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Preface

In occupational and environmental medicine biological monitoring (BM) means the determination of chemicals or their metabolites in human biological material. The overall aim is to determine the internal dose and the resulting biochemical or biological effect of a chemical, which was taken up by humans from the environment. Therefore, BM is an essential tool in risk assessment, since it can be used to verify that an absorbed dose of a chemical does not entail an unacceptable health risk on an individual basis. In contrast to ambient monitoring, BM is a great step forward in occupational and environmental medicine, since ambient monitoring can only show the presence of a chemical in air, water or food. Therefore, BM is an integral part to protect workers' health and is recommended by law in the countries of the European Union to assess exposure to chemicals at the workplace.

BM is closely tied together to analytical chemistry and biochemistry. Sensitive, reliable, and robust analytical procedures are prerequisites for BM. Especially, the progress in the development of new analytical instruments and advanced clean-up methods for complex biological matrices such as blood and urine is of importance. It did not happen by chance that BM has its roots in the determination of metals in human body fluids by atomic absorption spectrometry (AAS) back in the 60's, e.g., the determination of lead in blood samples of the general population. Not least thanks to biomonitoring, the use of lead additives in gasoline has been identified as a major source of lead uptake. Overall the studies resulted in a ban of lead in gasoline and consequently in a decrease of lead levels in blood over the last decades. A major step forward in BM was also the use of gas chromatography (GC) and high pressure liquid chromatography (HPLC). GC and HPLC are predominantly used to assess the internal dose to organic solvents and their metabolites. Moreover, in combination with mass spectrometry (MS) it is possible to accurately identify and quantify chemicals in human body fluids in the range of ppb and ppt. Examples are persistent organic pollutants such as chlorinated dibenzodioxins and dibenzofurans and polychlorinated biphenyls. Mass spectrometry devices (e.g., ICP-MS), however, can also be used for BM of particular metals (platinum, uranium), which still cannot be accurately quantified by AAS. In addition, our dream of analyzing high-molecular and polar organic chemicals became true by the invention and use of LC/MS^n.

Using modern analytical instruments such as GC/MS^n or $HPLC/MS^n$ it is not only possible to measure the internal dose (exposure monitoring) but also the biological effective dose (biochemical effect monitoring), e.g., macromolecular adducts of chemicals or their metabolites. Today we succeed to analyze the reaction products of carcinogenic substances with proteins like haemoglobin. We consider these adduct surrogates for the chemically changed DNA. On the other side, DNA adduct analysis is still in its infancy. To determine DNA adducts as biomarkers of effect is one of the main goals in BM, because the chemically changed DNA represents the initial step of chemically-induced cancer.

It is important to mention, that the quality of analytical methods in BM is checked by internal and external quality assurance. Both, internal and external quality assurance programs, are an integral part to assess the precision and accuracy of biomonitoring methods. Regarding quality assurance, BM makes the running for ambient monitoring, where certified

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standard quality control material usually does not exist.

This Special Edition comprises information on three topics: (i) exposure monitoring, (ii) biochemical effect monitoring, and (iii) quality assurance in BM. Although the Special Edition presents some reports on metal analysis and speciation (uranium and arsenic), the main focus is on chromatographic techniques. Beside many well-known ''old-fashioned'' methodologies (e.g., GC/FID and HPLC/UV) various important and new analytical techniques (e.g., GC/MS^n and $HPLC/MS^n$) are also described. The overall aim is also to present an overview on BM of the most important substances of concern in occupational and environmental medicine (e.g., organic solvents, alkylating substances, persistent and contemporary pesticides, amino- and nitro-aromatic compounds, and polyaromatic hydrocarbons). Hopefully, the results presented here will allow the reader to get a broad overview on BM and encourages him/her to use the literature sections for on-going studies.

We do owe a great debt to a diverse collection of scientists, who contributed to this Special Edition of Journal of Chromatography B. Without their help and research activities in BM it would not have been possible to prepare such an anthology. Additional thanks are due to the referees of the submitted articles, and to Elsevier Science and the editors of J. Chrom B, who invited us to be Guest Editors for this Special Edition.

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