Cadmium in the Human Environment: Toxicity and Carcinogenicity. GF NORDBERG, RFM HERBER, L ALESSIO, eds. (Pp 469; price £60). 1992. Lyon, France. Distributed by Oxford University Press. ISBN 92-832-2118-4

This substantial volume records the proceedings of a three-day symposium on the toxicity and carcinogenicity of cadmium, with contributions from an international group of experts, held in September 1991, in Gargnano, Italy, organised by the International Agency for Research on Cancer (IARC) of the World Health Organisation. Presentations were given on analytical procedures, adequacy of quality control, and reference values for cadmium in blood and urine. A session on ecotoxicology considered the distribution of cadmium in the environment, uptake by crops, accumulation in animal tissues, and enrichment of soil and water from anthropogenic sources. Studies were reported in Belgium that show subclinical changes in renal tubular function in the general population above a threshold of urinary cadmium as low as 2 µg/24h. A panel discussion on human exposure and ecotoxicity considered how best to estimate exposure and critically interpret the findings, taking into consideration the issue of acceptable risk.

A series of papers considered metabolism and toxicology of cadmium from factors affecting intestinal uptake from the diet, pulmonary deposition and clearance after inhalation, and placental uptake to the induction of metallothionein and its role in both preventing and mediating tissue damage. The role of cadmium in calcium metabolism was considered in relation to the greater predisposition to osteoporosis in postmenopausal women who smoke.

The principal issues considered, however, were those of renal damage and the experimental and epidemiological evidence for carcinogenicity. Contributions on renal effects were provided from the Cadmibel study in Belgium and from population based and occupationally exposed groups in Japan. A panel discussion on renal effects of cadmium exposure considered the significance of changes in renal function in non-occupationally exposed subjects to comparatively low environmental cadmium levels. It was queried whether the health significance of increased excretion of low molecular weight proteins is well enough understood to permit their use for decision making in risk management.

Although renal tubular dysfunction has been regarded as the critical effect after long term human exposure, the increasing evidence for the carcinogenicity of cadmium raises the issue of a stochastic dose response model for cancer risk. Experimental evidence was presented on genotoxicity, with evidence for the cadmium-metallothionein complex causing strand breaks and the cadmium ion inhibiting DNA repair, with

conflicting evidence in cytogenetic studies on occupationally and environmentally exposed groups.

In experimental studies subcutaneous cadmium exposure in rats has been shown to increase the incidence of prostatic tumours but only at doses below the threshold for cadmium induction of testicular dysfunction, or if testicular dysfunction was prevented by pretreatment with zinc. The same investigators also showed a paradoxical effect of cadmium on haemopoietic tumours. Aerosols of cadmium oxide, sulphate, and less clearly cadmium sulphide induce a dose response increase in lung cancer in rats but not in hamsters, with an equivocal response in mice. The significance of these experimental findings to human cancer and the validity and limitation of animal experimental studies in assessing lung carcinogenicity was considered.

Two epidemiological studies of cancer in workers exposed to cadmium were presented, both showed an increased mortality from lung cancer with evidence of a dose response relation. A significant dose response relation between cumulative cadmium exposure and lung cancer risk was shown in one, but the other major study, which also provided evidence of a dose response relation, was unable to attribute the lung cancer excess to cadmium owing to the presence of multiple confounding factors. Methodological aspects of the epidemiological association between cadmium and human cancer were considered, where it was concluded that any future study should incorporate data that make it possible to control for the most important confounders, including smoking, diet, and air pollution. A panel discussion considered relevant issues including the problems involved in the extrapolation of data from long term animal studies to humans and the need for further studies on the effects of environmental cadmium exposure.

The symposium concluded with a talk by Sir Richard Doll, in which he critically examined the shortcomings of the current studies. He pointed out the consistently negative epidemiological observations on prostatic cancer over the last ten years, and questioned whether exposure to amounts smaller than those liable to cause nephrotoxicity pose any risk of lung cancer. He concluded that a lung cancer risk after inhalation can at present neither be excluded nor confirmed.

Eighteen months after this symposium, the IARC classified cadmium as a category one human carcinogen, by a majority but not unanimous decision. The enigma of both nephrotoxic and carcinogenic effects of cadmium remains. The proceedings of this symposium provide valuable material and should be studied by all concerned with the health effects of cadmium in our environment.

The proceedings should also be of inter-

est to postgraduate students in the field of environmental and occupational health. The references provided by each contributor are relevant and up to date, and although expensive, the volume can be considered good value for money.

G KAZANTZIS

Electromagnetic Fields (300 Hz to 300 GHz) Environmental Health Criteria, No: 137. (Pp 282 (English with summaries in French and Spanish); price Swiss Francs 34, US\$30-60). 1993. Geneva: World Health Organisation. ISBN 92 4 157 137 3.

The possible health hazards of electromagnetic fields are suddenly in British courts and newsworthy. This timely monograph aims to inform both national discussions on protective measures and those having to prepare statements on the impact of new facilities on environmental health. Prepared by a diverse international panel of experts the arcane title illustrates the gap that exists between the few who are competent in this difficult area, and the many who are beginners. The 300 Hz-300 GHz range is that part of the spectrum stretching up from the lower end of voice frequency through to industrial induction welders and the radio and TV frequencies to portable phones, microwave ovens, and radar, stopping short of infra red. Power transmission frequencies are therefore excluded.

The scientific chapters are authoritative and accessible, with 500 references up to the middle of 1990. Topics include physics, sources of exposure, measurement techniques, dosimetry, and the elements of a protective measures programme. Of particular interest is discussion of the interaction of fields with organisms and the established and putative effects on animals (by physiological system), and on humans. The bottom line is that the health hazard is related to heating, and that radio frequency fields have not been found to be mutagenic and are therefore unlikely to act as initiators of carcinogenesis. A 12 page glossary is helpful; the two sides of recommendations for further studies are very broad reflecting the difficulty of defining what key mechanistic studies should be pursued. Attention is drawn to the need for a good case control study, which cannot be undertaken until methods for making meaningful personal exposure measurements are developed.

This is a useful book, it has few competitors (the previous edition was in 1981), and is good value for money. The volume of new data may soon blunt the edge of the conclusions but the basics are there and likely to be of continued use to students of any age.

A BULMAN