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The Planning of Research

ALTHOUGH the social reactions of science are now widely realised and the dynamic nature of science is also perceived, the idea that society itself is dynamic and not static has yet to be grasped. Once this fundamental conception has been realised by the general populace, effective attempts can be made to utilise the scientific method and outlook to release our social order from many of the disorders which it has incurred. The attention which is to be paid at the forthcoming British Association meeting in Aberdeen to the relations between the advance of science and the life of the community is definite evidence that the idea is gaining ground, and although speakers at that meeting may feel they are 'preaching to the converted', the consequent focusing of public opinion on the subject cannot be other than helpful.

Among other attempts in recent months to face these issues and to stimulate discussion may be mentioned the further statement on "Liberty and Democratic Leadership" issued early this year over a large number of representative signatures, which referred particularly to housing, the stimulation of consumption and the organisation of distribution, and the survey of scientific research in relation to social needs described by Prof. Julian Huxley in his recent book "Scientific Research and Social Needs". Apart altogether from his valuable account of research activities in progress, Prof. Huxley poses a number of fundamental questions which require attention before we can outline any adequate programme of research in relation to social problems. Something much more than scientific research in the narrow speculative sense is required : we need also the scientific spirit and method in the shape of careful planning.

The map of scientific research which Prof. Huxley attempts to draw is in itself an important preliminary to such planning. It reveals at once the lopsided development of the scientific structure of Great Britain and the lamentable neglect of the sciences dealing with man. The imperative necessity of organising research less from the production side and more from the consumption end towards the needs of the individual citizen also emerges, and these two factors alone throw a flood of light on the real causes of the displacement of labour or technological unemployment.

If science is to fulfil its function in the modern State, we must, in fact, regard it as a social activity

and not as something apart from the rest of human life and interest. Not only is sharp distinction between pure and applied science no longer possible, but also the scientific movement as a whole requires scientific study, and its activities must be planned as much as any other social or industrial activity, if the maximum results are to be obtained and its resources wisely exploited. This planning of science must precede the wider participation of the scientific worker in social activities. Through it must come the assembly and exploration of the scientifically ascertained facts in neglected fields, upon which alone wise action can be based.

It is probably at this point that such organisations as the Royal Society, the British Association, the British Science Guild, the Federation of British Industries, the Association of Scientific Workers might render valuable service. Through their efforts it should be possible to map out the scientific resources of the country, and make authoritative recommendations for the re-orientation of these resources and for the attack on neglected problems of outstanding importance. An important instrument in this respect would obviously be the newly reconstituted Parliamentary Science Committee.

Some of the more conspicuous gaps demanding such a re-distribution of scientific effort from the physical sciences into the biological and related sciences, as urged by Sir Josiah Stamp at the British Association meeting at Leicester last year, may be briefly indicated. In regard to agriculture, for example, even on the production side, many of the scientific results already available could be applied immediately to reduce costs for the farmers and enable more of them to make a reasonable and assured profit instead of living from hand to mouth with failure a persistent menace. On the other side, with very large sections of the population underfed and undernourished, the resources of science should be capable of ending the restriction of output and sabotage. The proper application of existing knowledge could at least double the production of food in Great Britain and raise world production to a level which would provide the population with a sufficiency of the right types of food to ensure full health and growth and energy for all.

Here, as in such questions as adequate housing, town and country planning, the utilisation of scientific results involves economics and politics. Without the large-scale planning of industry, science is liable to cause as many difficulties as it resolves. There is all the more reason therefore for applying scientific methods not only to technology and production but also to the organisation of particular industries and to the economic life of the nation as a whole. Any subject is capable of examination by the scientific method, and consumption is just as much a problem for scientific research as is production.

Even in regard to industry in the more limited sense, there are gaps in the existing structure of research which should be filled by such re-orientation of scientific resources. Taken as a whole, industry appears to be unwilling or unable to provide the broad scientific background of research out of which new applications grow, or to undertake long-range fundamental investigation on a large scale. The standardisation of materials and processes alone offers a field for much more extensive research, which would have important social as well as economic results, and frequently provide traditional methods and standards with a scientific foundation, thus making improvement possible. As craftsmanship thus becomes based on scientific data instead of half-conscious knowledge, technical obstacles to social progress in such fields as building, for example, are more readily removed.

The improvement of processes, the introduction of new processes and products, and the development of new uses for materials are all ways in which in many industries research needs organising and directing in a wider and more effective manner. This involves very often the acquisition of the scientific spirit by the management of industry, and the facing of the whole question of training for management. Next to nothing has yet been done in the scientific study of consumption and distribution. A really scientific investigation of how to stimulate consumption, or into retail distribution, is required to obtain the facts essential for scientific decision as to a policy for action.

The idea of regarding society itself as a proper object for scientific research is new to many, but is quite definitely forced on us by such surveys as that carried out by Prof. Huxley and the situation it reveals. Moreover, the scientific worker can scarcely be in any doubt that a scientific attitude to social questions is better than an unscientific one. There are many problems presented in education, the penal system, public health and industrial welfare, in which a proper supply of scientifically ascertained facts is an indispensable preliminary to wise action. Notably does the study

of population with the view of controlling it offer attractive possibilities.

The merest glimpse of the possibilities of improving the quality of human life in this way which emerges from such a survey should be sufficient incentive to the mobilisation of scientific forces to this end. To fill in the gaps which exist in research by national direction and planning of research is a first step, and may demand, as suggested by Prof. Huxley, the creation of a social advisory committee and research council corresponding to those responsible for planning and financing research in the economic field. Such a council would not only be able to plan out the lines of an adequate campaign of research, but also would assist in obtaining the necessary supply of research workers trained in the social sciences by modifying both the distribution of scholarships awarded in different branches of science and the science curricula in schools and universities.

Action along such lines is essential in the acquisition of scientific knowledge of the possibilities of changing society and solving our social problems if that knowledge is applied. To secure that application and exercise such control over society is another matter. Even in such matters as health there are all kinds of obstacles to be overcome. Poverty, religious prejudices, vested interests, public ignorance and apathy, and sectionalism are all barriers to action based on knowledge and to planning on a national scale. Moreover, the group mind itself is normally much more self-centred and backward than that of the average individual forming the group, and planning on a national scale has in itself at least the possibilities of further friction and obstacles to wider developments through the development of international friction. The exploitation of science for sectional ends, however large, may actually intensify present rivalries and create further chaos before men learn to subordinate their sectionalisms to the claims of the world unit and co-operation on an international scale.

The outstanding progress in every field of human activity and happiness, which is really within our grasp if science were applied in the international scale as thoroughly and efficiently as it is at present within the limits of a single business or a single industry, holds out every inducement to overcome the difficulties which private profit or national sovereignty present. After all, if the form and direction of science itself are largely determined by the social and economic needs of the place and period, even in the international sphere science is influencing the world structure. Here as elsewhere it is making for the breakdown of the system which gave it birth, and demanding the creation and development of a new order in which the needs of mankind can be more effectively served. The conception of science as a social function intimately linked up with human history and human destiny, moulding and being moulded by social forces, should summon forth from scientific workers something of the energy required to translate into policy and action the knowledge acquired by their work. Such energy will find its expression alike in the discharge of their own civic responsibilities and in sharing with their fellow citizens both this vision of the new and greater social possibilities if that knowledge is sincerely and courageously applied, and the faith that human reason by using wisely the scientific method can give us the control of our destiny.

Electroacoustical Reproducers

Loud Speakers: Theory, Performance, Testing and Design. By Dr. N. W. McLachlan. (Oxford Engineering Science Series.) Pp. xii+399. (Oxford: Clarendon Press; London: Oxford University Press, 1934.) 40*s*. net.

A PERUSAL of recently published textbooks on acoustical matters reveals that the major problems associated with the design and operation of reproducing equipment are dismissed with provoking brevity, or politely ignored. It is a source of some wonder that until now this subject of such vital concern to all designers of wireless receivers should have the singular distinction of being overlooked by the vigorous band of technical authors. Yet such is the case with but trivial exceptions. However, in this third and massive volume of the Oxford Engineering Science Series, Dr. McLachlan has dealt with the broad subject of loud speakers in a fresh and thoroughgoing manner. The treatment of the multifarious topics has been as mathematical as the themes allow, and on the theoretical side is strikingly complete. The author has been such a prolific contributor to the knowledge of the subject himself that we have good grounds for expecting the information to be up to date and authoritative.

The widely scattered and recent literature on loud speakers has been drawn together in an excellent way, and the bibliography is particularly well set out, while the reliability of the statements