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

Hearing and Noise in Industry. By W. Burns and D. W. Robinson. (Pp. 241; illustrated; 35s.) London: H.M.S.O. 1970.

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

Benzene: Uses, Toxic Effects, Substitutes. Meeting of Experts on the Safe Use of Benzene and Solvents Containing Benzene. Geneva, 16-22 May 1967. Occupational Safety and Health Series. (Pp. 294; available free of charge from International Labour Office, Geneva.) Geneva: International Labour Office. 1968.

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

detailed commentary on the medical supervision of workers. Medical supervision remains essential for it is never certain that benzene is absent from its homologues and aromatic solvents and the homologues, which are suggested as substitutes for benzene, are not in themselves entirely without local and systemic toxicity and cytotoxicity. The form of the medical examination is discussed in full, the examination of the peripheral blood for cellular constituents being considered optimal if made at three-monthly intervals. Further indications of occupational exposures and their intensities are commented on in respect of (1) the concentrations of benzene and homologues in solvent liquids and gasolines, in the air of the workplace, in the blood and the expired air; (2) the concentrations of phenol and sulphates in the urine; and (3) the activities of certain enzymes in whole blood.

An arresting statement is that in the supervision of human exposures, the concentrations of benzene in whole blood should not be allowed to exceed $40 \mu\text{g}/100\text{ml}$ during the working week and $5 \mu\text{g}/100 \text{ ml}$ after the weekend, or a 48-hour break. Whether workers would agree with twice-weekly venesections is problematical. Individual and collective measures of protection as well as individual risks and susceptibilities are commented on as well.

C. G. HUNTER

An Introduction to Experimental Aerobiology. Edited by Robert L. Dimmick, Ann B. Akers, and three associate editors. (Pp. xvii + 494; illustrated: 225s. Chichester: John Wiley (Environmental Sciences and Technology series). 1970.

The dedication to William Firth Wells and David W. Henderson (unfortunately misprinted 'Hendersen') epitomizes both the pioneer nature of this book and the wide ranging treatment of the subject. It is a fitting tribute to their respective contributions to this rapidly growing branch of biology, which, whilst still somewhat of an art, as the editors so rightly point out, is now assuming its proper position in the field of disease transmission.

The text is divided into three sections. Part I consists of six chapters dealing with aerosol mechanics and generation, the measurement and significance of relative humidity, methods of aerosol sampling, and the effects upon bio-aerosols of air-ions and chemical pollutants. One feels that the use of animals as sampling devices really merits a separate chapter rather than inclusion in Chapter IV, but this does not detract from the solid and scientific foundation that these six chapters provide for the support of the remainder of the edifice.

Part II, consisting of four chapters, is principally devoted to methodology, the first three chapters being concerned with the physics and operation of stirred aerosol chambers, the rotating drum and dynamic aerosol chambers respectively. The fourth chapter (Chapter X), which is twice as long as the runner-up, ranges over virtually the entire field of microbiological laboratory safety with considerable thoroughness, stressing the importance of accidentally produced aerosols.

Part III is entitled Analysis of Concepts and Results, and consists of nine chapters dealing with survival of organisms in the air-borne state, fungal aerosols, immuniz-

ation by aerosols, human respiratory infection, hospital cross-infection, and dental and veterinary aerosols.

This volume would be remarkable, if only for the enormous amount of useful information that 21 authors have gathered together and compressed into it, but the result is well balanced and coherent. Illustrations are numerous and good, the bibliography profuse, and there is a useful glossary before the index. There is a crop of minor proof-reading errors, but otherwise production is excellent. This book is a 'must' for all involved in the study of the aerial transmission of micro-organisms. It is unfortunate that the cost is somewhat unattractive to the individual student.

H. M. DARLOW

Digest of Pneumoconiosis Statistics 1968. (Pp. 17; 11 tables; 5s. 6d.) London: H.M.S.O. 1970.

This annual report always makes interesting reading for anyone concerned with pneumoconiosis, as it provides a comprehensive review of the prevalence of diagnosed pneumoconiosis in different industries over the previous five years.

In the coal mining industry the number of boardings of men still employed in collieries in which pneumoconiosis was first diagnosed has dropped from 9 149 in 1963 to 539 in 1968. A more sensitive measure of the prevalence of coalworkers' pneumoconiosis is given by figures relating to 419 collieries from the National Coal Board Medical Service Periodic X-ray Scheme. All categories of pneumoconiosis are shown, including category 1, which is not recognized legally. The overall prevalence of coalworkers' pneumoconiosis has dropped from 11.8% between 1959 and 1963, to 10.6% between 1964 and 1968, and although many of the collieries show little or no change in this prevalence rate between these two periods, several show a marked reduction.

Boardings at which pneumoconiosis was first diagnosed are now 2.4 per thousand employed. In five National Coal Board areas out of the total of 17, there are no disablement assessments above 40% and the great majority of such assessments in all areas are below 40%.

In industries other than coal mining, there has been a gratifying fall in the number of boardings, except in slate mining and quarrying, steel foundry work, and work with asbestos where the figure for 1968 is still relatively high, although less than in 1967.

The majority of the disablement assessments made in all forms of pneumoconiosis were less than 30%, with relatively few seriously disabled men. Pneumoconiosis is now predominantly a disease of middle age and the elderly. Deaths from all forms of pneumoconiosis show a steady fall from a total of 1 287 in 1963 to 809 in 1968, although the latter figure is provisional. Under the National Insurance Injuries Acts and the Pneumoconiosis, Byssinosis and Miscellaneous Diseases Benefit Scheme, disablement benefits for pneumoconiosis are now being given to 49 892 men but this again is a steadily declining number.

About 16% of coal miners whose lung radiographs were scrutinized in 1968 were referred for boarding, and pneumoconiosis was diagnosed in 25% of these. For all forms of pneumoconiosis from other industries 42% of scrutinies led to a boarding, and of these the disease was