Evolving toxicology

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Toxicology as a science has not evolved to keep pace with the chemical revolution, according to Thomas Hartung writing in the International Journal of Risk Assessment and Management, Hartung highlights ten problems that must be addressed if toxicology is to be made fit for purpose in the 21st Century.

Until the industrial revolution almost the complete gamut of poisons and toxins lay in the natural realm. Lethal alkaloids from toxic plants, arsenic-containing rocks, noxious fumes from fires and plenty of other sources of risk. It wasn't until the Industrial Revolution and the maturation of alchemy to chemistry, that synthetic chemicals became an issue. In the 19th and 20th century, chemists identified literally tens of millions more chemicals in nature and in their laboratories and turned what was essentially a world of arsenic and old lace into the vast chemical space of toxicity we know, but cannot comprehend fully today.

According to Hartung of the Center for Alternatives to Animal Testing at Johns Hopkins Bloomberg School of *Public Health*, in Baltimore, Maryland, USA and also of the University of Konstanz, Germany, there are ten main issues to be addressed in modernising toxicology:

The disparity of testing requirements and risk acceptance for different products and geographical areas, throughput and costs of testing versus testing needs, limited predictivity for humans, precautionary approaches from drug development adapted to other areas, animal use, new products not suitable for traditional tests, new hazards not covered, mixtures of toxicants not addressed, individual susceptibilities and vulnerable

subpopulations not covered, and poor basic research and publication standards.

Hartung concedes that it is relatively easy to criticise and yet the issues seem obvious in his analysis and that change is needed. He suggests that given the intransigence in the world of international toxicological policies and methods this overarching issue must be overcome first before these ten issues can be addressed. "While current approaches are still needed, there is room for substantial change," he says. "To meet the challenges of the 21st century, revolution rather than evolution is required."

More information: Thomas Hartung. Evolution of toxicological science: the need for change, *International Journal of Risk Assessment and Management* (2017). DOI: 10.1504/IJRAM.2017.082570

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