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## THE INTERNATIONAL LABOUR ORGANISATION

THE International Labour Organisation remains almost alone of the institutions framed to promote international co-operation, understanding and world order after the War of 1914–18. Although its staff has been drastically reduced and all but a small group of officials have been transferred to Montreal, the Organisation continues to function effectively. From its new working centre it is issuing the *International Labour Review*, its studies and reports, its Legislative Series and from time to time organizes a series of meetings and conferences. The recent Labour Conference in New York was the most outstanding of these meetings, and to many it was a surprising but impressive witness both of the contribution which the Organisation is rendering to the practical improvement of labour conditions throughout the world and of its importance in the tasks of reconstruction which already lie near to our hand.

It is not too much to say that the act of faith involved in summoning the Conference at the present period has given to the world a fresh inspiration of the worth of the principles embodied in the Organisation. Already the pledge of the delegations of Poland, Czechoslovakia, Jugoslavia and Greece, announcing the formation of a *bloc* of those nations to serve as a basis after the War for a confederation from the Baltic to the Ægean, in which the four freedoms will be assured, demonstrates how the Organisation serves, as no other institution, as a rallying point for the Governments of the nations overrun by destruction. The Organisation represents and upholds an international way of life which would build up wealth, progress and security through the pursuit of common aims and purposes, and the exploitation, not of men, but of the abundant material resources of the world.

The realization that the International Labour Organisation stands for ideals and a way of life diametrically opposed to those of the Axis powers gave vitality to the recent Conference and related it immediately to the war effort at present engrossing the attention and resources of the surviving democracies. That realization is reflected in the outstanding address of President Roosevelt to the delegates at Washington on November 7, and in such utterances as those of Mr. E. J. Humbro, president of the Norwegian Parliament, who declared : "If we do not win the war there will exist only one law in national and international labour relations—the law of master and slave."

The ringing challenge to Nazi-imposed serfdom with which the Conference resounds would alone have made it memorable in these days. Its attempt to interpret the ideals of social security and to translate into practice the four freedoms

of which President Roosevelt has spoken made it beyond question a world event the significance of which is likely to grow rather than diminish with the passage of time. The fresh impetus to the task of planning the organization of international co-operation, to ensure that the abundant productive capacities of the world are used to satisfy the needs of its peoples, may well prove its most enduring value.

What gives reality to this issue at the present time is not merely that social policy is a central preoccupation, both because of its immediate relevance to defence and because it is ultimately at the core of the issues which the War will decide. If freedom from want means economic understandings which will secure to every nation a healthy peace-time life for its inhabitants everywhere, or in the words of the Atlantic Charter, "fullest collaboration between all nations in the economic field, with the object of securing for all improved labour standards, economic advancement and social security", or again, "assurance that all men in all lands may live out their lives in freedom from fear and want", the realization of that support presupposes the whole-hearted co-operation of the American Government and people. Anglo-American co-operation is the first condition of success in the schemes of post-war reconstruction that the International Labour Organisation may be able to prepare.

For this reason the proceedings of the Conference have rightly been viewed against the background of the Atlantic Charter with all the new hope of social security implicit therein. The report of the acting director, Mr. E. J. Phelan, on "The I.L.O. and Reconstruction", advocates the formulation of a social mandate which would represent an important step in preparation for the fulfilment of the great social aims to which Great Britain and the United States are committed in the Atlantic Charter. Mr. Phelan suggests that at a turning-point in the world's history when the general social objective of economic security is to be the mainspring of concerted political effort, the Organisation should be solemnly charged with its share of the task, that thereby men and women throughout the world should be given the guarantee that their Governments will vigorously pursue the effective realization of such a policy through its instrumentality. The formulation of such a social mandate would constitute a general declaration of international social policy and would give the International Labour Organisation a programme to implement, completing it with all the detail necessary.

The emergence of the social objective is emphasized by Mr. Phelan in a striking section of the second part of his report dealing with future policy. Leaders in countries not yet directly involved in the War are as committed to the idea that the objective of economic policy should be improvement in general conditions of life as are those of the British Commonwealth and her Allies. Twenty years of experience has testified to the grave inadequacy of labour legislation in the old, limited sense, and economic security itself is not to be interpreted narrowly but rather as the condition which enables men to build, on the secure basis of an assured standard of material well-being, a fuller, richer and a freer life. The Governments of the members of the Organisation, declares Mr. Phelan, seek economic security for all citizens, achieved in a manner which respects individual dignity and liberty; and since this can no longer be provided by the interplay of blind economic forces, self-preservation dictates that national and international policy must be directed deliberately to that end.

Mr. Phelan realizes to the full the gigantic task which the achievement of economic security represents, and the importance of the spirit in which that task is approached. In his survey of the social and economic background, however, he notes repeatedly tendencies or developments necessitated by war-time measures which should facilitate the mobilization of reserves for peace-time aims —the new conception of the duties of employment offices in the organization of a war economy is an example. Moreover, the whole character of the International Labour Organisation makes it natural for any reconstruction conference to turn to the Organisation in the consideration of social questions, and to use the Organisation as part of its machinery rather than attempt to constitute from its own membership a committee in which employers and workers could not easily be represented.

The stress Mr. Phelan lays on the tripartite constitution of the International Labour Organisation in this connexion is noteworthy. The character of its constitution may well be one factor that has been responsible for its survival when other international institutions have proved ineffective and fallen by the way. It is, however, of particular significance when the Organisation is domiciled in North America and much of its activity is concentrated in the Western hemisphere. The succession of strikes in the United States which has recently hampered production is a reminder that in labour relations that great democracy is a generation or more behind Great Britain. It may well be hoped that during its stay in North America, the International Labour Organisation may make important contributions to the establishment of smoother relations between the State and organized industry.

The New York Conference had before it a main report on methods of collaboration between public authorities and employers and workers' organizations, and the publicity which the Conference received should at least assist to make known to American public opinion the rich experience in such matters upon which the Organisation can draw. Moreover, the American people will not have overlooked the stress which Mr. Winant laid, in his valedictory report, upon co-operation between Governments and organizations of employers and workers. Unless such effective co-operation is achieved, said Mr. Winant, the democracies cannot survive.

Mr. Phelan, however, is not content to call for a social mandate in general terms. He sets out for discussion the main points and principles which such a mandate should cover. They include the elimination of unemployment; the establishment of machinery for placing, vocational training and re-training; the improvement of social insurance in all its fields and in particular its extension to all classes of workers; the institution of a wage policy aimed at securing a just share of the fruits of progress for the worker, and a minimum living wage for those too weak to secure it for themselves. Further points are measures to promote better nutrition and to provide adequate housing and facilities for recreation and culture; greater equality of occupational opportunity; improved conditions of work; an international public works policy for the development of the world's resources; the organization of migration for employment, and settlement under adequate guarantees for all concerned; and the collaboration of employers and workers in the initiation and application of economic and social measures.

Action clearly must be taken now on some of these points. Plans for the resumption or increase of the production of articles of general consumption now restricted or regarded as non-essential, plans for the establishment of new industries and the development of new materials and new techniques, such as the greatly increased industrial use of plastics, plans for housing schemes and for public works, both national and international, must be ready, together with the machinery for putting them into operation, if severe and dangerous dislocation of employment is to be avoided when the War ends. Certain forms of international action are likely to be taken to meet urgent needs without waiting for any general reconstruction conference —for example, measures to feed the peoples of Europe. An admirable broadsheet issued by Political and Economic Planning on planning post-war industry has already indicated the extent to which an attempt could be made now to treat the internal demand and supply schedules, even if it could not be fully decided.

This analysis itself gives cogency to Mr. Phelan's general argument. Unless some attempt is made to analyse demand and product, the unemployment situation alone may well once again get out of hand. P E P's attempt to list in very general form some of the questions which must be considered in drawing up reconstruction programmes, and to indicate the kind of principles on which the productive machine can be geared to the satisfaction of needs, is a valuable contribution to the constructive thinking and planning which alone can make possible any effective control of post-war production and distribution over a period of years. Without such control the basic industries will assuredly experience a violent boom followed by an equally violent slump. With control, replacement demands should provide industry with a steady load for some years after the War.

The P E P broadsheet concludes that the authorities responsible could give a lead to industry even at this stage of the War. Guiding principles could be formulated now and the preparation of post-war production programmes commenced. The Government could give the necessary stimulus and practical assistance to industrialists who are thinking of their own future, for it is most essential to decentralize the work behind the planning and the programmes among as many bodies, firms and individuals as possible. Programmes must be considered as a whole, since there are so many industrial inter-relationships to be taken into account. What is really important is that the guiding principles should be formulated as far in advance as possible, for it is the expectations of people which will condition the ease with which they accept particular policies. The expectations formed now will largely shape the future.

Reference is made in the broadsheet to an impressive number of public and private bodies, from Mr. Arthur Greenwood's Reconstruction Committee, Lord Reith's Consultative Panel on Physical Planning, Sir Frederick Leith-Ross's Bureau, Sir William Beveridge's Committee on the Social Insurance and Allied Services and the Inter-Departmental Committee on Demobilisation, to the regional reconstruction organization establishment in Birmingham, Manchester, Leeds, Newcastle-on-Tyne and elsewhere, the committees established by the Royal Institute of British Architects, the Institutions of Civil, Electrical and Mechanical Engineers, and the Reconstruction Department set up by one of the largest aircraft companies, which are making surveys of probable post-war markets and labour and material supply. All are facing one aspect or another of that first important task of domestic reconstruction after

the War—the conversion of British industry from the production of war supplies to the production of the basic needs of a civilized community with the minimum of dislocation, unemployment and social friction. Whether, however, we approach the problem from man-power aspects against the background of demobilization, from the consumer end, as in the broadsheet, or from that of the most effective structure to be given to British industry after the War, even the domestic problem cannot be handled in isolation from the international situation. International organization properly understood, as Mr. Phelan observes, is indispensable to the creation of the conditions in which national freedom can be effectively and safely exercised.

To deal with the social and economic problems which will be encountered at the end of the War, existing national powers will require to be used to the full for national measures. Concurrently, international measures must be taken by the appropriate international bodies if national action is to be effective, and not find itself baffled and defeated by circumstances out of its control. Indeed a real and determined attack on the social problem, the elimination of poverty and the social evils that arise from it, as well as of mass unemployment, and the securing of a higher standard of life for men and women throughout the world involve international action on a greater scale than that of the inter-war period, and greater financial resources to equip and extend international machinery must be forthcoming. Mr. Phelan's report contains abundant evidence to justify the act of faith which summoned the Conference in New York. The attention thus directed to the valuable experience already gained by the International Labour Organisation should lead, to the fuller recognition by all the Governments of the free nations of its effectiveness as an instrument of their declared post-war social policy, to its full utilization for that purpose and to placing at its disposal the necessary resources. Nothing is more certain than that the building of a new economic and social order to satisfy the hopes and expectations that have already been aroused, and to compensate for all the sacrifices now being made in the cause of freedom, will demand not only all the greater powers and resources placed in our hands by science, all the new experience of social and economic controls and of the government of world industries being acquired in our war effort, but also all that rich experience of co-operation between workers and managements and Governments the world over which twenty-two years of service have made available in the International Labour Organisation.

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# AN INDICTMENT OF CIVILIZATION

Man: The Mechanical Misfit
By G. H. Estabrooks. Pp. xi+251. (New York: The Macmillan Company, 1941.) 10*s*. 6*d*. net.

THE thesis maintained in this book by the professor of psychology in Colgate University, is that civilization is to perish, not by war, but by the action of certain evils which are inherent in our Western way of life. "Let us suppose," he writes, "that this war takes the very worst turn possible. All the countries, including America, are in turn invaded, and their cities reduced to ruins. Hardly possible, but let us suppose it occurs. Even so, it would seem to the writer that the reverse would be purely temporary. We still have ample human brains to reconstruct our culture from memory or from books." In this verdict the reviewer is in agreement with the author.

According to the author, man made a fatal mistake when "some 10,000 years ago," he began to clothe himself in that "glossy stuff called civilization"; it was then he threw overboard Nature's basal law, which Darwin named 'natural selection'. Cromagnon man, who lived in uncivilized times, was the product of "open competition", "an almost perfect man-beast". His successor brought the germs of that most fatal of all human diseases —civilization. Nature had given him a large brain "to aid in the bitter struggle for survival in a ruthless world". Instead, civilized man "sidestepped" Nature and used his big brain to succour the weak. So it has come about, according to Prof. Estabrooks, that our cities are filled more and more with men and women who suffer from hereditary disabilities of brain and body. It is only a matter of time, and civilization must come to an end for lack of people who are fit to carry it on.

This bald statement of the author's main thesis does a grave injustice to the racy and epigrammatic style in which he has presented it. In dealing with serious problems—and the annihilation of mankind by the civilization he has so laboriously created certainly belongs to this order—it is well to strip away the wrappings and get at the contents of the parcel. The chief content is the assertion that, in the human world as in the animal world, natural selection, survival of the fittest, the law of the fang and claw, to use the author's phrase, is the fundamental axiom of Nature. Perhaps the emphasis

which Darwin gave to the law of natural selection has led so many popular writers to overlook the fact that among social animals the qualities of the "heart" are just as potent in the struggle for survival as are claws and fangs. If only Darwin had expanded the brief paragraph I am to quote from his "Descent of Man" into a long chapter, for which he had ample material, the error into which so many writers on human evolution fall would have been avoided. The paragraph is this :

"For these communities which included the greatest number of the most sympathetic members, would flourish best, and rear the greatest number of offspring." (Chap. iv, p. 163.)

We have now good reason to believe that from the very beginning of what may be termed the period of human evolution, men were grouped in local communities, such as Darwin has postulated in the paragraph just cited. The ever-increasing duration of the period of the infancy of the human young rendered the prevalence of the laws of mercy and of co-operation within the groups more and more advantageous. The law of 'claw and fang' also prevailed, but its main objective was the defence of the local community. Pity for the weak was just as much the subject of natural selection as were man's sterner pugnacious qualities. I therefore hold that Prof. Estabrooks is in error when he assumes that our solicitude for the unfit is an attitude of mind introduced among us by civilization.

To this criticism Prof. Estabrooks may reply : "No matter when mankind began this maudlin sentimental care for the unfit, see how the practice works in a modern state." In the United States there are ten million feeble-minded citizens, one million of them confined in institutions. A "college group", 1,000 strong, provides the succeeding generation with only 800 individuals, while one thousand morons contribute 6,000. No State could stand up to such a substitution in its population. Thirty-two of the States have sanctioned by law the sterilization of the hereditarily unfit ; the law is a dead letter in all thirty-two States save one. Is this refusal to face a problem in eugenics a manifestation of the "insanity of the sane", as Prof. Estabrooks maintains, or is it the persistence of that instinctive love of mercy mankind brought with it from the jungle—a fear that if it tampers with one part of its birthright, it may lose the whole ? I leave the query unanswered ; but I believe that in a struggle between two nationalities, one of which nurses humanitarianism within its borders to the full, while the other throws it overboard, it is the humanitarian State which will be the ultimate survivor.

No doubt Prof. Estabrooks is in the right when he maintains that modern civilization has beset the path of its habitues with temptations which were unknown to our uncivilized ancestors. He instances the case of a pair of educated parents, finding they could not afford both a child and an 'auto', decide on the latter. This choice, according to the author, was made under the action of the "pleasure principle, the greatest force guiding human and animal behaviour", a principle which, in the reviewer's opinion, fails to explain several forms of human behaviour. The author, however, does not mention that our uncivilized ancestors—and some of our civilized—had also their temptations. They had to think whether there was food enough to fill a "new mouth" and, if not, solved their problem by the practice of infanticide. A tribe which indulged in this practice beyond replacement rate soon fell a victim to the law of natural selection.

The two most urgent problems which the civilized have to solve are, in Prof. Estabrooks' opinion, (1) the abolition of feeblemindedness and (2) the abolition of war. The solution of the first is "startlingly simple ; sterilize all the mentally retarded for just one generation and feeblemindedness will practically cease to exist"—a result altogether at variance with the verdict given by British geneticists. War he regards as "racial insanity" ; it is "a wholesale butchering of our best stock". "Nature's great law, the survival of the fittest, is here not only ignored ; it is reversed." Prof. Estabrooks does not give a moment's consideration to the position of a nation whose manhood refuses "the honour of facing the machine gun and tank" ; such a nation does not survive ; war illustrates the law he so strenuously advocates—the survival of the strongest.

In his preface the author informs us that "this book is intended to represent a point of view—nothing more". Certainly his point of view loses nothing from the vigour and clarity of its presentation. He shares with his colleague Prof. Hooton of Harvard, not only the gift of humour and a faculty for vivid verbal presentation, but also the tendency to gain emphasis by the use of exaggeration. When he informs us that "up to now, education in its broadest sense has been the most potent force leading to human degeneration", we feel he is seeking to produce an effect rather than to inculcate truth. It was by education that Galton hoped to introduce the practice of eugenics.

Notwithstanding my criticism, there can be no doubt that Prof. Estabrooks has written a book with a high and healthy purpose ; he seeks to bring home to parents who spend on personal pleasure what should go to the building of a new generation, the guilt of racial embezzlement.

A. KEITH.

# SPECTROGRAPHIC TABLES

Tabelle der Hauptlinien der Linienspektren aller Elemente nach Wellenlänge geordnet
Von Prof. H. Kayser. Zweite Auflage, neu bearbeitet und herausgegeben von Rudolf Ritschl. Pp. viii+269. (Berlin: Julius Springer, 1939.) 28.50 gold marks.

Massachusetts Institute of Technology Wavelength Tables:
With Intensities in Arc, Spark or Discharge Tube of more than 100,000 Spectrum Lines most strongly emitted by the atomic elements under normal conditions of excitation between 10,000A and 2,000A, arranged in order of decreasing wavelengths. Measured and compiled under the direction of Prof. George R. Harrison by Staff Members of the Spectroscopy Laboratory of the Massachusetts Institute of Technology assisted by the Works Progress Administration. (A Publication of The Technology Press, Massachusetts Institute of Technology). Pp. xxix+429. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1939.) 90*s.* net.

THE appearance of these books is a sign of a more permanent aspect of the times than that which unfortunately must now engage most of our attention. Not only are the tables now before us of great intrinsic importance; they are significant also as a symbol of the transition of atomic spectroscopy from the field of physical theory, where the greater part of its work has now been completed, to that of industry, biology, and other activities in which it can find practical application.

Spectroscopy—spectrum analysis, as it was then called—began as a department of chemistry, but owing to the vagaries which spectra exhibited, arising from little understood variations in the source of luminosity, chemists soon reverted to their more dependable methods, and the practice of spectrum analysis was left for a few decades to astronomers. Stars had to be analysed by their spectra or not at all, and despite many inevitable mistakes, the almost exclusively astronomical period of spectroscopy saw many important advances. It was not until 1913, however, when the Bohr theory indicated the true character of spectrum emission, that the apparent inconsistencies began to be understood, and for the next fifteen years the study of spectra dominated research into the structure of the atom. The knowledge thus gained made spectroscopy a trustworthy instrument for investigating not only chemical composition but also the physical conditions existing in laboratory and industrial processes, the transient existence of intermediate substances during chemical changes, and a variety of other problems to which its relevance had not been suspected. It is in this epoch that we are now well immersed, and its *sine qua non* is the existence of accurate and comprehensive tables of wave-lengths, intensities and identifications of spectrum lines. The volumes under review represent the latest and most complete attempts to provide such tables.

The Kayser-Ritschl volume is a revision of an earlier publication, the general plan of which it retains with some improvements. New lines have been included, and most of the errors of the previous volume have been corrected, though the V line at λ 3876·08 is still given as 3877·08, and the non-existent V line, 6219·55 (apparently an error for 6119·55, which, however, is given), still appears, while the V I and Ti II lines, at 4395·24 and 4395·04, respectively, are each given twice in different places. On the whole, however, the volume seems to have been considerably improved. One great defect of the earlier edition has been corrected by the definite division at about 2,000A. between measurements in air and those in vacuum. Formerly, no indication at all was given of the medium in which lines in this region were measured.

Harrison's book is the first result of an entirely new project, involving the mechanical measurement, by the now well-known instrument installed at the Massachusetts Institute of Technology, of most of the wave-lengths recorded. While Kayser-Ritschl contains about 27,000 lines between 90,000 and 32 A., Harrison gives nearly 110,000 lines within the range 10,000—2,000 A. The much greater 'density' of lines in Harrison is further accentuated by the fact that only lines of neutral and singly-ionized atoms are given, whereas Kayser-Ritschl is not confined within any excitation limits. Furthermore, Harrison very usefully includes 1381 band-heads, identified, however, not by the molecule of origin but by its 'principal' atom, so that the CN bands, for example, are assigned to C. This is an unfortunate "simplification" for which it is difficult to find the justification, unless it be the inadequate one that "the tables are designed principally for use in spectroscopic analysis of materials and for identifying impurities". The publication as a whole, however, is a remarkable *tour de force*, which it is difficult to admire too highly, and of which the value can scarcely be exaggerated. Some idea of the mechanical mastery achieved over a very difficult

problem is given by the statement that "the wave-lengths of more than a thousand lines can be recorded in one minute without difficulty", and it might be added that there is no evidence of any sacrifice of accuracy.

The Kayser-Ritschl data have been taken from what are considered the most trustworthy sources; there has been no averaging of all available figures. This is true also of those of Harrison's wave-lengths which are not original measurements, but, unlike Kayser-Ritschl, he gives the sources in such cases. Kayser-Ritschl's wave-lengths do not go beyond the second decimal, since the disagreement between observers seems to make greater precision illusory. Harrison usually gives a third decimal, but doubts its accuracy. Neither volume gives hyperfine structures. Kayser-Ritschl includes forbidden lines, with their identifications if known and celestial sources if not, but Harrison omits all such lines, even if they have been produced in the laboratory. *Raies ultimes* are denoted in Kayser-Ritschl by the letters LL after the chemical symbol in the main table. Harrison gives no such indication, but lists *raies ultimes* in two separate tables, in order of wave-length and classified under the several elements, respectively. The degree of ionisation when known is given in both volumes by the usual numeral, I, II, . . . placed after the chemical symbol. When it is not known, Kayser-Ritschl places B, F or G (denoting arc, spark, or vacuum tube) after the symbol, and the single intensity number refers to that source. Harrison, however, retains the older method of giving a separate intensity column for each source, though a warning is given that the scales of the columns are not comparable, so that a line given a larger intensity number in the arc than in the spark might yet be enhanced in the spark. Both volumes are well printed, but Kayser-Ritschl is the easier to read. The small Clarendon type used in Harrison needs careful scrutiny to avoid misreading, and, even so, one is liable to confuse Ti and Tl, for example.

Books of this character cannot be satisfactorily reviewed until they have been in constant use over a long period. Two years under abnormal conditions provides less experience than is desirable. The impressions on which this review is based have come mainly from the measurement of plates of a specially prepared *raies ultimes* mixture, containing all the spectroscopic elements except indium and the rare earths, and showing many hundreds of lines throughout the ordinary regions of the spectrum. This work has shown very definitely that the volumes are complementary to one another and cannot properly be considered as alternatives. For most problems, and for preliminary work in all, Kayser-Ritschl is the more useful, Harrison containing too many lines within a short range to do more than confuse the investigator. Suppose, for example, a prominent line appears at a position estimated as between 4020 and 4021A. It will probably be Sc I, which has a *raie ultime* at 4020·40. Harrison, however, gives 29 lines within this range of 1 A., two of which are given considerably higher intensities than Sc I, and others comparable intensities, although, in fact, they are all relatively unimportant lines of their respective elements. Kayser-Ritschl gives five lines, with Sc I as the strongest. Since most workers use small dispersion spectrograms, not permitting the highest accuracy in measurement, Harrison gives little help. For those, however, who have facilities for precise measurement and for whom accurate identification is essential, Harrison may become indispensable. It is claimed that the lines given comprise one-half of those known, and account for 99 per cent of the radiation emitted by atoms within the range of wave-length covered. It is therefore clear that the volume serves better as a means of excluding possible alternatives to an identification adopted than as a ready guide to the identification to adopt.

Incidentally, it may be remarked that an almost indispensable supplement to such tables as these is a table of multiplets of the elements such as is partially provided in Miss Charlotte E. Moore's "Multiplet Table of Astrophysical Interest". The problem of the Sc I line referred to above could probably be settled at once by looking for the other three lines of its multiplet, and taking the relative intensities into account.

The mention of intensities introduces the most glaring defect of both books—the extremely unsatisfactory treatment of the problem of intensity scales. The problem is admittedly very difficult. Obviously no significance can be attached to the relative intensities of lines of different elements when the elements producing them exist in unknown proportions in the source; nor can lines far apart be given directly comparable intensity numbers because of variation of plate sensitivity. Within a single spectrum and a short wave-length range, however, the numbers can be at least in the right order of magnitude, and this order is often the only available factor in deciding a particular identification. How badly the need is met can be illustrated by a single example, chosen before the recorded intensity numbers were looked up, so that it may be taken—as, in fact, it is—as typical of the general chaos. The example is the well-known *DF* sextet of VI, containing the *raie ultime* at 4379, which covers only a short range of wave-length. The following are the arc intensity numbers of the lines in the two volumes, compared with those recorded by Miss Moore in the publication

referred to above, which are based on King's furnace spectra :

| | Kayser-Ritschl | Harrison | Moore |
|---|---|---|---|
| 4379·24 | 10*R* | 200*R* | 150*r* |
| 84·73 | 120*R* | 125*R* | 125*r* |
| 89·99 | 100 | 80*R* | 100 |
| 95·24 | 10 | 60*R* | 80 |
| 4400·59 | 60 | 60 | 60 |
| 06·65 | 80 | 40 | 80 |
| 07·66 | 70 | 15*h* | 70 |
| 08·21 | 70*R* | 30 | 70 |
| 08·52 | 50*R* | 30*h* | 90 |
| 16·48 | 20 | 15*w* | 20 |
| 21·59 | 20 | 30*h* | 20 |
| 26·01 | 15 | 25*h* | 20 |
| 29·80 | 15 | 30 | 15 |

This needs no comment, but a word may be added on the desirability—particularly in Harrison, where the lines occur at such small intervals—of making an attempt to give lines of different elements intensity numbers roughly proportionate to their relative prominence in their own spectra. The present numbers are utterly meaningless in this respect. For example, Harrison records two lines of Fe I, at 3243·109 and 3190·651, as having arc intensity 50. These lines are so weak that they do not appear on Buisson and Fabry's well-known map of the iron arc spectrum obtained from almost pure iron and intended as a record of the whole spectrum. On the other hand, the *raie ultime* of W, at 4008·753—in a region where plate characteristics should give it relative prominence—has intensity 45. It is much to be hoped that a satisfactory intensity scale will take precedence of the inclusion of wave-numbers in the future improved tables which Harrison promises.

In spite of all defects, however, these volumes represent an enormous advance over anything of the same character that has preceded them, and they are indeed indispensable in any laboratory in which spectroscopy is applied to practical problems. Spectroscopists everywhere will acknowledge a deep debt of gratitude to the compilers for the care and patience with which they have carried out a very great task. HERBERT DINGLE

# THE EXTRA PHARMACOPŒIA

The Extra Pharmacopœia
By Martindale. Twenty-second edition. In two vols. Vol. 1. Pp. xxxviii+1289. (London : The Pharmaceutical Press, 1941.) 27*s*. 6*d*.

THE first volume of the twenty-second edition of the Extra Pharmacopœia—Martindale—has appeared at about the time that it might have been expected if there had been no war. It looks like its immediate predecessors and, like them, will be almost indispensable to the physician and the pharmacist, who are expected to know all that is new in the way of medicines, whether they be respectable and approved or merely advertised. A great part of the material for this edition had fortunately been collected before the War had cut international communications and slowed up the output of scientific work. More than two thousand new medical and pharmaceutical papers are abstracted and the revision committee has had to put much more of the book into small print to make room for the new matter without making revolutionary changes in the format.

The arrangement of the information still leaves something to be desired, and it is fortunate that there is a good index. Drugs with closely allied actions are generally classified together, but choline, because of its relation to acetylcholine, is discussed in the article on acidum aceticum, which is absurd. Sympathomimetic amines are arbitrarily divided up so that some of them are included with adrenaline and others with ephedrine.

Data from the first three addenda to the British Pharmacopœia, the second supplement to the British Pharmaceutical Codex, the new French and Japanese Pharmacopœias and the new supplements to the United States and Dutch Pharmacopœias are included. Some of the information about proprietary names has been eliminated because the drugs are no longer available in Great Britain. This is unfortunate because it makes the book less complete as a work of reference, without any compensating advantages except a small saving of space. There is no guarantee that the drugs which are mentioned are available ; many of them are not.

The amount of information in this book is prodigious, and it is difficult to select examples of the changes that have been made without making out a long list. Sulphanilamide and its derivatives occupy no less than 37 crowded pages. Many new hormones and vitamins have been dealt with and there is much information about such new interests as blood transfusion, heparin, penicillin, chlorophenolic and higher phenolic antiseptics. The section on vaccines, sera, toxins and antitoxins now covers 74 pages. An entirely new therapeutic index has been compiled in which diseases are arranged alphabetically, with a list of the treatments recommended and the pages of the book on which references to these treatments will be found. This index will be very useful to medical men.

The book as a whole gives an interesting picture of the unprecedented advances in therapeutics which have occurred in recent years.

### The Revolution in Physics

By Ernst Zimmer. Translated, and with a Preface, by H. Stafford Hatfield. Pp. xv + 240. (London: The Scientific Book Club, 1941.) 2*s*. 6*d*.

THERE are almost numberless little books written to help the layman to understand modern physics. At first sight this modest volume is yet another. But not quite. It deals, as they all do, with the rapid development of physics, indicating how it is that our concepts have become less and less mechanical. But here the similarity ends. The usual course is to make up for so much hard going by generous quantities of applied science, wireless, television, and other 'benefits'. In this book the author, however, decides otherwise. He makes a moving, almost passionate, appeal for pure knowledge, without thought of application, still less of reward. The whole outlook is remarkably unselfconscious, and, for that reason alone, most refreshing. Prof. Max Planck's short introduction is characteristic and charming.

Naturally enough, the writer is a little pedestrian in his dealings with the classical quantum theory, but very much the reverse in his discussion of positivism, determinism and Heisenberg's Uncertainty Principle.

There are a few typically Teutonic lapses; for example, Clerk Maxwell is described as "English"—more than sufficient to cause the first Cavendish professor to rotate in his grave. It is hard to judge of the translation without access to the original: on the whole it seems well done. Certainly it is faithfully done, since one gets glimpses both of the author's occasional touches of *Lehrkörperheit*, and yet of his natural facility as an essayist.

F. I. G. R.

### The Observer's Book on Meteorology

By William Alexander and W. J. D. Allan. (The Observer's Books, No. 6.) Pp. 110. (London: George Allen and Unwin, Ltd., 1941.) 2*s*. 6*d*. net.

THIS book is written for pilots and observers in the R.A.F., who will find in it much useful information. It is marred by some inaccuracies, over-sweeping generalizations and dubious explanations of phenomena that meteorologists have not yet succeeded in explaining. One of the inaccuracies is probably a misprint—the reference on page 77 to a shallow depression as one above 1,100 millibars. Minor ones that might confuse a student of elementary meteorology include the statement (p. 36) that pressure gradient is usually expressed as the distance in miles between two isobars of two millibars difference in pressure, a quantity that is in fact proportional to the reciprocal of the gradient, and (p. 52) that in the British Isles it is customary to refer to northerly winds as polar winds and southerly winds as equatorial winds; apart from the absence of any necessary connexion between the direction of the wind and its past history there is the contradictory statement (p. 66) that polar air has a tendency to flow in a westerly direction and equatorial air in an easterly direction. In the paragraph on snow (p. 97) the explanation of the formation of snowflakes is unorthodox and unlikely, nor is it inevitable to have rain on the ground when snowflakes fall through a layer of air above 32° F. (Why not sleet?). One would like to know the grounds for attributing (p. 78) tropical cyclones and temperate tornadoes to the same cause. Weather forecasting with the aid of isallobaric charts is not as simple as the account on p. 110 implies, although the changes described sometimes take place.

### Our Wonderful Universe

An Easy Introduction to the Study of the Heavens. By Dr. Clarence Augustus Chant. New edition, revised and enlarged. Pp. 281. (London, Bombay and Sydney: George G. Harrap and Co., Ltd.; Toronto: The Ryerson Press, 1940.) 5*s*.

THIS work is written specially for young people and the subject is approached from the observational side: mathematics are completely absent from the text. The copious illustrations will prove very helpful to the tyro as will also some of the simple experiments which have been suggested, for example, the camera and flash-lamp apparatus, described in Chapter 1, to illustrate the rotation of the earth. Part 1 gives a brief outline of the general structure of the universe and Part 2 deals with the solar system, concluding with a short account of the origin of the sun and planets. Reference is merely made to the nebular hypothesis and the tidal theory; in the limited space the author finds it impossible to state any of the objections to either of these theories. In Part 3 the reader will find an excellent account of the stellar systems, proper motions, variable stars, double stars, star clusters, nebulæ, etc. Detailed descriptions are impossible in dealing with such a vast programme in a single volume, but Prof. Chant has succeeded in condensing an enormous amount of useful information into the work, which will stimulate young readers to pursue the subject further in more advanced text-books. The value of the book is enhanced by the illustrations and photographs—210 altogether—which greatly increase the interest in the various sections.

M. D.

### The Promise of Scientific Humanism Toward a Unification of Scientific, Religious, Social and Economic Thought

By Prof. Oliver L. Reiser. Pp. xviii + 364. (New York: Oscar Piest, 1940.) 4 dollars.

THE author advocates the use of non-Aristotelian logic. This would mean abandoning the laws of identity, contradiction and excluded middle. He claims that such a revolution in thought would eliminate many ancient and modern fallacies, and introduce a new and better era in science, philosophy and social relations. In spite of some good points he fails to make out a case. His exposition is often rhetorical and cloudy; he uses indiscriminately all sorts of opinions, sober and speculative, good and bad; he shows no capacity for critical judgment. Altogether the new non-Aristotelian logic sounds very like the old sophistry that Aristotle's logic was designed to expose.

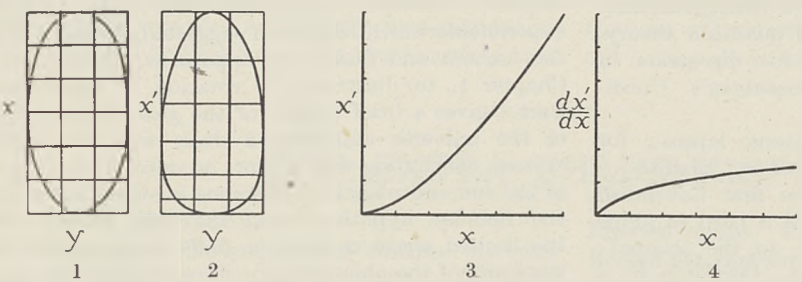
A. D. RITCHIE.

# THE 'LAWS' OF BIOLOGICAL GROWTH

By P. B. MEDAWAR

DEPARTMENT OF ZOOLOGY AND COMPARATIVE ANATOMY, OXFORD

THE study of mere increase in size and weight has steadily lost the interest of British students of growth since D'Arcy Thompson[1] and later Huxley[2] directed their research to other fields. Many of the beliefs about organic growth that formerly seemed reasonable or even self-evident—in the existence, for example, of an integral biochemical process known as 'growth metabolism'—have now been refuted or superceded ; and it is only quite recently that students of growth have stopped applying to the organism the fiscal concept of interest, or increments of size, accumulating at finite intervals. Minot[3] always used it. The inspection of curves of growth has nevertheless made known a number of general principles concerning the dependence of the size of organisms on their age which it is very worth while to collate and comment upon. These laws are of the growth of *individual* organisms. It was Davenport[4] who first pointed out the unsuspected extent to which curves of growth compiled from mass statistics may be corrupted by what are in reality curves of distribution. At puberty, for example, the growth of individual boys shows a marked spurt, the time of onset of which in the male population as a whole is normally distributed about a mean value at approximately 14½ years. The 'adolescent growth component' of the mass curve of human growth, to which Robertson[5] fitted his well-known 'monomolecular autocatalytic' function, does not occur in the curve of individual growth. Davenport showed that it was essentially a modified Gaussian curve of error, indicating the distribution in time of the onset of adolescent growth spurts.




ILLUSTRATING THE TYPE OF CHANGE OF SHAPE BROUGHT ABOUT BY A SIMPLE GROWTH GRADIENT.

The transformation from an elliptical to an ovoid outline is illustrated by the grids superimposed on Figs. (1) and (2). The ordinates or $x'$-values in (2) are those which correspond to *integral* values of $x$ in the normal grid (1). In (3) the 'mapping function' $x' = f(x)$ which defines the transformation is plotted in the usual way ; its essential feature, as (4) shows, is that the slope of the curve $x' = f(x)$ never decreases as $x$ increases.

The laws themselves require a varying amount of critical attention. Each describes a general trend of growth ; they take into account neither short-term fluctuations or periodicities, as in animals with an annual cycle of growth, nor more pronounced singularities, such as those brought about by metamorphosis in animals which undergo it. Unlike some mathematical approximations, they lose accuracy and significance in proportion as the period of time over which they are intended to apply becomes shorter. Nor do these laws apply over the whole of the life-cycle. They should be taken to refer to the 'functional period' of development, namely the period which begins with the blocking-out of the main organ systems in the embryo.

1. *Size is a monotonic increasing function of age.*

Less formally, organisms do not decrease in size as they grow older. A more casual statement, such as that 'organisms increase in size as they increase in age', would be much less satisfactory, for it could be shown to entail an unproved belief, namely that in the course of their development organisms approach a limiting size. It is plausible to suppose that they do so, and most of the functions commonly used to describe the course of growth are functions with limiting values. But it is important not to exclude, at all events in a formal way, the possibility that organisms reach a *maximum* size at which they remain virtually stationary during the latter part of their life.

2. *What results from biological growth is itself, typically, capable of growing.*

Biological growth is fundamentally of the multiplicative type : that is the only 'law of growth' commonly recognized as such. It justifies the almost universal use of the relative differential $dw/Wdt = d/dt$ ($\log_e W$) as the one most likely to give a significant expression of change of size. The estimate it provides is of the *specific growth-rate*, and the special instance of growth by the compound

interest law corresponds to a uniform specific growth-rate.

3. *In a constant environment, growth proceeds with uniform specific velocity.*

The truth of this important principle, with its Newtonian flavour, has been demonstrated on a number of occasions, perhaps most clearly by Richards[6] for population growth in colonies of yeast. The 'constancy' which the law requires is not only of the external environment, but of the *milieu interne* as well. Outside work must be done on a growing system if its environment is to remain constant, and since the *milieu interne* of complex organisms is not accessible to the sort of experimental control which is required, it is only tissue-cultures and populations of non-cellular organisms which can be induced to grow 'logarithmically' for any significant length of time. The fourth law, then, relates the second to conditions which actually hold in the development of many-celled organisms.

4. *Under the actual conditions of development, the specific acceleration of growth is always negative.*

While the growth-rate may rise and then fall, as it does in any organism the growth of which is described by a sigmoid curve, the *specific* growth-rate always falls. There are few, if any, exceptions to this general rule. Roughly speaking, it means that 'what results from biological growth', although capable of growing, is not capable of growing as fast as its precursor. Minot regarded the degree to which it fails to do so as a measure of senescence. Senescence is therefore a process taking place continuously throughout life. This is Minot's great contribution to biological thought.

5. *The specific growth-rate declines more and more slowly as the organism increases in age.*

The specific acceleration of growth $d/dt\ (dw/Wdt)$, while always negative, rises progressively to zero during the course of life. In short, 'organisms age fastest when they are young'; or, to put it in a more familiar way, they develop more slowly as they grow older. The rate at which the specific growth-rate declines is an important parameter in any equation for growth, and its value can in certain circumstances be measured by purely experimental means[7].

These laws provide a fairly stable background for the quantitative analysis of growth. An obvious omission is of an expression for the differential growth of the parts of an organism, or of parts in relation to the whole. One possibility, which has been examined exhaustively by Huxley, is that the specific growth-rates of comparable parts of an organism bear a constant ratio to each other throughout the greater part of life. This relationship has been described as 'simple and significant'; and what it chiefly signifies is that senescence, measured by the rate at which the specific growth-rate declines, proceeds at an approximately uniform rate throughout the organism. This latter theorem, which is far from self-evident, and which might have been the most important *inference* from any established facts concerning constant ratios of specific growth-rate, was treated by Huxley as one of the *axioms* he used to provide a deductive basis for the doctrine of constant specific growth-rate ratios in general. A more general and far-reaching statement about growth-rate patterns is Huxley's theorem that, typically, the particular growth intensities of the parts of an organism are spatially arranged in an ascending or descending order of magnitude. Organisms which conform to this pattern may be said to 'exhibit a growth gradient'. The generality of the gradient pattern reflects our conviction that a large part of the physics of development is primarily a physics of diffusion. This is the chief physiological importance of the theory.

The gradient theory may also be used to define, within broad limits, the *type of change of shape* which occurs during the developmental growth of an organism or of one of its parts. For the transformations which can be designed to assimilate any two shapes adopted by a developing organism can, in principle, be defined by a substitution of variables in the equation which describes one shape or the other. The new variables are functions, sometimes called mapping functions, of the ones they replace. Transformations are defined by the properties of these functions. The gradient theory restricts the mapping functions which define the transformations of development to membership of a large but distinct class. Consider, for example, an axial gradient of growth which distorts the outline of an organism in one dimension only. If $F\ (x, y)=0$ describes the original outline, the new outline will be represented by the equation $F\ (x', y)=0$, where the key to the transformation is the mapping function $x'=f(x)$. The gradient theory, strictly interpreted, merely requires $dx'/dx$ to be a monotonic function of $x$. In other words, the characteristic mapping function is one of which the first derivative is a monotonic function of one or the other of the original variables.

By a natural extension of this interpretation, the gradient theory can be generalized to admit transformations which are the *products of* transformations so defined. The product of one transformation with another is the result of applying one to the result of applying the other, and it should usually be taken in a definite order. In generalized form, the theory therefore states that complex changes of

shape can be significantly resolved into simple changes of shape of the type defined above. The word 'significantly' is meant to express our assurance that the whole procedure is not merely an analytical device, but that the product of transformations corresponds to the combined or successive action of distinguishable physiological processes.

This interpretation of the gradient theory, which will be given a fuller treatment elsewhere, relates it to the more comprehensive methods of analysing organic form which were designed by D'Arcy Thompson. The danger of over-simplification is of course very real : for example, the outline drawings of animals with which we are obliged to start our analysis of shape are themselves affine transformations of the three-dimensional objects they represent. But once they have been recognized as such, our purely informal simplifications and assumptions lose a great deal of their virulence. There is something more in the analysis of growth-rate patterns than a determination to see order where no order exists.

[1] Thompson, D'Arcy, "Growth and Form" (Cambridge, 1917).
[2] Huxley, J. S., "Problems of Relative Growth" (London, 1932).
[3] Minot, C. S., "The Problem of Age, Growth, and Death" (New York, 1908).
[4] Davenport, C. B., *Coldspring Harbor Symposia*, 2, 203 (1934).
[5] Robertson, T. B., "The Chemical Basis of Growth and Senescence" (Philadelphia, 1922).
[6] Richards, O. W., *J. Gen. Physiol.*, 11, 525 (1928). Richards uses the term 'constant growth-rate' in the sense in which 'constant specific growth-rate' is used here.
[7] Medawar, P. B., *Proc. Roy. Soc.*, B, 129, 332 (1940).

# LIFE AT HIGH ALTITUDES

By Prof. A. J. Carlson
University of Chicago

MEN of science at the symposium on "Life at High Altitudes and Aviation Medicine" held at the University of Chicago on September 23 as part of the University's fiftieth anniversary celebration heard dissertations ranging from a description of an "Altitude Human Race" to the physiology of the free fall and of parachute jumping.

Since fright, rather than basic physiological reactions like blood pressure or heart action, is one of the chief causes of fainting in a delayed-opening parachute jump, use of a small guide parachute which prevents twisting and spinning in mid-air—conducive of fright—will contribute much to the safety of parachute jumpers.. In addition, the 'anti-spin' chute prevents tangling with the parachute lines which sometimes occurs, if the parachutist is twisting when he pulls the rip cord.

These points, given particular emphasis by the strategic military desirability of delayed-opening jumps, were made by Prof. Andrew C. Ivy, professor of physiology and pharmacology in the Northwestern University. Prof. Ivy reported research in collaboration with Prof. Anton J. Carlson, of the University of Chicago, in a paper on "The Physiology of a Free Fall through the Air".

It is worthy of note, pointed out Prof. Ivy, that the person who is in a position where a delayed fall is advantageous would be given confidence by the early opening of the accessory, 'anti-spin' parachute, and this, plus falling in a more natural, or semi-erect posture,. would decrease the likelihood of inexperienced persons fainting from fright.

It is Prof. Ivy's belief that when it is necessary to bail out of an aeroplane, a delayed opening of the parachute has certain strategic advantages : the jumper is less likely to foul another jumper, an aeroplane out of control, or falling aeroplane parts ; an open parachute is an excellent target for the enemy ; if the parachute is opened at an altitude of thirty thousand feet or more the jumper may lose consciousness from lack of oxygen unless he carries a supply with him ; if the aeroplane is moving rapidly and the parachute is opened soon after leaving the plane, the jumper is likely to be injured and the parachute and its attachments ripped. When a person jumps from an aeroplane, his rate of fall decreases or increases to an approximate rate of 120 miles per hour. At 300 miles per hour the shock load to the jumper and the parachute is five thousand pounds.

In experiments covering five jumps with a human subject, Mr. A. H. Starnes, following earlier experiments with dummies and apparatus, verified that :

(1) Except in flights as fast as would be experienced in a jump from a descending dive bomber, there is no appreciable unfavourable influence on heart-rate and blood pressure.

(2) A fleeting mental 'black-out' occurs shortly after the jerk of the riser straps caused by the chute opening. Otherwise in a calm and unfrightened jumper, mental reactions are clear, rapid and normal.

(3) The same difficulty in hearing was found as is experienced facing, or with the back to, a high wind. Vision was not impaired when goggles were worn ; the eyes watered without goggles.

(4) There was no feeling of nausea even in spinning, because of the brevity of the time. (The longest drop was 16,500 feet at 158 miles per hour, which took seventy-one seconds.)

(5) Contrary to the findings of Dr. H. G. Armstrong of the U.S. Army, there was no sensation of floating in space when the eyes were closed. Subjectively Mr. Starnes was aware of the drop because of the wind rush and other sensations. He "felt that he was falling, and falling rapidly".

The "Altitude Human Race", a biological entity differing radically in several respects from other branches of mankind, was postulated to describe the dwellers of the Andes mountains of South America by Dr. Carlos Monge, of the University of San Marcos, in Lima, Peru.

Listing a score of vital differences between the man of sea-level and the man of the Andes, living at 10,000–16,000 ft. above sea-level—Mt. Whitney, highest peak in the United States, is 14,495 ft. ; there are thirty-three South American peaks higher than seventeen thousand feet, the highest, on the Chile-Argentine border, Mt. Aconcagua, 22,834 ft.—Dr. Monge also described the disease 'chronic mountain sickness', which afflicts lowlanders when they start to live in the high altitudes.

In the Andes, Dr. Monge pointed out, twelve million persons are living all the time under conditions at an altitude where the oxygen pressure is 85. mm as contrasted with the sea-level pressure of 150 mm.

Describing the high-altitude human race, Dr. Monge said the heart of Andean natives actually beats more slowly following exertion. It seems that increased vagal action causes the bradycardia, which may be considered the law of the altitude heart. We find all the conditions of athletic heart. Chronic anoxia (lack of oxygen, such as that characterizing high altitudes) is a permanent stimulus to improve heart efficiency.

Dr. Monge suggested that this man has some of the biological characteristics needed for an aviator, and that perhaps a better knowledge of the physiology of the man born and living at fifteen thousand feet would help the learning of the required conditions of fitness for high-altitude flight. Since 1928, Peruvian aviators have flown over the Andes continuously at higher than fifteen thousand feet elevation.

Comparing the acclimatization of high-altitude dwellers to the instinctive force which causes the annual migrations of birds, Dr. Monge cited the factor of altitude as one which in the recent Bolivian-Paraguayan war "killed more people [high altitude soldiers made to fight in the lowlands] than the enemy's bullets". The day will come, he pointed out, when these vital matters will receive due consideration for the welfare of the altitude human race.

Men of the Andes may be considered as belonging to a special climato-physiological variety of the human race. In fact they are closely related to their geographical surroundings : altitude, radiation, humidity, ionization, and so on. The sociological behaviour of such men and the telluric (earth-related) environment appear as a whole, as a biological system which cannot be divided, as a climato-physiological unity. They have to adapt themselves on coming down to the coast ; they cannot always stand the meteorological conditions of lower lands ; they become predisposed to disease of the lungs, as has already been reported by Dr. Monge.

But the struggle for life obliges them to come down ; and then ensues a fact which is worth noting. Every year about one hundred thousand men come down to sea-level for agricultural work, but after about three months they go back to the altitude. They never stay at the coast no matter what it offers them.

These peculiar annual human migrations of high-plateau societies are a very well-known fact of biological significance. "Like the swallows, Andean men have the sense of returning home". Therefore, they have the same problems of acclimatization to face when going down to a land not always fitted for their physiological equipment. Usually acclimatization at the coast is easier than that on the highlands. But there are the facts, the study of which is of utmost importance for the knowledge of Andean populations.

How the body mechanisms which constantly tend to maintain the vital balance between acidity and alkalinity adjust to high altitude by stimulating increased breathing, but offsetting the chemical effects of this increase on the blood, was reported by Major David B. Dill, of the U.S. Army Air Corps. Major Dill spoke on "Acid-Base Balance in High Altitudes".

Reporting the Andean expedition to Chile in 1935, in which members of the expedition lived at 17,500 ft. and worked at 18,000 ft., Major Dill described the "beautiful integration of the mechanisms of the organism which combat disturbances of the balance arising from abrupt and prolonged exposure to oxygen deficiency".

In the long-run process of acclimatization, when the acid-base relation is thrown out of equilibrium because of limited availability of oxygen, he said, the increase in the number of red blood cells (oxygen carriers) makes it possible for arterial blood to take up as much oxygen as at sea-level.

In the short-run compensation for acute oxygen shortage, Major Dill listed four steps by which the balance is temporarily maintained: the reduced oxygen in the arterial blood stimulates increased breathing by the action of the carotid body, a small emergency mechanism lying beside the carotid artery (in the neck); this raises the oxygen content of the blood, but causes an increase in alkalinity; this excess is absorbed through the buffering capacity of body proteins, thus relieving the inhibition which alkalosis characteristically exerts on the respiratory centre in the brain, producing a balance between the activity of the respiratory centre and the carotid body.

The chain of events involved in acclimatization (as contrasted with short-run compensation) has been seen to involve a series of reactions:

(1) Lactic acid in the blood remains unchanged while at rest.

(2) After the first few hours of adjustment, the saturation of oxygen in the arteries attains a constant level.

(3) Lung ventilation is maintained at an increased rate.

(4) Arterial blood, after initial alkalinity, eventually assumes its usual reaction.

(5) Both free and combined carbon dioxide in the blood are reduced, but the ratio between them (which governs the respiratory centre) is eventually restored to its usual value.

Taking part in these reactions, Major Dill pointed out, are the lungs, the respiratory centre, the carotid body, the blood-forming tissues, and the kidneys. The over-all result is that man, without taking thought, is enabled to live and work in an atmosphere that contains only half as much oxygen as at sea-level.

Although in experiments in which atmospheric pressure was reduced to one-sixth its sea-level value, the exchange of gases in the lungs goes on as usual, it must be admitted that the possibility of a disturbed acid-base balance exists at any altitude above thirty thousand feet if the period of exposure is long enough. Decompression illness, or bends, may be experienced. If this affection becomes acute, one sees increased respiratory volume, and unless return to lower altitude is prompt there may be circulatory failure and collapse.

The symptoms here seen are like those of shock at ground-level. The stimulus to the respiratory centre presumably originates from a diminished blood supply to the brain and the accumulation of carbonic acid in the respiratory centre. With return to low altitudes, relief is usually prompt.

# OBITUARIES

## Dr. E. S. Beaven

THE passing on November 12 of Dr. Edwin Sloper Beaven at the age of eighty-four, after a brief illness, will be deeply regretted by a wide circle of friends in Great Britain, and by many in other countries to whom he was known either by personal contact or through his published works.

Dr. Beaven was born near Heytesbury in Wiltshire, and for the greater part of his life resided in the neighbouring town of Warminster, where he carried on the business of malting. Early in his career Beaven became associated with Messrs. Arthur Guinness, Son and Co., the celebrated brewers, an association which influenced the science of brewing, and more particularly all aspects of barley production in the British Isles, in a remarkable manner.

As a maltster the involved question of quality in malting barley attracted Beaven's inquiring mind, and one of his earliest investigations, carried out in collaboration with his friend Dr. J. M. H. Munro, dealt with conditions influencing this important attribute.

But Beaven came of yeoman stock, and it was not long before the convictions engendered by such an ancestral background led him to extend his investigations to the many questions affecting the production of barley. Thus, starting first in the garden of his residence, and later on a more extended scale on land acquired for the purpose, Beaven began a series of nursery and field experiments, now world-famous. These investigations, started on his own initiative, and continued for a period of more than half a century, entirely at his own expense, were a consuming interest throughout his long life. Largely because of the care in execution and then in the clarity of exposition of the results derived therefrom, the experiments at Warminster have for many years been a source of inspiration to visitors from all parts of the world.

One of the most valuable features of the material gathered together at Warminster with meticulous care and patience, was a world collection of species and varieties of barley. This material eventually formed the basis of an authoritative classification of the genus, published by Beaven in 1906, which remains a standard exposition of the subject.

Beaven's most active years coincided with the reappearance of Mendel's theory of heredity, and he applied the new conception enthusiastically in the production of improved varieties of barley. Early in the century he began a long series of hybridizations that culminated in the production of the now well-known and widely grown variety Plumage-Archer. This barley, which will always be honourably asso-

ciated with Beaven's name, exemplifies one of the few successful attempts to secure high grain productivity, allied with high malting value.

In the course of the development of Plumage-Archer, the necessity of a small-scale system of yield testing became insistent. To this Beaven applied himself with characteristic thoroughness, and eventually evolved the chequer board system, which with some modification is now widely employed by plant breeders, and later the drill-strip system for testing larger quantities of material on a field scale.

Beaven's interest in all aspects of barley production, both at home and abroad, was unbounded. No journey was too long, if at the end he could see something new or verify the basis of some conclusion he had arrived at. His audience was consequently always a large one, and because of his enthusiasm, always appreciative.

Despite the many calls of his business, Beaven took a keen interest in all activities directed to the improvement of agriculture, to which he himself had contributed so signally. He was present as a member at the first council meeting of the National Institute of Agricultural Botany in 1919. In 1929 he was elected chairman of the Council; he served again in the same capacity in 1939, and owing to the outbreak of war retained this position during 1940, and up to the date of his death. In 1932 he was chairman of the Farmers' Club.

Beaven's work in furthering the science of crop improvement was recognized by the University of Cambridge, from which he received the honorary degree of LL.D. in 1922. He was awarded the Horace Brown Gold Medal by the Institute of Brewing in November 1930.

Beaven's personality will remain a vivid memory to his friends and acquaintances. Apart from a boundless enthusiasm for his particular subject, his outstanding characteristics were a directness of approach to a problem, an independent outlook, and a fearlessness and tenacity in maintaining his point of view. He possessed a keen sense of humour, and although always severely critical, his generosity of feeling, particularly to youth, was unfailing.

Beaven owed much to the influence of a happy family life, and sincere sympathy is extended to his widow and to three daughters who survive him.

HERBERT HUNTER.

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We regret to announce the following deaths:

Prof. Phillipo Bottazzi, formerly professor of physiology in the Universities of Genoa and Naples, aged seventy-four.

Prof. Carrie M. Derick, emeritus professor of morphological botany and genetics in McGill University, on November 10, aged seventy-nine.

Prof. H. S. Hower, head of the Department of Physics in the Carnegie Institute of Technology, on October 10, aged sixty-four.

Dr. J. A. Nelson, formerly research entomologist in the U.S. Department of Agriculture, on August 9, aged sixty-five.

Prof. W. A. Noyes, emeritus professor of chemistry in the University of Illinois, on October 24, aged eighty-three.

Dr. J. S. Owens, well known for his work on atmospheric pollution, on December 6.

Prof. Peter Sandiford, professor of educational psychology in the University of Toronto.

Prof. Hans Spemann, professor of zoology in the University of Freiburg-im-Breisgau, aged seventy-two.

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# NEWS AND VIEWS

## Administration in International Affairs

THE Sydney Ball Lecture on "Administrative Problems of International Organization", delivered by Mr. F. P. Walters, which has now been published as Barnett House Paper No. 24 (Oxford University Press. 1*s*. net), is highly relevant to the tentative discussions on post-war international reconstruction which are now proceeding. On the grounds both of efficiency and economy, the advantages of a central organization at the service of all the special staffs required are obvious, and Mr. Waters postulates further that some such centre as Geneva and an annual meeting similar to the assembly of the League of Nations, as well as the secretariat, will be required before dealing with the special problems of administration concerned with the organization of an international centre and its relations with participating Governments. He stresses first the value of a separate department for League affairs, the need for which would have been more apparent in Great Britain but for the general efficiency of the Civil Service and the exceptional ability and energy of officials in the Foreign Office—a tribute from a League official which should be noted. He suggests further that the League budget should include an appropriation for ten or fifteen officials to be seconded each year from the Foreign Offices of different countries to spend six months or more in the secretariat, and he lays a great deal of emphasis on the advantage of cost of membership of committees, travelling expenses of delegations, general expenses of council meetings, the Assembly, and of conferences or special commissions being borne by the League budget as a whole and not by individual States. Similarly, he urges that assistance and advice given through the League or the International Labour Organisation should generally be regarded as a proper charge on the common budget.

The main point throughout Mr. Walters's review of the administrative side of international organization is that such work should be adequately financed. To starve it as has been done in the past may have

been a vital factor making the difference between failure and success. Mr. Walters suggests that an expenditure of from two to two and a half times the average expenditure of the last twenty years might have meant an increase in prestige and activity which would have meant success and not disaster. He considers that the sectional organization of the League secretariat has proved its value, as well as the planning of that secretariat on international rather than on national lines. Its morale has come creditably through a heavy test, and it has proved surprisingly easy to get people to undertake work for the League. The official attitude adopted by members of the secretariat has been fully justified. Apart from Mr. H. R. G. Greaves's study of the League committees, the administrative side of the League's work has received comparatively little attention, and the concentrated wisdom of this lecture should be sure of attention from all those who are giving close study to problems of international organization.

### Mass Psychology and the 'New Order'

IN a paper in the *Journal of Social Psychology* (11, 59–77; 1940), Prof. Vyscheslevzeff, of the University of Geneva, maintains that modern sociology cannot function, nor contemporary upheavals be understood and 'new orders' firmly established without the application of collective psychology, notably that of Jung, and especially his "collective" ("common to all men") Unconscious. Durkheim's view that the good lies in collective forms and division of labour is refuted by quoting Jung on the deformation of personality by specialization, which is held to be not really civilization but barbarism. The antinomy in classical German sociology of *Gemeinschaft* (community) and *Gesellschaft* (society) is particularly stressed. The former has the inner solidarity of, for example, the family or clan, and is characterized by a "collective unconscious", that is, the inherited propensities and archetypes of Jung; the latter is more like a constructed machine, that is, is artificial, and characterized by "collective conscious" (rationality). But they conflict (cf. Engels in the more limited economic sense), like the unconscious and conscious (including the 'personal' unconscious) in the mind of the individual. The problem is to harmonize this sociological conflict by a kind of fusion.

Prof. Vyscheslevzeff indicates that the conflict does not appear on the surface in Soviet communism because the *Gemeinschaft* has been eliminated or rather repressed (by the State), communism being solely rational, unreligious, non-traditional and non-mythical. But the paper under review was written before the outbreak of war and it might be suggested that the invasion of Russia has resulted in a re-emergence of *Gemeinschaft* and may possibly modify Soviet communism, spiritually at least, in the future. In Germany it seems to be implied that the two sociological group-categories exist side by side, in spite of leadership, for example, "racial superiority", "back to Wotan", etc., and "German organization". In looking for a nation which has succeeded in harmonizing the conflict, Prof. Vyscheslevzeff instances England, the Anglo-Saxon culture. "Only thus is it possible to understand the unusual adherence to tradition, to patriarch forms, to ancient symbols, to religion, to habit, together with a belief in progress, the striving for maximum rationalisation and ordering of all realms of life, everywhere bringing in the element of conscious purposefulness. . . . England presents an astonishing synthesis of 'community' and 'society': the collective unconscious with the collectively-apprehended and organised freedom." This view would seem to merit the attention of those who may desire to see a radically new order in Great Britain after the War.

### Health of New Zealand

ACCORDING to Dr. M. H. Watt, director-general of health for New Zealand, the year 1940–41 was on the whole the most favourable for health that the Dominion has had. Infantile mortality of the European population fell to 30·21, of which 22·03 is accounted for by 722 deaths in the first month of life. Of these, 606 occurred in the first week and another 72 in the second week. In 330 deaths among the new-borns prematurity was the only cause of fatality. The death-rate from tuberculosis among the Europeans was only 0·388, which is a low record for New Zealand and probably for any country, but this disease came next to cardio-vascular disorders, cancer and violence among the causes of European mortality. Among the Maoris the mortality from tuberculosis was 4·132 out of a total mortality of 17·51. Although syphilis has always shown a low incidence among both Europeans and Maoris, it is increasing in both, especially among the latter. Hydatid disease is more prevalent in New Zealand than in any other country, 120 new cases with 16 deaths being expected every year. The low incidence of endemic disease during 1940 was shown by the fact that there was only one death from measles, and 11 deaths from Flexner dysentery among 161 cases. There was a fall in maternal mortality from 3·64 in 1939 to 2·93 in 1940 due mainly to decline in fatality of puerperal sepsis and septic abortion. The total European births shrank from 27,881 in 1927 to 23,935 in 1935, when the birth-rate reached the low level of 16·17. Among the Maoris, on the other hand, the number of births increased from 1,495 in 1927 to 4,265 in 1940, and the rate from 23·22 to 46·87, while the infantile mortality in 1940 was 87·22 and the general death-rate 17·51.

### Smallpox in the United States

ACCORDING to the June issue of the *Statistical Bulletin*, the organ of the Metropolitan Life Insurance Company, of New York, there were fewer cases of smallpox in the United States in 1940 than in any previous year on record. The 2,839 cases reported represented a drop of more than 70 per cent from the previous year, and were little more than half the total reported in 1934, the previous record low year for smallpox. In an area containing one quarter of the population, namely, the New England States and

the Middle Atlantic States plus Delaware, Maryland and the District of Columbia of the South Atlantic Division, not a single case of smallpox occurred in 1940. In that year, as in every year, the majority of cases were reported in the north central area and in some of the western States. In most of these States large numbers of people disregard the danger of contracting smallpox, and minimize or ignore the efficacy of vaccination. On the other hand, in the neighbouring country of Canada, smallpox has been practically eliminated, as is shown by the fact that in 1940 there were only eleven cases and no deaths, while in eighty-seven cities there was not a single case.

### Psychiatry in Sweden

In a recent address (*Nordisk Med.*, 10, 1921; 1941) at the opening of the new Psychiatric Clinic at the Caroline Hospital, Stockholm, Dr. Viktor Wigert gave a retrospect of clinical psychiatry in Sweden during the last hundred years. In 1844 it was stated by the authorities in charge of the hospitals in Sweden that no expert knowledge was required for the treatment of insanity, which was therefore no concern of public health. This pronouncement had been occasioned by a demand made by a Royal Commission headed by Dr. Carl Ulrik Sondén that all institutions to be built for the care of the insane should provide for the treatment as well as for the confinement of the patients. Sondén, who was a pioneer in Swedish psychiatry, was the first to emphasize the importance of instruction in this branch of medicine, which was introduced in Sweden by Dr. Nils Gustaf Kjellberg, at the Uppsala Asylum in 1859. Kjellberg was an eminent man of science, who as early as 1863 expressed his conviction of a causal connexion between syphilis and general paralysis. In 1861 psychiatry was made a compulsory subject for the medical student in Sweden. In the 'nineties demands were made, particularly by Prof. Frey Svenson of Uppsala and Dr. Bror Gadelius of Stockholm, that special clinics for instruction in psychiatry should be created and that professors of psychiatry should be relieved of their duties as senior physicians to large asylums. Opposition to this demand, however, was not overcome until 1928, when it was decided to open a psychiatric clinic at the Lund University Hospital. The establishment of a similar clinic at the Uppsala University Hospital has since been decided upon, but this has not yet been completed. The psychiatric clinic recently established at the Caroline Institute of Stockholm finally realizes Sondén's desire for an institution for the cure of mental diseases.

### War and Birds

One of the most noticeable effects of the war-time conditions upon British bird-life has been the rapid increase of magpies, judging from reports in many parts of the country. Much larger flocks than usual have been seen in many counties, like Cheshire, but there is no evidence of any harmful effect. The cessation of game preservation and 'vermin' shooting is the chief cause, and the jay, carrion-crow and sparrow-hawk have shown increases from a similar cause. The felling of woods on a large scale is, however, affecting the distribution of the long-eared owl, woodcock, heron, rook, hawfinch as well as some of the woodland mammals and rarer birds of prey. Efforts to locate hobbies breeding in Wiltshire in 1941 failed.

### The Night Sky in January

The moon is full on January 2d. 15h. 42m. U.T. and new on January 16d. 21h. 32m. Lunar conjunctions with the planets occur on the following dates: Mercury on January 18d. 5h., Mercury 4° S.; Venus on January 18d. 13h., Venus 2° N.; Mars on January 24d. 8h., Mars 5° N.; Saturn on January 25d. 17h., Saturn 3° N.; Jupiter on January 27d. 10h., Jupiter 5° N. On January 21d. 1h. Mercury is in conjunction with Venus, Mercury being 6·2° S. Mars, Jupiter and Saturn are well placed for observation during the night, and Saturn's ring system is well presented for observation. Venus can be seen in the evening hours in the west and does not set until 19h. in the middle of the month. The earth makes its closest approach to the sun on January 2. The Quadrantid meteor shower is active on the first few days of January: the radiant is at R.A. 5h. 24m., Dec. 51° N., but this shower is not usually very conspicuous. On January 26d. 22h. 17m. there will be an occultation of $\gamma$ Tauri, mag. 3·9. During the month the interval from sunset to sunrise in the latitude of London shortens by 1h. 12m.

### Announcements

The following officers of the Iron and Steel Institute have recently been elected: *President*, Mr. James Henderson; *Vice-president*, Dr. Andrew McCance; *Hon. Treasurer*, The Hon. R. G. Lyttelton; *Members of Council*, Prof. J. H. Andrew and Mr. N. H. Rollason. Mr. Walter S. Tower, president of the American Iron and Steel Institute, has been nominated an honorary member of the Institute, and the presidents of the Sheffield Society of Engineers and Metallurgists and of the Sheffield Metallurgical Association have been appointed honorary members of the Council.

Catalogue 27, entitled "Science", has recently been published by Ifan Kyrle Fletcher, late of 26 Old Bond Street, London, W.1, and now of Merridale, Caerleon, Mon. It contains lists of old books on astrology, chemistry, mathematics, medicine and physics, as well as important works on civil and marine engineering from the library of Sir William Cubitt (1785–1861). Among the books of special interest and rarity are William Beaumont's "Experiments and Observations on the Gastric Juice and the Physiology of Digestion" (1833), Thomas Vicary's "The Englishman's Treasure with the True Anatomie of Man's Bodie" (1599), the "Histoire de l'Académie Royale des Sciences avec les Mémoires de Mathématique et de Physique", vols. 1700–1730, lacking the volume for 1728, but containing the rare supplementary volume for 1718, and Robert Boyle's "Paradoxa Hydrostatica" (1670).

# LETTERS TO THE EDITORS

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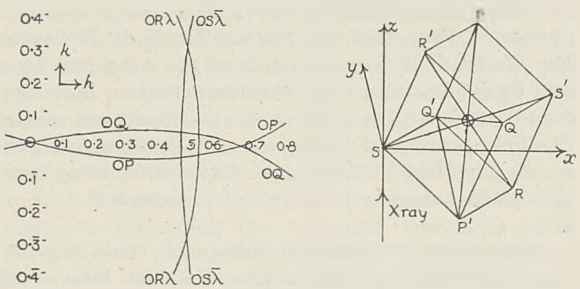
## Diffuse Spots in X-Ray Photographs

IN a recent letter[1] Mrs. Lonsdale reports that the shapes of certain "diffuse spots" in the pattern due to mono-chromatic X-rays which have been scattered by sodium are in agreement with calculations made by Jahn, and points out that this is the more noteworthy because the calculations had to take into account the peculiar anisotropy of the elastic constants of sodium.

I have previously observed that simple diffraction formulæ provide an accurate position of the positions of the spots, and also of many of the peculiar forms which they assume[2]. These formulæ are independent of the elastic constants.

For example, one of the photographs attached to Mrs. Lonsdale's letter shows a four-square spot. The sodium cell is body centred. The four conditions that the centre of the cell shall be in phase (by means of integral differences of wave-length) with the corners can be stated in the form of equations, which describe the relations between the direction cosines of the diffracted ray. Four of these curves are found to intersect in four points close together (see the accompanying figure), and the positions of these points agree within experimental error with those of the corners of the four-square spot in the photograph. It follows that at each of these four points, the centre of the cell is in phase with two of the corners and very nearly in phase with the other two. The combination is strong, and the peculiar diffused spot may be supposed to be its consequence.




The figure on the right represents the body-centred cubic sodium cell. The points $SRS'R'$ are in the plane of the paper: $PQ$ and $P'Q'$ are perpendicular to it, and so is the $y$ axis to which they are parallel. The X-rays are parallel to the axis of $z$. The angle between $SR'$ and the axis of $z$ is 20·5°. The figure on the left shows the $(hk)$ curves. For example, $OP$ is the locus of those values of $(hk)$ which the diffracted ray must have if the path by way of $O$ is of the same length as that by way of $P$: along $OR\lambda$, the path by $O$ differs by one wave-length from that by way of $R$.

The simple diffraction formulæ have so far predicted accurately all the positions of the diffuse spots, except that in a few cases spots are absent that might have been present according to calculation. If I apply the theory which ascribes the spots to the interaction of the structural periodicities of the crystal and the periodicities of elastic waves, I am not equally successful. It may be that I misunderstand the theory, which I would describe in the following way:

To take a simple case, let a wave be travelling along one of the principal axes of a simple cubic cell (such as that of potassium chloride). The velocity of the X-rays is so great in comparison with that of the elastic wave that the latter may be taken to be at rest while it is under consideration. The full period along the axis is now the least common integral multiple of the two wave-lengths. A super-lattice comes into existence. Waves of various lengths running in all directions provide an infinite number of these super-lattices, all of them integral multiples of the cell lattices.

When monochromatic rays fall on a perfect crystal there are no reflections. Laue photographs are blank. But when these conditions are only realized approximately (the possibility of the number of scattering centres being small is excluded from the theory under consideration) there may be accidental reflections. The multiplicity of super-lattices provides increased opportunities, and the diffuse spots are supposed to be the consequence.

One method of calculating results in a simple if approximate way is to assume only the one crystal cell, and to allow planes to have at least one fractional index. In every zone one such plane can be found to be a reflecting plane in the circumstances of the experiment. If the axes of the zones lie in the cubic face of the crystal on which the incident rays are striking almost normally as in the case described in NATURE[3], the calculated result is a network which agrees closely with observation for points near the origin but is seriously wrong farther out. If other zone axes are chosen, and there seems to be no reason for limiting them in the above way, indications are given which do not agree with observation.

It would be a strong support to the elastic wave theory if the calculations could correct this interpretation and show an agreement with the case quoted in the communication in NATURE to which I have referred.

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Nov. 28.

[1] NATURE, 148, 628 (1941).
[2] *Proc. Roy. Soc.*, 179, 51, 94 (1940).
[3] NATURE, 146, 509 (1940); *Proc. Roy. Soc.*, A, 179, 54 (1940).

## Influence of Temperature on Gel Formation

IT has been pointed out[1] that in the sol-gel change, gel formation should be more rapid the higher the temperature, in the absence of changes of solubility with temperature.

In the case of pectin-sugar gels, the method of preparation is generally such that the temperature of the mix is dropping while setting takes place, so that the dependence of setting rate on temperature is complicated. It is well-known, however, that jellies can be prepared by mixing a pectin-sugar solution not sufficiently acid for gel formation, with an acid solution; the mixture can then be maintained at a constant temperature during the setting period. Sucharipa[2] states that with mixtures of this type, setting is more rapid as the temperature is lowered: on the other hand, in a recipe booklet[3] for the use of these mixtures, it is stated that setting may be slower in cold weather.

It has been found in a series of experiments on jellies prepared from apple pectin, and containing 50 per cent sugar, that, over at least a limited temperature range, setting is much more rapid at the higher temperatures. The same effect was found, though to a less marked extent, with jellies containing 60 per cent sugar.

Two samples of apple pectin were used: *Pectin A*. Alcohol precipitated from commercial apple pectin. 80 per cent of total carboxyl groups esterified. Equivalent wt. = 1,110. *Pectin B*. Prepared by treating commercial apple pectin with sodium hydroxide in the cold, then acidifying and precipitating with alcohol. 67 per cent of total carboxyl groups esterified. Equivalent wt. = 630.

Jellies were acidified with citric acid or citric acid-potassium citrate mixtures: in all cases citrate was 0·8 per cent (as citric acid) in final mixture. *p*H measurements made on 50 per cent solution of jelly.

The following are some typical results:

| No. | Pectin (% as calcium pectate) | Per cent solids (refractometer) | *p*H | Time for first signs of setting | | | |
|---|---|---|---|---|---|---|---|
| | | | | 6° C. | 13° C. | 30° C. | 50° C. |
| 1 | A, 0·35 | 52 | 2·80 | 15 days | Between 9 and 24 hours | 100 min. | 60 min. |
| 2 | ,, | 52 | 3·05 | Not set 22 days | Not set 22 days | 33 hr. | 48 hr. |
| 3 | ,, | 62 | 3·38 | 3 days | 55 min. | 30 min. | 20 min. |
| 4 | ,, | 62 | 3·70 | Not set 12 days | 5 days | 3 days | 4 days |
| 5 | B, 0·36 | 52 | 2·44 | 6 hr. | 50 min. | 70 min. | 4 days |
| 6 | ,, | 52 | 2·80 | Not set 10 days | Between 6 and 20 hr. (at 20°C.) | Between 6 and 20 hr. | Not set 10 days |
| 7 | ,, | 62 | 3·20 | Several hours | 7 min. | 2 min. | 7 min. |

In all cases, mixtures which had failed to set at one temperature, set when the temperature was altered to that found to give most rapid setting. In all cases except series (6), the sugar-pectin solution was kept for several hours before mixing at the final temperature: the series (6) jellies were prepared by boiling, and then transferring portions of the mixture to tubes for storage at the temperatures given.

Of particular interest is the marked difference in the effect of temperature on mixtures made with the two pectin samples. This is in agreement with the more recent work on the effect of methoxyl content of pectin on jelly setting[4] and particularly with American work[5] on the relation between combining weight of the pectin and setting time (in a mixture which is cooling).

It is hoped to continue these experiments over a wider range of conditions: at present, it appears that the time for setting to commence is a minimum at a tmeperature dependent on the composition of the mixture, involving at least the composition of the pectin, the total solids present, and the *p*H.

I have to thank Messrs. H. P. Bulmer and Co., Ltd., for permission to publish this note.

R. McDOWELL.

H. P. Bulmer and Co., Ltd.,
Hereford.
Dec. 4.

[1] Lawrence, *Ann. Rep. Chem. Soc.*, **37**, 118 (1940).
[2] Sucharipa, "Die Pektinstoffe", p. 304 (1937).
[3] Issued by "Pomosin".
[4] Hinton, "Fruit Pectin", 61–68 (H.M.S.O.).
[5] Olsen, Stuewer, Fehlberg and Beach, *Ind. Eng. Chem.*, **31**, 1015 (1939).

## Nomenclature of Fowl Genetics

THE nomenclature of fowl genetics has become somewhat confused in recent years. So many characters have been investigated that the difficulty of designating symbols for the corresponding genes has increased considerably. There have been much overlapping and repetition, and the same symbol now frequently represents two, or even three genes. To experimental poultry breeders, and to students attempting to keep in touch with the latest developments, this position gives rise to much confusion.

The accompanying table gives a few symbols chosen at random, which have been used to represent more than one gene, and will serve to illustrate the difficulties:

| Gene | Character | Quoted by[1] |
|---|---|---|
| *F* | Feathering | Munroe (1938) |
| *F* | Frizzled plumage | Jull (1940) |
| *H* | Hatchability | Hays (1924) |
| *H* | Henny feathering | Punnett (1937) |
| *A* | Broodiness (1) | Goodale *et al.* (1920) |
| *A* | Egg size (1) | Hays (1929) |
| *A* | Pigment | Numerous |
| *C* | Chromogen | Quin (1936) |
| *C* | Broodiness (2) | Goodale *et al.* (1920) |
| *C* | Egg Size (2) | Hays (1929) |
| *P* | Mesodermal Pigment | Bateson and Punnett (1911) |
| *P* | Pea comb | Numerous |
| *P* | Production persistency | Hays (1927). |

I am drawing up a complete summary of known nomenclature; but it is evident from the accompanying list that the system is in need of standardization. The use of symbols such as $P^1$, $P^2$, $P^3$, etc., is to be recommended, as it avoids the confusion which arises from the practice of some authors of using small letters appended to the symbol. Thus, the gene for light iris is given as *Br*, which is ambiguous, for it could equally well be interpreted as a combination of a dominant gene *B*, and a recessive *r*. This introduces unnecessary difficulties, especially if a long genotype is being dealt with; for example, *AABbFFBBCcLlRRPPccGGHHMmNNEeEEBrbrPp SSWwDD* would allow of numerous interpretations, instead of being at once a self-evident description of the bird's genotype.

The present system leaves much to be desired, and any hope of reaching an understanding of fowl genetics will only be possible when some definite standard of nomenclature is introduced.

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[1] For references see Jull, M. A., "Poultry Breeding" (1940).

## Isolation of a New Alkaloid from Perennial Ryegrass

INDEPENDENT investigations in our respective laboratories have resulted in the isolation from perennial ryegrass (*Lolium perenne* L.) of a new constituent with unusual optical properties. Further study has shown that the material is an alkaloid of empirical formula (hydrochloride) $C_{36}H_{22}O_3N_4(OCH_3)_4.2HCl$. It yields precipitates with all the usual alkaloidal reagents and is soluble in alcohol and chloroform, slightly soluble in acetone, ether and water. Dilute solutions of the base in chloroform are golden yellow, with a green fluorescence which can be detected in ordinary daylight at concentrations of 1 in $5 \times 10^6$. The alkaloid is reduced by titanous chloride to a colourless material which can be quantitatively reoxidized by ferricyanide. The name perloline is proposed for this fluorescent alkaloid.

Some 40 gm. of perloline have been prepared in our two laboratories in the course of the past growing season, using the usual methods for chloroform- and alcohol-soluble alkaloids. The key to large-scale preparation lies in growing grass with sufficiently high alkaloid content, and this problem has not been completely solved.

The observed variation in concentration is high, ranging from a trace (about 3 μgm. per gram dry matter) to 1 mgm. per gram. The conditions governing high alkaloid content are obscure, but in general the highest concentrations have been noted at times corresponding with rapid growth.

A simple and rapid method of assay has been devised, depending on the colour of solutions of the base in chloroform. It requires only 2 gm. dry material.

In addition to perloline, several other alkaloids have been found in ryegrass, but data concerning them is at present indefinite.

A full account of the investigations on the preparation, characterization and pharmacology of perloline will appear in the *N.Z. Journal of Science and Technology*.

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## Determination of Death in the Larvæ of the Potato Root Eelworm

ONE of the major difficulties in the work of helminthologists has been to differentiate between living and dead nematodes. According to Lapage[1], most of those who have studied the metabolism of these worms have taken their failure to move either as a result of or without the action of a stimulus as an indication that they are not alive.

This difficulty has again arisen in the course of work by me on the biology and control of *Heterodera schachtii*, the eelworm which attacks potato roots and causes a serious diminution in crop in many districts.

First-stage larvæ are liberated by the action of potato root excretion on the cysts of the eelworm which are found in the soil of an infested field. These larvæ then penetrate the potato rootlets with the ultimate formation of new cysts which remain in the soil and thus increase the infestation. In the laboratory the larvæ can easily be obtained in quantity by immersing cysts in potato root excretion.

Normally under suitable conditions most of these larvæ are in active motion, but it frequently happens that they lie quite still for a relatively long period and then, for some undiscovered reason, recommence active movement. They may also show no sign of movement when observed in watch-glasses, but yet be able to penetrate potato rootlets. Thus it is exceedingly difficult to distinguish whether larvæ are in a state of dormancy or whether they are dead. According to Baunacke[2] who made a study of the beet strain of this eelworm, that part of the larval body near the oral end, which is almost completely hyaline in the living larva, becomes granular after death occurs. This tends to impart a uniform opacity to the dead larva. After treatment with certain solutions or after exposure to certain degrees of heat, larvæ of the potato strain of *H. schachtii* have been observed to be in a condition similar to that ascribed by Baunacke to a dead larva. Other larvæ have been seen to show a peculiar distension of the body wall near the higher end of the intestine, while this organ itself had become displaced.

Though it is known that living nematodes may in certain cases have the appearance of being dead, it has been ascertained that larvæ of the potato strain of *H. schachtii* in the above-described conditions could not be induced to form cysts on the roots of potato plants. Such larvæ were considered to be dead.

It was also determined that dead larvæ of both these types could be more clearly distinguished from living larvæ by staining with a solution of 0·025 gm. iodine in 100 c.c. 1 per cent potassium iodide solution. The most satisfactory procedure was to use five drops of this solution in 2 c.c. of a larval suspension. The suspensions employed contained some larvæ in active motion and some considered to be dead. The latter absorbed the iodine and were stained within a few minutes, being best observed after 10–20 minutes. Those larvæ which were moving and thus known to be alive originally became motionless after a few minutes but yet retained the appearance of living larvæ for several hours and did not absorb the stain. They were killed, however, when left in the solution overnight.

The iodine penetrates the dead larvæ through the mouth, and by careful observation a yellowish coloration may be seen starting at this end and gradually permeating the whole body.

Larvæ which exhibit a slight granularity in the upper region of the body, that is, larvæ which according to Baunacke's criterion are newly dead, do not take up the iodine immediately. They do stain, however, after being allowed to stand for 24–48 hours before applying the solution. Work along this line is being conducted in connexion with the thermal death point of the larvæ.

First-stage larvæ which had been kept in potato root excretion solutions for several weeks, and which by using up all their reserve food material had become practically colourless and clear except for a small granular portion near the mouth, absorbed iodine only slightly in this region while the rest of the body remained almost unstained. This is apparently due to the absence of intestinal contents in larvæ which had been in a free state for several weeks.

Hence larvæ of the potato strain of *H. schachtii* which appear granular in that part of the body which in the living larvæ is hyaline also show an internal absorption of iodine and may be considered as dead. The two main disadvantages of the staining process are that the iodine itself eventually has a toxic effect and that the staining does not take place immediately after death.

This work has been conducted during the tenure of a Carnegie Research Scholarship.

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Dec. 4.

[1] Lapage, G., "Nematodes Parasitic in Animals" (London, 1937).
[2] Baunacke, W., Untersuchungen zur Biologie und Bekampfung des Rubennematoden (*Heterodera schachtii*, Schmidt). *Arb. Biol. Reichamst. Land. u. Forstw.*, XI (1922).

## Sheets of Pure Epidermal Epithelium from Human Skin

THE margin between dermis and epidermis is one natural-splitting layer of human skin. By the gentle tryptic digestion of flat human skin slices for a length of time depending on their thickness, it is possible to disengage the epidermis in the form of an intact sheet uncontaminated by mesodermal elements. There is histological[1] and clinical[2] evidence that the *elastic fibres* of the so-called 'basement membrane' play an important part in anchoring the epidermis to the underlying tissue. Elastic fibres are known to be rapidly and specifically dissolved by trypsin.

The skin-slice should be the thinnest possible razor cut, the Ollier-Thiersch graft of plastic surgery. In theory, the Thiersch graft cuts through the base of the projections of the Malpighian layer into the dermis and therefore contains only so much of the dermis as lies between them. Studying expertly cut grafts I have found that even when the slice is so thin as to be transparent, it is lined on the inside by a sheet of dermis which is interrupted only by the holes into which the hair-follicles fit. Paper-thin shavings of rabbit, rat or dog skin may be used in place of human skin; but the excessive number of hair follicles makes the splitting reaction less clear cut.

The digestion fluid I use is a Seitz-filtered 0·5 per cent solution of B.D.H. trypsin powder in Tyrode's solution containing 1 : 100,000 phenol red and adjusted by means of it to *p*H 7·8–8·0. Digestion takes place at 37° C. Under these conditions, 1 ml. of the digestion fluid clots 5 ml. of calcified milk in 90–110 seconds. For *thin* slices, an hour's digestion is quite sufficient. The epidermis disengages of its own accord in the middle of the slice and can be lifted off or cut away with fine forceps and scissors.

Tissue-culture studies on the reagent described above show that at least some cells in isolated fragments of the chick-embryo's heart survive tryptic digestion even after a treatment lasting eighteen hours. There is this and other evidence that the epidermal sheet remains 'alive'. On the other hand, emulsions of isolated skin cells and epithelial islands, prepared by prolonging digestion until the Malpighian layer undergoes erosion and maceration, or, better, by simply scraping the epidermal sheet under Tyrode's solution, are probably irretrievably damaged, although they make excellent histological smear preparations. This is because the cells of the 'prickle-cell' layer are united to one another by fine cytoplasmic processes, and destroying one cell—for example, by pricking—initiates a reaction of nuclear coagulation which is propagated at least to immediately neighbouring cells[3].

This work has been reported at a technical stage in the hope that epithelial sheets will be useful to workers studying specific cellular metabolism, diffusion and so forth. Thiersch grafts cannot be cut exactly to the size of the recipient area, so that left-over pieces of skin are usually available in the theatre. They may be stored for a day or two at 4° C. after laying them raw side downwards on squares of gauze moistened with Ringer's solution.

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[2] Clinical and other evidence is discussed by Sutton, R. L., and Sutton, R. L., "Diseases of the Skin", London, 1939, pp. 5–6, 562–7.
[3] Chambers, R. W., and de Renyi, G. S., *Amer. J. Anat.*, **35**, 385 (1935).

## The Relations between Science and Ethics

To the interesting discussion aroused by Dr. C. H. Waddington in NATURE[1] may be added comments reflecting United States opinion on the matter.

It was remarkable that three leading American biologists, representing the east, mid-continent, and west, should have come to about the same conclusion at the same time regarding a biological basis for ethics. Different approaches led to the same general position on the part of Prof. E. G. Conklin, emeritus professor of biology at Princeton University, Prof. C. Judson Herrick, emeritus professor of neurology at the University of Chicago, and Prof. Samuel J. Holmes, professor of zoology at the University of California. Conklin[2] says, "Biologically life is maintained by continual balance, co-operation, compromise, and the same principles apply to the life of society. The highest level of human development is attained when purpose and freedom, joined to social emotions, training and habits, shape behaviour not only for personal but also for social satisfactions. Conduct bringing the broader and more lasting satisfactions is the better." According to Herrick[3], "That social stability upon which the survival and comfort of the individual depend and that moral satisfaction upon which his equanimity, pose and stability of character depend arise from the maintenance of relations with his fellow men which are mutually advantageous." Holmes[4] says, "Morality becomes just one phase of the adjustment of the organism to its conditions of existence. As a good body is one which runs smoothly and efficiently in the maintenance of its vital functions, so a good man is one whose conduct not only maintains his own life on an efficient plane, but conduces to the enhancement of the life of his social group." Both Conklin and Herrick would agree with Holmes in saying, "Peoples may believe that their moral customs derive from a supernatural source, but one potent reason for their adoption is their conduciveness to survival."

These statements suggest that American biologists have come to the same position as Dr. Waddington in regard to the nature of science's contribution to ethics, that is, in revealing the character and direction of evolution with the elucidation of the consequences "in relation to that direction, of various courses of human action". Our British colleagues may recall

Conklin's volume, "The Direction of Human Evolution", which was published in 1921, and which offers much detailed evidence in support of Dr. Waddington's position.

At the 1940 Christmas meeting of the American Association for the Advancement of Science in Philadelphia, the Section on Historical and Philological Sciences held a symposium on "Science and Ethics". Participating in this symposium, over which I had the honour of presiding, were Profs. Herrick, Conklin, Holmes, Teggart, Mackay, Galdston, de Santillana, Sigerist, Sarton, Shryock, Gerard, Birkhoff, and Mayer. At the conclusion of the discussion, the section unanimously agreed to a descriptive statement which seems justifiably inducible from data now available. While taking into account criticisms of the intellectual validity of traditional ethical statements as raised by psychology, anthropology, dialectic materialism, or logical positivism, the statement of these American men of science indicates that they are willing to agree, at our present "level of analysis" as Dr. C. H. Darlington[5] might put it, that certain biological generalities have moral consequences. The recognition by conscious individuals of these consequences, results in "ethical principles as actual psychological compulsions derived from the experience of the nature of society."

The statement may be put in a formal manner: The probability of survival of a relationship between individual humans, or between groups of humans, increases with the extent to which the relationship is mutually satisfying and advantageous. This principle was first formulated in this manner at a memorable seminar in the Santa Cruz redwoods in July, 1939, when the Pharmacology Laboratory of the University of California entertained Profs. Conklin, Herrick, and Olof Larsell.[6] It was then appreciated that this formulation is merely a special case of the more general biological principle: The probability of survival of individual, groups, or species of living things increases with the degree with which they can and do adjust themselves harmoniously to each other and to their environment.

The ethical significance of this general principle appears in relation to the common biological urges for survival and satisfaction. Consciousness of the operation of this generality suggests the wisdom of such altruistic, considerate, and magnanimous conduct as is intuitively considered 'good' in all ethical systems. The social customs and conventions now with us have so far exhibited survival value in a Darwinian sense. We may apply evolutionary criteria to them and attempt the formulation of a *modus operandi*. Such a formulation constitutes the statement. The principle operates, whether we as humans are conscious of it or not. To promote the conscious appreciation of such natural principles is part of the business of science. There appears to be scientific justification for what philosophers have maintained for centuries, namely, that knowledge of ourselves and of our environment has in itself ethical significance and moral consequence.

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[1] NATURE, **148**, 270 (1941).
[2] *Scientific Monthly*, **49**, 295 (1939).
[3] *Scientific Monthly*, **49**, 99 (1939).
[4] *Science*, **90**, 117 (1939).
[5] NATURE, **148**, 344 (1941).
[6] *Scientific Monthly*, **53**, 133 (1941).

## Mathematical Theory of Population Movement

AMONG the obvious motives of mankind are the tendencies to seek company and to seek living-space. If we were to regard these tendencies as being in simple opposition to one another, we should expect the population to be able to remain uniformly spread over any uniform piece of land; and the familiar contrast between town and country would then appear, to the theoretical mind, as a mystery requiring explanation. We may, however, seek a hint as to why people concentrate into towns from Sir James Jeans's theory of why matter concentrates into stars[1]. For his theory is also concerned with two opposing tendencies: to draw together by mutual gravitation and to spread out by pressure.

Let $\rho$ denote the density of the astronomical matter, supposed initially uniform, let $s = \delta\rho/\rho$ be its concentration at any time $t$ and place, let $p$ be its pressure and $\gamma$ the constant of gravitation. Then Jeans showed that deviations from uniformity occur in accordance with the equation

$$\frac{d^2s}{dt^2} = 4\pi\gamma\rho s + \nabla^2\left(s\frac{dp}{d\rho}\right). \quad . \quad . \quad . \quad (1)$$

The essence of Jeans's theory is that the opposition between gravitation and pressure is not simple: the former is represented by a term in $s$, the latter by a term in $\nabla^2 s$. These considerations led me to inquire whether the existence of towns could be explained by

$$\frac{ds}{dt} = \gamma\rho s + \left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)\left(s\frac{dp}{d\rho}\right). \quad . \quad . \quad (2)$$

in which $\rho$, supposed initially uniform, is the number of persons per square kilometre, $s = \delta\rho/\rho$ as before, $x$ and $y$ are horizontal co-ordinates on a flat portion of the earth, $\gamma$ is a constant expressing gregarious attraction, and $p$ is called pressure of population. The social equation (2) has been made of viscous type by replacement of the astronomical $d^2s/dt^2$ by $ds/dt$.

Whereas Jeans began the astronomical theory with $\gamma$ known and $p$ clearly understood, and thence deduced the spacing of the stars, we have to begin the social theory at the other end, and work backwards to find out more clearly what $\gamma$ and $p$ mean. Equation (2), in which $dp/d\rho$ is an unknown constant, explains why the population does not remain uniformly spread. For the amplitude of a standing wave of $s$ either grows or diminishes, according as the wave-length is greater or less than a critical length. It can be deduced that $dp/\gamma d\rho$ is of the order of magnitude of the ratio of the number of persons in a country to the number of towns in it. Further, $dp/d\rho$ is seen to play the part of a diffusivity in equation (2). From the observed time of dispersal of concentrations having diameters much less than the distance between towns, it can be estimated that $dp/d\rho$ is of the order of $10^5$ cm.$^2$ sec$^{-1}$. Whence it follows that $\gamma$ is of the order of 10 or $10^2$ cm.$^2$ sec.$^{-1}$ person$^{-1}$ for normal people.

A fuller account is ready for publication as part of a book.

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[1] Jeans, Sir James, "Astronomy and Cosmogony" (Camb. Univ. Press, 1929).

# RESEARCH ITEMS

### Production of Cancer by Ultra-violet Irradiation

THIS topic was discussed by H. P. Rusch and B. E. Kline at the Autumn Meeting of the U.S. National Academy of Sciences held during October 13–15. The idea that sunlight is an important causal agent in cancer of the skin is not new. The high incidence of skin cancer in sailors has long been known, and nearly fifty years ago 'seaman's skin' was described as a precancerous condition attributable to continued exposure to light. However, only in the last decade has experimental support been formed for the theory of direct causation of cancer by sunlight. The authors have determined the wave-lengths of the spectrum responsible for cancer production and measured the amount of energy required for the process. White mice were used in these studies. The wave-lengths responsible were found to lie between 2,900 A. and 3,341 A. The minimum time for the development of tumours was about two and a half months, and it was not necessary to irradiate the animals throughout the precancerous period. Once initiated, carcinogenesis proceeded without further exposure, and sometimes several months elapsed between the end of irradiation and the appearance of tumours. Very little radiant energy was needed to initiate those changes which culminate in tumour formation. The tumours produced were true malignant cancers of the same type found in humans.

### Controlling the Micropopulation of the Soil

IN a paper read at the Autumn Meeting of the U.S. National Academy of Sciences held during October 13–15, C. Thorn of the U.S. Bureau of Plant Industry reviewed experimental work towards control or direction of the microbial activities of the soil to produce desired ends. The destruction of waste plant and animal matter by soil micro-organisms is the function of the soil micropopulation most commonly understood. Variations from comparatively small totals to fabulous numbers of soil organisms were recorded. There arises the possibility of controlling this capacity of the normal groups represented in the population to multiply with great rapidity, in such a manner as to produce great decomposing power at selected times and for our purposes. For example, such activity may either rob a root parasite of available nutrients or actually destroy the parasite. Application of the principles developed in the control of take-all of wheat and cotton root rot were discussed.

### Gardeners and the Moon

MANY practical gardeners insist that some plants grow best from seeds sown at a particular phase of the moon. K. Mather and J. Newell have obtained some experimental evidence on this question (*J. Roy. Hort. Soc.*, 66, Pt. 10, Oct., 1941). There is apparently no consistent lunar effect upon germination; but it is unfortunate that the authors do not appear to trust their results in one experiment where a marked effect of the April full moon was demonstrated. The work requires to be repeated many times, with full measurements of lunar radiation and of other climatic factors, for the problem is one involving the microclimate round a plant—it is far more than the investigation of an astrologically inspired opinion.

### Fungus Diseases of the Carrot

THE tenth part of a series of articles by D. E. Green on "Hygiene in the War-time Vegetable Garden" (*J. Roy. Hort. Soc.*, 66, Pt. 11, Nov., 1941) contains a short reference to several diseases of carrots, information about which is not readily available. Black rot, *Alternaria radicina*, violet root rot, *Helicobasidium purpureum*, storage rot, *Sclerotinia sclerotiorum*, and soft rot, *Bacterium carotovorum*, are briefly described.

### Vitamin C and Respiration

IN 1933, Harrison, in exploring the possible connexion between tissue respiration and *l*-ascorbic acid, found that addition of the vitamin to liver tissues of scorbutic animals increases their *in vitro* oxygen uptake. G. A. Snow and S. S. Zilva (*Biochem. J.*, 35, 783, 787; 1941), in studying this phenomenon in greater detail, now find that the respiration of liver slices from guinea-pigs maintained on a quantitatively restricted diet (containing, however, ample vitamin C) is indeed considerably increased by the addition of ascorbic acid. Furthermore, the stimulating action on the respiration is not confined to ascorbic acid alone, but can be brought about by the presence of chemically related compounds, such as *d*-glucoascorbic acid and reductic acid, which possess a similar reduction potential but no ascorbic activity. The inhibition by phloridzin and pyrophosphate and the failure of cyanide, iodoacetate and malonate to inhibit the above accelerated respiration produced by ascorbate on the liver tissue of underfed animals indicates that this increased respiration may be connected with any of the stages concerned in the anærobic formation of triosophosphate from glycogen or in the aerobic degradation of the intermediate products, but not with the compounds formed by the anaerobic breakdown of triosophosphate.

### Seismic Activity since 1904

SEISMIC activity in the twentieth century has recently been discussed by B. Gutenberg and C. F. Richter ("Seismicity of the Earth", by Beno Gutenberg and C. F. Richter, Geological Society of America, Special Paper No. 34, August 30, 1941). The data are chiefly instrumental concerning shallow shocks, though some new data on deep focus shocks are included. 54 great shocks during 1904–39 have been given revised epicentres, all large shocks from 1926 until 1933 are listed, and many other epicentres are given. Much of the data comes from the International Seismological Summary. The authors suggest that the earth's surface consists of relatively inactive blocks separated by active zones of three groups: (1) the circum-Pacific zone, which contains many shallow shocks, many intermediate depth shocks, and all the very deep shocks; (2) the Mediterranean and trans-Asiatic zone; (3) narrow belts of shallow shocks which extend (*a*) through the Arctic and Atlantic Oceans, following the mid-Atlantic ridge, (*b*) through the western Indian Ocean from Arabia into the Antarctic, (*c*) the African rift valleys. Gutenberg and Richter suggest that the annual average includes about one great shock, about a hundred potentially destructive shocks, and about one million shocks potentially strong enough to be felt in a settled area. Seismic energy is released at a mean rate of about $10^7$ kilowatts, most of it in

the large shocks. It is possible that the persistence of oceanic troughs and gravity anomalies, together with the occurrence of earthquakes, requires that in the regions affected there is a continuously operating mechanism, such as would be provided by constant subcrustal flow.

### Hydrocarbon Flames in Atomic Oxygen

A RE-EXAMINATION by K. H. Geib and W. M. Vaidya (*Proc. Roy. Soc.*, A, 178, 351; 1941) of the flames of hydrocarbons burning in atomic oxygen shows that the ethylene bonds are strong in benzene and acetylene, but are weak and diffuse in ethylene. $C_2$, CH and HO are also present. Methyl alcohol gives the HO and CH bonds and also 'cool flame' bonds rather faintly, while formaldehyde shows only the HO bond at λ3064. The ethylene flame bonds are absent from the flame of benzene burning in atomic hydrogen, which yields only $C_2$ and CH bonds. The Balmer lines also appear, however, due to stray light from the main discharge.

### Fission Yield by Fast Neutrons

THE 1,100-kv. tube of the Instituto di Sanità Pubblica at Rome was used by a group of workers, M. Ageno, E. Amaldi, D. Bocciarelli, B. N. Cacciapuoti and G. C. Trabacchi, for measurements of the fission cross-section of uranium for neutrons produced in the reactions Rn + Be, D + C, D + D, D + Be, D + B and D + Li (*Phys. Rev.*, 60, 67; 1941). From the fact that the mean cross-section has about the same value for neutrons of the D + D, D + Be, D + B reactions, it was concluded that the fission cross-section has a value $\sigma_f$ which remains nearly constant between 1 and 10 Mev. For neutrons of the Rn + Be and D + C reactions the fission cross-sections seem to be, respectively, about $\frac{1}{5}\,\sigma_f$ and $\frac{1}{8}\,\sigma_f$. Finally, for neutrons of the D + Li reaction the mean cross-section is $1{\cdot}4\,\sigma_f$. This fact was interpreted by N. Bohr as due to successive transformations which are possible for energies of the impinging neutrons larger than 10 Mev. A similar increase of the fission cross-section was observed also for thorium, in very good agreement with the theoretical predictions of Bohr.

### The Mills-Nixon Effect

THE bond angles in a molecule containing a saturated 5- or 6-membered ring fused to a benzene ring cannot have the normal values in the aliphatic and aromatic portions. W. H. Mills and I. G. Nixon, in 1930, inferred from substitution experiments that the double bonds in hydrindene and tetralin are frozen to the particular Kekulé structure in which the bond angles are the least strained. This conclusion is somewhat modified in detail by taking account of excited ionic resonance states of the benzene molecule, and in 1935 L. E. Sutton and L. Pauling published an approximate quantum mechanical treatment which showed that theory predicts a relatively small stabilization of one Kekulé structure in hydrindene and in tetralin. An investigation of 1,3,5-tribromobenzene, *o*-dibromoxylene, *o*-dibromohydrindene and *o*-dibromotetralin by the electron diffraction method, made by A. Kossiakoff and H. D. Springall (*J. Amer. Chem. Soc.*, 63, 2223; 1941) has given some interesting results. It is shown that the complete fixation of the double bonds in the hydrindene or the tetralin compound is excluded, that there is a large amount of double-bond character for the C–Br bond in the bromobenzenes, particularly in the hydrindene derivatives, which throws light on the relative importance of the excited ionic states, and that the effect of strain on the benzene molecule (Mills-Nixon effect) is primarily concerned with changes in the contributions of excited states of the molecule rather than with fixation of double bonds into a particular Kekulé structure. In agreement with Sutton and Pauling's calculations, the change in external bond angles of the benzene ring caused by the fusion of a saturated ring is shown to be very small.

### Space Motions of Solar Prominences

THE first exhaustive study of the structure of solar prominences in the three space co-ordinates $x$, $y$, $z$ is reported from the McMath-Hulbert Observatory (*Pub. Obs. Univ. Michigan*, 8, 123; 1941). From nearly 2,000 $H\alpha$ spectroheliograms of a prominence on September 20, 1940, taken on motion-picture film with two spectroheliographs (one for cross-motions and one for radial velocities), the parameters $x$, $y$, $dz/d'$, and $t$ are measured for four easily identified prominence knots. For each knot a process of graphical integration then gives the true space motion as a function of $t$. The only difficulty, that of arriving at $z$ from $dz/dt$, is ingeniously solved by making an approximate estimate of the constant of integration from subsequent observations of the prominence as a dark marking projected on the disk. From the data thus derived, a model of the prominence has been constructed; and photographs of this model taken from various angles show a close resemblance to frequently observed prominence forms. The accelerations derived from the observed displacements and velocities are of the order of one tenth that due to unopposed gravitation at the solar surface, though for short intervals of time accelerations exceeding the gravitational value have been observed. The radial and cross velocities are of the same order, as would be expected if the observed effects are due to mass motion of the prominence atoms, as distinct from a travelling excitation.

### Dimensions and Masses of Wolf-Rayet Stars

CECILIA H. PAYNE-GAPOSCHKIN (*Telescope*, May–June) has discussed the star *H.D.* 193576, known to be a spectroscopic binary, and recently found by Dr. S. Gaposchkin at Harvard to be also an eclipsing binary. A considerable amount of speculation had been made about the size and mass of a Wolf-Rayet star; but now, assuming that *H.D.* 193576 is representative of this type, a volume six times and a mass ten times those of the sun can be taken as approximately correct. The bright-line spectra of these stars reveal the presence of highly ionized atoms of the commoner elements, notably helium, carbon, nitrogen and oxygen. The width of these bright lines led to the conjecture of nebular stars of enormous size, because the novæ, which have many points of resemblance to Wolf-Rayet stars, expand to vast dimensions. On the other hand, the displacement from the normal wave-length of these bright lines led to the picture of small, dense stars, the shift arising from the intense gravitational potential. Now that the size and mass are known, both the width and displacement of the lines appear in a new light. It is suggested that the red shift of the bright lines (a phenomenon occurring also in 29 Canis Majoris) is caused by washed-out absorption lines on the violet edges of the bright lines. The gravitational red-shift in a star of size and mass like those just given for a Wolf-Rayet star would be only about one hundredth of what has been observed.

# HUMAN BIOLOGY IN EDUCATION*

UNTIL comparatively recently biology might well be said to have been the 'Cinderella' of the sciences so far as primary and secondary education in Great Britain were concerned. Over a period of about ten years, however, the subject has become recognized more and more as of vast cultural and academic importance. Consequently it is finding its place in many schools where it was hitherto completely ignored and in all cases the number of students studying biology has increased. This is well exemplified in the number which take the subject in the School Certificate, though even to this day the percentage is far too low. During 1940 in the School Certificate 22 per cent took biology and 19 per cent General Science; in the Higher School Certificate only 7 per cent took biology.

We are, however, not concerned so much with the importance of biology as an educative subject but rather with the form and content of the biological syllabuses from junior school to university. The syllabuses are unsatisfactory from several points of view but the most important is that of man himself. In most syllabuses he scarcely finds a place. One reason for this might easily be that many academic biologists do not realize that biology is the science of life and not merely a union of zoology with botany. Human biology is the science of life as it affects man himself and it thus finds itself invoking aid not only from zoology and botany but also from the other specialized biological sciences such as medicine, agriculture, anthropology, ethnology and sociology. Human biology consists of a comparative account of the anatomy and physiology of the human body followed by further inquiries into man's place in the web of life, the nature of diseases, especially as they affect mankind, inheritance, and so forth. These are certainly essential components of human biology but the potentialities and applications of this tremendous subject are legion. Surely the study of the biology of mankind must not merely be regarded as a detached and academic survey of structure and function. It must go further and launch bravely into investigations of all these powerful individual social relations which are biological in origin. The question of the results of both good and bad nutrition is involved. The same can be said for population movements and their attendant effects, not excluding war. Soil and its significance is another aspect. So is the influence of psychological study as a powerful weapon in the hands of thinking and feeling man. Human biology is therefore the biology of mankind, not merely the biology of man.

Knowledge of the general principles of positive health is essential in these modern times of urban living, yet it receives scant attention in most biology courses. Aspects of healthy living such as fresh air, housing, exercise, personal cleanliness, human parasites, risk of infection, industrial diseases, etc., need not necessarily be grouped together under a general heading of health, because pegs on which arguments in this connexion can be based are constantly cropping up in a course of biology so that health subjects could be brought in at various points thus giving, apart from empirical knowledge, what is just as important, additional interest.

The science of nutrition was beginning to take shape long before the War. People were beginning to become vitamin conscious but very often along the wrong channels. There are very few people now who have not heard of vitamins, if only through the medium of a dance tune. It is doubtful, however, if one per cent of the population could give any idea of what a vitamin is or what it does. This should therefore form a subject of instruction and the biology course is the place for it. The history of work on vitamins, from the empirical work in the sixteenth century of the navigator Hawkins and later of Dr. J. Lind to the biochemistry and physiology of to-day, simply told, would be of great educative value. The same applies to nutrition. The sociological and economic implications of nutrition have been brought out very clearly by such workers as Sir John Orr, and their work is receiving the consideration it deserves in the planning of the national health and diet. But this is due to the exigencies of war; it must continue in peace-time, and the basis for its continuance lies in the schools and the universities. A detailed knowledge of the chemical composition of carbohydrates, proteins, fats and mineral salts and vitamins is not necessary, but some knowledge of the significance of these foodstuffs in relation to energy, body-building, malnutrition, deficiency diseases, etc., is desirable.

Technical knowledge which might be considered for inclusion in biological courses especially in the schools involves such subjects as farming and gardening. Schools in rural areas often include these subjects in their curricula though in most cases they are treated as separate subjects. They might well be incorporated in a general biology course, but in spite of this only about one in every ten of the British farmers receives any form of technical training.

Another important subject to whom biological knowledge would prove of inestimable value is the mother in the home. The home with its family life is a veritable biological laboratory. Yet few mothers are technically prepared for the responsibility of directing that laboratory, having little or no knowledge of such subjects as normal psychology, health, hygiene, nutrition, sex, child development and child guidance. Other examples could be given, but here are two—one of man outdoors and one of man indoors—which show what a mistake is this ignorance of the general public where elementary problems of the biology of mankind are concerned.

Human reproduction, too, should be given its logical position in biology curricula. It should not be avoided or ignored; nor again should it be over-emphasized. One is on safe ground in stating that by far the majority of elementary biological curricula, though probably dealing with sexual reproduction in general, and in plants and a certain number of the lower animals in particular, stop at the stage where human reproduction should be logically considered. This is undesirable, but, on the other hand, there is a risk of over-emphasizing it. Human reproduction could be brought into that part of the curricula dealing with heredity in plants and animals. Here reproduction might be combined with considerations of evolution, variation and genetics. Heredity in

*Extract from the opening address by the Chairman, Mr. L. J. F. Brimble, to the Conference of Lecturers and Teachers held under the auspices of the Educational Advisory Board of the British Social Hygiene Council at Ashburne Hall, Manchester, during December 13–14.

man is a very wide subject but general points are valuable even to the child mind. The biological conception of ethnic races, for example, should be emphasized, thus, especially at the present time, counteracting the poisonous results of the prostitution of such concepts for political advantage such as is seen in the Nazi Aryan theory of *Herrenvolk*. A general review of these subjects would develop a social consciousness among children and students towards people of weak hereditary endowments.

A general idea of the origin of man could naturally follow instruction on evolution and heredity. So, too, could the origin of many of man's social attributes which would involve an elementary study of the main conceptions of anthropology, ethnology and archæology. This is scarcely touched upon in schools. A review of the origin and history of mankind would logically lead up to the present status of man in the living world and hence to the destiny of mankind. Modern science is changing the environmental setting of man at an ever-increasing rate. This calls for active and continuous readjustments (adaptation) both physically and psychologically. Here human biology through the study of emotions can arouse a better social conscience since it can formulate new social standards. For example, nutritional deficiency could be eliminated in a measurable time from Europe, as shown by Sir John Orr. It would not take much longer to do the same thing in the British Colonies, as shown on several occasions lately by Lord Hailey, though it can and should be tackled. Eventually nutritional deficiency could be attacked and eliminated from the whole world, as envisaged by Mr. J. G. Winant.

So-called abnormalities in man are now much better understood than they were at one time. They have been in many cases set free from mythical and magical taboo, and are known to be psychological or hormonal. Knowledge of the causes of such abnormalities would bring a more practical and less sentimental sympathy from the general public and especially from those in authority. A more rational view of what is right and what is wrong would surely be the outcome of all this. This aspect of human biology could not be included in courses for children, but should certainly be studied by teachers so that they may be adequately equipped to deal with situations as they arise.

Human biology has given a fresh and more balanced approach to personal evaluation and character training. It would equip the teacher himself with a better insight into the character (normal and abnormal) of his pupils. It would liberate the vexed question of sex from the ignorance, taboos and emotional complexes by which man is hemmed in socially.

Thus it may be said without much fear of contradiction that human biology is lifelong and continuous. Some will go so far as to say that it should displace academic biology (as at present formulated) in education. But even the most moderate will agree that man and mankind ought to receive major consideration in any comprehensive general biology syllabus ; yet he does not. Places where human biology might well be introduced are chiefly the teacher training colleges and departments and the junior and senior schools where there is no domination of an external examination syllabus. It is a difficult subject to teach, much more difficult, for example, than higher mathematics, and few teachers are at present mentally equipped to deal with it. In spite of this, however, it should be developed because (*a*) it is far more effective in facts and ideas ; (*b*) it is far more interesting ; (*c*) it relies less on detailed routine laboratory experiments but leads to demonstrations and experiments on the self, and other interesting activities such as visits to farms, water-works, hospital laboratories and to talks by such social biologists as medical officers of health, nurses, etc.

As expressed in the Autumn issue of *Biology* (7, No. 2), there is a strong case for the study of human biology, in which man himself becomes the centre of interest, seen against the background of all the living matter to which he is related, and of the material world. Human biology grows out of nature study and academic biology, which still dominate our text-books and syllabuses ; but it is something of more entrancing interest, at once more personal in its application and of far greater educational worth. For the problems of human biology confront us at every turn : problems of individual and public health, of nutritional standards, housing, population movements, of race and nation ; problems of family life, of the relations and responsibilities of one person to another, and of the social policy of the State. Human biology brings up questions of personal conduct, of moral values and character formation, and of the most intimate relations between one individual and another. Penetrating further into the realm of the mind, we are faced with problems of the ethical basis of philosophy and of the ultimate ideals of life itself. Here we find vistas opening out inviting action, and leading to further inquiry, especially in the universities, for on many of the burning questions of human biology no clear decision has yet been reached.

Yet in nearly every case existing knowledge is decades ahead of educational practice, and we have before us the immense task of trying to make good the lag between general opinion and what is already known. But the function of human biology does not end at being an academic discipline, for it must be given effect in public administration and national policy, since national policies are the mass movements of mankind. How deeply involved human biology is in national policy comes out clearly in this present war. The whole policy of the Fascist powers rests on conceptions of human biology which were disproved by the leading biologists of the world some decades ago ; while the conceptions themselves spring from human attributes and environmental conditions no longer holding full sway in the countries of their origin. By contrast, the Democracies, often almost unconsciously, all too tardily, are in the process of putting into action what is best in biological knowledge, as, for example, in the schemes for free milk, health protection, etc.

Yet in all this, little help is forthcoming from our universities and educational authorities. Only as it were by chance do we come across pointers which show the way, as during the Conference on Science and World Order recently held in London. The widespread apathy with regard to pressing problems of human biology affecting the nation's future is a sad reflection on the ideals for which we are at war. But the outlook for human biology now is more favourable than it has been for a very long time.

Only one or two points have been made here in the attempt to show how important human biology is to educational principles and practice. Like any other

subject it has special applications in special cases and emergencies, and it certainly has its novel and unique problems during war-time. There is scarcely any need to enumerate the special war-time problems which are worthy of consideration from the point of view of human biology. A mere mention of a few of them is sufficient to give basis for later discussion. For example, the whole problem of evacuation. This was one of the most successful sociological experiments of our time, when it first took place; that is so far as the organization of the actual evacuation itself is concerned. But there seems to have been very little consideration of biological and psychological aspects of the case in the reception areas themselves. Authorities, for example, apparently underestimated the strength of parental affection, or overestimated parental self-control. Insufficient regard was directed to the emotional unity of the family, and as little to its economic unity. That is one of the main reasons why the initial success of the scheme has since been generally negatived in a large number of cases. Another problem is that of broken homes and broken family life caused either by evacuation or the calling up of menfolk and of women into the Fighting Services or movement of women and men to other industrial areas. Emotional tension due to the War has received a certain amount of study by the Ministry of Health, chiefly from the medical point of view. Certain psychological studies have also been made, but the problem as a whole has not received the attention which it deserves. The effect of the War on young adolescents is also deserving of attention, especially in the many cases where abnormally high wages are being paid to young boys and girls. These are just a few examples of special problems raised by the War, and there are no doubt many others, all of which come within the purview of human biology.

At no point in the nation's history have young people had such independence and freedom as to-day. Never before have they had such opportunities of following the wrong lines of individual and social development, but complementary to this, never has there been such an opportunity for teachers to offer correct guidance. Never has there been such opportunity for building up the characters of the younger generation on a foundation of true knowledge of personal worth and thus preventing them from being lured away by the cheap type of personality appeal in which an individual is singled out for the special favours of fortune. Emotions come before understanding and personal success bears no relation to the common good. So much nowadays depends upon mutual sympathy and understanding particularly between the opposite sexes. All this was shown only recently by messages sent by the Prime Minister and others to the great International Youth Rally recently held in London telling youth of its responsibilities towards the nation, but we must also realize that youth in a social sense has definite claims upon those of maturer years and this is one of them. That youth deserves our help goes without saying, but how we are going to carry it out is a matter for discussion. That youth can be misguided *en masse* has been shown by Nazi Germany where the Hitler Youth, probably through no fault of their own, may now be considered to be workers of iniquity and of primitive passions. If it is possible to organize and misguide youth, then it should be equally possible to organize and guide youth along the right lines. This could be done through the school, youth organizations, etc.; but the unit of the family itself must never be ignored. It is necessary to impress upon youth the biological principles of family life and to make them realize as few do that (as Cardinal Hinsley pointed out in a recent stirring address in Westminster Cathedral) the dignity of the family is not wrapped up solely in the begetting of children.

# ISLAND FAUNA RESEARCH

THE University of Oxford, since 1938, has contributed towards the cost of research into the problems of island faunas, with special reference to the Pacific, and, in particular, the Marquesas Isles.

Mr. E. P. Mumford, of Jesus College, who is conducting the inquiry, has made it one of his chief aims to obtain publication of faunistic lists by experts, so that information may be collated and available. An important recent publication from the Smithsonian Institution (Misc. Coll., 99. No. 8; 1941) by Prof. Jackson is a check-list of the terrestrial and freshwater Isopoda of Oceania. This was made possible by grants-in-aid from the contributions of the Royal Society and the British Association to the central fund at Oxford, and from the publication committee of the University of London. The paper contains a noteworthy discussion of the whole subject in which Prof. Jackson concludes: "The assumption of land connections between the islands is gratuitous and would seem to provide more time than is necessary to account for the comparatively small range of differences observed, while the assumption that man is responsible [for the distribution of the Isopods under review] would seem to provide too little."

Other lists that have been published in connexion with the activities of this research include, among Insecta, the Collembola, Dermaptera, Embioptera, Anoplura, Mallophaga, Homoptera (Cercopidæ), Neuroptera, Coleoptera (some Adephaga, Polyphaga-Diversicornia, Lamellicornia, and Rhynchophora), Hymenoptera (Cynipoidea, Formicoidea, Serphoidea, Bethylidæ and Anteonidæ), Diptera (some Nematocera, Aschiza, and Pupipara), and Siphonaptera. Among Crustacea, the Amphipoda: among Arachnida, the Chelonethida. These lists have appeared in publications of the Bernice P. Bishop and other museums, and in scientific journals.

The recently published fourth volume of the Proceedings of the Sixth Pacific Science Congress at San Francisco in 1939 contains, among other contributions to faunistic questions, two papers by Mr. Mumford on the present status of studies of faunal distribution with reference to oceanic islands, and on the present status of knowledge of Polynesian freshwater faunas. A preliminary account of an investigation of the Euploeine butterflies of Melanesia is contributed by Prof. G. D. Hale Carpenter.

Those interested in furthering this investigation by observations or records, or desirous of obtaining information, are asked to communicate with Mr. E. P. Mumford, Box 802, Stanford University, California, or with Prof. Hale Carpenter, University Museum, Oxford.

# TUNG-OIL TREE CULTIVATION IN INDIA

THIS tree (*Aleurites fordii* Hemsl.), an inhabitant of China, produces the Chinese wood oil of commerce, the oil being used in the manufacture of paints and varnishes owing to its rapid drying qualities. It came into prominence during the War of 1914-18 when it was extensively used in the treatment of aeroplane fabrics as a water-resisting varnish. China is the chief source of production of tung oil, and the United States the principal consumer. In 1936 the United States imported more than 600,000 tons, and large quantities are annually imported by Great Britain and India.

In China the tree grows in profusion in the mountainous tropical and sub-tropical regions. The United States commenced to form plantations of the species early in the present century, and there are now about 175,000 acres, chiefly in Mississippi and other southern States. Experiments in its cultivation in the British Empire were first initiated by the Imperial Institute in 1917 in India and a number of Colonies, but they were inconclusive. The matter was taken up in 1927 by the Advisory Committee of the Institute in collaboration with the Director of Kew and the Director of the Research Association of British Paint, Colour and Varnish Manufacturers, seed obtained from China and Florida being distributed to various countries of the Empire.

It is said that there are now grounds for considering that, so far as India and Burma are concerned, the industry can be developed either as a self-supporting one, in view of the growing commercial importance of tung oil, or as a cottage industry in places where the plants can be easily grown and seeds marketed, or in tea-gardens as a subsidiary industry. This opinion is based on the fact that experiments have now been carried out for two decades with varying measures of success in localities in India and Burma and in Ceylon, Malaya and East and South Africa. The question is dealt with in *Indian Forest Records* (New Series) Sylviculture, "Note on the Cultivation of the Tung-oil Tree (Aleurites spp) in India", by M. V. Laurie and J. N. Sen Gupta, both of the Forest Research Institute, Dehra Dun, India, 4, No. 3 (Manager, Govt. of India Press, Delhi, 1941). Artificial regeneration, nursery practice, manures, planting sites, tending, dangers, costs and growth and yield are discussed.

A hint is given that there are market competitors in drying oils such as Perilla oil, Viticica oil and Po-yok oil, although they are inferior, while recently synthetic resins have been developed which may reduce the use of tung oil in process work, one of the latest developments being a castor oil derivative.

# REPORTS AND OTHER PUBLICATIONS

*(not included in the monthly Books Supplement)*

## Great Britain and Ireland

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University of Sheffield. Thirty-sixth Annual Report of the Senate to the Court of Governors. Pp. 13. (Sheffield: The University.) [512

Royal College of Surgeons of England. Scientific Report for the Year 1940–1941. Pp. 28. (London: Royal College of Surgeons of England.) [1012

## Other Countries

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Annual Report of the Board of Regents of the Smithsonian Institution, showing the Operations, Expenditures and Conditions of the Institution for the Year ended June 30, 1940. (Publication 3606.) Pp. xiii+512+107 plates. (Washington, D.C.: Government Printing Office.) 1.50 dollars. [1911

National Research Council. American Geophysical Union Transactions of 1940. Part 1: Reports and Papers, Joint Regional Meeting, Section of Hydrology and Western Interstate Snow-Survey Conference, South Pacific Coast Area, Stanford University, California, January 12–13, 1940. Pp. 144. 1.25 dollars. Part 2: Twenty-first Annual Meeting, April 24 to 27, 1940, Washington, D.C.; Reports and Papers, General Assembly and Sections of Geodesy, Seismology, Meteorology, Terrestrial Magnetism and Electricity, Oceanography, Volcanology, Hydrology, and Tectonophysics. Pp. 145–780+6. 3.75 dollars. Part 3: Regional Meetings (a) Richmond, Virginia, December 1938, (b and c) Seattle, Washington, June 1940; (a) Symposium with American Association for the Advancement of Science (b and c) Reports and Papers, Western Interstate Snow-Survey Conference and Section of Hydrology (North Pacific Coast and North Continental Divide Areas). Pp. 779–1062. 1.75 dollars. Part 4: Regional Meeting, Colombus, Ohio, December 1939; Symposia under auspices of the American Association for the Advancement of Science (a) Applications of Mathematics in the Earth-Sciences (b) Hydrologic Problems in the Ohio and Michigan Basins. Pp. 1063–1148. 1 dollar. (Washington, D.C.: National Academy of Sciences.) [1911

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U.S. Department of Agriculture. Technical Bulletin No. 766: The European Earwig. By S. E. Crumb, P. M. Eide and A. E. Bonn. Pp. 76. (Washington, D.C.: Government Printing Office.) 5 cents. [2111

Annual Review of Biochemical and Allied Research in India. Vol. 11 for 1940. Pp. iv+173. (Bangalore: Society of Biological Chemists, India.) 3 rupees; 6*s.* [2111

Indian Forest Records (New Series). Botany, Vol. 2, No. 1: Common Grasses of the United Provinces. By Dr. N. L. Bor. Pp. vii+222+64 plates. (Delhi: Manager of Publications.) 9.14 rupees; 15*s.* 6*d.* [2411

# FORTHCOMING EVENTS

SATURDAY, JANUARY 3

JOINT MEETING OF TECHNICAL INSTITUTIONS arranged at the request of the Mines Department (in the H. H. Wills Laboratory, Royal Fort, Bristol), at 2.30 p.m.—Discussion on the Best Ways and Means of Improving the Efficient Use of Fuel and Power in Existing Industrial Plants, under Present Conditions, and to Invite Constructive Suggestions. (To be opened by Mr. J. G. Bennett.)

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