ANIL AGGRAWAL'S
Internet Journal of
Forensic Medicine and Toxicology
The world's first online journal devoted entirely to forensic medicine and toxicology · Published 1 January and 1 July

VOL. 3, NO. 2
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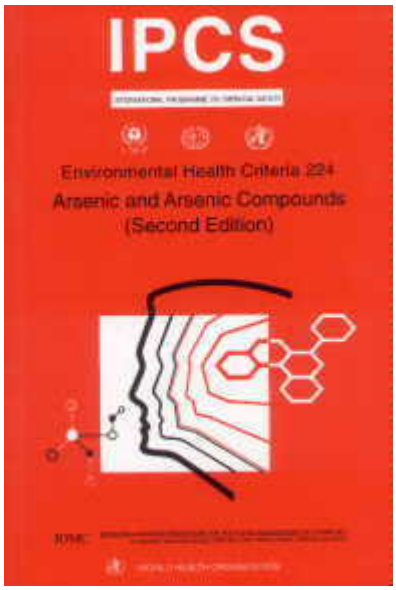
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ARSENIC AND ARSENIC COMPOUNDS

Arsenic and Arsenic Compounds, 2nd Edition, (Environmental Health Criteria 224), International Programme on Chemical Safety
World Health Organization, Avenue Appia 20, 1211 Geneva 27, Switzerland, Publication Date 2001, xxviii + 521 pages, ISBN 92 4 157224 8, ISSN 0250-863X, NLM Classification: QV 294: Price Sw.fr. 108.00; in developing countries: Sw.fr. 75.60

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The book under review is one of a series of monographs brought out by the WHO regularly since 1976 when the first volume on mercury was released. The decision to publish such monographs was taken in 1973 after the WHO Environmental Health Criteria (EHC) Programme was initiated. Sponsorship is jointly undertaken by the United Nations Environment Programme (UNEP), the International Labour Organization (ILO), and the World Health Organization (WHO). Together, these three Organizations have evolved the International Programme on Chemical Safety (IPCS), the primary objective of which is the assessment of risks to human health and environment from exposure to chemical so that steps can be taken to minimize the hazards.

Since its inception, the EHC Programme has been responsible for the publication of exhaustive monographs on more than 200 toxic chemicals, each of which goes through a rigorous process of selection, research, and preparation. Selection of chemicals is based on several criteria, including the existence of scientific evidence to suggest that the substance poses a hazard to human health or environment, and that it is associated with significant human or environmental exposure. A priority list of chemicals is thus prepared which is dealt with one by one, by experts in the field. In this way, over a period of time, excellent monographs have been released on diverse chemicals which provide invaluable information on the sources, properties, environmental distribution, human exposure, kinetics and metabolism in laboratory animals and humans, evaluation of health risks, and analytical procedures relating to these substances. The EHC monographs, as they are popularly called have thus become widely established, consulted, and recognized throughout the world.

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The book under review is no exception and is as immaculate in every respect as all the others. In fact, this is the second edition on arsenic and arsenic compounds, and represents the concerted efforts of a team of experts including J. Ng, A. Gomez-Caminero, P. Howe, M. Hughes, E. Kenyon, D.R Lewis, M. Moore, A. Aitio, and G. Becking. The task group however comprises 27 experts overall, and it is a sad commentary on the state of Toxicology in India that in the entire list, only one Indian name finds mention. This is in spite of the well known fact that arsenic poisoning is rampant in certain parts of the country, assuming virtually epidemic proportions, especially West Bengal.

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Arsenic is perhaps the most important of all the heavy metals (barring lead) from a toxicological perspective. Part of this importance stems from its ubiquitous occurrence in the environment. Arsenic is actually a metalloid, i.e., a substance which possesses some of the properties of a metal, and is widely distributed in the earth's crust, as well as in trace quantities in rock, soil, water and air. Higher concentrations are found in certain areas due to various reasons. While arsenic concentrations of ground water usually fall within the range of 1-10 mg/ litre, much higher levels (up to 1000 to 5000 mg/litre) can occur in some regions, e.g., Taiwan, Chile, Bangladesh, and parts of Mexico, Argentina and India (West Bengal). When such water is used for drinking purposes, arsenic poisoning results.

Environmental contamination with arsenic mainly results from mining and smelting operations, as well as from the use of fossil fuel, arsenical pesticides, and wood preservatives. Exposure of humans to arsenic is of course well known to cause serious health problems, both acute and chronic. Acute toxicity can cause gastroenteritis, cardiovascular and nervous system disorders, and death. Long-term exposure is causally related to multi-organ damage, dermal changes, and carcinogensis.

In view of the foregoing, it would be abundantly clear that a monograph dealing exclusively and exhaustively with arsenic as an environmental contaminant would be most welcome to toxicologists and health professionals, especially if it pertains to its toxicity. The book under review fits the bill perfectly. Any attempt at bettering the effort of Dr. J Ng and his distinguished team would be like gilding the lily! The book which is admirably compact for the amount of information that is packed into it, begins with a preamble that introduces the reader to the origins of the WHO Environmental Health Criteria Programme and its objectives. This is followed by a summary that sums up the salient information contained in the book, which serves as a very useful overview.

The main part of the book deals at great length with the chemical and physical properties of arsenic, occurrence and sources, distribution in the environment, patterns of human exposure, kinetics and metabolism (in laboratory animals as well as humans), health effects, and finally, analytical procedures to detect the poison in various kinds of samples. The book concludes with some useful recommendations for future research, and rounds off very admirably with nearly a hundred pages of recent authentic references listed alphabetically. There are even summaries in French and Spanish at the very end which this reviewer cannot really evaluate, but must undoubtedly be as flawless as the rest of the monograph!

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The parts of the manuscript of particular interest to this reviewer include the discussions on the toxicity of arsenic and the methods of analysis. The results of short and long-term exposure on laboratory animals and in-vitro systems are particularly revealing (and alarming). Throughout the text, inorganic and organic arsenicals are dealt with separately, which is most appropriate since these two groups differ from each other in so many respects. Regarding the effects of arsenic on

humans, it is fitting that sufficient emphasis has been laid on the exposure arising from drinking contaminated ground water, which is what led to the West Bengal epidemic of arsenic poisoning. Apart from causation of hypertension and cardiovascular disease, conclusive evidence implicates arsenic in the genesis of various cancers. It is a sad truth that precious little is being done in India and several other developing countries even today to prevent or control the deleterious consequences of arsenic exposure.

Regarding analytical procedures for arsenic, the authors have delved into in all the methods that have been evolved beginning with the mostly antiquated colorimetric and gravimetric methods to the more recent techniques utilizing atomic absorption spectrometry, inductively coupled plasma-mass spectrometry, anodic stripping voltammetry, particle-induced x-ray emission spectrometry and radiochemical methods. Detailed descriptions of these methods have been dispensed with, and instead emphasis has been placed on recent trends and developments. Readers interested in more details about any particular method are encouraged to consult the relevant references and peruse original works or specialized texts.

In conclusion, this monograph can be justifiably accorded the status of an authentic and most reliable reference source on the environmental toxicity of arsenic and should find a place in every library stocking toxicology texts, as well as medical institutions, hospitals and laboratories. A minor flaw, if one could call it that, is a relative lack of illustrations and photographs to complement the text. Also, addition of some basic information on the management of arsenic toxicity in animals and humans would make the book more complete. Converting the present paperback structure to a hardcover version can serve to enhance durability and may be considered as an option for future editions (without compromising too much on economy)



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Dr.V.V.Pillay has been in the vanguard of the movement among medical professionals in India to develop the neglected field of Toxicology. He has published extensively in both the scientific and lay press on matters relating to Toxicology, as well as his chosen discipline - Forensic Medicine. Dr.Pillay has authored 6 books on Forensic Medicine and Toxicology, and has received an award for one of them (Modern Medical Toxicology), generally considered to be a trend setter among books on the subject in India. He has reviewed several books on Toxicology for the Internet Journal of Forensic Medicine and Toxicology. Dr.Pillay received a scroll of honour in appreciation of work done in the field of Toxicology from the Medicolegal Society, All India Institute of Medical Sciences, New Delhi. He has established a state-of-the-art Poison Control Centre, recognized by the World Health Organization at the institute where he is currently employed (AIMS, Cochin). Among his most sought-after publications is a 700 page reference work on Toxicology.

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