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Role of Biological Monitoring in Nano-Safety

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Abstract: The ability to predict and then mitigate potential health effects is mandatory for sustainability of nanotechnology. Although screening strategies to expedite hazard and risk assessment (RA) of engineered nanomaterials (ENM) proceed, the complex and multi-faceted nature of events occurring at the nano-bio interfaces at the organism level means that currently the full replacement of in vivo assessment is not possible. Since the chemical and biological identities of ENM are subject to changes in environmental settings from emission sources to site of accumulation and effect within the body, a case-by-case approach to assess their hazard potential using simplified models to predict complex outcomes is required. It is therefore foreseeable that the knowledge-based body of experimental data can take advantage from a complementary approach relying on biomarkers of exposure to detect relevant effects in target organs at early and reversible stages and to identify subgroups at risk. Though the issue of (nano)specificity of biomarkers is challenging, yet evidence resulting from experimental and epidemiological studies with conventional particles suggests similar paradigms for particle/nanoparticle hazard. Validation of biomarkers in human studies will allow to overcome uncertainties due to the use of simplified models, lack of quantitative data, and provide RA with relevant information.

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