

The conference "Trace Elements in Human Health and Disease," held in Stockholm on 25–29 May 1992, was organized as the third international conference of the International Society on Trace Elements Research in Humans (ISTERH). Part of the program was organized jointly with the Scientific Committee on the Toxicology of Metals of the International Commission of Occupational Health (ICOH), namely, the three symposia that form the basis for the present volume: (i) Biological Monitoring of Trace Elements – Reference Values in Environmental and Occupational Health, (ii) Carcinogenicity of Trace Elements, and (iii) Risk Assessment for Essential Elements – Contrasting Essentiality and Toxicity.

The symposia were sponsored by the International Agency for Research on Cancer (IARC), Lyon, France, and by the International Life Sciences Institute (ILSI), Washington, DC, the United States. They also received considerable encouragement and support from the Swedish Work Environment Fund, Stockholm, Sweden, and a meeting of the Editorial Committee was held at the office of the Fund in Stockholm on 5–6 February 1993, when the final manuscript was reviewed and approved by the Committee for publication.

The topics of the present volume, the biological monitoring, carcinogenesis, and risk assessment of trace elements, are of great current interest in the field of metal toxicology. The results of previous conferences organized by the Scientific Committee on the Toxicology of Metals (SCTM) served as the basis for the contributions and discussions at the present symposia. The biological monitoring of toxic metals was the topic of an SCTM conference in Rochester,¹ and the present symposium on this topic made an important contribution, particularly to the field of reference values for metals (typical values for defined populations), identified during the Rochester conference as a weak link in the chain when available data are applied to practical monitoring pro-

grams. There were also important contributions that provided new information on several important elements and emphasized the progress made in the field of *in vivo* measurements in humans. Information was also updated in the symposium on carcinogenicity, in which an account was given of recent evaluations by IARC² in this field, previously the subject of a major workshop conference organized by SCTM in Atlanta, Georgia, in the United States.³ The need to consider mechanisms of carcinogenesis for each metal in the evaluation and assessment of cancer risks was underlined. Additional data and evaluations on carcinogenicity, including possible molecular mechanisms for elements such as chromium and nickel, and for fluoride, were presented and the problems of evaluating human exposures to complex mixtures were emphasized. Results of the recent SCTM/IARC symposium Cadmium in the Human Environment: Toxicity and Carcinogenicity, held at Gargnano, Italy,⁴ were reported and included in the overall discussion.

The basic principles for assessing risk related to the toxicity of metals and their compounds were defined at the SCTM meeting in Tokyo,⁵ and these principles were further developed in discussions on the interaction between the toxicity and essentiality of metals during an SCTM workshop meeting in Stockholm on factors influencing the metabolism and toxicity of metals.⁶ The symposium reported in the present volume, "Risk Assessment of Essential Elements — Contrasting Essentiality and Toxicity," was based to a large extent on the considerations presented at a conference organized jointly by ILSI and the US Environmental Protection Agency and held in Herndon, Virginia.⁷ The proceedings of that conference are being published; the reports in the present publication relating to the Herndon meeting are therefore presented only as extended abstracts. The new concepts developed during the Herndon conference were presented at the present symposium, and they provided a basis for discussion in relation to previ-

¹ Clarkson T, Friberg L, Nordberg GF, Sager P. Biological monitoring of toxic metals. New York, NY: Plenum Press, 1988:686 p.

² Further evaluations of beryllium, mercury and cadmium made by IARC in February 1993. To be published in the IARC monograph series, volume 58 (in press).

³ Belman S, Nordberg G, ed. Workshop conference on the role of metals in carcinogenesis. *Environ Health Perspect* 1981;40:3–42.

⁴ Nordberg GF, Alessio L, Herber RFM, ed. Cadmium in the human environment: toxicity and carcinogenicity, Lyon: International Agency for Research on Cancer, 1992. (IARC scientific publications; no 118.)

⁵ Nordberg GF, ed. Effects and dose-response relationships of toxic metals. Elsevier Scientific Publishing Company, 1976.

⁶ Nordberg GF, ed. Factors influencing metabolism and toxicity of metals: report of an international meeting. *Environ Health Perspect* 1978;25:3–41.

⁷ Olin S, ed. Risk assessment of essential elements: proceedings of a conference on risk assessment of essential trace elements, Herndon Virginia, 1992. To be published by ILSI.

ously developed risk-assessment concepts used for the toxicity of metals in earlier SCTM evaluations. It was agreed that additional consideration would be useful both in terms of further discussion and the development of useful concepts and principles for evaluations allowing an adequate balance between considerations of essentiality and toxicity and also in terms of making adequate allowance for safety and uncertainty factors. It was obvious that not only better data on toxicity and essentiality are needed, but also that a formal mechanism for coordinating the toxicologic and nutritional aspects of such data is lacking. Such a mechanism should be established by an appropriate international organization.

The present volume represents a considerable effort on the part of the individual authors, and the Editorial Committee wishes to express its appreciation to all the authors concerned for their collaboration. For the technical work involved in the administration and typing, the editors and the Editorial Committee is indebted to Ms M Lundgren and Ms B Edstedt. Mr J Jackson served as language editor of this volume. Technical and economic support was provided by the Swedish Work Environment Fund, IARC, ILSI, and Boliden Mineral AB. Conversion factors for metal concentrations in micromoles and micrograms are given in the appendix at the end of this volume (p 140).

Editorial Committee