{\cdot}7) \times 10^{-26}$ cm^2 for the fission cross-section in thorium at 9-Mev. deuteron energy.

Details of the experiments are described in a paper in print in the *Communications of the Copenhagen Academy of Sciences* where, also, a description of the cyclotron has just been published[3].

[1] Jacobsen, J. C., and Lassen, N. O., *Phys. Rev.*, **58**, 867 (1940).
[2] Krishnan, R. S., and Banks, T. E., NATURE, **145**, 860 (1940).
[3] Jacobsen, J. C., Det Kgl. Danske Vidensk. Selsk. Math.-fys. Medd. **19**, 2 (1941).

EDUCATIONAL PROGRESS IN THE UNITED STATES

By R. WEATHERALL

ETON COLLEGE

IN recent years, C. V. Good, of the University of Cincinnati, has made a practice of preparing an annual review of educational progress in the United States[1]. In his report for 1940 his method has been to compile a list of educational issues, and then to cite illustrations of the manner in which they are being met. These issues may be summarized as follows:

DEMOCRATIC SOCIETY AND PUBLIC EDUCATION

A great deal of thought is being given to the problem of education for good citizenship in a democratic society. To achieve such an aim requires individuals who have respect for other people, a concern for group problems, and a willingness to use intelligence in problem solving. In dealing with educational matters there is a marked tendency towards co-operative effort. This includes the pooling of ideas by teachers and administrators, and extensive use is being made of joint discussions between teachers and students. In this way the students themselves are being encouraged to ask and answer questions which should help them to evaluate current social, economic and political trends, and to establish helpful relations with other members of the community.

EDUCATION AND THE EMERGENCIES OF NATIONAL DEFENCE

Almost to a greater extent than in Great Britain, teachers and the general public alike in the United States are giving consideration to the repercussions which the present world crisis is having upon the educational field, and to the extent to which by educational means support may be given to the national effort. As the report points out, education is called upon to defend human resources, culture, and American democratic processes, as well as to assist in the material defence of the community and nation. Federal participation in education is extending, and in the service of youth, unification in Federal policy is being brought about in the spheres of health, education, and social welfare.

YOUTH PROBLEMS AND CURRICULUM

Under this heading consideration is being given to the needs of the large number of pupils who will not proceed to college, and who do not require specific technical training. The problem of the responsibility of the community towards young people between the ages of eighteen and twenty-one, who cannot be readily absorbed into industry, is also receiving attention. The United States Employment Service is concerning itself with the adjustment of school-leavers to suitable occupations, and with the best way of enabling young people to enter upon rural life. Other investigations are dealing with the specific problem of Negro students: their development during adolescence, and their status in the existing social and economic order.

To a far greater extent than occurs in the British Isles, public opinion makes itself directly felt in educational policy, and recourse is being made to the

American Institute of Public Opinion. On this point it is interesting to note that a large majority of the public do not feel that education is over-emphasized, although the school-leaving age is some two to three years higher than in England. The large proportion of pupils remaining at school into their middle teens is leading to increased attention being given to individual aptitudes and preferences. As an institution the school is not so directly tied to the college. Freedom from prescribed college requirements has acted as a challenge and a stimulus to the school, and has resulted in a period of great educational growth.

A programme to make science teaching answer the needs of young people has been organized by the Bureau of Educational Research in Science at Teachers' College, Columbia University. This investigation is being carried out on a comprehensive scale, and should lead eventually to conclusions of great significance.

Appraisal and Implementation

As indicated above, educational institutions in America cannot be considered in any way as being tied down by tradition. Not only are they very closely in touch with public opinion, but also continuous discussion is taking place between administrators, teachers, and students as to educational aims and the extent to which they are being achieved. Educational policy thus becomes dynamic, itself the subject of rational investigation, and capable of readjustment from time to time. The Evaluation Study of Bennington College, for example, is intended to be a permanent feature of the College. It is planning to investigate the nature of the College's total educational programme, how this programme developed, the purposes behind the programme, the assumptions underlying the purposes, to what extent these purposes are being realized, and the changes which staff and students consider should be made for the College to achieve its aims more effectively.

Teacher Education

There is little danger that standards among teaching personnel are likely to decline during the present emergency. The spread of examination tests is bringing about some standardization with regard to qualifications, which makes for facility in the selection of candidates. But with the extension of a national system of examinations there arises the risk that examinations may become an end in themselves, not merely the means, and so lay themselves open to commercial exploitation.

The Social Pole of Science and of the Man of Knowledge

The report points out that it is high time that the social responsibilities of scientists and of research workers be recognized and accepted. In the past, emphasis on material production and on the instruments of war has led to technological unemployment and to the partial neglect of problems of human welfare, health, domestic life, and education, with the biological and social sciences starved in deference to the more immediately profitable physical and chemical sciences. Since science and research are determining factors in the destiny of mankind, a social policy for science must be formulated to guarantee that such knowledge will be used for the welfare of society.

[1] *School and Society*, vol. 53, no. 1368.

THE BRITISH COUNCIL

THE report of the British Council covering the year ended March 31, 1941*, pays a warm tribute to the work of Lord Lloyd. The Council has recognized two main duties, first, the defensive role in the resistance to and disproval of charges brought against us by German and Italian propaganda and, second, the positive mission of carrying to other countries a knowledge of the contribution which Great Britain has made and still makes towards the science of life and government.

The chief methods adopted by the Council for this purpose are the formation of new or the encouragement of existing British cultural centres abroad, and the Council is now responsible for British Institutes in Malta, Cyprus, Palestine, Egypt, Iraq, Spain and Portugal. Most of the anglophil societies encouraged by the Council are now found in Latin America although before the War the Council was in touch with no less than 250 such societies, many in France, Germany, the Netherlands and Scandinavia. The Council also encourages British schools abroad as well as English studies in foreign schools and universities, and throughout these institutions and elsewhere the knowledge of the English language. Competitive scholarships, valued at £250, are awarded to well-qualified post-graduate students from foreign countries and from the Empire.

Such activities have been inevitably modified by the War. One of the Council's main tasks has been to build up in the premises of the anglophil societies of British institutes and also in foreign universities and other institutions general libraries of English books and to this has been added the presentation of scientific and technical works to specialist libraries abroad. A book export scheme has been initiated to encourage the sale abroad of British books of cultural importance as well as a book review scheme intended to secure the review of British books in foreign newspapers and periodicals.

A small fortnightly publication has been issued since March 1939 under the title *Britain To-day*, containing generally an editorial and three articles written for the foreign reader on subjects which may be expected to be of interest to him. Reference is also made to the work of the Council in regard to films, particularly the commission of documentary films on carefully chosen subjects dealing with British life and achievements and the commission or

* The British Council. Report for 1940–1941. Pp. 176. (London: The British Council, 1941.)

acquisition of films intended for educational purposes abroad or describing scientific or technical achievements which it is desired to make known abroad. An Advisory Scientific Committee has also been formed which it is intended should work in three or more panels, one under the chairmanship of Sir William Bragg dealing with pure science, a second under the chairmanship of Sir Edward Mellanby dealing with medicine, and a third under the chairmanship of Sir William Larke dealing with engineering. Sir William Bragg is also chairman of the Advisory Scientific Committee as a whole.

Previously, the Council's interest in scientific publicity was shown chiefly in co-operation with the British Medical Information Service, the dispatch of a number of scientific and learned periodicals and books abroad including a complete section of the South American Book Exhibition, the preparation of a Spanish hand-book of British industrial practice, in conjunction with the British Standards Institution, and the presentation of equipment to a hospital in Sana'a and to a bacteriological institute in Chile.

FORTHCOMING EVENTS

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

Friday, August 29

ASSOCIATION OF SCIENTIFIC WORKERS (at Conway Hall, Red Lion Square, London, W.C.1), at 6.30 p.m.—Open Meeting on "Science and the Soviet Union". (Speakers: Dr. Joseph Needham, F.R.S., Dr. Martin Ruhemann, and others.)*

APPOINTMENTS VACANT

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

LECTURER IN THE ELECTRICAL ENGINEERING DEPARTMENT, and a LECTURER IN THE MECHANICAL ENGINEERING DEPARTMENT—The Principal, Heriot-Watt College, Edinburgh (August 30).

HEAD OF THE SCIENCE DEPARTMENT OF THE BLACKBURN MUNICIPAL TECHNICAL COLLEGE—The Director of Education, Education Offices, Blackburn (August 31).

HEAD OF THE ENGINEERING DEPARTMENT OF THE BLACKPOOL TECHNICAL COLLEGE—The Director of Education, Education Department, Caunce Street, Blackpool (September 1).

(a) ASSISTANT ENGINEER and (b) an ENGINEERING ASSISTANT—The Engineer to the River Great Ouse Catchment Board, Elmhurst, Brooklands Avenue, Cambridge (endorsed 'Appointment (a) or (b)') (September 1).

HEADMISTRESS OF THE KENYA HIGH SCHOOL FOR GIRLS, NAIROBI—The Secretary (I.P.R.), Board of Education, Alexandra House, Kingsway, London, W.C.2 (September 1).

LECTURER FOR THE MECHANICAL ENGINEERING DEPARTMENT—The Principal, Merchant Venturers' Technical College, Bristol (September 2).

DEPUTY BOROUGH ELECTRICAL ENGINEER to the Great Yarmouth Corporation—The Engineer and General Manager, Electric House, Regent Road, Great Yarmouth (September 5).

ENGINEER to the Lower Medway Internal Drainage Board—The Clerk to the Board, 71a Bank Street, Maidstone (September 13).

REPORTS AND OTHER PUBLICATIONS

(*not included in the monthly Books Supplement*)

Great Britain and Ireland

Proceedings of the Royal Society of Edinburgh. Section B: Biology. Vol. 61, Part 1, No. 5: On Cardiopteridium, a Genus of Fossil Plants of Lower Carboniferous Age, with Special Reference to Scottish Specimens. By Prof. John Walton. Pp. 59–66+1 plate. 1*s*. Vol. 61, Part 1, No. 6: Mutation and Lethal Effects of Ultra-Violet Irradiation on *Drosophila*. By Dr. K. Mackenzie. Pp. 67–77. 1*s*. (Edinburgh and London: Oliver and Boyd.) [58

The Scientific Journal of the Royal College of Science. Vol. 11: Containing Papers read during the Session 1940–1941 before the Imperial College Chemical Society, the Royal College of Science Mathematical and Physical Society. Pp. viii+94. (London: Royal College of Science.) [58

University College of Wales, Aberystwyth: Welsh Plant Breeding Station. War Food Production, Advisory Bulletin No. 5: Seeds Mixtures. By M. T. Thomas. Pp. 22. (Aberystwyth: Welsh Plant Breeding Station.) 1*s*. [58

Scottish Society for Research in Plant-Breeding. Report (abridged) by the Directors and Report by the Director of Research to the Annual General Meeting, 17th July, 1941. Pp. 30. (Edinburgh: Scottish Society for Research in Plant-Breeding.) [58

Scientific Proceedings of the Royal Dublin Society. Vol. 22, No. 40: The Effect of Wave-Length on the relation between the Intensity of Illumination and the Current in Selenium Rectifier Photo-Cells. By H. H. Poole and W. R. G. Atkins. Pp. 393–398. 6*d*. Vol. 22, No. 41: Atmospheric Pollution in Dublin during the Year 1940. By A. G. G. Leonard, Bridget P. McVerry and D. Crowley. Pp. 399–404. 6*d*. Vol. 22, No. 42: Estimation of Ammonia and Urea by a Modification of the Conway Diffusion Method. By Einhart Mawerau. Pp. 405–414. 1*s*. Vol. 22, No. 43: The Phenol Amidine Reaction; the Detection of Guanidine, Guanidine Derivatives, and Urea, by means of Thymol and Hypochlorite. By William Robert Fearon. Pp. 415–422. 6*d*. Vol. 22, No. 44: The Hydrolysis of Laminarin; Isolation of a New Glucose Disaccharide. By Dr. Vincent C. Barry. Pp. 423–430. 6*d*. (Dublin: Hodges, Figgis and Co., Ltd.; London: Williams and Norgate, Ltd.) [58

Proceedings of the Royal Society of Edinburgh. Section B: Biology. Vol. 61, Part 1, No. 7: The Genetical and Mechanical Properties of the Sex Chromosomes, 8: The Cat (*Felis domestica*). By Dr. P. C. Koller. Pp. 78–94. 1*s*. 6*d*. Vol. 61, Part 1, No. 8: The Structural Differentiation of Chromosome IV of *Drosophila simulans* and its Behaviour in *melanogaster* Genotype. By Dr. B. M. Slizynski. Pp. 95–106. 1*s*. (Edinburgh and London: Oliver and Boyd.) [68

Institution of Automobile Engineers. Fatigue Failure of Crankshafts: Interim Report by C. G. Williams and J. S. Brown. (No. 8800. B, Class 262, 52.) Pp. 22. Durability of Gears. First Interim Report by H. D. Mansion. (No. 9153. B, Class 336, 42, 55.) Pp. 24. Engine Bearing Temperatures: Road Tests. (No. 9167. B, Class 278, 192.) Pp. 4. Engine Bearing Temperatures: Bench Tests. (No. 9166. B, Class 278, 192.) Pp. 4. (London: Institution of Automobile Engineers.) [68

Other Countries

Memoirs of the Geological Survey of India. Palæontologia Indica. New Series, Vol. 31, Memoir No. 1: Upper Palæozoic Faunas of North Sikkim. By Dr. Helen M. Muir-Wood and Dr. Kenneth P. Oakley. Pp. iv+98+4 plates. (Calcutta: Geological Survey of India.) 5 rupees; 8*s*. [18

Journal of the Indian Institute of Science. Vol. 23A, Part 8: Attempts towards Synthesis of Cantharidin, Part 3: Condensation of Ethyl $\beta\beta'$-Diketotetrahydrofuran-$\alpha\alpha'$-Dicarboxylate with α-Bromo Esters. By B. H. Iyer and P. C. Guha. Pp. 159–168. 12 annas. Vol. 23A, Part 9: Azo-Dyes; Coupling of 5-Hydroxy-3-Amino-1:1-Dimethyl-$\Delta^{3:5}$-Dihydrobenzene with Diazonium and Tetrazonium Compounds. By Balkrishna H. Iyer. Pp. 169–174. 10 annas. Vol. 23A, Part 10: Condensation of *C*-Acetyl Methone with Aromatic Aldehydes. By Balkrishna H. Iyer. Pp. 175–182. 12 annas. (Bangalore: Indian Institute of Science.) [58

Ceylon. Sessional Paper 16, 1941: Report and Accounts of the Coconut Research Scheme for 1940. Pp. 18. (Colombo: Government Record Office.) 25 cents. [58

Bulletin of the Bingham Oceanographic Collection. Vol. 7, Art. 4: Plankton Studies, 4: Georges Bank. By Gordon A. Riley. Pp. 74. (New Haven, Conn.: Yale University.) 1.10 dollars. [58

Potassium. A Symposium held by the Royal Society of New South Wales, August 7, 1940. Pp. 32. (Sydney: Royal Society of New South Wales.) [58

Forty-third Annual Report of the Carnegie Museum for the Year ended December 31, 1940. Pp. 50. (Pittsburgh: Carnegie Institute.) [58

Commonwealth Prickly Pear Board. The Biological Campaign against Prickly Pear. By Alan P. Dodd. Pp. iv+177+37 plates. (Brisbane: Government Printer.) [58

Commonwealth of Australia: Council for Scientific and Industrial Research. Pamphlet No. 107: Food Composition Tables. Compiled by Hedley R. Marston and Mary C. Dawbarn. Pp. 36. (Melbourne: Government Printer.) [58

U.S. Department of Agriculture. Circular No. 605: The Internal Application of Chemicals to Kill Elm Trees and Prevent Bark-Beetle Attack. By R. R. Whitten. Pp. 12. (Washington, D.C.: Government Printing Office.) 5 cents. [58

Records of the Geological Survey of India. Vol. 76, Bulletins of Economic Minerals, No. 2: Chromite. By A. L. Coulson. Pp. 30. (Calcutta: Geological Survey of India.) 10 annas; 1*s*. [68

Report of the Botanical Survey of India for 1939–40. Pp. 18. (Calcutta: Government of India Press.) [68

Union of South Africa: Department of Agriculture and Forestry. Science Bulletin No. 227 (Locust Research Series No. 8): Laboratory Experiments on the Improvement of Poison Baits for Hoppers of the Red Locust, 1936–37. By C. du Plessis and M. C. A. Nolte. Pp. 44. 3*d*. Science Bulletin No. 230 (Locust Research Series No. 9): Laboratory Experiments on Poison Baits for the Brown and Red Locust, 1937–38. By A. Lea and M. C. A. Nolte. Pp. 56. 6*d*. Chemistry Series No. 164: Poisoning by Arsenic in South Africa. By Dr. P. R. van der Riet Copeman and Dr. P. A. E. Kamerman. Pp. 16. (Pretoria: Government Printer.) [68

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