

# NATURE

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## SCIENCE AND SOCIETY

MUCH indeed has happened since Prof. J. R. Marrack in 1937 contributed his stimulating essay on the "Social Implications of Biochemistry" to the volume of essays "Perspectives in Biochemistry" which was presented to Sir Frederick Gowland Hopkins by past and present members of his laboratory on his seventy-fifth birthday. It is now widely realized that not only, as Prof. Marrack pointed out, does the future trend of biochemical investigation into problems of nutrition depend largely on what form society takes, but also the whole trend of scientific work or even thought. The impact of society on science is as unmistakable as that of science on society.

That recognition has already found expression in important developments both in the field of science itself and in the world of politics. We have seen the formation of a new Division of the British Association for the study of the social and international relations of science. Nuffield College, Oxford, has been established as well as the National Institute of Economic and Social Research. Although the stress laid on research in the Report of the Royal Commission on the Distribution of the Industrial Population has yet to be implemented, the proposal in the minority report for the establishment of a commission of research covering all matters—land, agriculture, minerals, amenities, etc.—affected by national development finds widespread support.

In the field of politics account has been increasingly taken of the new knowledge of nutrition in handling questions of food supply and food production during the War, and there is evidence that Government is prepared to face the questions involved in the provision of diet standards based on the biochemical work of the last thirty years, and at least implement the possibilities thus opened up of raising the standards of health of a large proportion of the people of Great Britain through the provision of an economic and better diet by expanding social services, and a determined attack on malnutrition and its causes. That much, at least, is implied in the conception of a social minimum now gaining support, and its application is by no means limited to the people of Great Britain. Its bearing on the questions of Colonial welfare and development and on the feeding of the people of the enemy-occupied territories after the War, as well as on European economic and social reconstruction, are equally to the fore. The formation of the Bureau under Sir Frederick Leith-Ross announced at the second meeting of the Inter-Allied Council in September is evidence that practical effect is being given to such ideas, and the American co-operation then indicated will assuredly not be withdrawn or diminished now that the United States has entered the War.

The most striking feature of all such developments is, however, the immense amount of *ad hoc* inquiry, investigation and research which is still required over the whole range of the social sciences as a basis for policy and action. It is this that raises such

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studies to the priority level even in war-time, if having won the War we are not once again to lose the Peace. Even in the field of internal reconstruction the same condition holds. Lord Reith has already indicated the importance he attaches to research in a statement on the work of his Department made as long ago as February last year, and Mr. Greenwood, the Minister in charge of reconstruction, has stressed the importance of such surveys as those of the whole field of social insurance and allied services including unemployment assistance and workmen's compensation which Sir William Beveridge has undertaken. Further, plans are being made for the Agricultural Economics Research Institute to conduct a survey of problems of agricultural reconstruction when the necessary funds are assured. Mr. Greenwood has referred particularly to the North-East Regional Reconstruction Group of which Prof. J. H. Jones is honorary secretary. This is only one of several regional reconstruction organizations. Also, there are the investigations of Political and Economic Planning, and particular importance is attached to the work of the Demographic Survey of the 1940 Council. Mass observation, too, makes valuable social surveys, though we believe its scope and the intensity of its work are rather limited compared with similar social surveys and observations frequently made in the United States.

It is clear, therefore, that the importance of social research is recognized by the Government and that the co-operation of other institutions and bodies, whether local or regional, industrial or professional, is welcomed as leading to the development of new technique. Despite these numerous activities it also appears that not only is some real co-ordination and central guidance desirable but also much more effective financial support. In the absence of greatly extended Government assistance there is no evidence that many of these activities will be able to make more effective contributions than the Social Science Department or Economics Research Section of those Universities like Manchester and Liverpool which have already entered the field of social economics.

It is no disparagement of the work which has been carried out by such departments or by the National Institute of Economic and Social Research to suggest that with extended financial resources they might already have made much more important contributions to the solution of social problems of national and not merely local importance. This question of finance, with the further question of objective research, is in fact the vital one to consider in judging the proposal recently advanced by Prof. George Catlin in a letter in *The Times* of December 22, although regard should be had to the general background already outlined. The urgency of the need for more intensified research in the social sciences and a scientific examination of the impact of science upon society has been repeatedly stressed in *NATURE* over the last decade or so. A more biological approach is also an urgent need in the study of local, national and international policies, as is well argued by Mrs.

Neville-Rolfe on p. 90—a thesis which she and others have been urging for some time past.

Prof. Catlin expresses his regret that the opportunity was lost ten years ago of establishing a social science research council as a genuine academic council representative of all branches of the social sciences in Great Britain. Such a scheme involving the survey of projects for research, the allocation of financial assistance and aid in personnel for the prosecution of such research and the direction of endowments into fields the probable fertility of which had been explored, would have done more than augment the resources of the struggling university departments or other research organizations. It would have provided an organ for an authoritative voice of the social sciences and immensely strengthened their position in respect of objective research.

On p. 88 Prof. Catlin urges strongly that the establishment of a representative social science body, of the highest academic standing and the fullest professional knowledge, that can freely express itself in a fashion that will command attention within this sphere is required to avoid the natural limitations of the Royal Society and the British Association with regard to social science. Such a body could have corrected many false conclusions in the past and could assist the Government and public authorities in many directions likely to be of paramount importance. Moreover, long-range work under such a council in fields, for example, like economic reconstruction and population studies, would be beyond suspicion of political bias.

This latter point is probably of the more importance since there is a sense in which the scientific work and thought which are required to provide the material which will enable social structures to be designed with full knowledge by Governments and administrators inevitably involves entering the political field. This, as Sir Richard Gregory has pointed out, is another matter from political partisanship, and provided the functions of the expert and the administrator are not confused there is no justification for the fear of science becoming entangled in controversial politics presenting a bogey to the advance of the social sciences by the application of impartial scientific methods and principles to the problems involved in them. Indeed, Prof. A. V. Hill, in supporting Dr. Catlin's proposal, has suggested that the Royal Society might help, as it helped in establishing the British Academy in 1902, and while urging the application of the results of science to human betterment has uttered a warning against allowing our desire for betterment to upset our scientific conclusions or bias our scientific judgments.

Prof. Catlin's proposal has also been warmly welcomed in the correspondence columns of *The Times* by Mr. F. S. Stone, acting secretary of the National Institute of Economic and Social Research, who, indicating the willingness of the Institute to cooperate, points out that the Council of the Institute does not attempt or claim to cover many important branches of the social sciences such as anthropology and social psychology, although as Mr. Charles Madge

has pointed out, the Council of the Institute is potentially the social research council for which Prof. Catlin asks. We take the view, however, that research in the social sciences to be effective must cover a much wider field—in fact, it must invoke the aid of almost every branch of science. We cannot, therefore, subscribe to Mr. A. Farquharson's view, expressed on p. 101, that "the narrower field [of sociology] may be appropriate as defining a useful field of operations for the present and that the wider view should not be dropped altogether out of sight". We envisage a much wider basis for the proposed activities, and this is illustrated by the other articles published in this issue. The foundation should be as broad and comprehensive as possible if the proposed organization is not to make the grave error of following a too narrow and specialized path. The President and Honorary Secretary of the Royal Anthropological Institute have also supported the proposal and indicated the willingness of that Institute to cooperate. Moreover, in their letter they stress the urgency of the need for such action.

The need for some kind of central research organization with adequate resources at the present time appears to be generally accepted, though the exact manner in which this need should be met gives rise to some difference of opinion. Prof. Abercrombie, stressing the need for scientific research into population problems, family units, industrial location, quality of farmland, transport, etc., with reference to planning for reconstruction, has suggested reconsideration of the proposal in the Minority Report of the Barlow Commission for a permanent commission of research as another alternative to the social research council worth examining.

The articles published in this issue of *NATURE* indicating the need for research in the various branches of sociology leave no room for doubt as to the imperative necessity of some such step. A much more generous endowment of such research through Government grants and the great foundations and trusts is to be hoped for to redress the disparity between our research effort in the biological and social sciences and in the physical sciences and to check the dangerous gaps arising through the unevenness of the whole research front.

The present proposals very clearly cannot be considered altogether without regard to the present structure and organization of scientific research as a whole in Great Britain. Moreover, there is some difference of opinion among our contributors as to the exact form of the organization required, and some clarification of thought as to the functions which it should serve must precede the establishment of any new body. Sir Frederic Kenyon, for example, visualizes some organization on the lines of the Royal Institute of International Affairs or of the Institute of Chemistry, for the collection of facts and the formation of opinion or formulation of principles in social science. Mrs. S. Neville-Rolfe suggests rather the formation of an Institute able to act in a consultative-directive capacity. On the desirability of a central research institu-

tion competent to attract investigators of distinction, to encourage co-ordination and concerted planning there is general agreement. Adequately financed and staffed and ably directed, such a central research organization, through its various departments briefly envisaged in the following articles, could make an immense contribution to the wise and effective use of our resources both in war and in peace.

There seems to us a grave risk involved in the suggestion that a Social Sciences Research Council be established along lines similar to those of the Agricultural and the Medical Research Councils. The ramifications of the social sciences go much farther and involve a larger number of special sciences than either of the other two, which are naturally confined to more or less well-defined though limited fields of action. Furthermore, these two already existing Councils have great assets in research personnel and accommodation for medical and agricultural research already existing in the universities, colleges and institutes throughout Great Britain. This cannot be said for the social sciences. Most of the special sciences become involved in sociology. Some receive attention from the point of view of their impact on society; but this only in certain universities and the various institutes already existing for the purpose which are specialized or are very narrow in their terms of reference. In the case of the social sciences, therefore, it seems that what is most desirable is the formation of a central institute with a permanent staff where research could be carried out or organized and deputed to university or other centres which already have the necessary staff and material. Research should be the key-note of the organization of such an institute; data would be gathered, sifted and correlated; funds administered; information supplied; and courses of lectures, refresher courses and vacation schools organized.

Platforms for the expression of points of view, for symposia on the social sciences and for discussions concerning the impact of science on society already exist and have done and are doing useful work. Almost every section of the British Association, for example, discusses in some way or another the social implications of its own particular scientific discipline, and the Division for the Social and International Relations of Science, under the chairmanship of Sir Richard Gregory, has already done work of inestimable value along these lines. Then there are the other more limited institutions and societies. But all these exist chiefly for the expression of points of view and for the determination of policy. Only within very narrow limits can they be expected actively to carry out research, and it is research in the social sciences which is so urgently needed. For this, some new form of central organization is, without doubt, badly needed, and now is the time for its foundation. Problems peculiar to war-time would receive prior claim, and thus would be laid a sure foundation for the development of the organization after the War, so that science could play a more practical part in the establishment and keeping of that kind of peace for which everyone is hoping.

## CENTRALIZED RESEARCH IN THE SOCIAL SCIENCES

### THE CASE FOR RESEARCH IN THE SOCIAL SCIENCES

By Prof. GEORGE E. G. CATLIN

Sometime Professor of Politics in Cornell University

IT is common ground that the task of social reconstruction after the War is going to take a pre-rogative position. Upon its success or failure is going to depend the future condition of Europe, and not only of Europe. In the alternative, we shall have not only a revolutionary epoch, but also a revolutionary epoch that is not even successful. The question here is whether this reconstruction is simply going to be carried through by practical men, dominated by the departmental notions of their own personal and limited experience, or whether the politicians are going to call in those who have, as a professional matter, made a systematic survey of the entire relevant data.

There is a second issue which, at the risk of paradox, I would venture to call even more important. It is that of the advancement of science. The social sciences have been embarrassed by the highly emotional and personal nature of much of the subject-matter with which they have had to deal—although it has been pointed out to me that medical science might have been overwhelmed by the same embarrassment (which has periodically threatened it) if it had lowered its standards of objectivity. To say that every economist is liable to be prejudiced, as the late J. A. Hobson said, is clearly true. To say that therefore there can be no economic science does not follow. The social sciences have suffered from the prejudice of those whose interests were liable to be undermined—so did the physical sciences in their day, but the enemy was then dubbed 'superstition', not 'practical sense'. They have suffered, as Hobbes said, from politicians who regarded them as 'dangerous', and even from eminent universities which have regarded them—as also the physical sciences were once regarded—as undignified upstarts. The great University of Cambridge declined to accept a grant for a chair of sociology, while the ancient University of Oxford had many, doubtless entirely necessary, chairs of divinity in various forms.

While the social sciences have been regarded as wicked attacks on the humanities by the humanists, they have, alas! been regarded as bastard little brothers by the physical and natural scientists. For some purist academics scarcely anything at all has been science save mathematics and mechanics. For others, no less dangerous, everything capable of being the subject of lengthy meditations has been *Wissenschaft* and science. As a kind of compromise, when the overwhelming practical importance of these sciences in a disturbed world could no longer be denied, the awakened practical men and journalists asked for 'scientific opinions', and the awakened citizen-scientists began to express their opinions in profusion. Astronomers, biologists and physicists talked about the nature of the State and the rectitude of credit and tariff, as did also the astrologers, and every writer of fiction or *belles lettres* who had what is called 'a name' and whose articles would sell easily in the commercial, popular press. On the whole, speaking from the point of view (which, of course, has

to be considered) of the pay-box, the astrologers led.

For myself, I happen to be a humble political scientist who has spent twenty-two years on the job. The science is immature. Few even of my own colleagues agree with me in everything—but then, neither do the mathematicians agree. That there is a political science I contend along with Machiavelli and Hobbes, Spinoza and Bentham, Mill, Sidgwick, Marx and Lenin. Unlike the last, I hold that it can most helpfully at the moment be provisionally interpreted by the Hobbes-Adler hypothesis of the quest for power and that many of its hypotheses are capable of empirical and quantitative demonstration. These are deep matters, suitable for discussion elsewhere. But, since I put this argument forward (and I admit that it was received with acute scepticism) the work of Bertrand Russell on power, and the revolutionary 'mass observation' studies of Harrison and Madge seem to have done something to confirm it as the tenable hypothesis which alone I submitted it to be.

Political science, however, is perhaps the weakest and most uncertain (although, if Plato be right, the most august and promising) of the social sciences. Whatever be the quarrels of the schools, who will deny that a trained economist is more qualified to discuss economics than a layman? Or a statistician statistics? Or a psychologist psychology?—although I have heard learned humanists at college high-tables demonstrating with finger and port glass that experimental psychology was *contradictio in adjecto* and, moreover, a waste of college funds.

The Social Science Research Council of America, for which I once had the honour of acting as a director of research on the subject of the socio-medical controls under the Eighteenth Amendment, has in its wisdom decided to include, within the field of the social sciences, economics, political science, sociology, anthropology, statistics (including vital statistics), psychology and history. The case of history must seem dubious, since it is generally agreed that there can be no science of history as such, but as a fact-classifying discipline the practical advantages of the inclusion of Clio in this company may perhaps outweigh the disadvantages. Plato's rule about the preliminary study of mathematics and Lord Kelvin's rule about the measurable nature of the material of exact knowledge are remembered. As has been well recognized in the School of Human Relations (which owes its establishment in large part to President Hutchins (now of Chicago)), there are various claimants for admission to the circle such as social hygiene on the margins of medicine, and criminology on the outskirts of law. However, the present system works.

This Social Science Research Council began in the United States in the middle of the 'twenties in quite a humble way, with a modest budget. It boasted no offices and not even a salaried secretary, but only a 'secretary to the chairman'. At this time Professors Charles Merriam and Wesley Mitchell played leading parts in getting the organization firmly established. There was little sign of that 'American over-organization' of which my old friend, Professor Graham Wallas, was afraid. Later, first Professor Lynd and then Professor Crane were appointed as secretaries general. The two famous reports on Economic Trends and

Social Trends were carried through by the Bureau of Economic Research and the Social Science Research Council respectively, the second under President Hoover's patronage and bearing his name as "The Hoover Report". The great prestige of the Council, with its princely offices, is something that has been built up on solid and vital work.

The failure of the Eighteenth Amendment, at great public cost and with inestimable damage to law observance, showed the danger of social legislation and even of 'noble experiments' carried through without adequate psychological understanding or sociological analysis. Nevertheless, it was clear, in about 1929, that there was going to be more social legislation deeply affecting the way of living of the community. The question was whether it was to depend upon power or upon knowledge, or upon mere muddle and afterthought. Financial aid was obtained from the Halley Stewart Trust in order to establish a preliminary committee to survey the social research work being carried out in Great Britain, as has been mentioned by me in the columns of *The Times*. Sir William Beveridge, Profs. Carr-Saunders, Gregory, Pigou and Wallas, Lord Stamp, Messrs. Farquharson (rapporteur), Stanley Unwin and others served. Some of us felt that the final report might profitably urge the establishment of a Social Science Research Council of Britain, and this was in some measure done. However, for reasons that need not be discussed here, the broader scheme proved abortive. Largely owing to Lord Stamp's activity, the Institute of Economic and Social Research was established, to do valuable work. After talks with Lords Astor and Tweedsmuir and Mr. Tom Jones, the other scheme died. The humanists were not very sympathetic and there was some confusion between the fields of social research and social service, and also doubt whether only economics was mature enough to be regarded as a science.

At the same time suggestions were put forward for a scheme for strengthening legislation by party political research (a matter of interest to Lord Astor and to Mr. Wedgwood Benn, Mr. Roden Buxton, Sir Oswald Mosley and the Fabians) and for a Social Advisory Council to the Government, the latter being put forward in memorandum form in 1930 to Mr. Ramsay MacDonald. Later, the Economic Advisory Council (a very unfortunately constituted body) was established. The design, however, of those who were interested in thus 'rationalizing politics' was not to confound party politics or governmental policy with academic and long-distance research, but precisely, by the establishment of different although related organs, to distinguish these fields of propaganda, policy and research which are so habitually confounded.

For this reason, although I have noted with interest Prof. Patrick Abercrombie's suggestion in *The Times*, and I believe there is a very strong case for reconstituting the ineffective Economic Advisory Council, I would emphatically not be in favour of establishing any academic council under the Cabinet, and still less (Heaven forbid!) make any Civil Service department. Absolute independence, the staking of personal academic reputations for integrity, the highest standards of objectivity, long-distance research—these are the requisites. It by no means at all follows that such research has no practical consequences, and this of the most vital character.

I would take research into population changes as one instance. Great prejudices, economic and religious, are stirred. The sovereign pride and the

national and racial rivalry of States are affected. It is all very difficult—and all very practical. The final war is the biological war. Many of the facts are matters of 'cold' statistics, although, of course, ultimate questions of values do not come within the purview of science. The medical man, for example, works on the hypothesis that the life of the patient should be preserved. There may be occasions when morally it should not. It is outside his province to decide the morals of infanticide but only to carry out the Hippocratic oath. That is his hypothesis.

There is probably a strong case for establishing an Institute of Vital Statistics, Demography and Social Biology. But no departmental institute can fulfil the work of the Council, nor can the institutes representative of other departments—anthropology, sociology, experimental psychology, industrial psychology or the various societies such as the Royal Historical Society be expected to serve under its banner. A general council is required.

On the analogy of what has already been done or recommended, I would suggest that the functions of a Social Science Research Council should be (a) to survey the field of the social sciences and to prevent overlapping in research; (b) to provide a channel of financial aid from individual benefactors, public foundations and the Government; (c) to pass upon and initiate schemes for research; (d) to provide finance and aid in the provision of personnel and office facilities for such research; (e) to publish, where desirable, the results; (f) generally to promote the interests of, and to advance, the social sciences; (g) to be an organ for voicing the collective opinion of social scientists on such occasions as it may be desirable to express them; (h) to represent the social scientists of Great Britain at relevant international gatherings; (i) to aid the Government and appropriate public bodies in social scientific research, when called upon to do so. I do not contemplate the Council members themselves being called upon, as such, to undertake research. This should be done by individual experts who are recognized authorities in their special subject, a background of advisers being supplied by sub-committees *ad hoc*. The function of the Council should be initiatory and generally supervisory.

The constitution of the Council involves more difficulties in Britain than in the United States, where every discipline has its own national association. I would, however, suggest that every holder of a chair or a readership in the selected subjects in the British universities should be *ex officio* a member, and probably also the directors of the relevant institutes and the presidents of the recognized national societies. It will be borne in mind that their main executive function, apart from the raising of funds, which can be left to the officers, would be the appointment of vigorous sub-committees to do the actual work. A special relationship would need to be established with the Royal Society, the British Academy and the British Association. But the less the American model, in constitution, is departed from the better—although, of course, a British institution can be expected to operate in a typically British rather than a typically American way.

The establishment of such a body, such as would gratify a Petty or others of the founders of the Royal Society, might well be one of the greatest steps for the advancement of science and one of the most original contributions to far-sighted and reasonable government in our century. It could do something to vindicate democracy as government by discussion,

comment and reason, against government that claims to be efficient but rests on the principle of mere party power. Before there can be what is readily called 'scientific government' (be it 'scientific socialism', 'scientific business', or what have you) there must first be science, not apologetic but organized, independent, authoritative.

## BIOLOGY AS A SOCIAL SCIENCE

By MRS. S. NEVILLE-ROLFE, O.B.E.

**I**F a social structure that provides for the emotional freedom and development of personality is to be the outcome of the present struggle, then an immediate effort must be made to harness individual emotional energies to this purpose. If the present world-wide destruction of man and his material assets by his fellow-men is not to inflict irreparable damage on civilization, man must make a supreme effort to safeguard and improve human quality. He must collate his scientific and spiritual values—to this end the gulf between the scientific and extra-scientific leaders must be spanned by as wide a bridge of common agreement as possible—direct his knowledge and energy to the fostering of individual emotional maturity and to the conscious control of his own evolutionary processes. Both intellect and emotions must be mobilized in the pursuit of a satisfying purpose in life, by applying to man the existing knowledge of social biology and by directing the desires and capacities of the present generation to further research (related to man) on personal and genetic development.

The knowledge and experience drawn from all parts of the world and from all groups working on biological problems—both theoretical and practical—should be immediately collated by an organization designed to promote its application and to foster further research.

To this end it is suggested that an institute having social biology within its purview should be called into existence, representative of scientific thought and world-wide experience, and able to act in a consultative-directive capacity.

Social biology is interpreted, for the purpose of this article, as including all those branches of science and administration directly concerned with man in relation to the genetic, traditional and environmental factors that shape his personality and influence his social relationships.

Many branches of general biology have contributions to make, including functional anthropology, genetics, psychology, physiology and biochemistry. The educationist, sociologist and statistician are also needed as channels of application as well as the administrator, the statesman, the medical man and the judiciary.

The time-lag between knowledge and practice in its application to the quality of man himself is unduly long. If the causes are recognized, it may hasten their removal.

### Social Effects of Unrecognized Biological Factors

It has in recent years become obvious to some of our Empire administrators that man is being shaped to a large extent by his environment. The effect of soil erosion on tribal customs; the effect on nutrition, and ultimately on fertility, of relating currency to

cattle; the effect of soil starvation and over-recruiting of labour on tribal and family life; the break-up of tribal life brought about by intellectually imposed changes in spiritual values—all are problems of social biology and are now seen by some with clarity for what they are.

We recognize the effect of imposing Western factual knowledge on peoples whose emotional values are still governed by tribal tradition. We can see the results of this unconscious but large-scale experiment in social biology among the detribalized Africans living in ports and industrial towns. Their emotional lives rooted in the traditions and governed by the values of the tribe, its family structure, its land tenure, its totems and its magic are not integrated with the newly acquired factual knowledge, or with the required behaviour pattern of a more complex culture. Unless these former deep-rooted and emotionally desired standards and customs are carefully re-interpreted and related to the higher values embodied in the European culture it is sought to impose, so that these are willingly accepted, there is deterioration in character, personal unhappiness and a sense of frustration. Some apparently successful experiments in social biology have already been made—for example, the substitution of competitive prowess in the hunt or in sport for the head-hunting qualification for full tribal membership and marriage, and the modification of the original mutilating initiation ceremonies to a form adapted to the ritual entry to a Christian community.

While we recognize the emotional childhood of the African and rightly explain his irresponsibility as due to the personal conflict between his own values and new knowledge, we have not recognized the same conditions as obtaining in ourselves.

Psychology, anthropology and endocrinology have of recent years widely extended our understanding of the emotional nature of man. Many well-known phenomena hitherto quoted as evidence of the 'unchangeability of human nature' are now seen as the result of infantile desires being unrecognized as such by the intellect and remaining as overshadowing influences or subconscious prejudices often impelling the adult to behaviour entirely at variance with the dictates of reason. A factor of supreme importance, but not yet consciously applied, is that the first appreciation of 'values' comes through the emotions. An intellectual giant may be gravely frustrated in personal life by an uncontrolled temper, arising from subconscious emotional causes, or by an emotional immaturity which denies him the harmony of adjustment in marriage.

Human energy has been directed to training the intellect but has ignored the emotions. Knowledge will not affect behaviour or lead to action until implemented by emotional driving force, which can only be secured when both mind and emotion accept a common objective and purpose in life. Though this is known to the psychologist, it is not adequately applied by the educationist, nor is it generally understood by the public.

### Emotional Development of the Child

The Child Guidance, the 'Home and School' and the Mental Welfare Councils, and a number of individuals are working out techniques for the emotional development of the child, on the basis of existing knowledge, and indicating lines of research and inquiry.

No systematic popular education has, however, yet brought to parents or to administrators that understanding of the emotional make-up of the young child that is vital if its needs are to be met. Under war conditions the quickest and most effective way must be sought to give the children of to-day the best opportunities of developing into emotionally balanced and mature adults capable of being responsible citizens of a real democracy.

To-day, even when an administrative reform is made, the general ignorance of psychology and social biology results in the cause of the reform not being understood by those who carry it into effect, thereby nullifying the intended advantages.

A number of the progressive local authorities and philanthropic organizations have already abolished the large institution for the care of children; but many have not appreciated that the reason for the change is to provide for the satisfaction of the child's emotional need for parent-substitutes, and therefore they omit to provide sufficient staff in the cottage home to enable any one person to express affection to the individual child, or to enable the child to have the emotional outlet essential to its development. They ignore the psychological reason for the change of policy. Nor is it appreciated that substitutes for both parents are required. A widow, untrained, charged with the entire care of twelve children, single-handed, has no time for 'mothering'; the frequent employment of widows, though it reduces the cost to pension funds, ignores the need for the father substitute. This is no small problem. It involves about 45,000 children in Great Britain—27,460 under local authorities and about 18,000 under voluntary bodies<sup>1</sup>.

Unfortunately, most members of local public assistance committees and of philanthropic bodies have had no opportunity for acquiring even a bowing acquaintance with social biology. Yet, these same authorities to-day are often grappling with the vast problems of evacuation. Surely there is urgent need here for responsible advice and guidance if serious but avoidable war damage to children is to be prevented.

### The Adolescent

Again, the personality develops at adolescence; the values and outlook then adopted will influence the youth and girl throughout life as citizen, marriage partner and parent; yet no systematic provision is made to explain the working of their own minds, bodies and emotions, to give them some idea of the interdependence of the different aspects of personality or to indicate how they may consciously integrate their own so as successfully to pursue a projected plan of life.

During the last ten years, as an emergency measure, about 100,000 of the 14-16 and 16-25 age groups have been given brief biological instructional courses on the place of sex in life, under the aegis of the more progressive local authorities and their youth committees by the British Social Hygiene Council, but what is that among the 6,571,800 young people of that age<sup>2</sup>?

What an opportunity is missed, too, in the administration of the National Health Insurance Acts, because our legislators and administrators did not appreciate their biological responsibilities!

Each year the young people leaving school for industry provide (supposedly) for their future health by registering under the Acts. In 1941 the age was lowered to fourteen and fifteen, the eligible entrants

numbered 730,000, and these added their names to the medical men's panels. Unfortunately, under the name of 'health'—an ideal to be desired and striven for—only disease is paid for, or considered. The power to educate for health is in the preamble of the Act, but has never been implemented.

### Social-Biological Problems

Knowledge of the effect of the endocrine equipment on character and behaviour has been available for years, but has not yet effectively influenced either our legal system or our moral judgments. In spite of the constructive work of the Institute for the Scientific Treatment of Delinquency, we still inflict prison sentences and label as recidivists many needing medical treatment and care.

No attempt has been made to relate new biological knowledge affecting man to our social values. This often results in social welfare and individual behaviour being at variance. Take, for example, society's attitude to health and disease. No teaching on the psychology of the normal person—only the abnormal—is now included in the general medical training. Surely mental health is of paramount importance to the understanding of his patients' minds and emotions and is as essential to a medical practitioner as an understanding of their physiology and pathology.

Instead of a biologically minded community seeking the attainment of positive physical and mental health, and adapting the social structure to that attitude, there is a clash of values confronting the medical practitioner, which has seriously checked the application of science to man's development. As a social biologist the private practitioner should educate and work for the maintenance of health and the prevention of disease. As a citizen he must earn his living and maintain and educate his family. With our present knowledge of preventive medicine and our present form of medical organization, the two duties conflict.

Every professional barrier is raised to prevent medical practitioners taking an active part in popular health education; they in turn oppose every attempt at extending the field of preventive medicine through free clinics. The preventive early treatment of ailments and disease will, under the present system, reduce their means of livelihood. Even advice to the normal adult by competent lay people on preparation for, or adjustment within, marriage has been opposed by the medical profession, although the group of subjects concerned do not form part of ordinary medical training. Payments are made in relation to disease; the practitioner is not paid, as in ancient China, to keep his patients healthy. No community educated biologically would support a form of medical organization which created a vested interest in disease. That Western civilization has done so has undoubtedly been a factor in delaying the application of human and social biology.

It is cure of disease for which society pays and which therefore provides the large incomes.

### Emotional and Intellectual Values In Conflict

One of the causes of the time-lag between knowledge and practice is the divergence between intellectually accepted truth and the traditional interpretation of spiritual or emotional values.

Although for two thousand years the statement that figs cannot be gathered from thistles has been

repeated, had we applied the observation to man, and acted on it, we could have prevented the birth of many inherent defectives and increased the proportion of the genetically well endowed. The traditional opposition to selective parenthood persists. Emotional inhibitions have prevented the objective analysis and discussion of sterilization, limited even the discussion of entelegenesis to scientific journals, and buried in oblivion the interdepartmental report on abortion.

War conditions are directly affecting the number and quality of the coming generation, both born and unborn, yet no authoritative scientific guidance is available from those with real knowledge of the biological factors involved to those responsible for the mobilization and welfare of the man- and woman-power of the nation. It is urgent that existing knowledge should be reviewed and applied administratively to prevent ignorant good-will inflicting permanent genetic damage.

Young men and girls removed from home surroundings are marrying at short notice with no pre-marriage preparation or post-marriage help to adjustment. The result is a rising number of separation orders in 'war-marriages'. Some attempt is fortunately made by the Women's Services to keep marriage partners in touch, but no national policy in relation to the family is implemented.

Opposition to the use of vocational guidance arises from the widespread ignorance of biology. The effect on production and working efficiency of emotional anxieties is quite ignored, but is of serious import. The head of a training school for men between 19 and 21 reported that working efficiency had risen 10 per cent after courses of instruction relating to sex adjustment had been given.

The added personal responsibility deriving from the widespread knowledge and practice of contraceptives has altered personal values and necessitates constructive thinking. The increasing sense of parental responsibility accepts at a higher value the planning for a consciously desired child. The recognition of the value to individual development of both the play and the reproductive aspect of sex needs new social customs, new and personally accepted controls. A community seized of the truth of social biology will appreciate the impossibility of relating the spiritual and biological values of the 'unique relationship' in marriage, essential to full personal fulfilment, providing the required background for the child, and quite possibly an important instrument of human evolutionary advance, in a social structure that defers marriage until years after maturity, and for a large proportion of the population postpones parenthood beyond the optimum reproduction age. To-day, the emotional immaturity of the population and the absence of any attempt to relate new knowledge to emotionally accepted values in the field of personal and genetic progress limits emotional reactions in the mass to the primitive and childish. Hence the constant stimulus to irresponsible behaviour from commercially provided entertainment.

It is therefore of great moment that the proposed re-introduction of 'religious teaching' in the schools should take the form of an endeavour to inspire youth to rethink the traditional forms in which spiritual values are expressed; it is hoped authority will not seek to impose dogmas, but will clarify the truth they embody in a form that may go beyond, but would not conflict with, factual knowledge.

The dangerous ease with which false values may

be presented to the intellectually ignorant in a form which will satisfy the mind and release the emotional drive is seen in Germany. The false values of aggression and aggrandizement have followed the correct technique in the wrong direction, with the resultant chaos and disaster of a world war.

### Science and Inspiration

There is a need to collate inspirational truth with factual knowledge. Truth is expressed in many forms. The great religious leaders of the world have proclaimed the facets of truth gained through intuition and inspiration, in forms designed to appeal to the emotions. They have provided the positive philosophies of life that have been a major influence in dictating man's behaviour. Each inspired leader has clothed his vision of truth in forms related to the knowledge and the social structure of the age in which he lived. Those religious systems that become static and anchor 'truth' to the conditions of the age in which they are formulated, die out; the gap between factual knowledge and religious teaching steadily increases—until the gulf between the emotional ideal and intellectual knowledge creates divergent values, uncertainty of direction and ultimately, cleavage in personality.

Those religions that re-interpret the form and retain the spirit of intuitional inspiration are dynamic and alive. Organized religion tends to oppose intellectual advance and takes refuge in an appeal to primitive emotion. This has probably been an important factor in prolonging the emotional childhood of man. On the other hand, workers in the field of science have tended to leave aside the realm of values except as it affects them in common with their fellow-citizens. Thus, when their views have been expressed they are often accorded an authority which they properly carry in their own subject, but which they would be the last to claim in one they had not studied.

The Christian ethic asserts the unity of truth and the essential value of the individual personality. The form has been constantly re-interpreted in the light of factual knowledge. The respect, for example, for personality, which now takes a central position in its teaching, has only recently been interpreted as applying to women as well as men. A girl's marriage partner was arbitrarily chosen by her father, usually on economic grounds, until quite recent times. Even some bishops were polygamous up to the Middle Ages, and it is often forgotten that in an economically ignorant world Church dignitaries opposed the abolition of slavery.

Values formulated from a small basis of factual knowledge, if unchallenged, retain their emotional appeal after discoveries and developments which demonstrate their error have enriched the traditional intellectual inheritance; the old values become the prejudices of those who are too apathetic intellectually and too fearful emotionally to challenge current interpretations. This is another factor in the time-lag.

The discoveries of the last three generations have now created in living religions a dangerously wide gap between knowledge and practice, between intellectual and emotional values, but that conscious and satisfying re-interpretation is possible can be demonstrated by a personal experience.

Some years ago in India, it was my privilege to give a course of lectures on the development of the



adolescent, to a large body of Hindu teachers. The span of years between the onset of the first physical signs of puberty and the attainment of physiological and psychological maturity was indicated. The Sarda Act was at that time before the country and the question of child marriage prominent in their minds. At the completion of the course, the chairman and members of the Teachers' Committee asked for a private conference. A number of pertinent physiological questions were put and answered factually and objectively. At the end, the chairman turned to his colleagues and said: "This is quite clear—we must have misinterpreted the Upanishads."

### Social Biology in Administration

While man's further progress demands the projection of a unified and clarified ideal, there is no barrier other than that of the ignorance of the life sciences on the part of the responsible members of society to prevent the immediate application of much current biological knowledge that would promote human betterment.

Biology would appear to be of major importance to those responsible for leadership or who have jurisdiction over their fellows, at home or overseas—in Government and administration, the Church, the law, in the Defence Forces, industry, commerce and the social services. Yet, owing to present educational organization, it is among those who aspire to leadership that biological knowledge is conspicuously lacking. The majority of those seeking high office take the 'humanities' at the university. These are descriptive of the accomplishments of the mind and emotions of man—literature, history, language, but exclude the study of man himself as a living organism reacting to his environment, capable of the conscious integration of personality and responsible for the quality of posterity.

Dr. E. Lewis-Fanning carried out a small sampling inquiry in which "He extracted from the current Whitaker's Almanack, the names of the officers holding the rank of principal assistant secretary or a higher rank in various Government Departments. Of the 94 gentlemen in his sample, 42 were bred in the University of Oxford, 18 in Cambridge and 34 in some other or even in no university. We traced the academic careers of 40 of the 42 Oxford men and of the 18 Cambridge men. Of the Oxford men 31 took the School of Lit. Hum., 7 the School of Mod. History, 1 Mod. Hist. and Lit. Hum., 1 Jurisprudence and Lit. Hum. Of the Cambridge men 7 took the Classical Tripos, 5 the Mathematical Tripos, 1 each Natural Science, History or Law, 3 Mathematical and Natural Science, History or Law, 3 Mathematical and Natural Science Triposes. The sample is small, but a vocational bias of the humaner letters is indicated. Of the seven dignitaries in the War Office caught in Dr. Lewis-Fanning's sample, 5 had taken Firsts in Classical 'Greats'."<sup>3</sup>

A diplomat, administrator, politician or educator has at present no alternative but to become well acquainted with the biological sciences or to remain entirely ignorant of man's capacity to direct his own progress, so far as formal education is concerned, and is unequipped even to recognize the biological damage now often inflicted by social and administrative measures devised by the biologically ignorant.

We also have past errors to adjust. In recent reports on Colonial labour policies, stimulated by the International Labour Office, questions of social

biology are constantly emerging. For example, the recent report of Major Orde Browne<sup>4</sup> describes the labour compounds of Northern Rhodesia and points out the human damage of these abnormal living conditions—a community preponderantly male; such women as are present, are without their normal agricultural occupations and are passed on as temporary 'wives' from one man to another; the system encourages the spread of venereal disease and gives no stability for a family. But "the compound which admits of at least a proportion of married men is from every point of view preferable".

The malnutrition disclosed among the population of the fertile islands of the West Indies could not have persisted through three generations of general education had those in charge of administration, education and industry had an opportunity of sharing available biological knowledge. 'Education' had omitted any instruction or guidance in life or in the art of living. The cultivation, preparation and preservation of suitable food, use of local building materials, positive guidance in fitting the environment to the needs of man and the conscious development of man himself, all were ignored.

In 1939, with edible fish abounding in the surrounding seas, a population suffering from poverty and malnutrition paid for the import of 237,541 cwt. of canned fish<sup>5</sup>.

*Factual knowledge, without emotional development, cannot civilize the individual.* While it is one of the assets of British secondary school education that 'character training' is an admitted objective, the type of character is that adapted to the British social structure. Colonizing governments have tended to transfer unadapted the educational system of the Mother Country to conditions overseas. Formal education is seen in its true colours in such new settings. It appears largely as a memory gymnastic, without influence on the man or woman as complete personalities. The facts memorized are unrelated to the emotional life or to traditional spiritual values; therefore, like discarded religious dogma, they have but little effect on behaviour. Such education tends to split rather than integrate the personality, to promote rather than resolve emotional conflicts.

For example, the deep-rooted and subconscious rhythm hunger of the African has been repressed, not drawn out and utilized, as a powerful aid to emotional development. This has had one peculiar result, with which I came in contact in Jamaica. Primitive African tribal dances can be seen and heard at dead of night in distant valleys or river beds—the rhythm of the music and the chant of the voices being African in cadence and tone. While the words, when analysed, are those of a Moody and Sankey hymn, the form and spirit of the dance are those of the African tribe. It is reported that primitive tortures have been inflicted under conditions of rhythm-ecstasy to enforce a local idea of Christian morality.

Again, the churches relate the 'value' of 'modesty' to the covering of the body with clothing, irrespective of skin colour, culture or climate. The West Indian is a practising Christian, therefore is fully clothed. The climate is tropical and heavy rain showers frequent. Many have no change for night clothing. In the old huts with mud floors the damp was absorbed; by the modern concrete floors it is not. Responsible local medical opinion recognizes this as one factor in the high tuberculosis rate. Another is the persistence of the deep-seated fear of the 'duppy'

(the ghost spirit in bird form) which has been unresolved, because ignored, by education. Tradition decrees that all windows are hermetically sealed at night, however crowded the room.

It is only to be expected that in the West Indies to-day Major Orde Browne can report, "there is a lack of objective or purpose among young people nearing the end of their school days"<sup>5</sup>.

The anthropologist and the psychologist need to co-operate with the educationist in designing the technique of cross-culture education.

Is it not urgent that those searching for truth in the laboratories and by observation and those experimenting in its application to man in the different parts of the world (now available) should be brought into close collaboration? The discoveries of scientific workers and the experiences of administrators in India and the Empire would be of real value to the directors of education and to the youth committees of Great Britain. The collation of information and analysis of the problems would be facilitated by such a forum and study-circle as could be provided by an institute which had research in social biology as one of its active terms of reference.

### Social Biology in Education

A serious factor in checking progress is the almost entire omission of human or social biology in the curricula of British universities, teachers' training colleges and schools. It is claimed that the younger generation are better placed to rethink values as they are less influenced by current prejudice, and recently acquired intellectual knowledge is more vivid. It is therefore vital that youth should be equipped with all available factual knowledge that bears on man himself and his potential development if their philosophy of life is to embody the nearest present perceivable approximation to truth.

Without a minimum of general understanding of biological principles, such discoveries as are made find no receptive public; there is no general critical and knowledgeable body of opinion to relate new facts to existing problems, and no appreciation of the value to man of the progress made possible by the efforts of the scientific worker, hence the absence of financial and social recognition for the biologist.

Funds have in recent years been available for research in agricultural biology in the interest of the farmer, the stock breeder, the poulterer and the gardener; but so far neither Governments nor individuals have come forward to encourage and subsidize research and observational experiment on man himself. The outstanding exception is Sir Francis Galton, who endowed the only chair of eugenics in Great Britain, now held by Prof. R. A. Fisher. The Weldon chair of biometry, now held by Prof. J. B. S. Haldane, is unfortunately limited by the proviso of the trust to "the higher statistical study of biological problems".

Research fellowships and studentships provided by bequest, trusts, and industry abound for physics, chemistry, engineering and the arts; but in universities those reserved especially for the study of man as a social biological unit can be numbered on the fingers of one hand.

An analysis of the distribution of exhibitions, scholarships, studentships, fellowships, prizes and medals, from four universities, recently made by Dr. I. Frost, discloses that in a total of 346, three go to genetics or psychology, one to social psychology and

ten to physiology. Fortunately, there are forty-three awards open to any subject, so that, as interest in those subjects affecting man attract the outstanding students, work in human and social biology can receive encouragement<sup>6</sup>.

At present a degree in biological science at a university has to be in zoology, botany or the more specialized biological subjects such as medicine, agriculture, etc. There is no university course in social or human biology, while certain university courses in social science still ignore the subject. That this practice does in fact deflect attention from, rather than to, 'man' is shown by a demonstrator in zoology at a well-known university who deplored the lack of opportunity for the consideration of the human in his teaching and was told by his professor that he was "very daring" to use the human skeleton as a demonstration subject, and that it was "too dangerous" for him to include the human skull—this was 1941 not 1641. Under these conditions, a feeling has arisen among some zoologists and botanists that problems relating to man and his adjustment to environment are outside their purview.

At the end of last century and at the beginning of this, physics and chemistry had a struggle with the arts for *Lebensraum* in general education. The last few years have seen biology struggling with the other sciences for a share of the limited school time allotted to science. Educationists are still far from realizing that a general knowledge by pupil and teacher of the normal characteristics of man himself and some appreciation of the art of living should be fundamental to all education.

Social biology provides the basis for personal health and social relationships, and would enable a responsible democracy to create a social structure designed to enable man to attain his potential mental, emotional and physical stature. It was from the Empire and India that came the first appreciation of its importance. A special conference was held in connexion with the Imperial Social Hygiene Congress of 1930 from which memoranda, urging the introduction of the biological sciences to Colonial education, were transmitted to the Colonial Education Conference and to the Colonial Office Advisory Committee on Education. These representations were later supported before the Committee by Dr. W. K. Spencer and Prof. Julian Huxley and resulted in Prof. Huxley's tour of the African colonies. His subsequent report to the Government on "Biology and the Biological Approach to Native Education in Africa", and the publication of "African View", together with Margery Perham's outstanding work, marked real progress. The way was prepared for the guide to Colonial development provided by Lord Hailey's "African Survey".

In 1932 the then Prime Minister appointed a Committee on "The Education and Supply of Biologists", in which the importance of introducing the subject in home education was emphasized. The Hadow and Spens Reports brought science and the education of the adolescent under review. Authority now gives encouragement to nature study and biology but still hesitates to direct the attention of youth to the study of man and mankind as emphasized by Mr. L. J. F. Brimble in a recent address<sup>7</sup>. Of those who advance so far, many still believe that, provided something be taught in school about man's capacity to breathe air and digest food, the major responsibilities, namely, those of reproduction and the integration of man's own personality, can be ignored.

In 1932 also, the National Conference on the Place of Biology in Education drew together educationists and biologists who fully ventilated the question. A similar conference followed in Scotland. The Education Advisory Board of the British Social Hygiene Council gave permanent form to the movement. It has for nine years pressed the claim, first for time for general biology in the school curriculum, then that the biology taught should relate to man and extend to social biology.

Syllabuses for three alternative approaches up to School Certificate standard were prepared: from a basis of nature study, by Sir Arthur Thomson; from a basis of hygiene and physiology, by Prof. Winifred Cullis; and from general science, by Prof. Julian Huxley.

The results of the various efforts are reflected in the steady increase in biology shown by the School Certificate returns:

		SCHOOL CERTIFICATES							
		All Schools in England and Wales.							
		1933	1934	1935	1936	1937	1938	1939-40	
Biology	...	6,179	7,383	9,968	13,467	15,111	15,852	15,602	
		9%	11%	14%	18%	20%	21%	22%	
General Science		2,560	2,842	3,204	4,156	4,771	8,784	13,465	
		4%	4%	5%	6%	6%	11%	19%	

In the present emergency the demand is growing from teachers and education authorities for refresher courses on human biology and for short courses for 'school leavers' on simple social biology, but the need and the urgency is beyond present resources.

Under war conditions teachers of evacuated schools have many additional demands on their time and good will from the out-of-school needs of their pupils; some guidance to them on problems of psychology and social biology is badly needed.

Interest in social biology as applied to education is growing rapidly and war conditions demand effective action.

An attempt has been made to present a few practical instances, drawn from home and overseas, of failure to use existing knowledge, of lack of opportunity for those working in different fields to exchange experience, of opportunities missed for the application of biology to human welfare. The war effort is handicapped by man's emotional immaturity and biological ignorance.

It is suggested that a central organization for social biology should be inaugurated and that its first step now should be to evaluate existing knowledge and to consider methods of its application to current problems. The second, to invite the attention of universities, research councils, institutes and Government departments to questions meriting immediate research, observation and inquiry. The third, to promote constructive discussion in the re-interpretation of our social and spiritual values. The fourth, to act as a consultant body to governments, local authorities and professional bodies. The fifth, to provide information to responsible persons and to promote post-graduate teaching.

A number of groups are already interested in or concerned with application and research in one or more branches of human and social biology. For example, the departments of physiology, psychology and anthropology at the universities, the Medical Research Council, the National Institute of Social and Economic Research, the Royal Anthropological Institute, the Rockefeller International Board and certain philanthropic trusts.

In the practical application of social biology, the Eugenics Society, the Child Guidance Council, the Institute for the Scientific Study of Delinquency, the Nutrition Society, the British Social Hygiene Council, etc., are all doing a certain amount of the kind of work which should be given wider scope.

Concerned in the administrative measures with biological implications are the local authorities, through public health, education, public assistance and evacuation, magistrates, lawyers, probation officers, the medical profession and various departments of government.

Responsible for guiding public opinion are the Press, the Church, the educationists and the writers.

In Great Britain, a pioneer effort of a voluntary character has been the precursor of most national developments: from Drake and his privateers to the British Navy; from the Church schools to general compulsory education; from the friendly societies to National Health Insurance. A central organization having social and human biology within its purview might well blaze the trail for a national administration consciously directed to the improvement of human quality.

A national conference could, in the first instance, be convened to which all concerned would be invited in their individual capacities. The object would be the formation of an organization which would include the scientific worker in social biology and other social sciences at home and overseas, together with administrators and leaders in those fields affecting personal and social welfare. The sessions of the conference would be planned to summarize accepted factual knowledge, to indicate researches already perceived as desirable which could be promoted under responsible auspices and to stimulate the development of a positive philosophy of life satisfying to both intellect and emotions, embodying the ideal of man consciously directing his own progressive evolution.

From the conference, a small and active provisional executive could be charged with the task of appointing working committees, of forming a representative governing body, of seeking funds and of making initial plans for the co-ordination and presentation of research. In the case of social biology, consultative groups should be brought into existence without delay to advise on problems of emotional development and guidance, evacuation, juvenile delinquency, the care of the abnormal and sub-normal, preparation for marriage and marriage adjustment.

A panel of qualified lecturers would offer elementary and post-graduate courses in the social sciences; for example, in the case of social biology they could be offered to Civil servants and local authority officials and members, to magistrates and lawyers, to medical practitioners and the allied medical services.

Qualified lecturers could be nominated by the organization to participate in social science and other courses provided by the universities.

The committees concerned with research, with practice and with ethics would be in a position to submit questions needing analysis, observation or inquiry to the existing organizations equipped either to finance or to undertake the tasks.

Large funds for new enterprises, except for those directly related to war, or immediate post-war problems, could not be sought; but where the application of existing knowledge could materially increase the efficiency or reduce the human damage of the war effort—either safeguard or improve present or future human quality of physique, intelligence and

character in the population—immediate action could be called for.

A number of the services suggested could be offered on an economically self-supporting basis.

To desire and seek truth and embody its wisdom in a plan of life is surely an ideal which will call out man's highest endeavour.

<sup>1</sup> Local Government Directory, 1941, pp. 231-243. This excludes Home Office Approved Schools. (Annual Report of Ministry of Health, 1938-1939, p. 202.)

<sup>2</sup> Gen. Statistical Review, 1938. Table 1, p. 1.

<sup>3</sup> "The Social Distribution of University Education" by Prof. Major Greenwood. (*J. Roy. Statistical Soc.*, 102, pt. III, 368 (1939)).

<sup>4</sup> "Labour Conditions in Northern Rhodesia", by Major G. Orde Browne. Colonial C.M.I. No. 150. (H.M. Stationery Office. 2s. net), 24, 25.

<sup>5</sup> "Labour Conditions in the West Indies", by Major G. St. J. Orde Browne. (H.M. Stationery Office, 1939), p. 70.

<sup>6</sup> This, of course, excludes the medical and surgical research opportunities—these with few exceptions are directed to disease, not even to preventive medicine or to the maintenance and promotion of positive health. Dr. Frost, medical secretary of the British Social Hygiene Council (in a personal communication), has analysed the data available in relation to the Universities of London, Liverpool, Manchester and Birmingham. The distribution of exhibitions, scholarships, studentships, fellowships, medals, prizes and research grants is as follows: divinity, 5; medicine (including dental surgery), 64; history and law, 36; art and architecture, 24; music, 1; teaching, 6; classics, 8; foreign languages (including phonetics), 27; journalism, 3; literature, 17; geography and geology, 6; mining, metallurgy and engineering, 42; archaeology, 2; chemistry, physics, science, 51; mathematics and statistics, 12; physiology, 10; social science and economics, 22; commerce, 8; genetics or psychology, 3; philosophy, 2; zoology or botany, 5; open, 43; specifically social psychology (Graham Wallas Memorial scholarship), 1.

<sup>7</sup> NATURE, 148, 787 (December 27, 1941).

## IMPACT OF THE PHYSICAL SCIENCES ON SOCIETY

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THE *cause célèbre* of the Inquisition *v.* Galileo Galilei has often found mention in the columns of NATURE. In every recrudescence of the old controversy between science and religion it is as certain to crop up as King Charles's head in Mr. Dick's memorial, or as the burning of coffee berries at Costa Rica in a certain type of political argument, and with about equal relevance. The opprobrium showered on the instigators of that famous trial has been, perhaps, somewhat excessive. Their methods must be condemned—truth is not to be suppressed—but in their recognition that scientific discovery raises problems of vital import to society as a whole the Jesuit Fathers showed an insight into the potentialities of science which it would have been well if it had been shared by the statesmen of the past hundred years or so. The impact of discoveries in the physical sciences upon a society unprepared to receive them has led to an enormous increase in material wealth, but at the same time has raised a host of social, economic and political troubles from which the world is suffering to-day.

Though deplorable, it is not surprising that the far-reaching consequences of the work of the natural philosopher were not foreseen either by philosopher or politician. In spite of the often repeated statements to the contrary from upholders of a certain political philosophy, the discoveries in physics which have done most to change the face of society were not made with the conscious desire of meeting the material needs of mankind. Michael Faraday did not begin the researches which led to the discovery

of electro-magnetic induction and issued in the present electrical era, in an attempt to improve on the Bunsen cell, nor did Sir J. J. Thomson discover the electron with the object of enabling the world to listen in to the B.B.C. Without in any way depreciating the painstaking and often brilliant work of the applied physicist, who, for very little reward, harnesses the principles of physics to the benefit—or destruction—of mankind, it remains true that the great revolutionary advances have been made by men who have had no motive except the undowered pursuit of truth in the natural world. The man who seeks for the love of the search will discover more than a man who is just looking for his collar-stud. Paradoxically enough, the first requisite for any further great progress in the application of science to the welfare of society is that the man of science shall be able to pursue his researches in absolute freedom from economic motive or State direction. Science in fetters will ultimately fail even in its ancillary duties as the handmaid of industry.

This being so, it is important if the disadvantages of the *laissez-faire* policy of the past are not to be perpetuated, that steps be taken now in preparation for dealing with the discoveries pregnant with new possibilities which are sure to come along. Research is always most difficult, though often most rewarding, in the no-man's-land which lies between the different sciences. It is likely to prove exceptionally difficult when the sciences differ as widely as physics and sociology: yet a liaison between the two is the most hopeful way of ensuring that the vast potentialities which the physicist is ever laying bare should be utilized for the welfare, and not to the hurt, of mankind. There is inevitably a pause, longer or shorter, between the discovery of a new principle, and its application. It is in this interval that direction and control can most easily be exercised. An excellent example of an opportunity happily grasped in time is provided in the control of broadcasting in Great Britain by the creation of the British Broadcasting Corporation. Instances where the opportunity was not seized may be left to the reader's own judgment.

The problems facing any central organization for sociological research are not, however, merely those of procuring a greater use of the unfolding powers revealed by the physicist. There are some possibilities which it might be wiser not to develop, and others where the application might be wisely delayed until necessary adjustments in our social organization had been made. An illustration, on a small scale, is provided by modern traffic conditions in our great cities. It is reported that the late Marquis of Salisbury would order his carriage and pair to await him in Downing Street ten minutes before his train for Hatfield was due out at King's Cross. It is doubtful whether a Secretary for Foreign Affairs just before the War could have cut the time of the journey so fine, although his modern car had some ten times the top speed of the Marquis's equipage. A more serious example of 'bad-timing' is provided by the whole history of the industrial era.

Almost every material problem is essentially a question of the proper utilization of energy; and practically every payment we make is directly or indirectly a payment for energy. Matter itself is indestructible, and though not unlimited in quantity, more than ample for our needs. Man's ability to gratify his desires on the material plane is limited only by the energy which he can control. It is for this reason that physics, which is the science concerned

with the study of energy in all its protean forms, has played so large a part in the material developments of the past hundred and fifty years. Until the beginning of the scientific era man had to rely for his supply of energy mainly on his own body, aided by that of domestic animals and to some extent by wind and water. The advantage of the human body as a machine is, of course, its infinite adaptability. There are still, and probably always will be, operations for which its unique co-ordination of mind and movement is essential. The disadvantage is its running expenses, which, compared with other forms of energy, are very high. Electrical energy equivalent to that which a man can produce can be had for a copper or so a day. Steam-power, on a large scale, is even cheaper. Unless a man's time is worth less than a penny or so an hour any mechanical operation which a machine can be designed to carry out can be performed much more economically by the use of one or other of the newly discovered forms of energy. Therein lies the explanation of the enormous increase in material wealth since the beginning of the so-called industrial era. It has been estimated that the average citizen of the United States was, just before the War, enjoying amenities equivalent to those which in classical times would have demanded the services of thirty slaves. There is no reason to suppose that the process has reached or even approached its limits.

There is, as everyone knows, a reverse side to this encouraging picture. The scrapping of obsolescent machinery is economically sound, but if the machine happens also to be a man the results are extremely distressing. It is perfectly true that on the balance and over a period of time the introduction of scientific sources of energy has found employment for far more workers than it has displaced. New physical discoveries have formed the basis of great new industries, and more workers with a far higher average output are now employed than ever before. The change-over period is, however, bound to cause intense suffering, unless the changes can be foreseen, and plans worked out to ease the transition. Only by constant and co-operative study and research can this be ensured.

The introduction of new forms of energy has, moreover, introduced more permanent changes into the structure of society. When each worker was his own power unit his work could be carried on effectively anywhere. Those were the days of the master craftsman, and a man could be, and frequently was, his own master. Steam-power, the first to be introduced, requires for its most economical application to be generated in large units. Moreover, the prime cost of installation was high. Workers had to go to the machine, and the factory system sprang into being. The early evils associated with that system have been largely eliminated, partly by enlightened legislation, partly by the gradual realization, as a result of psychological research, that dismal and unhealthy conditions of working are inimical to high output. A modern factory compares very favourably in its amenities with the average university research laboratory. The scale of living of the factory worker to-day is far higher than that of the home producer of a hundred years ago, while owing to ancillary scientific inventions such as the radio, the cinema, and quick cheap transport his facilities for enjoyment have been greatly enhanced; and owing to cheap energy his hours of work reduced. So much lies on the credit side; and, as I have said before, the limit has not yet been reached.

If, however, we believe that man does not live by bread alone, not even by bread and circuses, there may be another side to the question which at least merits investigation. What, if any, has been the effect on the men concerned of transforming a number of at any rate semi-independent skilled artisans into a body of factory operatives? Assuming with Ruskin (a much discredited writer whom, I am told, few read to-day) that the true wealth of a nation lies in the quality of its individual citizens rather than in the mass of its material possessions, how does say five or six hours a day (supposing factory hours to be reduced to that number as they easily might be) spent in tending three or four automatic machines, or in any of the monotonous and mindless operations of a mass-production plant compare, from that point of view, with a somewhat longer daily period spent in an occupation where hand and brain are harmoniously employed together in the production of a finished article? Some preliminary research on these matters has been begun. Much more is needed. I would only add that should some decentralization prove to be desirable from a human point of view, the facilities are available to effect the transition without too great a loss of output. The transformation of steam into electrical energy has made the distribution of cheap energy to small production units an economically sound proposition.

The plea for the wider application of science in social affairs is often presented as if it were merely a matter of more research, and a fuller application of the results of research in everyday life. In the case of the biological sciences, from which direction the pressure mainly comes, this is undoubtedly true. Freedom from disease, an ample sufficiency of good food, and appropriate clothing are fundamental necessities, and the biologists do well to insist on their ability to satisfy them. One would like to define the task of the physical sciences as the liberation of man from drudgery, so that he might be free to develop and enjoy his higher faculties, of which his creative ability is not the least. Owing to the, perhaps not unnatural, emphasis which has been placed on the accumulation of material wealth, it is doubtful whether the sum total of the drudgery of the world, of labour in which it is impossible to take either joy or pride, has been substantially reduced, though hours of work have been lessened, and can be still further reduced as the potentialities of physical research are more fully applied.

It would, I think, be an error to suppose that under any system of planning the volume of fundamental discovery in physical science could have been much increased, or the pace of its application to social purposes profitably accelerated. It is direction rather than speed which has been lacking. New powers have been exploited without a full consideration of their remoter repercussions upon society. To take perhaps an extreme but poignant example, the destruction of the heart of Coventry was implicit in those few brief seconds for which the first aeroplane lifted itself from the ground, but no warning was given, or at any rate was not heeded until too late.

The question of what constitutes 'the good life' is one of philosophy and religion, not of science. A wise society will take from the treasure house of science whatever it needs for the furtherance of its purposes, leaving unexploited, or at any rate severely controlled, what might be harmful. Society, however, needs, and is entitled to, the best advice on the more immediate, and the more distant consequences of the use,

or neglect, of the opportunities provided by scientific discovery. Neither physicist, economist, nor sociologist is competent alone for this task. A combination of the three might do much to direct the stream of progress into the happiest channels.

## SOCIAL SCIENCE, STATISTICS AND POPULATION PROBLEMS

By D. CARADOG JONES

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THE vice-chancellor of one of our modern universities has been heard to state on more than one occasion that he has failed to discover what is meant by social science. In a lesser man that might be taken as lack of appreciation of a field of knowledge fraught with immense consequences to mankind; but in this case it was no doubt intended as a criticism of social scientists because they have not defined with any precision the boundaries between their own and other sciences. That is not surprising in view of the rapid development of interest in the study of sociology. Interpreted widely, as it should be, it would include any branch of knowledge concerning man regarded as a social animal, in short, the study of human groups. Although, for convenience of observation, individuals may be isolated, interest centres in their social behaviour, their relationship to other individuals similar in many respects to themselves. But the diversity between them, in temperament, in outlook, in aims, is of even greater importance than the likeness. It is these differences, if not delicately handled, that produce strains and ruptures—strikes, wars and revolutions—in the body politic. There is an attraction in superficial remedies for such conditions, but they do not last. We spend our energy too often upon the perfecting of the machinery of social life, while neglecting the source and spring of all motivation: it is like designing a car, stream-lined and beautiful in all its parts, only to find that we have no suitable fuel to make it run smoothly. One of the most fundamental of the social sciences is psychology, because it explores the nature and causes of the divergences between individuals in their innermost citadel where they are most intimately revealed.

Another fundamental social science is philosophy, which creates harmony out of an assembly of seemingly discordant voices. This is achieved by discovering the purpose of life and so relating a diversity of means to a single-minded end. The individual converted, the right leader found, it can turn a mob into a disciplined army; but the purpose of the army is not to wage war upon some other faction. This social philosophy is essentially moral: it takes all the world as its parish, for in the realm of science there can be no partisanship. The warfare will not be against flesh and blood, but against ignorance and disease of mind and body, a ceaseless campaign systematically waged to get the best out of the rich natural resources available for the well-being of all mankind.

Assuming the philosopher to have contributed his share to the shaping of the new world, the political scientist will next be called upon to design regional and international instruments capable of transmuting the

philosopher's ideal plan into realized fact; the public administrator will assume responsibility for the right use and control of these instruments; and jurists will codify agreed rules to regulate social behaviour. As the curtain unfolds, the stage is seen to be set for actors almost without number, and each must play his part. The social historian warns us against the purchase of experience at too dear a price; he would have us profit by the mistakes committed in the past. The geographer deals with the reactions of human groups to their environment; it is his task to make an inventory of the raw materials latent in land and sea, to consider the most profitable use to be made of them, and to determine whether some areas are not too densely packed in view of their resources while others are starved of people to develop them adequately. Problems concerning the distribution and exchange of commodities come within the province of the economist; while the town planner contrives to apportion the land wisely to different uses, thereby preventing that haphazard building which has so frequently distorted the natural beauty of the countryside.

Hitherto we have failed to make a success of world government, not because we have lacked experts in all the social sciences mentioned, but because it has been nobody's business to survey the world as a whole and to co-ordinate the activities of these experts so that they work to a common plan. There has been another reason for failure: we have interpreted wealth in material terms and not in terms of human satisfaction. Economists and statisticians must take their share of the blame because, in comparing the standard of living of one class with another or the national income of one country with another, they have used money value as their measuring rod—with this much justification, that it seemed to be the only means of accurate measurement to hand. Yet, taken alone, it can be but a very imperfect index of what is really valuable in life. If we are to take true stock of a country's wealth, should we not start with the people who inhabit it? Apart from them, no other kind of wealth has sense or meaning.

So far this review has been in general terms. When we come down to practical details, we quickly discover large gaps in our machinery for making a satisfactory survey of the resources of even a small part of our own Empire, leaving other countries out of the account. Yet, to undertake such a continuous survey should be one of the main functions of the social scientist. Acting on the principle already enunciated, the most important feature of this stock-taking would be to trace the trend of population, in size and character. It was well known before the present War began that the population of Great Britain, in common with that of most other European countries, was fast approaching a decline, and the War itself will have gravely aggravated this condition. But population must always be considered in relation to the area occupied and to the stage of culture reached. With that in mind, the question arises—How shall optimum population be defined? And, having defined it, how shall it be achieved and how maintained? Clearly the optimum is not merely a matter of size. More important than their number is the quality of the people who inhabit any country. But quality varies from class to class, from individual to individual, and even from age to age in the same individual. Hence, as a first step towards a definition of the optimum, it would be well to try to assess the size and quality of the actual population at some

given date, and to measure the effect upon it of a changing environment. Until such periodical assessments can be made over a sufficient interval of time, we shall be working to a large extent in the dark, lacking any standards or axis of reference.

How far do we take stock of the human wealth of the nation at present? The census provides us with a reasonably accurate count of the people every ten years, and enables us to classify them by location and by households. The population can also be split up into age groups, by sex, marriage condition and occupation. This gives us a photographic record at the date when the count is taken. In addition, day by day during intercensal periods, there is a legal obligation to register every new birth, marriage and death, and very few, in fact, escape registration. But, wasteful as it seems, these records have hitherto been kept in isolation from each other and from the census returns. There are, no doubt, administrative and other difficulties in linking them together, but these should not prove insuperable tasks.

Since every marriage starts a new family, the potential source of new wealth, and birth represents the actual creation, while death is the destruction, of human wealth, the State should keep as complete an account of these vitally important events as any efficient business firm does of its gain or loss of material goods, and should relate them to one another. This could be accomplished if, at every registration of a marriage or death, the law required the production of copies of the birth certificates of the persons concerned, and at every registration of a birth the production of a copy of the civil registration of marriage. It would be possible then to start a card index of each family at its foundation on marriage, and to keep it up to date by adding fresh records of birth, marriage or death as they occurred, until each member of the family, parents and children, passed out by death or started a new card by marriage.

The family, though the smallest, is undeniably the most important unit of social life, and these family cards, when analysed by random samples—drawn from different districts, or from different occupational groups determined by the occupation of the head of the household—would provide a rich mine of research material for students of social science. Important differences in marriage tendency, in fertility, in the incidence of mortality would come to light, and we should be in a much better position than we are now to say which sections of the community are contributing most and which least to the population of the future. Associated with individual identity-cards, such a scientific registration scheme could be used also to keep track of movement from one region to another, and of migration into and out of the country, as does the admirable system of registration which has been in use for some years in Sweden. No names, of course, would be disclosed; the material would be used solely for administrative and research purposes.

Periodical surveys should also be made of random samples of different classes of the population, in order to determine what is representative of each class—and the amount of variation from the average—in physique, nutrition, health, intelligence, temperament, character. In war-time the need for a detailed examination of the physique and health of all applicants to join the services is recognized as imperative. The need is no less in times of peace,

but any such medical inspection is then confined in general to children of school age and those who take up certain types of occupation. In the task of establishing authoritative standards or norms of physique, nutrition, and health, by the analysis of selected random samples, the statistician will have to lend his aid to specialists in health and nutrition.

When we go on to consider the measurement of intelligence, our difficulties increase. The more important the quality to be measured, the less satisfactory are our instruments for the purpose. Some headway has been made in devising intelligence tests for the young, and we can certainly start by making as complete a survey as possible of the rising generation. But considerable research is still needed before we discover satisfactory devices for the assessment of temperament and character. Yet it is only when we reach the stage of trying to measure any such characteristic, however imperfectly, that we find ourselves impelled to seek to understand its true meaning and to define it in terms free from ambiguity.

Stress has been laid in this article on the importance of taking periodical stock of the population, because it is mainly in the people that the interest of the social scientist lies. But the people express themselves in their institutions and in what they make and do, so that our national stock-taking would be incomplete without a survey of all other forms of wealth. This opens up still wider vistas for investigation. The young hold the key to the future; we must therefore examine whether our educational system is such that we make the best use of the human material at our disposal. Pushing the inquiry further back—Is the training given to our teachers the most suitable for its purpose, and are they chosen in the best possible way? There is urgent need also to ask why, as man's capacity to produce grows, industrial depressions are intensified. What are the frustrations which prevent the free flow and exchange of goods and services? Are the ruling factors economic, dependent upon the improper adaptation of money to its purpose and the unwise handling of facilities for the creation of credit, or are they associated with selfishness, the power of monopoly and vested interests, possibly misguided even from the point of view of their own self-interest? Again, as opportunity for rest and recreation increases, are we learning to use it to better advantage? Under a machine economy the pace of work and of living generally is vastly accelerated. How is rest for the mind and for the nervous system to be obtained? Are these questions that can be settled by the medical man only or have they a psychological or spiritual basis?

So wide and intricate are the problems involved in any survey on the scale contemplated that the co-operation of experts in many fields would be essential to unravel them. A central research institute, if of independent status like a university, and adequately financed, would undoubtedly attract the services of distinguished men of science. It should have a permanent staff; but it should be able to enlist also the aid of other social scientists, whether in universities or associated with such bodies as have already been founded by private benefaction for the purpose of social research. In order to prevent overlapping and to secure comparability of results in all such inquiries, it would be the function of the central institute to encourage co-ordination and concerted

planning. Along these lines it should be possible in due course not only to ascertain the value of our possessions but also to get some idea of the potential capacity of our people, and thereby to raise the general standard of living and national culture to a much higher level than we have yet achieved.

## ETHICAL AND POLITICAL REMODELLING OF SOCIETY

By SIR FREDERIC KENYON, G.B.E., K.C.B., F.B.A.

THE rehabilitation of a wrecked and bewildered world will be the task of the years which lie immediately before us. In 1919 we hoped that we might restore the world as it was before 1914, with additional provision for its security. In 1942 we know that that attempt failed, and that when the present threat to civilization has been defeated it will be necessary not to restore an old world but to lay the foundations of a new one. A movement which has been in progress for a generation has been greatly accelerated. The foundations of society have been broken up. A new outlook on social relations has become necessary, and we have to orient ourselves in the new circumstances.

Up to the outbreak of the War of 1914-18 we were in effect living on the Liberal philosophy and political economy of the middle of the nineteenth century. Its corner-stones were individualism, *laissez-faire* and free trade; its prophets were Mill, Herbert Spencer, Fawcett. The State should interfere as little as possible. The individual should be left to develop in his own way; to buy in the cheapest market and sell in the dearest; to aim at material welfare and let the devil take the hindmost. It was a philosophy unimpeachable if once you accepted its fundamental axiom, that the whole duty of man is to cultivate material prosperity. Its best exponents recognized that the 'economic man', for whose conduct they enunciated principles, was not necessarily the whole man; but the politicians and the popularizers of scientific thought ignored this qualification, and for some three generations these doctrines governed the thought and the political practice of the nation.

There were always some—Carlyle, Ruskin and the Christian Socialists notably—who combated a political economy which they accused of being soulless. There were always some who maintained that, while unrestrained individualism was good for the strong and might bring wealth to a State, it involved unjustifiable suffering for the weak. A sense of social responsibility began to grow, and took visible form in the 'eighties, in such movements as the Salvation Army and the foundation of university settlements. Gradually, almost unconsciously, the State and the local administrations accepted more and more responsibility for the welfare of the people. The 'social services' assumed an ever-increasing importance in national and local budgets, which meant in fact that the larger incomes were curtailed for the benefit of the smaller. The War of 1914-18 intensified this movement; it gathered strength in the uneasy years of peace from 1918 until 1939; and with the new War it has come with a rush. The State has assumed control of nearly every form of activity. Large incomes are taxed to the verge of extinction. Hundreds of millions are drawn from the profits of individuals and companies and applied to keeping down prices for the poorer

classes and increasing their earnings. The exigencies of war have brought us to accept, almost overnight and without a struggle, an almost complete measure of national socialism, and a very extensive levelling up and down of incomes. The problem now before us is, how much of this remodelling of society should and could be carried forward into the years of peace which will follow when once the forces of evil, with which we are engaged in a death-struggle, have been overcome.

The great danger is lest this problem should be approached under the old forms of political controversy, with the leaders of each party striving to stake out claims for those whom they represent, and to turn to their material advantage the opportunities of the moment. This, by whatever party it is practised—employer or employed, capital or labour, the 'haves' or the 'have-nots'—is war profiteering, the turning of the exigencies of war to one's own material profit. It may be more justifiable on one side than on the other; but the basis is the same, the nineteenth-century doctrine that everyone should do the best he can for his own material advantage.

The remedy needed is something far more fundamental. We have been so saturated with the doctrine that material welfare is the prime aim of life that we do not realize that it has not always been so. Material welfare has, no doubt, always been a motive of human action, and often a powerful one, but it has by no means always been the predominant one. It has not always been held that man lives for bread alone, or that "they should take who have the power, and they should keep who can". We know now to what the unrestricted application of this doctrine has led us. We want now to reconsider its validity, objectively and impartially, and to determine how it can be improved or replaced.

We want, in fact, a new political philosophy; and in this phrase the epithet is not used in the restricted sense of parliamentary and municipal controversies, "where ignorant armies clash by night", but in the sense in which "politics" means the art of living together in a civilized and organized community. This art has to be thought out afresh, and the thought needs to be as unimpassioned as possible. It is also of the first importance that the thinking and the formulating of its results should be done without delay, in order that the field may not be pre-occupied by the combatant politicians (in the narrower sense), and that the results of dispassionate thought may be at the service of the statesmen who eventually have to lead the reconstruction of our national life.

It is for this reason that the establishment of some form of central organization of sociology seems to many persons to be a desideratum. Just as the Institute of International Affairs serves a useful purpose in the collection of facts and the formation of opinion on international matters, and as institutes of archaeology or chemistry or chartered accountancy bring together those who are interested in these subjects for the interchange of views, so a similar organization for sociology would serve as a forum for the formation of the new philosophy of social relations which seems to be needed. This is not so unpractical a proposal as it may seem to those who are satisfied with the limited vision of immediate controversy. It does not mean that long-bearded and unpractical scholars will sit down to elaborate paper constitutions or new Utopias. It means rather that those who are engaged in social activities will pool their experiences, will be invited to formulate



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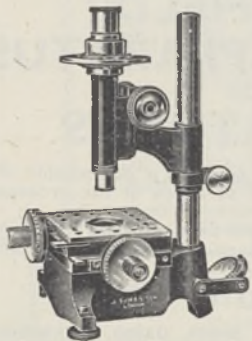
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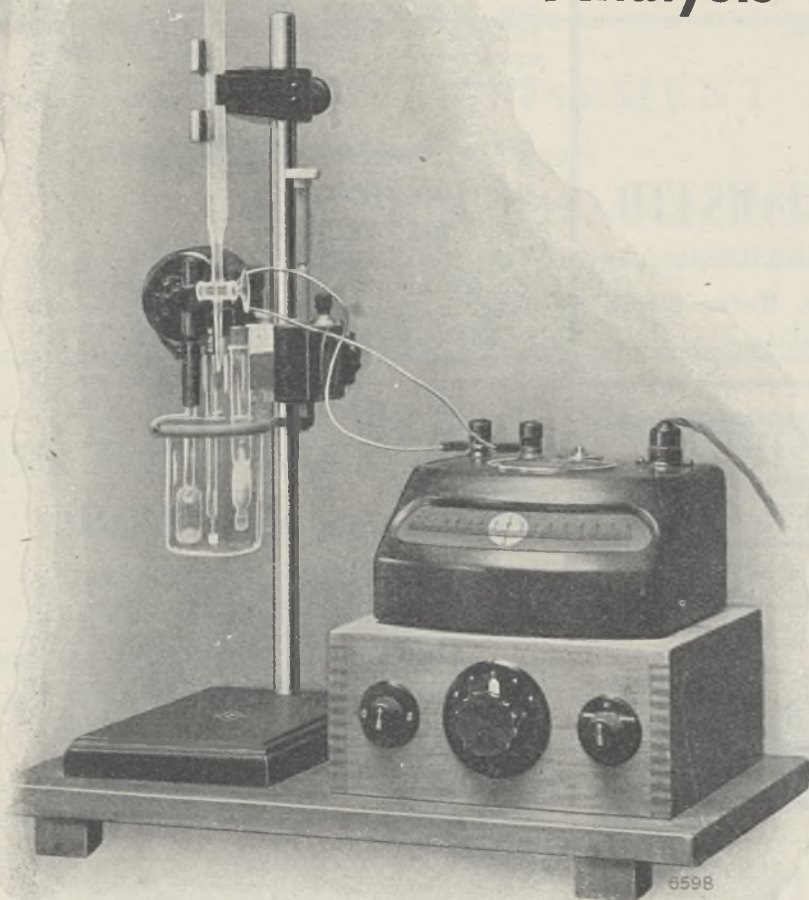
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their principles, and will be encouraged to work on a basis of co-operation rather than controversy, to see how much harmony can be achieved, not how much can be seized by force from an unwilling opponent.

For the operations of such an organization some guidance can be derived (as in so many other provinces of thought and science) from the Greeks. For Plato and Aristotle and their followers ethics and politics were intimately connected. The virtues of the State were the virtues of the individual, writ large. The social and political ideal of Aristotle is thus expressed by Mr. W. L. Newman :

"The State exists for the exercise of the qualities which make men good husbands, fathers and heads of households, good soldiers and citizens, good men of science and philosophers. When the State by its education and laws written and unwritten succeeds in evoking and maintaining in vigorous activity a life rich in noble aims and deeds, then and not till then has it fully attained the end for which it exists. The ideal State is that which adds to adequate material advantages the noblest gifts of intellect and character, and the will to live for their exercise in every relation of life, and whose education, institutions and law are such as to develop these gifts and call them into full play."

It is indeed the restoration of the connexion between ethics and politics that must be the principal aim of the new social philosophy. The whole tendency of political thought in the nineteenth century was to divorce them. Religion was excluded from the education given by the State, because religious disensions divided the people so deeply. The current political economy deliberately excluded moral considerations, in order to concentrate on purely material considerations. In every department of life, in art and literature no less than in economics and politics, the intrusion of morality or religion was resisted. The economic man, not the ethical man, was made the basis of political theory, and material wealth was the goal of political practice.

The last hundred years have seen these principles tried out, and we are now in a position to estimate the result—a considerable amount of material success, leading to a moral *débâcle*. It would be the task of the organization proposed to study how the good can be separated from the bad ; how freedom of the individual in thought and action can be made compatible with justice to all ; how individual initiative can be encouraged without exploitation of the less fortunate masses ; how the standard of life can be raised for the many without forfeiting the benefit which the whole community receives from the exceptional abilities of the few. We have been told that civilization has become mechanized ; what it needs is to become moralized. We have before us terrible examples of the results of totalitarian control unrestrained by morality. We can see its efficiency, and we can also see its demoralizing effects. The new political philosophy must aim at securing the first without incurring the second ; and this can only be achieved by the objective and dispassionate thought which an organization for sociology would cultivate.

We cannot afford to wait for an individual to give us the guidance which we need. If such a genius should appear, to be the Adam Smith or the John Stuart Mill of a new generation, it would be a godsend ; but the need is urgent, and the ground can at least be prepared by co-operative effort. From such effort we may hope to obtain that philosophy of human affairs which Socrates, twenty-three centuries ago, declared to be necessary for the right conduct of life.

## RESEARCH IN THE HISTORY OF SOCIOLOGY

By ALEXANDER FARQUHARSON

General Secretary, Institute of Sociology

IN any discussion upon the better organization of research in the social sciences in Great Britain the question of the place to be assigned to historical research will inevitably arise. This article leaves on one side the problems of the general development of research in social, economic and cultural history, and considers only the need for research in the history of the scientific study of society. The intimate connexion between that history and the general history of thought and of science will not be forgotten.

The history of the scientific study of society may be conceived in a wider or narrower sense. At its widest it may be taken as including all attempts throughout the history of mankind to present a systematic and consistent picture of the structure and development of particular societies and of groupings of such societies up to the limits of the known world. The work of Herodotus in the Hellenic world, of Ibn Khaldun in the Moslem world, and of Lord Hailey and his colleagues in the recent "Africa Survey"—to take three handy examples only—would fall under this definition. Research might deal with such topics as methods used (personal observation, second- or third-hand report, forms of record), models followed, the debt of each worker to what went before, a comparative study of interpretations of phenomena recorded.

A great part, however, of the work to be done would be in a field already occupied by historians as students of methods used and interpretations adopted in historical studies. An account of a society at a particular moment of time in the past has in general already won recognition as a source for its history, and in many cases has been subjected to an intensive critical examination<sup>1</sup>. Further, there already exist general critical accounts of such sources for particular epochs and territories, and also general accounts of the development of historical studies, the accumulation of material for these, and the growth of historical method.

The impossibility of separating the 'static' and 'dynamic' views of society becomes even clearer when pre-history and archaeology are considered. The same material remains must be used in reconstructing either a picture of social conditions at a moment in the past or a panorama of social development from stage to stage. Further, this wider history must take account of theories of society, from Aristotle to Toynbee, and the critical work already expended on these by historians, philosophers and sociologists.

The historian of the scientific study of society must accept all this accomplished work as the foundation of his own. He has, however, something fresh to contribute, and that something is of extraordinary value. One aspect of it is the attempt to relate the historical outlook and methods of each epoch and its theories of society to the political and social structure and the culture of that epoch. The other aspect is the attempt to assist the re-shaping of historical studies to harmonize with the political and social structure and culture of the present and the immediate future. In Great Britain the latter task is already in hand ; for historical studies in recent years have been notable for their reflection of current interest in social and economic problems ; to-day the weight assigned

to social, economic and cultural history is perhaps as great as that given to political history. Research in the history of the study of society would demonstrate insistently the relativity of historical study and the need for its continuous readjustment to social needs.

In its narrower sense the history of the scientific study of society would have in view only the period, once the spirit and outlook of science, and in particular the application of these to the study of human society, have gained recognition. Here again, a distinction must be made between a wider and a narrower field. The historical research now in question could be extended to cover all the social sciences, or it could be restricted to sociology in its more limited sense.

This distinction corresponds to an ambiguity in the definition of sociology long recognized and discussed by sociologists<sup>2</sup>. Among these it is generally agreed that sociology deals with such matters as social organization, social development and the relation of the individual to society, attempting always to sort out the more general tendencies observable in particular societies and in human society as a whole. Some sociologists, however, have put forward much larger claims. According to these, sociology is and should be recognized as a general theory of human society in somewhat the same sense as biology is a general theory of living matter; each of the special social sciences would thus fall into place as a department of sociological study. So far, however, this view of sociology has failed to establish itself, one main reason being that the methods used by the various social sciences have been distinct and in some cases difficult to reconcile. Many sociologists would, however, agree that the narrower and wider views of sociology are not antagonistic, that the narrower view may be appropriate as defining a useful field of operations for the present, and that the wider view should not be dropped altogether out of sight.

Leaning now towards the narrower view, the need for research into the history of sociology as a recognized department of study may at once be admitted. Descriptive histories already exist<sup>3</sup>, but it would be possible to plan useful researches that would examine the development of sociology in a more fundamental way than has as yet been generally achieved. Such researches would deal not only with the chronological development of sociological studies, but with the conditions that influenced and directed that development in each country at each period. They might also deal with the circumstances of the life of each individual sociologist who has made a material contribution to that development, and the influences that helped to shape that contribution. They might further attempt to answer the question: What function was sociology as developed at a particular time and place expected to fulfil and did it actually fulfil—in other words, How did it fit into the general structure of society and of ideas? They might also shed light upon the ways in which sociology has been influenced by and has influenced thought and ideas in other fields. If such researches extended sufficiently far they would in time provide a sociological account of the development of sociology.

The value of such researches is not affected by the question that must arise when definite projects are discussed: Can such inquiries be usefully separated (except for temporary practical convenience in handling) from the general study of the history of thought and the history of science which has devel-

oped rapidly in recent years? It is clear that they cannot; indeed, the attempt to isolate the history of sociology would itself be unsociological, as it would put in the background or out of sight the environment of thought in which the central body of sociological ideas has developed and to which it has always been intimately related.

The project may be further defined. It has been said that, in place of a single sociology, there are to-day many sociologies, each an outgrowth of some national or sectional tradition; for example, American sociology, Catholic sociology, Marxian sociology. Researches might be planned which would exhibit the development of each of these sociologies in its relation to the tradition and social situation of the nation or section from which it emanated. (These might incidentally serve to reveal the elements that are common to those various sociologies however much they may differ in their selection and treatment of material and in their conclusions.) Such researches could not well be separated except temporarily from much wider studies. Catholic sociology is a part of Catholic thought; the Marxian view of society is an essential part of the Marxian system; American sociology is inseparable from the modern American social constitution and outlook. A body of researches into the various traditions in sociology would inevitably bring under review those larger fields.

If the wider view is taken and the need of historical research on the development of the whole body of the social sciences is considered, no fresh point arises. In the case of each social science we need more exact knowledge of its relation to the conditions under which it was born and grew. The influence of each upon the others is also a fruitful field of inquiry. It is probable that such historical research might bring more clearly into view and define more exactly the differences in outlook and method that now separate the various social sciences so much more widely than is required by practical convenience. It is possible that the fuller understanding thus developed might help towards the co-operation and co-ordination of these sciences. It would, however, be inappropriate to pursue the topic here.

There is one further subject upon which research into the history of social science should throw some light. My old teacher, Victor Branford, used to say: "The difficulty about the acceptance of sociology in a particular society (*e.g.*, English society) does not lie in its ideas, which are simple, but in the lives of those who cannot accept it." By this he did not intend to suggest the possibility of some facile and universal use of sociology as a guide in the common affairs of life; he meant that the attitude proper to the sociologist—open-mindedness, endeavour to discover root causes, sympathy with persons of different age, culture and education—was extremely rare; or, more generally, that what he would have called a scientific attitude in and to social life had gained little recognition and acceptance. The fact will scarcely be disputed by those who have given serious thought to the subject. It has an important bearing on the development of sociology in the future, and it might be made the subject of a plan for intensive historical and contemporary research, to form part of an inquiry into the general attitude to scientific method and scientific results which now limits all scientific development.

<sup>1</sup> For example, the "Domesday Book".

<sup>2</sup> On the scope of sociology, see Ginsberg, "Sociology" (Home University Library).

<sup>3</sup> For example, Sorokin, "Contemporary Sociological Theories".

## REVIEWS

## DECLINE AND REVIVAL OF ACID-BASE CATALYSIS THEORY

## Acid-Base Catalysis

By R. P. Bell. Pp. viii+212. (Oxford: Clarendon Press; London: Oxford University Press, 1941.) 12s. 6d. net.

THE establishment of a new truth invariably evokes a number of new fallacies; the brighter the light that a new theory sheds on its proper field, the darker, and the more distorting, the shadows in which it submerges the experience which lies around the borders of its true scope. The striking success of the theory of electrolytic dissociation based on mass action law blinded scientific workers for more than twenty years to the necessity of invoking a new principle for the explanation of the marked deviations from this law in solutions of neutral salts and strong acids and bases.

An equally paralysing orthodoxy, which also had its origin in the earliest classical period of physical chemistry, was the strict separation between the problems of chemical equilibria and chemical reaction rates. It was the pride of the physical chemist to be immune against the tendency of the ordinary chemist to confuse the two fields, and he felt it to be his mission to emphasize on all occasions that the problems of chemical reactivity could not be dealt with by reference to thermodynamics. This prejudiced his mind against taking proper notice of parallels between reactivity and equilibrium constants, where such parallels did exist.

The inquiry on which Dr. Bell reports in his book has gone on continuously for the last fifty years and is still concerned with the questions which were foremost in the minds of van t'Hoff, Arrhenius and Ostwald at the birth of physical chemistry. Nor are the new solutions to these problems due to any considerable extent to the incursion of more recent ideas from other fields; the modern theory of strong electrolytes, the recognition of the primary and secondary salt effects, the generalization of the concepts of acids and bases and the discovery of Brönsted's law do not borrow important elements from outside the original domain of van t'Hoff and Arrhenius. These successes were rather due to the efforts of that unusual type of originality, which—resisting the temptation of glittering modern openings—continues to cultivate a shadowy field, considered by others as exhausted and ossified, and finally breaks the ban of orthodoxy and revives the fire of the original problems by insisting on fresh intuitions gained from a new contact with the experimental material.

Such was the quality of the minds which renewed the study of electrolytes and of acid and base catalysis during the past three decades. Among these, pre-eminent was J. N. Brönsted, to whom Dr. Bell pays a personal tribute in the introduction of his book, and to whose work much of the material collected in it is due. Another considerable part of this material is supplied by the author's own research work, through the pursuit of which he has gained that remarkable insight which guides his treatise through all aspects of the subject. These aspects are varied and can often be properly assessed only by a careful

analysis of the chemical system and the prevailing experimental conditions, viewed in relation to a many-sided theoretical framework. A fair amount of such detailed discussion lends the book more the character of a critical report than that of a textbook. However, this makes it only the more useful to the advanced student, for whose use it is intended.

In the last few years before the War a number of attempts were made—in which Dr. Bell took an active part—to explain Brönsted's relation in terms of the atomic forces at play in the course of proton transfer. Dr. Bell's evaluation of these efforts will be most helpful to future investigators in this field. He points out the present gaps in the theory which look almost fatal, and yet asserts, and explains why, "it is difficult to believe that [it] does not contain the elements of the true explanation". He recognizes the limitations of the transition state theory, in particular where the activation energy of the reaction varies with temperature, yet makes good use of it for elucidating the general relationship between reaction rates and corresponding chemical equilibria. A chapter on "non-mechanical" proton transitions (tunnel effect) adds another field where a loosely fitting theory requires and seeks more substantial evidence. The open questions are again candidly discussed, yet the essential value of this line of investigation is effectively vindicated.

I was somewhat astonished to find no reference to such matters as G. N. Lewis's conception of proton-free acids; or Frumkin's connexion between Tafel's equation for the over-voltage of hydrogen and the laws of acid-base catalysis. But perhaps such omissions are required by the rigorously concise plan of the book, which reflects so truly the internal harmony of the curiously self-sufficient province which forms its subject.

M. POLANYI.

## HISTORICAL GEOGRAPHY—THEN AND NOW

## Geography and World Power

By James Fairgrieve. Eighth and revised edition. Pp. viii+376. (Bickley, Kent: University of London Press, Ltd., 1941.) 7s. 6d. net.

DURING the present century the subject of historical geography has developed from rather crude efforts to show how geography has influenced the course of history to the study of the use of possibilities by man in successive ages. Mr. Fairgrieve's book belongs to the earlier period, although its author has attempted to avoid obviously determinist doctrines by his definition of the word 'control'. "When we say", he writes, "that 'history is controlled by geography' we do not say that man is compelled by geography to use more and more energy, but that the precise way in which he has come to do this is largely controlled by his environment."

When one passes from the introduction to the main body of the book one realizes that the author has not wholly escaped from the contradictions inherent in the determinist view. The sea is "one of the great features whose power of protection has affected the world" (p. 21). But later (p. 329) examples are given of eleven powers which "have had sea power

or ocean power depending, some almost entirely, others to a less extent, on the ease, cheapness and certainty of water carriage, and on a certain knack of the sea, bred of familiarity and use". It is strange to reflect that in 1941 the lesson has not been learnt that it is the British Navy, and not the sea, which has provided the "power of protection" to Great Britain and many another land. The disadvantage of Mr. Fairgrieve's interpretation of geographical control may be seen in his attempts to keep pace with the activities of man. In 1920, so great had been the material efficiency of Germany that "almost the united strength of the whole world" was required to overcome it. Yet "though the conflict ended as it did, that does not alter the geographical position of Germany nor the characteristics of her people". (2nd Edition, p. 224). Surely, then, one would have expected a warning that the War of 1914-18 would be repeated as soon as that "material efficiency" was again strong? But Mr. Fairgrieve is no prophet: he remarks, in the present edition, that "material efficiency . . . has been the cause of war, and we should be rash to conclude that a final fixed state has been reached, for there has been no alteration either in the geographical position of Germany nor [*sic*] the characteristics of her people". Is this a real warning to us of the inevitability of events? If so, it ought to be pressed with greater vigour.

Any writer who attempts to deal with world history and world geography in all ages in less than four hundred octavo pages invites criticism even if he does not deserve it. It is possible to quote many misstatements, or at least to express doubts on many of the positive assertions that are made. Thus the statement made in 1920, and repeated verbatim in 1941, that the sea-powers of France, Italy, and Portugal are "in league with Britain" scarcely expresses the facts. Magellan never "sailed round Cape Horn" nor did Napoleon "keep all his troops in the north" of Spain in the Peninsular War. One cannot readily accept the implications of many of the sketch maps nor appreciate the value of arrows liberally supplied on many of them. Yet the fact that this is an eighth edition of Mr. Fairgrieve's book must be taken both as a measure of the popular appeal of the subject and as a tribute to the author, whose pioneer work in geography should never be under-estimated.

J. N. L. BAKER.

## ROMANTICISM AND SCIENCE

### Natural Science in German Romanticism

By Alexander Gode-von Aesch. Pp. xiii + 302. (New York: Columbia University Press; London: Oxford University Press, 1941.) 20s. net.

**H**ISTORIES of German literature usually distinguish a Romantic School of writers whose activities began in the closing years of the eighteenth century and continued until the fourth decade of the nineteenth century. The more obvious characteristics of these authors consisted of a certain antagonism to classical antiquity and to rationalism. They preferred the medieval and the mystical. They glorified the German past, and they fostered German nationalism and State-idolatry, the bitter fruits of which the world is now tasting, and not for the first time. More or less intimately associated with the Romantic School were certain famous philosophers—

the brothers Schlegel, Schelling, Schleiermacher, and the arch-totalitarian Fichte. In the circumstances it was to be expected that German Romanticism would not be lacking in world-views of some sort. To find any unity or harmony in these world-views would be rather difficult in any event; and Mr. Gode-von Aesch has increased his difficulties by including in the German Romantic movement some writers, like Goethe, Herder and others, who are not usually regarded as belonging to it. Sometimes, indeed, he seems to wander away altogether from the historic Romantic School, and to discourse about a Romantic world of thought without specific reference to individual representatives. At times, in fact, the reader gets the impression that the author has put together in his volume a number of separate essays which are not sufficiently interconnected to constitute a systematic exposition of the theme designated in the title of his book.

The speculative ideas embraced by the various representatives of the German Romantic School showed no originality. They were all taken over from ancient philosophy or medieval theology. Pantheism or panpsychism, the conception of man as a small world (microcosm) or of the world as a kind of colossal man (macroanthropos), the idea that love is what holds the universe together, and so on—these are all old thoughts; and they are not made either better or worse by being put into verse. This does not necessarily detract from the merits of the German Romanticists. It is no mean achievement on the part of literary men to give effective expression to world-views, even if they do not originate them. In the volume under review the philosophical speculations of many more or less Romantic authors are described, illustrated and analysed with some critical acumen; and all those who are interested in the study of German Romanticism will find much helpful material in this book. If its title had been "Philosophy in German Romanticism", its contents would have been described accurately, and no reader could have complained with justice that he had been led to expect something different.

The prominence given to "Natural Science" in the title of the volume is unfortunate. Of science, as the term is commonly used in English-speaking countries (that is, knowledge based on verification by experience), there is next to nothing in the thought of German Romanticism. Scientific terms like magnetism, gravitation, etc., it is true, occur with considerable frequency; but they are usually associated with non-scientific speculations, not to say extravagant fancies. Thus, for example, we are told that "animal magnetism proves beyond a doubt that we have . . . a soul which consists of the divine spark". Again, the attraction and repulsion of material bodies are identified with love and hate; and Empedocles is consequently proclaimed to have anticipated Newton. But it is unnecessary to multiply such examples, since it is admitted that "German Romanticism excelled in taking seriously all sorts of absurd quackery". In a sense, of course, there is plenty of romance in the history of science; but romancing is not science; and it is rather misleading to refer to such romancing as "Natural Science". In this connexion it may interest the author to be informed that, contrary to his assertion, Newton did *not* refuse to theorize about the causes of gravity; what he did refuse was to regard such unverifiable speculations, including his own speculations, as a part of science.

A. WOLF.



## NEWS and VIEWS

H.R.H. The Duke of Connaught, K.G., F.R.S.

By the death, on January 16, at the age of ninety-one, of the Duke of Connaught, the Royal Society has lost its senior Royal fellow, for he was elected so long ago as 1906 under the rule which permits of the election of "Any one of His Majesty's subjects who is a Prince of the Blood Royal". Apart from this distinction, the Duke was probably best known to scientific men as the president for many years past of the Royal Society of Arts, in the activities of which he took a keen interest. He was also president of the Royal Colonial Institute, a fitting acknowledgment of his statesman-like services as governor-general of Canada and on other missions to various parts of the Empire. His work as a public servant will go down in history as an important link in the chain which binds together the peoples of the British Commonwealth of Nations.

#### Letter from Sir William Hooker

PROF. J. WALTON, regius professor of botany in the University of Glasgow, has recently acquired a letter (the text of which follows) written by Sir William Hooker, the well-known British botanist who was regius professor of botany at Glasgow during 1820-41, after which he was appointed director of the Royal Botanic Gardens, where he was followed by his equally illustrious son, Sir Joseph Hooker. The letter was written from Halesworth to Mr. Morris Pollock of Glasgow, on September 22, 1820. Prof. Walton informs us that it will be preserved in the University of Glasgow; he does not know whether the silver vasculum referred to still exists. The corrections and mis-spellings are as in the original manuscript.

"Let me beg of you to accept for yourself & to offer to the rest of my friends, the students of my first years Clafs my sincere & grateful acknowledgements for the very beautiful Silver vasculum & the kind expressions of regard for me & my family contained in the address therein inclosed, which have reached me this morning.

"The truly elegant box with its appropriate ornaments is greatly enhanced in value in my estimation (though this I feel to be intrinsically far beyond what I can deserve) by the handsome manner in which it has been presented to me, & by a recollection of the smallness of the Clafs from whom I received it. Be assured that though I needed no token of your regard to urge me to exertion in the duties of my profession in the University of Glasgow, I nevertheless have felt a gratification in receiving it which I know not how to express, & which will render my return amongst those who have taken such an opportunity of showing their friendship for me & interest in my welfare doubly agreeable to me.

"I am still labouring in the cause of Scottish botany in the preparation of a Flora of your country which will be published before the commencement of my next years course. The occupation continually brings to my recollection plants that I have long ago gathered amidst the most delightful scenery, & which I little thought would have been turned to any account.

"Once more let me return you my sincere thanks for the most gratifying gift I ever received in my life, & through you let me offer to my other students the expressions of my acknowledgements & the

affectionate attachment with which I have the honor to be, My Dear Sir your & their most obliged & faithful friend & servant Wm. J. Hooker"

#### Regional Propositions for Tyneside

THE second edition of Mr. D. M. Goodfellow's "Tyneside: the Social Facts" (Newcastle-upon-Tyne: Co-operative Printing Society, Ltd., 1941. 1s.) includes two further chapters on "Regions and their Planning" and on "Regions: the First Facts", which are relevant to the discussion of the regional propositions in the recommendations of the Royal Commission on Local Government in the Tyneside Areas, adoption of which in the main was recommended in the original edition of the pamphlet. The first of these new chapters reviewing the operation of the Town and Country Planning Acts in practice, suggests that the real difficulties in Tyneside are not due to problems of compensation but to the multiplicity of authorities. Territorial planning is a means for reviving and developing the manufacturing and agricultural industries of the area, but these positive purposes will never be realized with the present authorities, and in the second new chapter an area comprising the geographical counties of Durham, Northumberland and the North Riding of Yorkshire is proposed as a possible unit which might come to be defined as a local government region. Such an amalgamation would be a very different matter from one based upon the Mersey, Manchester or Birmingham, but amalgamations are probably most difficult where they are most urgent. However desirable the formation of regions may be, it would not of itself automatically solve all the problems.

#### A New Form of Government

IN his pamphlet "A Sling against the Philistines: the New Machinery of Government by the People" Denis Becker (London: Andrew Dakers, Ltd., 1941. 9d. net) proposes the establishment of a Ministry and Court of Enlightenment as a means of freeing Parliament and Ministers from the influence of financial and other interests which stultify representation in Parliament and threaten the freedom of the Press. The Court of Enlightenment would consist of nominees of each of the principal universities, of the learned associations such as the Royal Society, the Law Society, the British Medical Association, the Headmasters' Conference; of each of the established royal societies devoted to the arts, such as the Royal Academy of Music, the Royal Society of Arts, the Royal Institute of British Architects; of each of the recognized ecclesiastical bodies; of the agricultural associations, of the Trades Union Congress and of the Employers Federation, with two or three nominees by the House of Commons and the House of Lords of outstanding members, two nominees by the Prime Minister of eminent men not connected with the institutions already specified, and a nominee of His Majesty's judges who would be *ex officio* chairman.

The nominees would be freely elected by the members of the institutions concerned at intervals not exceeding three years, and the Court so constituted would be charged primarily with the duty of advising the Prime Minister on the promotion of welfare and culture with special reference to the best use of the rising standard of knowledge, technique and scientific discovery. It would be responsible for the control of the B.B.C. and of the Ministry of

Education, and, through it, with the provision of the best form of education for the new generation, and also for the publication of a State newspaper. Mr. Becker further proposes that all Parliamentary debates should be broadcast in full on a separate wave-length, and he proposes new parliamentary methods. He claims that his proposals harmonize the three estates of sovereign power, represented by the people, executive power and the power of the mind; but he emphasizes also the need for a spiritual basis if any new machinery is to work successfully.

### Inter-American Relations

THE U.S. Office of Education is publishing a new series of some twenty pamphlets under the general title, "Education and National Defence", with the purpose of assisting educational institutions and organizations to make the greatest possible contribution towards the promotion of understanding and the encouragement of effective citizenship. Pamphlet No. 13 in this series, "Hemisphere Solidarity", is a teacher's guide on inter-American relations with special reference to Latin America, designed for senior high schools, to assist a better understanding of Latin-American neighbours and their contribution to the welfare of the western hemisphere as well as to stimulate thought on vital problems affecting mutual co-operation among the nations concerned. In addition to a discussion of methods of teaching hemisphere solidarity, it includes a suggested outline of problems and activities and a useful bibliography on sources of information.

### Sir Charles Parsons and Turbo-driven Fans

THE Christmas issue of the *Heaton Works Journal*, which deals with the activities of Messrs. C. A. Parsons and Co., Ltd., contains an article on early turbo-driven fans. In 1894, when Sir Charles commenced his experiments on turbo-driven centrifugal pumps, he constructed the first turbo-driven fan. This was to the order of Ramage and Ferguson, Ltd., of Leith, who fitted it on board the S.Y. *Speedy* for supplying forced draught to the boilers. The unit was a very small one, the turbine developing about 3 h.p. at a speed of 4,000 r.p.m. The fan was of the screw propeller type, but no particulars of its duty or its dimensions are to be found among the records at Heaton Works. In the following year Sir Charles took out a patent, No. 3024, covering "Improvements in Stationary and Portable Pumps Actuated by Steam Turbines". The first part of this patent deals with turbo-driven centrifugal pumps, while the latter part is devoted to turbo-driven fans. The first of the figures given shows a modification of his invention in which he applies the turbine directly to a screw fan for forced draught, or ventilating purposes. One of the steam turbines is directly coupled to the fan shaft upon which the screw fan is fixed. It revolved at a speed of 2,000-3,000 revolutions per minute, gave a pressure of 12-22 in. of water and delivered 5,000-7,000 cu. ft. of air per minute. Simultaneously the second turbo-driven fan was constructed for the lead works of Messrs. Cookson and Sons at Howdon-on-Tyne. Like the first fan, it was required for forced draught purposes. The turbine developed 60 h.p. at 3,000 r.p.m. and operated with steam at 80 lb. pressure. The fan, which was 36 inches in diameter and directly coupled to the turbine shaft, delivered 60,000 cu. ft. of hot lead gases per minute at a pressure of 5 in. of water when running

at 3,000 r.p.m. The plant was run for nearly seven years day and night (Sundays included) in hot lead fumes, at a temperature of nearly 500° F. and was only stopped twice a year, to allow of the flues being cleaned out.

### Octonarian Weights and Measures

IN "Octonaria" (*Math. Gaz.*, October, 1941) "Peter Simple" gives, in an account of an imaginary State, what is really a plea for a system of numeration and weights and measures based upon eight instead of ten. It is urged that continued divisibility by two is a property of the greatest importance. For example, the seven weights, each double the last, of 1, 2, 4, 8 ounces, and 1, 2, 4 pounds will make up every weight, to the nearest ounce, up to 127 ounces, whereas with the seven metric weights 1, 2, 2, 5, 10, 10, 20 grams, we get only as far as 50 grams. Some of the existing British measures fit easily into the octonarian system. For example, 8 pints = 1 gallon, 8 gallons = 1 bushel, 8 bushels = 1 quarter. As for money, if the crown (one eighth of £2) were divided into sixty-four pennies instead of the present sixty, each new penny would be fifteen sixteenths of the old.

The further proposal to have an octonarian system of numeration is more startling. In this, 10 would denote eight, 20 twice eight, 100 eight times eight, and so on. It is obvious that the risk of confusion would be very great, and the author's suggestion that 20 should still be called twenty, although denoting twice eight, seems to be a gratuitous increase of this risk. The plea that this system would reduce the length of the multiplication table does not seem a sufficient recommendation. The duodecimal system, which has many advocates, as allowing division by three as well as by four, is rejected by the author on account of the extended multiplication table necessary. There is one possibility not mentioned in this paper. If the octonarians and duodecimalians press hard enough, the British spirit of compromise may split the difference between eight and twelve and adopt a decimal and metric system.

### Luminous Paint

IN NATURE of November 1, p. 529, reference was made to luminous strontium sulphide and its possible use for A.R.P. purposes. Dr. S. Rothschild points out that although this substance has a long afterglow when fresh, owing to its great sensitivity to moisture it soon deteriorates, even when protected with a special coating. It is only stable when kept airtight between glass plates and to a certain extent when embedded in plastics. Luminous calcium sulphide is less sensitive to moisture but also less bright. Luminous zinc sulphide, however, is stable even in damp rooms and is now obtainable with an afterglow sufficient for A.R.P. purposes.

A similar luminous effect can be obtained by illuminating a fluorescent substance with the appropriate radiation. The B.A.B. fluorescent system of lighting (Colloidal Research Laboratories, Ltd., 66-70 Petty France, London, S.W.1) has been applied successfully to mark the approaches to Piccadilly Underground Station and elsewhere. The fluorescent substance is applied in the form of hard wearing lacquer on a white undercoat, and is illuminated by either a mercury vapour or a white light lamp fitted with a 'black glass' screen which is claimed to pass only the band 3340-4000 Å., thus absorbing the dangerous radiations of shorter wave-length.

## Health of Tanganyika

THE chief points of interest in the recently published annual report for 1939 of the Medical Department of Tanganyika Territory are the plans for the development of a native medical, nursing and public health service. The War has interfered with plans for nutritional investigations and relief for deficiencies, although a start has been made. As regards the incidence of various diseases the most important facts are as follows: the discovery of two fresh foci of sleeping sickness (663 cases with 184 deaths), cerebrospinal fever (2,183 cases with 237 deaths), the discovery of a plague-infected rat, and an investigation of smallpox. 248,533 cases of infectious and parasitic diseases were reported from various Government institutions. The most frequent diseases were as follows in the order named: yaws, malaria, syphilis, ankylostomiasis, gonorrhœa, schistosomiasis and tuberculosis. The population of Tanganyika in 1939 was: Europeans 9,165, Asiatics 33,974, and Africans 5,217,345.

## The Completed Map of North East Land

ALTHOUGH North East Land, the most easterly island of the Spitsbergen group, was known to the seventeenth-century whalers, it was relatively unexplored until some twenty years ago, except for an attempt by A. E. Nordenskjöld in 1873. The modern survey, begun by the Oxford University Expedition of 1924, was virtually completed by the Oxford Expedition of 1935-36, though some important work was done by the Swedish-Norwegian Expedition of 1931. The map published in the *Geographical Journal* of October 1937 is now revised in some minor and one major point by a new map in the *Geographical Journal* of October 1941 (A. R. Glen, "The Latest Map of North East Land"). This map makes use of the Norwegian aerial surveys of North East Land in 1938 which are not now accessible, and it shows one remarkable change. In the south a great lobe of the South Ice has overridden the coast on a thirteen-mile front and pushed ten miles out to sea. Recent investigations show that the ice of North East Land is in the main in retreat: small ice-free areas have been found on the east coast. This advance is probably purely local, and Mr. Glen suggests that it may be due to a tectonic disturbance or some internal glacial cataclysm. The whole surface of the ice lobe is heavily crevassed.

## National Central Library

THE twenty-fifth annual report of the executive committee of the National Central Library for the year 1940-41 refers again to the special war work of the Library for Government departments, research stations and industrial concerns, as well as to the service organized in co-operation with the county libraries and the Scottish Central Library for Students, for the supply of educational books to men serving in the Army in all parts of the British Isles. A similar service has been given to men serving in the Royal Air Force, and the Library has also been able to assist men serving in the Royal Navy and in the Mercantile Marine through the agency of the Seafarers' Education Service. At the request of the Home Office, the Library has organized, with the assistance of the local urban or county libraries concerned, a service for the supply of educational books to aliens in internment camps. The Library has acted as

agent of the American Library Association's Committee on International Relations in connexion with the distribution of American books and periodicals to men serving in the British Forces at home and overseas. With the assistance of the British Council, the Library has also been instrumental in supplying books in their own language to sailors, soldiers, airmen and civilian refugees from Czechoslovakia, Greece, Holland, Poland and other Allied countries now in the British Isles.

When the Treasury grant in aid to the Library for the year 1940-41 was reduced from £4,800 to £3,500, the trustees of the Rockefeller Foundation made an emergency grant of 8,500 dollars for the year 1940-41, and the Foundation has continued to provide money for the upkeep of the Bureau of American Bibliography. The trustees of the Carnegie United Kingdom Trust continued their grant of £4,000. The total number of books issued during the year decreased from 50,611 to 39,420, issues to university libraries being 2,433 as against 3,046 in the previous year; of these, 1,100 were supplied by university libraries themselves.

## Museum of the Royal College of Surgeons

THE scientific report of the Royal College of Surgeons for the year 1940-41 states that the Museum and store rooms were hit during an air raid, incendiaries increased the damage, falling girders broke up the basement below, and heavy rain the following days drenched the exposed specimens. The loss, though serious, was not complete. In the anatomical series 1,207 specimens survived out of 2,569. In the osteological series, out of 1,655 Hunterian specimens only 94 were saved, and 6,209 of 15,545 College specimens. On the other hand, the whole of the odontological series was saved. Nearly half the 5,400 Hunterian physiological specimens escaped, but only 2,026 of the 14,850 College specimens in this series. Of the human and comparative teratological specimens only 23 of 170 Hunterian specimens remain, but the College specimens have largely survived. The better part of the Hunterian pathological series remains, but the College specimens have been reduced to about a fifth, and the whole of the Townbee and Strangeways collection has gone; the Army Medical War Collection has been reduced from 3,000 to 100. All the mummified specimens and the historical collection are lost, and the instruments collection has been reduced from 2,500 to 2,000. The zoological and anthropological pictures have survived, including Tonks's war pictures. The total loss of specimens amounts to 39,259 out of 65,827.

## Vacation Apprenticeship Scheme

THE value of practical training, and of a close linkage with industrial practice during the undergraduate years, is receiving more and more recognition in scientific academic circles to-day. This is the case, not only in the engineering faculties, but also in branches of pure and applied science—chemistry, physics, and even biology. That this is also appreciated and valued by industrial firms themselves is apparent from the steadily growing success that has attended the Vacation Apprenticeship Scheme carried on by the Imperial College Union for the benefit of students of all departments in the Imperial College of Science and Technology. From its inception seven years ago, the scheme has shown a steady record of progress in spite of the uncertainties of the

past few years. In the summer of 1941, for example, 124 firms accommodated 181 students, granting them the opportunity to receive valuable experience in many of the experimental and production processes. The reports of the firms and of the students show how well and how smoothly the scheme is working. It is significant in this connexion that since the inception of the scheme, the average earnings per student reached its peak in 1941. During the summer vacation, July-September, 1942, more than three hundred students of the Imperial College will be available for varying periods of from six to eight weeks, and there is evidence that the co-operation of industry is likely to expand with this growing demand for absorption.

### The Linnean Society of London

THE Linnean Society of London is now holding some of its meetings (those of zoological interest) in conjunction with the Zoological Society of London. The Society has decided to invite by name botanists and zoologists who are refugees in Great Britain to attend the general meetings of the Society. If, therefore, any such botanists or zoologists will make application to the Assistant Secretary, the Council will consider the issue of invitations to attend the meetings.

The following discussions are being arranged by the Society: (1) "The biogeographic division of the Indo-Australian Archipelago; criticism of the Wallace and Weber lines, and of any other dividing lines, with an attempt to obtain uniformity in the names used for the divisions". The subject will be introduced by an account of the geological history and climates of the Archipelago, by Mr. J. B. Scrivenor, lately director of the Geological Survey, Federated Malay States (in April); (2) "Time, temperature and humidity in the germination of seeds", to follow an address on "Recent work on germination", by Dr. M. A. H. Tincker (on May 14); (3) "Intertidal zonation of animals and plants", introduced by an address on "The causes of the zonation of animals and algæ between tide marks", by Prof. T. A. Stephenson (on June 18).

### Broadcasts on the Sub-visible Universe

A SERIES of twelve talks under the title "Science Lifts the Veil", which deals with the structure of matter, is being given on Mondays in the Empire programme of the British Broadcasting Corporation. The talks, which were introduced by Sir William Bragg on January 5, have been arranged with the advice and assistance of the Science Committee of the British Council. Sir William Bragg explained the idea and significance of the theme. He pointed out that the growth of science and of its power is largely due to an increasing ability to see or recognize smaller and still smaller things. The range of the unaided eye is limited, and it has been natural to ignore what cannot be seen. The microscope opened the way to more thorough knowledge; other means have been developed in succession. As each fresh veil has been lifted from the regions of the sub-visible universe, a new range of knowledge has been revealed, and this has in many cases provided mankind with new powers over materials, life and health. The talks, which are being given by leading men of science, will explain the revelations that have come with the magnifying glass and the microscope, X-rays, the electron-microscope and other aids to

he exploration of the small. Their effect on the many forms of science, on those which deal with natural processes, the living cell, bacteria, health and disease, on those which deal with human construction, dyes, drugs, alloys, textiles and the materials handled every day, on those sciences which are concerned with the production, preservation, and the use of food, will be explained by men who have themselves taken part in the conquest of this sub-visible universe.

### Hill Sheep Farming

THE Agricultural Improvement Council for England and Wales has set up a Committee "to investigate the present position of hill and upland sheep farming in England and Wales and in the light of modern scientific knowledge to suggest measures that might be taken to improve the condition of hill and upland grazings, the health and hardiness of sheep stocks and systems of stocking and management". The Committee is constituted as follows: Lord De La Warr (chairman); Mr. J. C. F. Fryer, Mr. Moses Griffith, grassland adviser at the Plant-breeding Station, Aberystwyth; Mr. David Lewis; Dr. R. F. Montgomery; Prof. G. W. Robinson, professor of agricultural chemistry in the University College of North Wales, Bangor; Dr. R. W. Wheldon, lecturer in agriculture at King's College, Newcastle-upon-Tyne; Mr. W. Wilson. Mr. D. H. Dinsdale, adviser in agricultural economics, King's College, Newcastle-upon-Tyne, will act as technical secretary to the Committee, and the administrative secretary will be Mr. J. H. Banbury, of the Ministry of Agriculture and Fisheries, Lindum Hotel, St. Annes-on-Sea, Lancs.

### Announcements

SIR JOHN RUSSELL, director of the Rothamsted Experimental Station, has been appointed adviser to the Soviet Relations Branch of the Ministry of Information. During his well-known researches in agricultural science, Sir John has come into close contact with Soviet men of science and has travelled widely in the U.S.S.R.

MR. J. K. ROSS has been appointed assistant conservator of forests, Sierra Leone, in the Colonial Service.

PROF. ERWIN PAYR, emeritus professor of surgery at Leipzig University, has been awarded the Goethe Medal for art and science.

To meet urgent needs, some of them arising from the War, four new teaching departments have been set up at Leeds General Infirmary, devoted respectively to thoracic surgery, physiotherapy, radio-graphy and radiotherapy, and dietetics.

THE Board of Education announces that the scheme of State bursaries in science, tenable at universities and certain technical colleges, carrying fees and maintenance allowances, which was instituted last year to meet the demand for technical officers for the Armed Forces and for war industry, is being continued in 1942. Bursaries will be awarded as last year in engineering, physics-with-radio, and chemistry. Full particulars are being sent to the headmasters and headmistresses of secondary and public schools.

## LETTERS TO THE EDITORS

*The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications.*

## Excitation of Nematocysts

THERE has in the past been considerable discussion concerning the nature of the stimulus which causes the nematocysts of Cœlenterates to discharge. In some cases, it is quite clear that the mechanical stimulus to the cnidoblast causes an explosion of the enclosed nematocyst. But for the majority of nematocysts, discharge only takes place in the presence of food, and it has been suggested that the stimulus is essentially a chemical one. During a long series of experiments on the feeding of *Anemonia sulcata*, interesting evidence has been obtained as to the mode of excitation of nematocysts. In agreement with Parker and Van Alstyne<sup>1</sup>, I find the cnidoblasts of the tentacles of *Anemonia* are independent effectors. They respond, however, selectively to food. If touched by a clean glass rod, no discharge is normally obtained. If touched with a piece of human skin, there is copious discharge. The discharge, however, only takes place where there has been mechanical contact. Strong food solutions sometimes seem to cause spontaneous discharge of a few nematocysts. But it is easy to show that this is of no direct significance in the normal reaction. As a direct chemical stimulus, food is far less effective than certain surface-active substances such as bile salts (0.1 per cent), which produce a complete spontaneous discharge of the nematocysts. This action is, however, quite different from the normal response. Cotton wool soaked in dilute bile salts does not adhere to the tentacles; the nematocysts being discharged by the diffusing bile salt before contact is made. On the other hand, cotton wool soaked in food solution causes extensive discharge of nematocysts into the mass on contact. This is true even though the food solution employed is far below the concentration for spontaneous discharge. Clean cotton wool, soaked in sea water as a control, produces no discharge.

A simple experiment helps to explain these curious facts. If a tentacle is touched by a small clean glass bead, no nematocyst discharge takes place. If the tentacle is now immersed in food solution, for example, 10 per cent human saliva in sea water (centrifuged), there is little or no evidence of spontaneous discharge. But if the tentacle is now touched with a clean glass bead, a profuse discharge of nematocysts takes place on to the bead. Clearly, the food solution has acted by lowering the threshold to mechanical stimulation. We have in the cnidoblast the remarkable system of an independent effector excitable by a mechanical stimulus, but only excitable in this way when under the influence of specific chemical substances in the food.

Analysis of active food material shows that the effect is not given by carbohydrates or carefully fat-free proteins or their derivatives. The active substance is normally strongly adsorbed on protein, whence, however, it can be extracted by alcohol or acetone, though not by ether. The obvious suggestion is that the active substance is a lipid possessing polar groups. This suggestion is borne out by the fact that glass beads coated with trimyristin produce a discharge on coming into contact with the cnidoblasts. The results of this work will be published in a forthcoming paper.

Dr. J. H. Schulman of the Department of Colloid Science, Cambridge, and I have investigated the effect of a number of surface-active substances, both with respect to spontaneous discharge and to the normal contact response. The effects are highly selective. Whereas the salts of bile acids produce nematocyst discharge at low concentrations, many other capillary-active compounds such as the sulphate, amine or carboxylic salts of long-chain aliphatic substances cause no obvious spontaneous discharge, even in concentrations sufficient to cause rapid cytolysis.

Of the substances tested, the contact response was greatest to aliphatic esters such as trimyristin and ethyl stearate. Even pure paraffin wax can produce a moderate contact discharge of the cnidæ. On the other hand, long-chain fatty acids in which the surface is hydrophilic, or paraffin rendered hydrophilic by the presence of fatty acids or protein is without effect. This strongly suggests that the lipid substance concerned must come in actual contact with the lipid surface layer of the cnidoblast in order to exert its effect. These results will be published in another paper.

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Jan. 6.

<sup>1</sup> *J. Exp. Zool.*, 63, 329 (1932).

## Properties of Cuticle and Insect Ecology

THERE is no doubt that the physiological significance of insect coloration has not yet been fully realized by ecologists, while its direct survival value has often been overstressed. From this point of view Dr. Kalmus's article in *NATURE*<sup>1</sup> is to be welcomed. His treatment of the problem, however, is such that it may bring undeserved discredit to essentially sound ideas. Starting with references to some recent investigations on the physical properties of insect cuticle, Dr. Kalmus proceeds to formulate thirteen "Rules", based on the still scanty results of those investigations, on a number of assumptions (for example, "a dark cuticle is mechanically the stronger", which he admits to be an assumption not yet proved, but on which no less than four "Rules" are based), and on teleological speculation. The evidence quoted in support of each "Rule" is exceedingly meagre and often inaccurate, as a few examples will show. The mole cricket quoted in Rule 3 is not "entirely dark" but paler than most of its relatives. Rule 4 ("giant forms are usually black; bright colours are more frequent among small insects") is not supported by any evidence, and its correctness is highly doubtful. Mayflies, on the sole support of which Rule 9 rests, are not necessarily pale and some are even black. Eggs of Phasmodæa (Rule 10) are not "dark and hard", but always hard and only sometimes dark. Rule 11, stating that "most non-black insects are found in the tropics" has since been presented<sup>2</sup> in a more intelligible way by saying that "the proportion of non-black insects is greater in the tropics", but it is legitimate to ask on what evidence this statement, implying the existence of some numerical data, is based. Similar statements of alleged quantitative character constitute many of the "Rules", and it is surprising that they should emanate from a University Department of Biometry where more respect for statistical data would be expected.

The lack, or inadequacy, of evidence in support of the "Rules" caused me (in a letter to Dr. Kalmus) to call them dogmatic, and Dr. Kalmus is merely using a polemical trick in contrasting this definition<sup>2</sup> with that of Prof. Hale Carpenter<sup>3</sup>, who criticizes them for being vague. The fact is that most of the "Rules" are dogmatic, though the wording of some of them is vague. This vagueness ("usually", "frequently") anticipates all criticism based on concrete examples; a further safeguard is provided by explaining that the effects of the thirteen "Rules" are often contradictory and final results difficult to foretell; still further, all cases of coloration dependent on subcuticular pigmentation are brushed aside as irrelevant, although, for example, the absorption of heat radiation by a black insect does not depend on the histological location of the black pigment. In fact, Dr. Kalmus's attitude seems to be this: dark (or light) colour of any insect species must have *some* teleological reason, and if the colour contradicts one "Rule", another can be applied, until an "explanation" of the colour is found. As there are thirteen "Rules", the choice is wide. The technique of applying the "Rules" has been excellently demonstrated by Dr. Kalmus himself, in reply to Prof. Hale Carpenter's<sup>3</sup> query as to why in Ngamiland the diurnal Tenebrionids and the nocturnal Carabids are both black. The answer is "I think the beetles of Ngamiland provide quite good examples of Rules 12 and 14 (drought and vagility)". What kind of ecologist would be satisfied with this light-hearted way of solving his problems? Another example of Dr. Kalmus's versatility concerns weevils, the integuments of which are usually very hard, whatever the colour (thus refusing to observe "Rule" 3); in this case "a different process of hardening seems to be at work".

It is really incomprehensible why Dr. Kalmus formulated his points as "Rules". If he had said, for example, that long-lived insects *may be expected to be darker than their short-lived relatives*, it would have been a reasonable deduction from properties of cuticle; but saying, as he does, that "long-lived insects *are darker, etc.*" amounts to a dogmatic statement, which is possibly untrue. Most of the thirteen points deserve the attention of ecologists, since they suggest problems concerning physiological causes and biological effects of coloration; but it is to be sincerely hoped that no ecologist will be tempted to explain away his problems by consulting Dr. Kalmus's list of rules, or to follow his example of solving them with the aid of meagre physiological data, supplemented by wishful thinking on teleological lines.

Imperial Institute of Entomology,  
British Museum (Natural History)  
S.W.7. Dec. 19.

B. P. UVAROV.

<sup>1</sup> NATURE, 148, 428 (1941).

<sup>2</sup> NATURE, 148, 694 (1941).

<sup>3</sup> NATURE, 148, 693 (1941).

In my article I proposed a system of deductions from newly discovered physical properties of cuticle, formulated them as ecological rules and illustrated them by some examples. As the working mechanism of adaptation I postulated natural selection, thus escaping, as I hoped, the accusation of teleology.

If, as Dr. Uvarov recommends, ecologists interest themselves in these deductions, their observations will show, in due course, how many of my ideas are sound.

H. KALMUS.

## Difference in Resistance to Toxic Substances of Mutants of *Drosophila* of Different Body Colour

IN previous papers<sup>1,2</sup> it has been shown that mutants of four species of *Drosophila* with light-coloured cuticles are less resistant to desiccation than are those of darker body colour. This was taken to indicate that the light cuticles are more permeable to water than the dark. The following differences in resistance of the light and dark insects to various toxic substances may also be explained by differences in the permeability of the cuticles.

Heavy and light petroleum oils, a tar-oil emulsion in water, a pyrethrum extract and weak solutions of sulphuric acid were sprayed on batches of flies taken from a segregating  $F_2$  generation by means of an apparatus<sup>3</sup> designed to give uniform replicable deposits of known amounts of contact insecticides. The flies were supported on a textile material (tricoline) and males and females of the mutant and wild type flies were treated at a time, the insects being previously narcotized with carbon dioxide.

The yellow mutant of *D. pseudo-obscura*, race A and *D. melanogaster* showed a significantly lower resistance to all the substances tested as measured by the number of survivors, when compared with the wild type. The mutant black in *D. melanogaster* showed a slight increase in survival, whereas there appeared no difference between the mutant *ebony* in the same species and the wild type.

The yellow mutant of *D. pseudo-obscura* lost more weight after spraying with heavy or light oil than the wild type. The loss in weight of both forms was greater after treatment with the more volatile oil.

A collapse of the eyes of the dead flies was noticed after treatment with the light oil. The frequency of this effect was significantly greater in the yellow mutant of *D. pseudo-obscura* than in the wild type. This effect was not observed with the other substances.

It is not clear at present whether the differences in reaction of the mutants to all the chemicals used are due to a common cause. With the exception of pyrethrum, the substances tested or related products are likely to be found in the atmosphere, precipitations and on the vegetation of industrial districts. The differential behaviour between the light and dark insects found in these experiments may thus provide an explanation for the progressive selection of melanic forms in these areas.

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<sup>1</sup> Kalmus, H., NATURE, 147, 455 and 148, 428 (1941).

<sup>2</sup> Kalmus, H., Proc. Roy. Soc., B, 130, 185 (1941).

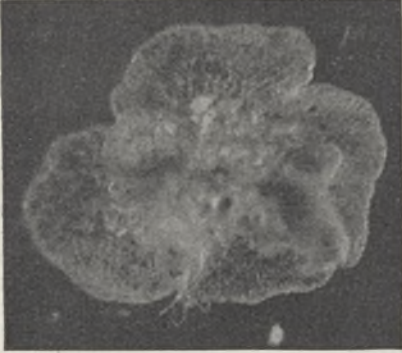
<sup>3</sup> Potter, C., Ann. Appl. Biol., 28, 142 (1941).

## A Ctenophore from the Palestinian Coast

SOME six weeks ago I set up a series of small sea-water tanks. One of these was planted with *Caulerpa prolifera*, *Caulerpa crassifolia* and *Zostera* sp. On October 29 we noticed in this tank three specimens of a creeping Ctenophore.

All the material present was from the Palestinian

coast, near Jaffa. So far as known to us, no Platystenean has up to now been described from the Mediterranean. Therefore we presume that we are dealing with the Red Sea form (*Cœloplana Metschnikowii* Kowalewsky, 1880) or else with a new species. If our specimens should belong to the Red Sea species, this would mean that this interesting animal—like many others—has succeeded in penetrating through the Suez Canal into the eastern Mediterranean.



A preliminary examination tends to confirm this diagnosis of the genus *Cœloplana*: the animal appears to be devoid of comb-plates but possesses the characteristic aboral papillae of *Cœloplana*. The animals are 12–13 mm. long and 9 mm. broad, and they were observed both creeping on the substrate and hanging on the water surface. One specimen swallowed an Isopod of 2 mm. length. The tentacles can be extended more than 15 cm. The accompanying photograph, taken by Dr. W. Koch, shows a specimen with one tentacle partly extended.

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Nov. 12.

J. HAAS.

## Northern Fringe of the Palæolithic in England

THE question as to whether the northern fringe of the Palæolithic in England extended into Yorkshire or not has long been a matter of controversy. Certain archaeologists have supported such an extension on the ground that many palæolithic types of implement have been discovered there, while most geologists have denied it on the ground that climatic conditions would have rendered any human penetration of Yorkshire impossible throughout the Ice Age.

For a thesis recently accepted by the University of Durham I have made a close investigation of this problem, re-examining both the implements discovered and the details of their discovery.

The investigation has revealed that many of the implements are undoubted palæoliths, but do not belong to any of the earlier Palæolithic cultures, being, with the possible exception of one group from Nidderdale, Debased Creswellian. At two sites at least, one in the Huddersfield region and the other near Settle, these palæoliths were certainly deposited prior to the earliest appearance of Mesolithic influences. The strata in which these palæoliths occur, in all cases where they can be identified, are post-glacial in date. The Palæolithic sites, almost without exception, are situated on elevated ground, the

majority on the Pennine Ridge, a few on the Yorkshire Moors and Yorkshire Wolds. The genuine palæoliths are few in number compared with the implements of later cultures; a few of the stone implements are of flint and comparatively well made, but the majority are of chert and exceedingly crude. As a general rule the better-made implements are the earlier, the more crude the later, though the latter tend to improve slightly as the period draws to a close.

These facts make it clear that there was a Palæolithic period in Yorkshire, but that this period was post-glacial, not interglacial, in date. Thus the opposed views of the geologists and the archaeologists can be largely reconciled.

It is possible to reconstruct in broad outline the sequence of events which brought about the above-mentioned conditions. The Creswellian Culture is known to have persisted in Derbyshire and Lincolnshire long after the contemporary palæolithic cultures on the Continent and even in southern England had been superseded by the Mesolithic<sup>1</sup>. During this period the ice withdrew from the greater part of Yorkshire, and immediately small hunting parties began to enter that county, keeping to the elevated ground, as the valleys and plains would still be impassable.

At first these parties would be mere seasonal visitors, returning to the Derbyshire and Lincolnshire centres for the winter; but as conditions improved, some at least settled in Yorkshire, living the life of nomadic hunters. The original migrants would take with them flint tools and weapons manufactured by skilled workmen at the North Midland sites, thus accounting for the comparatively well-made implements; but their descendants would have to improvise with the somewhat intractable local chert, which explains the deterioration of the workmanship.

There appears to have been a break in these migrations, during which mesolithic influences reached the Derbyshire and Lincolnshire sites, and when conditions further improved and a general advance northward was made, it was by a people in a mesolithic stage. The descendants of the earlier migrants were then either absorbed or became extinct.

It is hoped at some future date to publish full details of the evidence on which these conclusions are based, as well as a discussion of several subsidiary questions arising out of the main problem.

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H. N. GIBSON.

<sup>1</sup> Clark, J. G. D., "The Mesolithic Settlement of Northern Europe" 220 (Cambridge, 1936).

## Names of Electrical Units

IF the E.S.U. system is to be retained, Dr. E. A. Guggenheim's suggestion<sup>1</sup> that the unit of electrical charge in this system should be called the "franklin" has much to commend it. But why retain the E.S.U. system? The object of the M.K.S. system is to replace three existing ones, with their cumbersome conversion factors, by one single system which meets all practical requirements.

It is unsound to give an arbitrary unit value to more physical quantities than necessary, though the practice is sometimes unavoidable (we can, for ex-

ample, scarcely hope to avoid using the horse-power as well as the watt), but in electrical work there is no need to give an arbitrary value to more than one quantity in addition to the three mechanical ones of length, mass and time. In the M.K.S. system the quantity selected for permeability is  $10^7$  that of a vacuum. This automatically causes the permittivity of a vacuum to be  $1.113 \times 10^{-10}$  units. Arbitrarily to make the permittivity of a vacuum one unit as is done in the E.S.U. system is to over-determine the units. It is very much to be hoped that this practice will be dropped, particularly as the exact conversion factor is not such a round figure as given in Dr. Guggenheim's table. It would only be so if the velocity of light were exactly 300,000 km. per second, which it is not.

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<sup>1</sup> NATURE, 148, 751 (1941).

## Crystallization in an Inflated Rubber Balloon

It is well known that an oriented crystallization is produced in rubber by stretching. The rubber can be made to crystallize also by a two-dimensional homogeneous dilatation, as in the skin of an inflated

ticular specimen;  $b$  is the fibre axis indicating the direction of the main valency chain.

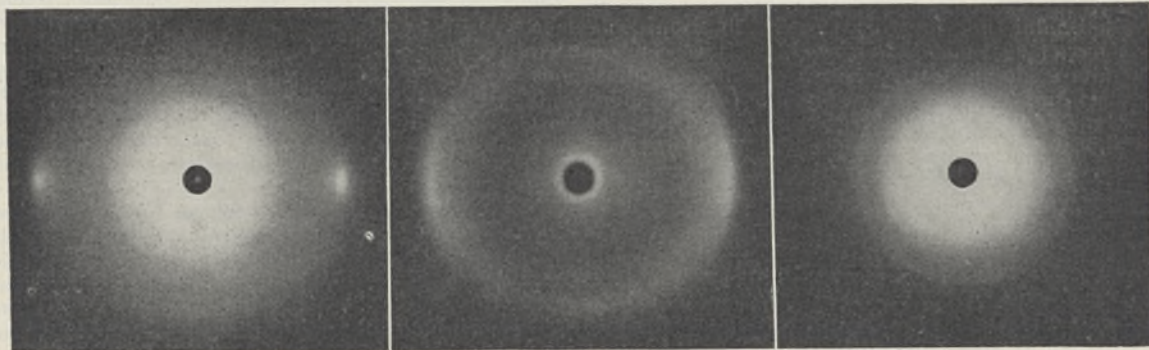
With this assumption, we interpret the result represented by Figs. 1 and 2 as follows. The dilatation of the rubber skin produces an oriented crystallization, the orientation being brought about by a tendency of the crystallites to arrange themselves with the  $b$ - $c$ -plane in the plane of the skin, that is, with the shorter  $a$ -axis perpendicular to the skin. The distribution in the plane around the normal is at random, giving as reflexions parts of Debye rings.

The effect is less marked in the thicker specimen, as will be seen when comparing Figs. 1 and 2. Fig. 3 is a photograph taken with the X-ray beam passing through the centre of the sphere. This gives, of course, two sets of reflexions, from the near and the far side of the balloon respectively. The second one is scarcely visible in the reproduction. There are two Debye rings each with spacings equal to the (002) and (012) reflexions of which the latter is much stronger. The (200) reflexion is either completely absent or extremely weak. These findings appear to corroborate the proposition outlined above, which indeed is closely connected with what is known as 'higher orientation' in thin stretched rubber bands.

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<sup>1</sup> Lotmar and Meyer, *Monatshfte.* 69, 115 (1936).



1  
Thickness, 0.1 mm., inflated to 31 mm. diameter. Distance, 8 cm., beam tangential.

2  
Thickness 0.6 mm., inflated to 49 mm. diameter. Distance 8 cm., beam tangential.

3  
Same as 2. Distance 6.5 cm., beam through centre.

X-RAY DIAGRAMS, TAKEN WITH UNFILTERED COPPER RADIATION, OF INFLATED RUBBER BALLOONS.

rubber balloon. I have experimented with small balloons of about 1 cm. diameter when slack, made of pure vulcanized latex by dipping. When a balloon like this is inflated to 3-4 cm. diameter and an X-ray beam strikes the sphere tangentially, photographs result as shown in Figs. 1 and 2, taken with balloons approximately 0.1 and 0.6 mm. thick when slack. The spacings given by the reflexions in the horizontal plane, which contains the centre of the sphere, is 4.22 Å.; those of the short arcs at top and bottom are 4.95 Å. and 6.24 Å., corresponding to the (200), (012) and (002) reflexions in the ordinary fibre diagram which was taken separately. The arcs are blurred as they originate on an extended area of the sphere. The sharpness of the horizontal reflexions, on the other hand, is enhanced by a focusing effect.

Accepting a monoclinic structure with an angle  $\beta = 83^\circ 20'$  as proposed by Lotmar and Meyer<sup>1</sup>, the dimensions of the elementary cell work out as  $a = 8.5$  Å.,  $b = 8.2$  Å. and  $c = 12.6$  Å. for this par-

## A Reversible Discharge Tube

IN a recent letter, Asundi, Singh and Singh<sup>1</sup> have described effects observed with a so-called reversible discharge tube. The phenomena recorded appear to be most easily explained by assuming that the discharge tube leaked slightly. This would account for the appearance of the hydrogen spectrum when the tube was freshly swept out with hydrogen, the appearance of nitrogen bands after standing, and the reappearance of the hydrogen spectrum on continuous running, the nitrogen being cleaned up by the aluminium electrodes, a well-known effect which is commonly made use of in hydrogen discharge tubes. The cleaning up would not occur so readily with external electrodes, and hence the discharge tube would be expected to continue to show nitrogen bands.

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<sup>1</sup> NATURE, 149, 22 (1942).



## RESEARCH ITEMS

## The Veddahs of Ceylon

AN important addition to our knowledge of the Veddahs of Ceylon has been made by W. C. Osman Hill, professor of anatomy, Medical College, Colombo (*Ceylon J. Sci.*, Sect. G, Anthropology, 3, 27; 1941). He has taken an extensive series of measurements of 34 living males of the race, noting in particular colour and hair development; 16 members of the series measured came from one group or clan—the Danigala. He adds measurements and descriptions of 68 skulls and 28 skeletons—most of which are in European museums, but others have been obtained from original sources. Particularly valuable are the photographs of living natives, among which one recognizes not only the more common Veddah type but also others showing resemblances to the Australian aborigine and to negroid peoples. These aberrant types also appear among the Dravidian-speaking tribes of Southern India. Dr. Osman Hill finds the outstanding characteristics of Veddahs—as of all dwarf races—to be an arrest of development at an infantile or immature stage; hence the small stature of the Veddah (the average male measures only 5 ft. in height), the tendency to the suppression of hair on face and body, the short, wide face, and in particular the small head and brain. In their physical appearance, the Veddahs are quite unlike the Bushmen of South Africa, and yet Prof. Osman Hill finds the two races have many cranial characters in common, most of these being of an infantile nature. The last racial census of Ceylon (1921) gave the Veddah population as 4,510; the numbers are decreasing rapidly; Sinhalese on one side, Tamils on the other, are filtering into Veddah country, with the result that hybridity is becoming common. Indeed, Prof. Osman Hill finds it necessary, on this account, to reject many skulls which have hitherto been accepted as pure Veddah.

## Rays and their Allies from the Eastern Pacific

A MOST useful account by William Beebe and John Tee Van of the rays, mantas and chimæras collected by the Eastern Pacific Expeditions of the New York Zoological Society has been published (Fishes from the Tropical Eastern Pacific. Part 3. Contribution No. 630, Department of Tropical Research, New York Zoological Society, *Zoologica*, Oct. 1941). This paper is concerned with collections from several expeditions and contains keys to the families of rays and mantas of the tropical eastern Pacific and to the genera and species. Forty-three rays and two chimæras are described with figures. Range, colour notes, field characters, size, local distribution, abundance, food and breeding are included in the description of each species whenever possible. The food notes are interesting. It is shown that several rays eat polychæte worms and small shrimps. *Narcine entemedor* had in its stomach "a pure culture of red polychæte worms, armed with strong spicules". *Discopyge ommata* fed on Amphipods, small shrimps and worms. This ray has a very conspicuous pattern and gives fairly strong electric shocks. Several species contained young in various stages of development and in others there were egg cases. A female manta or sea devil captured at the Galapagos Islands was eighteen feet in width and had an embryo 28 in. across, the disk with its tail protruding from the parent and the yolk sac almost absorbed—almost ready to be born.

## Young Pacific Sailfish

WILLIAM BEEBE has described two very young sailfish (*Istiophorus greyi*), one of which is the smallest ever seen (Eastern Pacific Expeditions of the New York Zoological Society. XXVII. Contribution No. 629. Department of Tropical Research. New York Zoological Society. *Zoologica*, 26. Part 3, Nos. 19-27; 1941). These were taken on the Eastern Pacific *Zaca* Expedition (1937-1938), one off the western coast of Mexico, 3½ in. long, which came up to the submerged light at night over a depth of about 67 fathoms, the other 1,200 miles to the south-east, off Costa Rica, 1½ in. long, taken in similar circumstances. The detailed descriptions of these two fishes are of great interest, as are also the notes on colour, habitat and especially the food. Externally they resemble the adult, having already a greatly elongated upper jaw and pelvic fins and enormously expanded dorsal fin. Internally, however, they are very different; their jaws are provided with quite ordinary teeth and the body is covered with scales. The whole skeleton must undergo a complete change and this is probably mainly due to the very different form of feeding and feeding movements. A comparison is made with a young Atlantic sailfish (*Istiophorus americanus*), and it is shown that the food is similar. In each species it was mainly copepods, all small Cyclopoida belonging to the tropical surface forms, and a very young fish, in one case certainly, in the other probably, a clupeoid. The fish were bitten in two and the copepods swallowed whole. The food of an adult *I. greyi*, also from the *Zaca* Expedition and weighing 115 lb., was seven small and one large squid, a two-inch paper nautilus, shell and invertebrate, and a 40-mm. Chaetodon, all quite uninjured. The fact that all this material is swallowed whole and undamaged is striking, especially as the adult fish is commonly reputed to obtain its food by using its snout like a slashing broadsword.

## Memory in Insects

W. H. THORPE (*Proc. Roy. Soc.*, 127, 424-433; 1941) has shown that larvæ of *Nemeritis* and *Drosophila melanogaster* reared on particular media gave rise to imagos which preferred these. Thus adults of *D. melanogaster* arising from larvæ reared on media containing essence of peppermint were not repelled by the smell, as are normal cultures. J. E. Cushing (*Proc. Nat. Acad. Sci.*, 27, 496-499; 1941) has been experimenting with a pure strain of *D. guttifera* which normally inhabits fungus-infested food. He raised some larvæ on fungus-free and some on fungus-infested media, and allowed the resulting adults to choose between them for egg laying. Again the conditioning of the larvæ significantly influenced the preference of the adult. He points out that this physiological change in the life of *Drosophila* acts on the mechanism of populations by influencing isolation, population size and selection pressure in a somewhat similar manner to the homing of birds or of salmon or to mating preferences.

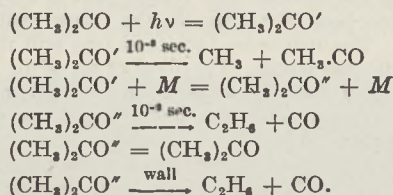
## Size Inheritance in Tomatoes

J. W. MACARTHUR (*J. Hered.*, 32, 291-295; 1941) has used four lines of tomatoes which have been inbred for at least twelve generations to explore the manner of inheritance and effect of size genes in the tomato. By intercrossing these lines, and planting lines and hybrids in a Latin square, an analysis of the fruit weights can be made by separation of the

variance due to environment (0.4 per cent), to varieties (99.4 per cent) and to error (0.2 per cent). Further, it was found that the  $F_1$  generation closely approaches the geometric mean of the parental lines. Thus it is demonstrated that the substitution of one set of genes for another gives a geometric and not an additive effect.

#### Photo-decomposition of Acetone

THE photo-decomposition of gaseous acetone is apparently a complex process, ethane, carbon monoxide and diacetyl being formed at room temperature in varying ratios depending on the circumstances. A re-investigation of the process by R. Spence and W. Wild (*J. Chem. Soc.*, 590; 1941) has brought to light some new features. It is shown that the apparently contradictory results found in earlier research by the authors and by Herr and Noyes in the continuum region of absorption can be represented by a single expression derived from a common mechanism. A purely radical type of mechanism is shown to be excluded by results in the banded region of absorption. The effect of pressure on the quantum yield and on the ethane/CO ratio is explained by the assumption of two activated states of the acetone molecule with very different life-periods of the order of  $10^{-8}$  sec. and  $10^{-2}$  sec., the second being a metastable state. This mechanism is:



At low pressures decomposition into radicals predominates and  $\text{C}_2\text{H}_6/\text{CO}$  can reach high values, while at pressures above 100 mm. direct decomposition into ethane and carbon monoxide is the primary process. The theory is complicated, but each phase has been related to some definite experimental result. It should be noted that the excited molecule of longer life does not yield free radicals but either reverts to the normal state or decomposes into ethane and carbon monoxide.

#### Intuition and Higher Space

THE term 'geometry' is now used in a very wide sense, and some mathematicians feel that there is an essential difference between that of one, two or three dimensions, in which spacial intuition is of great value, and modern extensions to four, five, or even an infinite number of dimensions. A method for the graphical representation of these higher kinds of spaces has now been given by M. Randall and B. Longtin (*J. Washington Acad. Sci.*, 31, 421; 1941). For  $n$  dimensions we replace the desirable but unattainable  $n$  mutually perpendicular axes by  $n$  parallel lines on a sheet of paper, so that a point in space of  $n$  dimensions is represented by  $n$  points on the paper. It is easy to pass to functional space of an infinite number of dimensions, for the point in functional space is represented by a continuous curve. Two applications of the methods of this paper are of some importance. They can be applied to the study of processes for separating the components of a mixture of several chemical compounds, and to the determination of the intensity of luminous energy concentrated in each wave-length of a spectrum.

#### Origin of Planets and Satellites

IN a paper on this subject (*Mon. Not. Roy. Astro. Soc.*, 101, 7; 1941), R. A. Lyttleton introduces certain modifications in the results that he had previously obtained. In some of his earlier papers he showed that in the evolution of a primitive rotating planet, when a state of instability was reached, the division produced a pair of masses of mass-ratio 3:1 approximately. In dealing with the gravitational energy of the critical ellipsoid, Lyttleton used a numerically incorrect value which led to the above ratio, but the use of the correct value shows that the mass-ratio must be at least 6:1 and possibly higher. In these circumstances it does not seem possible that Jupiter and Saturn should have originated from a single mass, as previously suggested, unless the initial mass-ratio has been reduced as a result of some increase of mass by these planets since this stage of their formation. Various lines of evidence suggest that such an increase could occur, though there is nothing to show that any of these alleged factors were actually effective. The modification introduced does not necessarily exclude the method of formation of the terrestrial planets and of the satellite systems of the great planets, which Lyttleton had suggested in his earlier papers, but it opens up the possibility of other ways in which various pairs of planets may be related. Of these the simplest situation would be obtained on the supposition that two primitive planets evolved by fission to produce Jupiter and Neptune, say, from one of them, and Saturn and Uranus from the other. It is admitted, however, that all four planets may have had separate origins, and other possibilities exist between these two cases.

#### Spectrophotometry of the Night Sky

THE intrinsic brightness of the night sky sets a natural limit to the photography of distant nebulae with large modern reflecting telescopes. If the spectral distribution of the radiation from the nebulae approximates at all closely to that of the light from the sky, we can expect no improvement of this position by the use of such devices as colour filters. However, the light from the nebulae is made up largely of starlight little different in quality from sunlight, whereas most of the night sky radiation is terrestrial in origin and is similar to auroral light: there may thus be a difference in spectral distribution which could be exploited in astronomical photography. H. W. Babcock and J. J. Johnson have now compared the energy distribution in the light of the night sky with that in the Andromeda nebula (*Astrophys. J.*, 94, 271; 1941). Spectra of both sources were obtained on Mt. Palomar with a quartz spectrograph fitted with an  $f/1$  Schmidt camera and attached to a 12-in. reflecting telescope. Each spectrogram was separately standardized with a standard lamp operated at 2580° K. The spectral energy curves are roughly parallel from the red down to about 4500 Å. From there to about 3200 Å., however, the night-sky intensity remains constant while the nebular intensity drops sharply. It is therefore suggested that improved contrast in the direct photography of nebulae can be obtained by using a filter to remove the unwanted ultra-violet light. This procedure is especially necessary when the elevation of the telescope is small, since the nebulae are then reddened by atmospheric absorption, while the night sky is brightest at low altitudes.

## THE PREDICTIVE METHOD IN ANIMAL ECOLOGY

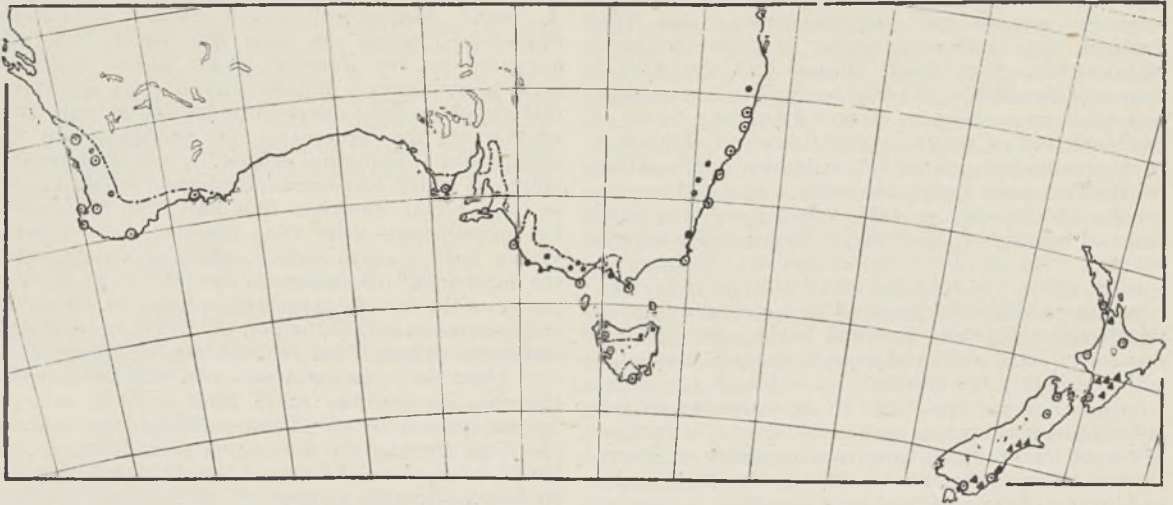
By DR. D. STEWART MACLAGAN

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EVERY scientific problem resolves itself into a quest for the relationship between two or more variables. The discovery of these inter-relations provides the basis for prediction and control, so important in the applied aspects of a science, and bespeaks the entry of the latter into the highest phases of its development. Although biology is one of the younger sciences, it has made such great advances in the descriptive phases that further developments are taking place along quantitative lines, with the ultimate objective of *predicting* the organic response to given conditions. The methods elaborated by the animal ecologist for the forecasting

predictions which were ventured in some of the earlier researches have been vindicated by recent experience, as follows:

From 1928 until 1930, a detailed ecological study of the collembolan, *Smynturus viridis* L., was undertaken, at the Parasite Laboratory of the Imperial Institute of Entomology.<sup>1</sup> Utilizing field data in combination with the results of planned laboratory experimentation upon the 'field physiology' of the insect, an attempt was made to determine: (1) the complete geographical range of existence of the insect, (2) where it would cause damage of economic significance every year, and (3) where it would become of economic importance occasionally. On analysing the environmental controlling complex of *Smynturus*, it was ascertained that the minimum rainfall for existence of this species is the minimum rainfall for oviposition, namely 0.12 in. a month, because the moisture requirements of this process are higher



of biological events in time, or in space, are still comparatively rough hewn, and certain fundamental principles will have to be taken as proved, for the present, since lack of space prohibits presentation of the ever-increasing mass of evidence upon which they are based.

The first is that populations of animals are controlled by a complex of environmental factors which are continually varying in intensity, both spacially and chronologically; and of which the climatic factors play the dominant part in the initiation (but not always in the termination) of the condition known as an epidemic or 'plague.' The second is that, although numerous factors operate simultaneously to retard population-increase in Nature, there are great differences in the relative significance of the various phases of the life-cycle, in so far as numerical increase of a species is concerned, so that 'critical' periods can be recognized. Thirdly, the critical periods are usually associated with the early stages of existence or with reproduction. The primary task of the biological forecaster, therefore, is the discovery and climatological delineation of critical periods in the life-cycle, such periods resulting from the high susceptibility of certain stages or processes to deviations from a narrow optimal range. These ecological concepts synthesize my views as the result of investigations conducted over a period of twelve years, and it is of interest to find that the

than those of any other process or phase in the life-cycle. The upper rainfall limit is approximately 7.0 in., due to fungus and bacterial attacks on the eggs, under conditions of excessive moisture. The upper temperature limit for the species is the maximum which can be tolerated by the stage least tolerant of high temperatures, namely, the embryonic nymphs, which cannot survive mean temperatures exceeding 66°F. The other temperature extreme is determined by the stage the activity of which ceases first when the temperature falls, and this is the egg, its threshold of development being approx. 44°F. Optimum conditions for multiplication of *Smynturus* occur when there is a monthly rainfall of 3.1-6.0 in., together with a mean monthly temperature of 52°-57°F. The damage to lucerne and clovers becomes of economic significance when these conditions obtain for two consecutive months. Further, the areas in which the insect becomes of economic significance occasionally are characterized, in general, by a monthly rainfall of not less than 2.5 in. combined with a mean monthly temperature of 51°-58°F., exclusive of the areas which conform to the requirements of the optimum environment.

Based upon the above criteria of favourability, a map was prepared to illustrate the predicted geographical range of *Smynturus* and the areas of probable economic significance. As a result, it was stated (*loc. cit.*, p. 181)—'it is evident that there are several

DISTRICTS COLONIZABLE BY *Smynturus viridis* L., (1) FAVOURABLE,  
(2) HIGHLY FAVOURABLE.

New Zealand	Many stations	Auckland, New Plymouth, Wellington, Dunedin, Invercargill, Rotorua, Nelson, Hanmer, Gore
W. Australia	Guildford, Perth, Northam, Narrogin	Watheroo, Albany, Bridgetown, Bunbury, Cape Leeuwin, Cape Naturaliste, Collie, Esperance, Karridale, York
S. Australia	Adelaide, Cape Northumberland	Port Lincoln, Cape Borda, Kingscote, Robe
Victoria	Cowes, Colac, Hamilton, Portland, Terang	Gabo Island, Wilson's Promontory, Lorne, Cape Otway
N.S. Wales	Lismore, Maitland West, Bowral, Parramatta, Adelong	Kempsey West, Port Macquarie, Sydney, Jervis Bay Nowra, Moruya Heads
Tasmania	Stanley, Eddystone Point, Zechan, Launceston	Hythe, Cape Sorell, Waratah, Currie

(1)

(2)

countries to which *Smynturus* is potentially a serious economic menace, the most important being New Zealand, the south-west corner of Cape Province, Natal, Chile, New South Wales, and the United States of America". At the same time, an attempt was made to portray, in greater detail, the limits of existence and of economic significance of the insect in Australia, on account of its known depredations in Western and South Australia. This led to the conclusion (*loc. cit.*, p. 183), "that there is a large tract of country in New South Wales and southern Victoria from which the insect has not yet been recorded, but to which, in the event of its introduction, it would undoubtedly prove to be a serious economic problem. Also, there exists a fairly large band of territory in the north and western parts of Tasmania which is highly favourable . . . although the insect . . . has not yet had time to demonstrate its full potentialities as regards numerical increase". In view of recent reports upon the economic status of *Smynturus*, these statements are of considerable interest to biologists in general and to ecologists in particular.

Thus, commenting on the lucerne flea in Tasmania, Evans<sup>2</sup> says: "it was introduced about 14 years ago and is now responsible for extensive damage to pastures"; whilst Pescott<sup>3</sup>, discussing the colonization of Victoria by the species, remarks that this "introduced insect, was, until several years ago, confined to the coastal areas of the Western District of Victoria, but recently it has been found scattered over other portions of the State". Entomologists of the Australian Council for Scientific and Industrial Research<sup>4</sup> report that the pest now occurs "in isolated areas in other districts in this State [Victoria] and in southern New South Wales". The situation in New Zealand has been summarized recently by Dumbleton<sup>5</sup>, thus, "In the North Island, the lucerne flea is known to be widely distributed in an area including Bulls, Palmerston North, Dannevirke, Woodville and Eketahuna. There is one isolated occurrence of the flea near Pokeno and another near Maraekakaho. In the South Island, the insect was found to be present over an area including Temuka, Timaru, Waimate, Oamaru, Mosgiel, Balclutha and Gore."

Hence, the predictions ventured by me in 1932 have materialized sooner than I expected. The accompanying map indicates, by means of dotted lines (Australia), and by triangles (New Zealand), the known distribution of the insect in numbers of economic significance; while the climatically favourable and highly favourable areas (based on the original climatic criteria) are represented by means

of a dot and a dotted circle, respectively. It is my belief that prediction of the abundance and distribution of animal-populations is a field of scientific endeavour which will yield results of great interest and value. With the co-operation of biologists and meteorologists this branch of ecology should be one of the most powerful weapons in the armoury of the economic biologist.

<sup>1</sup> Maclagan, D. S., *Bull. Entom. Res.*, **23**, 151 (1932).

<sup>2</sup> Evans, J. W., *Tasman. J. Agric.*, **8**, 93 (1937).

<sup>3</sup> Pescott, R. T., *J. Dept. Agric. Vict.*, **35**, 371 (1937).

<sup>4</sup> Rep. Coun. Sci. Indus. Res. Australia, **11** (1937).

<sup>5</sup> Dumbleton, L. J., *N.Z. J. Sci. and Tech.*, **20**, 197A (1938).

## CONDITIONS IN FACTORIES

IN a paper "Factory Inspection: a thirty-five years' Retrospect", given before the Royal Statistical Society on May 20, which has now appeared in the *Journal of the Royal Statistical Society*, Sir Duncan Wilson gives a most interesting picture of the developments under the Factory Acts leading to the prevention of accidents and the elimination of industrial disease, as well as indicating points at which statistical information is still lacking or incomplete. Between 1904 and 1938 the staff of the inspectorate more than doubled. Sir Duncan Wilson paid a warm tribute, which was endorsed in the subsequent discussion, to the way in which from the start the factory inspectors, relying on education and persuasion rather than on the full exercise of their statutory powers, had secured the co-operation of employers and managements. In the same period the expenditure had more than trebled and the figures quoted by Sir Duncan Wilson emphasized the huge increase in the use of mechanical power. While the number of factories has increased by about 70 per cent, the number of workshops or places without mechanical power has been reduced to about one half. The data show that industrial diseases have been fought with much greater success than accidents. Fatal accidents per 100,000 employed decreased from 17.6 in 1904 to 11.2 in 1938 and this decrease may be taken as a measure of the severe accident rate. On the other hand, reported accidents almost doubled in the same period. As the criteria were more stringent in 1904 the difference is much greater than would appear from the actual figures.

Sir Duncan Wilson notes that, although of late the proportion of very large factories has increased, about one third of the working population is accommodated in factories employing not more than a hundred workers and more than one half in factories employing not more than two hundred and fifty workers. The chief work of the factory inspector in fact lies in quite small factory units and the trouble there, as Mr. A. W. Garrett pointed out in the discussion, is that there is often not the broad outlook which characterizes the management in the larger concerns. Sir Duncan also directed attention to the high incidence of accidents among young workers under eighteen.

Statistical treatment of the available data over the period explored indicates a distinct tendency for the numbers employed to rise associated with a smaller tendency for accidents generally to rise and with a tendency for fatal and presumably other severe accidents to fall. The two curves are roughly

parallel, variations in numbers employed being positively associated with similar variations not only in the mere numbers of accidents but also with the risk of incurring them. Of the more personal aspects of industry, Sir Duncan does not think that the loss of paternalism involved in modern times in the formation of large combines replacing or absorbing the small employers is a pure loss, but emphasizes that many and probably most of the small employers were first concerned with profit and lastly with the safety, health and general interests of their workers. He refers to the noticeable change in the workers themselves and asserts that the bedraggled, ill-mannered and ill-spoken worker has been replaced by one with self-respect, good appearance and the best manners of any social class. Sir John Forbes Watson, in the discussion which followed, referred to the importance of the analysis of factory conditions in Great Britain as compared with others and the importance of developments in industrial medicine was stressed by Dr. H. B. Morgan, who paid a particularly warm tribute to the work of the factory medical inspectors. Mr. Robert R. Hyde, director of the Industrial Welfare Society, in a written communication, referred to the importance of ways and means of providing the smaller units of industry with some form of the medical service which has already been developed with such success in many large firms.

## RECONSTRUCTION AND ECONOMICS

IN a pamphlet entitled "Post-War Poverty and Unemployment Can be Prevented" issued last year (see NATURE, 146, 312; 1940) T. W. Wyatt and D. Caradog Jones challenged the assumption that a period of intense economic depression and serious unemployment is bound to follow the War, and urged that, on the contrary, it should be possible by a carefully thought-out plan, co-ordinating all forms of industrial activity, to change over from war production to peace production, utilizing the vastly improved capacity of production for creating new wealth. A postscript by J. R. Bellerby outlined five stages by which this could be achieved. Messrs. Wyatt and Caradog Jones have now, under the title "Britain's New Order"\*, issued as a sequel a further thoughtful study of methods of preventing post-war unemployment, which deals with some of the questions and doubts raised by their earlier pamphlet.

The pamphlet urges that local authorities should be encouraged to prepare schemes of work to put into operation as soon as ever private demand slows down after the burst of activity which may be anticipated immediately after the War. Government departments which are able to do so should set an example by initiating public works when the suitable moment arrives. The appointment of a commission with members drawn from all walks of life and responsible to Parliament is suggested to decide which schemes of public work should have preference and to regulate the purchase of surplus foods and materials for storage in different parts of the country. The criterion for determining the approval of or vetoing of any particular scheme should be its consistency with, or opposition to, the public interest.

\* Britain's "New Order": a Plea for a Sane Post-War Employment Policy. By T. W. Wyatt and D. Caradog Jones. Pp. 32. (Birkenhead: John Woolman and Sons, 1941.) 9d.

Every effort should be made to decentralize as much as possible and to interfere as little as possible with private initiative, subject only to the over-riding conditions that the national and municipal interest must come first.

Messrs. Wyatt and Jones urge that modern powers of production are so vast that they must be regulated or they will overwhelm us. It is within our power at the end of the War to build a new world, but we must scrap our old impressions of scarcity and of the need for all-round sacrifice to pay for the War. Taxes, accordingly, they consider should be made as light as possible, and they should be raised or lowered solely for the purpose of regulating purchasing power.

Money or credit required to keep production and exchange functioning should be created directly by the Government up to a strict limit when labour, machinery and materials were all fully and efficiently employed. This demands a high degree of skilled organization for which training and time may be required, and although Messrs. Wyatt and Jones believe that no radical change in the present economic system is required, they point out that sudden transition from a system based on production for profit to a new system based on production for use would be dangerous. The present system can be made to provide a much higher standard of life than we have hitherto enjoyed, and this higher standard will permit us to acquire the better education which is the pre-requisite for the organization of a more rational and efficient system of production for use and service.

All the machinery for a great forward stride, given the right direction and control, is at our command. The large surpluses of all kinds of commodities which are piling up in various parts of the world are as important to the countries of their origin as to those that receive them. Much of the urgent reconstruction required over a wide area will be completed in a relatively short time, and all this work must be undertaken regardless of cost. Purchasing power is the key to distribution, and the solution of the problem of distribution will remove one of the most potent obstacles in the path of a settled peace.

In their attempt to build on past experience, the authors are undoubtedly in keeping with the British tradition, and the work which it is proposed should be entrusted to a Parliamentary Commission is already largely in the hands of the Cabinet Committee under Mr. Arthur Greenwood, the Ministry of Works and Building, or the Leith-Ross Bureau.

Essentially the same ideas are outlined in two articles which have appeared in the October number of the American periodical *Fortune*. In the first of these, Mr. Geoffrey Crowther, editor of the *Economist*, at present visiting the United States, enters a powerful plea for a political democracy which includes a balance, and not merely a mixture, of the social and the profit motives. Mr. Crowther suggests, for example, that the whole of the question of food supply should be removed, in peace as in war, from the operation of the profit motive, and the incentive of order, or purposeful organization by the community, substituted for that of freedom and private profit, in much the same way that education is already organized on a service basis. The concept of social security, however, should not be limited to the satisfaction of basic needs. The extended Bill of Rights must be accompanied by an extended Bill of Duties including specific social service, whether in the defence forces, the health services, or in what-

ever special sphere the particular citizen may be best qualified to serve.

Such service would very materially ease the financial burden of the Citizen's Charter, and Mr. Crowther then suggests that over the remaining half of the national economy where the incentive of profit would continue to function, subject to the watching brief of the Government as trustee for the community, it is important to take the brakes off enterprise, and stimulate economic activity with the view of stimulating employment. The profit motive, he urges, is in dire need of assistance, and like Wyatt and Jones, he attacks the policy of excessive taxation as well as repression of enterprise or individuality through monopolies, cartels, trade associations, or the like. When the basic needs of the citizen have been met and his strongest fears removed, it is in an atmosphere of freedom that the human spirit can develop its full powers, and he contends that it should be possible for both the Left and the Right to accept a balance between freedom and order.

Mr. A. A. Berle, jun., Assistant Secretary of State, in an article on post-war development, urges that every defence industry should have a research staff working on plans for producing peace-time goods. A conference should be held to take inventory of these plans and to lay out a catalogue of the products that will be available when the War ends. This catalogue should be matched against known needs of the country for reconstruction, including such needs as relocation and modernization of city areas, new housing for several millions of families, public works, and nutrition, adequate in kind and quality to ensure public health. These needs are potential markets. Out of these and others like them there should be constructed markets sufficient to ensure full use of our plants and full employment for all our people.

Finance, Mr. Berle argues, is a technical problem, like engineering. We can afford anything for which we have materials, labour and reasonable needs. These are the only stop signs, and common-sense adjustment of war finance to peace finance will permit construction of markets to the extent necessary. Like Messrs. Wyatt and Jones, Mr. Berle is convinced as to the richness of the new era that modern technique puts within our reach, and he concludes with the reminder that economics tends to reflect the desires and wants of a country, and whether our new order is to be an enduring and stable order will depend above all on its moral basis.

## FORTHCOMING EVENTS

### Saturday, January 24

BRITISH RHEOLOGISTS' CLUB (in the Department of Physics, The University, Birmingham), at 1.15 p.m.—Discussion on "Classifications of Rheological Properties".

### Monday, January 26

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Dr. B. A. Keen, F.R.S.: "Soil Physics, Theory and Practice" (Cantor Lectures, II).

ROYAL GEOGRAPHICAL SOCIETY (at Kensington Gore, London, S.W.7), at 3 p.m.—Kodachrome Films by Mrs. Patrick Ness: "Burma, Indo-China, Thailand and Netherlands Indies".

INSTITUTION OF ELECTRICAL ENGINEERS (at Savoy Place, London, W.C.2), at 5 p.m.—Discussion on "Is there an Electrical Basis for Water Divining?" (To be opened by Mr. J. F. Shipley).

### Wednesday, January 28

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Mr. F. R. Yerbury: "The Post-War Home—Its Interior and Equipment", 4: "Adaptation of Design to Standardisation and Mass Production".

INSTITUTE OF PHYSICS (LONDON AND HOME COUNTIES' BRANCH) (at the Royal Institution, Albemarle Street, London, W.1), at 2 p.m.—Conference on "Electronics" (Chairman: Prof. J. D. Cockcroft, F.R.S.).

ROYAL METEOROLOGICAL SOCIETY (at 49 Cromwell Road, London, S.W.7), at 4.30 p.m.—Annual General Meeting. Sir George Simpson, K.C.B., F.R.S.: "The Electricity of Cloud and Rain" (Presidential Address).

## APPOINTMENTS VACANT

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

CIVIL ENGINEERING ASSISTANT experienced in LAND DRAINAGE WORKS—The Clerk to the River Trent Catchment Board, Catchment Board Offices, Derby Road, Nottingham (January 30).

BOROUGH ELECTRICAL ENGINEER—The Town Clerk, Town Hall, Burnley (endorsed 'Borough Electrical Engineer') (January 31).

LECTURER IN ELECTRICAL ENGINEERING—The Principal, County Technical College, Guildford, Surrey (January 31).

LECTURER IN MECHANICAL ENGINEERING—The Principal, Handsworth Technical College, Golds Hill Road, Handsworth, Birmingham 21.

LECTURER IN ELECTRICAL ENGINEERING—The Registrar, Wimbledon Technical College, Gladstone Road, London, S.W.19.

LECTURER IN MECHANICAL ENGINEERING SUBJECTS—The Principal, Kingston-upon-Thames Technical College, Kingston-upon-Thames, Surrey.

## REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

### Great Britain and Ireland

University of Leeds. Report of the Librarian for the Session 1940-41. Pp. 5. (Leeds: The University.) [2412]

Proceedings of the Royal Society of Edinburgh. Section A (Mathematical and Physical Sciences). Vol. 61, Part 2, No. 11: Quantum Theory of the Chemical Bond. By C. A. Coulson. Pp. 115-159. 2s. Vol. 61, Part 2, No. 12: Some Remarks occasioned by the Geometry of the Veronese Surface. By W. L. Edge. Pp. 140-159. 1s. 9d. (Edinburgh and London: Oliver and Boyd.) [2412]

National Central Library. 25th Annual Report of the Executive Committee, 1940-1941. Pp. 16. (London: National Central Library.) [11]

### Other Countries

Transactions of the San Diego Society of Natural History. Vol. 9, No. 29: The Long-Nosed Snakes of the Genus *Rhinocheilus*. By Laurence M. Klauber. Pp. 289-332 + plates 12-13. Vol. 9, No. 30: A New Species of Rattlesnake from Venezuela. By Laurence M. Klauber. Pp. 333-336. (San Diego, Calif.: San Diego Society of Natural History.) [2412]

Bulletins of the Zoological Society of San Diego. No. 17: Four Papers on the Applications of Statistical Methods to Herpetological Problems. 1: The Frequency Distributions of certain Herpetological Variables; 2: Illustrations of the Relationship between Populations and Samples; 3: The Correlation between Scatation and Life Zones in San Diego County Snakes; 4: The Rattlesnakes Listed by Linnaeus in 1758. By L. M. Klauber. Pp. 96. (San Diego, Calif.: Zoological Society of San Diego.) [2412]

Vegetable Cultivation in Hong Kong. By G. A. C. Herklots. Pp. iii + 86 + v. (Hong Kong: The Author, The University.) 2 dollars. [11]

Field Museum of Natural History. Botanical Series, Vol. 22, No. 7: Additions to our Knowledge of the American and Hawaiian Floras. By Earl Edward Sherriff. (Publication 506.) Pp. 405-442. 20 cents. Geological Series, Vol. 8, No. 8: A New Phororhacoid Bird from the Desado Formation of Patagonia. By Bryan Patterson. (Results of the Marshall Field Paleontological Expeditions to Argentina and Bolivia, 1922-27.) Pp. 49-54. 10 cents. Geological Series, Vol. 8, No. 9: Heteromyids from the Miocene and Lower Oligocene. By Paul O. McGrew. Pp. 55-58. 10 cents. Geology Memoirs, Vol. 2: The Upper Ordovician Fauna of Frobisher Bay, Baffin Land. By Sharat Kumar Roy. Pp. 212. 3.50 dollars. Zoological Series, Vol. 24, No. 24: Records of Large Fresh-Water Mussels. By Fritz Haas. Pp. 259-270. 15 cents. (Chicago: Field Museum of Natural History.) [11]

Sugar-Cane Investigation Committee of Trinidad. Field Experiments on Sugar Cane in Trinidad: Annual Report for 1941. By P. E. Turner, with a Brief Description of the Sugar-Cane Soils of Trinidad, by C. F. Charter. Pp. 196. (Trinidad: Government Printer.) [11]

Southern Rhodesia. Meteorological Report for the Year ended 30th June 1940. Pp. 58. (Salisbury: Government Stationery Office.) [11]

Indian Lac Research Institute. Annual Report for the Financial Year 1940-41. Pp. v + 41. (Namkum: Indian Lac Research Institute.) [11]

Smithsonian Miscellaneous Collections. Vol. 101, No. 5: On Solar-Constant and Atmospheric Temperature Changes. By Henryk Arctowski. (Publication 3641.) Pp. vi + 62. (Washington, D.C.: Smithsonian Institution.) [11]

### Catalogues

Rotameters: British Made Precision Flowmeters for all Gases and Liquids. (RM.120/1.) Pp. 26. (Portsmouth: Rotameter Manufacturing Co., Ltd.)