
One of the things which gives life its fascination is that on the large issues men of great experience and ability can both hold and express radically opposite views. In 1960, the Nobel Prize for Physiology and Medicine was shared by Sir Macfarlane Burnet and Sir Peter Medawar. In the concluding chapter of his autobiography, Burnet expresses the view that conventional laboratory research may be approaching a period of diminishing returns, and says of the genetic code 'No one can discover it again'. He likens science to a tree, and contends that the major branches are already plotted, leaving for the future an arborization of twigs. In his Tizard Lecture of 1965, Medawar took a different view - 'The ballast of factual information, so far from being just about to sink us, is growing daily less. . . . In all sciences we are being progressively relieved of the burden of singular facts, the tyranny of the particular. We need no longer record the fall of every apple.' Such changes are making scientists less rather than more specialized, and they can address themselves, often in concert, to larger problems.

In the same essay, Medawar pleads for 'a critical study of the organization of research', including 'the behavioural and intellectual structure of everything that goes into the enlargement of our knowledge and understanding of nature'. It is in this large context that Sir Harold's book deserves to be studied. It would have been easy for him to confine himself to the formal organization of government support for research, an area in which his experience is unrivalled; but not uncharacteristically he has chosen to put us more deeply in his debt by considering in depth the principles which must underlie such support. After an opening chapter on scientific development and its increasing social significance, he devotes four penetrating chapters to the 'structure of scientific knowledge'. This is followed by four chapters on the evolution of organized research, and the part played in this evolution by the universities, the research councils, the professions and industry. Three further chapters give Sir Harold's views on how these various agencies can be best used to further the future development of scientific research, in the light of his concepts of the structure of scientific knowledge. In a final few pages of masterly epitome, he draws together the main threads, and makes the important distinction between research within each province of natural knowledge (for which a purely scientific policy is feasible), and general policy for the support of scientific activities in a particular country (i.e., national scientific policy, in which the ultimate decisions are necessarily matters for government). For this second type of decision-making, which must be based on political, economic, and administrative, as well as purely scientific, considerations, he recommends 'an advisory body, the membership of which appropriately represents the range of considerations involved'.

In thus indicating the wide scope and general interest of this book, I have done scant justice to the closeness of the reasoning and the quality of the writing. These are perhaps best seen in chapters 2 to 5, where an essentially new view of the nature of the sciences is propounded with the aid of examples from a wide range of scientific activity, not, of course, omitting the biomedical, but far from confined to it. In the antithesis outlined in the opening paragraph of this review, Himsworth clearly stands much closer to Medawar than to Burnet, and indeed he regards the classical image of a 'tree of knowledge' as thoroughly misleading, since it suggests that the more specialized fields of knowledge stem from the more general. Sir Harold sets against this a 'globe of ignorance', into which penetrations are being made from a number of peripheral starting-points on the outer sphere of 'specialized' observations of natural phenomena. Each such penetration constitutes a 'sequence of knowledge', in which it is somewhat artificial to distinguish the 'basic' from the 'applied' and 'developmental', since the implied hierarchy is justified neither historically nor conceptually. Another consequence of this view is that 'Science' is not a unity but a set of separate sciences. This analysis of the relationship between the more and the less specialized domains of scientific activity represents a challenging contribution to the philosophy of science.

We return to the question of how the necessary influence of scientific thinking on government policy can best be achieved. Although scientists are no more (and no less) capable of political activity than other men, their predominant role is likely to remain that of practitioners of their own subject and expert advisers to government. However, it is comforting when giving advice to feel some confidence that it is being understood; and we need more politicians with a liberal education, which nowadays must include an appreciation of what science is about, and

2The Art of the Soluble (p. 114) Methuen, 1967.
its potentiality for the welfare of mankind. A step in this direction is the development in progressive universities of schools of 'liberal studies in science', designed not for professional scientists but for future administrators, politicians and executives.

D. A. K. BLACK


This book gives the results of what is probably the most definitive study so far of noise-induced hearing loss from exposure to steady noise. The survey was sponsored in 1962 for the investigation of occupational hearing loss from the standpoint of possible prescription under the Industrial Injuries Act and, within 18 months, a team from the MRC Wernher Research Unit on Deafness was examining workers in the special mobile audiometric laboratory at the first of the 32 factories to be visited. Up to three return visits were made over the next five years for retests of hearing and, during this time, the participating scientists and assistants numbered almost 40, including those from the National Physical Laboratory responsible for the noise measurements and for analysis of the data in conjunction with the corresponding hearing measurements. A final report of the study was referred to the Industrial Injuries Advisory Council in February 1969 and an appraisal of the report by the Council has been presented to Parliament. The book is the final report, with some minor amendments. It consists of a 50-page description of the study and summary of the results preceding 16 appendices which make up nearly another 200 pages.

Unforeseen difficulties are described, which were encountered in the course of the survey, not the least of which was the very small numbers of noise-exposed subjects found to be suitable for investigation at even the largest factories. Many subjects were unsuitable for reasons of exposure to considerable amounts of gunfire, to previous occupational noise, pathological conditions, and because their present noise exposure appeared to be too variable for accurate specification. Throughout the early stages of the investigation emphasis was given to finding subjects for a prospective study. As this proved virtually impossible, the main results are derived from retrospective and serial studies on nearly 800 subjects who worked in noise levels of 75 to 120 dB(A), and about 100 controls. The mean hearing level measured on the various control groups is shown to be significantly better than ISO standard.

Important findings include confirmation of the equal-energy basis for occupational hearing loss and, contrary to the results of other investigations, the continued increase of age-corrected loss beyond 10 years' exposure. On average, the 4-KHz dip was found in all the noise situations of the survey. The statistical distribution of the loss expected in a population exposed to a given noise is given both graphically and as a formula. Temporary threshold shift measurements were undertaken with a view to estimating susceptibility of the individual to occupational hearing loss, as has been attempted by many previous workers. An uncertainty not mentioned by the authors exists here, however, in that a person's noise susceptibility may well vary from day to day, as does his susceptibility to other adverse environmental effects such as to the pressure changes encountered in deep diving. Low correlations were obtained between indices of susceptibility to temporary and permanent effects and therefore a practical test of noise susceptibility is not proposed as a result of this work.

Industrial medical officers will be greatly interested in this detailed account of the investigation but the book serves to emphasize how much more remains to be done. Now that the long-awaited results are available, consideration is being given to the legal and practical problems arising over possible prescription. For the purposes of the survey, only pure tone tests were employed but, for dealing with individual cases where compensation is involved, experience has shown that it is essential to have available more sophisticated tests including the newer objective tests of hearing. Should the investigation result in the acceptance of occupational hearing loss as a prescribed disease, a necessary preliminary must be adequate training courses and improved prospects for the many levels of audiological personnel required to conduct large-scale assessments.

J. J. KNIGHT


This booklet includes the deliberations and recommendations of a meeting of experts on the safe use of benzene and solvents containing benzene held in 1967. Six of the 11 sections are contributions from Professor R. S. Truhaut of Paris – so the booklet is very largely a compilation by him of the chemistry, uses and toxicology of benzene and its homologues, and a reflection of his views on the substitution of benzene by 'less toxic' products. A second large contribution is made by the staff of ILO, and this is a detailed summary of national legislations and a bibliography of Soviet literature on the subject, which may be consulted by those interested. Naturally, where the experts are drawn from several nationalities, the precision of the meaning and terminology falters: benzene poisoning, benzolism, chronic in reference to biological effects, exposures, poisoning and toxicity are used too loosely. Notwithstanding these minor drawbacks, recommendations that the concentrations of benzene in solvents should not exceed 1 % and that the concentrations of the vapour of benzene in respired air should never exceed 25 ppm, 80 mg/m³, were agreed, and are important.

For the industrial medical officer concerned with occupational health and hygiene of benzene, its homologues and solvents containing them, this booklet is a very valuable source of information. The sections on the chemistry and uses provide a useful summary of known facts. Another section from a Professor Albahary (whose name is omitted from the list of participants) offers a
The Development and Organization of Scientific Knowledge

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doi: 10.1136/oem.27.4.385

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