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Towards a sustainable chemical future

Edwin John Routledge

Brunel University London, UK

Abstract

Since the start of the industrial revolution, society has become increasingly reliant on the use of chemicals, including pesticides, pharmaceuticals, plasticizers and personal care products, to name a few. In 2016, European chemical sales alone were valued at 507 billion Euros, with 80,000 chemicals reported to be in common use worldwide. Alongside the many benefits of chemicals to society, concerns about the impacts of certain chemicals to both human and wildlife health, including the so-called???Endocrine disrupting chemicals??? Is a topic of increasing concern? Since the term???Endocrine disruptor??? Was coined in 1991, extensive research into the effects of various chemicals, and chemical mixtures, on human and wildlife health has been conducted globally. More than 1,300 studies have suggested connections between endocrinedisrupting chemical (EDC) exposure and serious health conditions such as infertility, diabetes, obesity, hormone-related cancers and neurological disorders in humans. The range of endocrine targets captured by regulatory tests is expanding rapidly, and new mechanistic insights, such as epigenetic mechanisms of chemicalinduced disease, continue to challenge the regulatory frameworks designed to protect society and the environment. Difficulties still exist in balancing the trade-offs between the benefits of chemicals to society at point of use with the burden of proof needed to demonstrate the adverse consequences of the same chemicals once they are allowed to disperse in the environment. When dealing with such complexity, is it possible to achieve a vision of a sustainable society where chemicals are managed carefully throughout their lifecycle and where people benefit from their use and thrive within nature???S limits? What strategies and insights can sustainability science offer to help society balance the Toxic -Eco system? Recent Publications 1. Kaur S, Jobling S, Jones CS, Noble LR, Routledge EJ, Lockyer AE (2015) The Nuclear Receptors of Biomphalaria globate and Lottie gigantean: Implications for Developing New Model Organisms. PLOS One 10(4): UNSP e0121259. 2. Bannister R, Beresford N, Granger DW, Pounds NA, Rand-Weaver M, White R, Jobling S, Routledge EJ (2013) No substantial changes in estragon receptor and estragon-related receptor orthologue gene transcription in Marisa cornuarietis exposed to estrogenic chemicals. Aquatic Toxicology 140: 19-26. 3. Routledge EJ, White R, Parker MG, Somper JP (2000) Differential Effects of xenoestrogens on coactivator recruitment by estragon receptor (ER) alpha and ER beta. Journal of Biological Chemistry 275(46): 35986-35993. 4. Routledge EJ, Parker J, Odom J, Ashby J, Somper JP (1998) some alkyl hydroxyl benzoate preservatives (parabens) are estrogenic. Toxicology and Applied Pharmacology 153(1): 12-19. 5. Routledge EJ & Somper JP (1996) Estrogenic activity of surfactants and some of their degradation products assessed using a recombinant yeast screen. Environmental Toxicology and Chemistry 15(3): 241-248. Synthetic (manufactured) chemicals are a part of everyday life – they are everywhere and in everything. They can enter the environment through consumer use or industrial processes. Once in the Environment, some end up in our bodies, in wild flora and fauna, or in the atmosphere, potentially driving climate change. Chemicals production and consumption is set to double by 2030, from a $5 trillion industry globally in 2017, with production set to increase, mainly in emerging economies. If chemicals production is doubled, chemical pollution must not double as a consequence – rather we should aim to significantly reduce it from current levels. Current international attempts at the massive undertaking of addressing chemical pollution are not working. For the world to solve the major environmental and health challenges we face, there must be a sustainable chemicals revolution. We can only achieve this through senior-level engagement with the chemical sciences community through an authoritative, intergovernmental sciencepolicy interface. Early in 2020, we engaged with scientists in our community to develop our vision for a chemicals strategy, relevant to any nation in principle. We identified four pillars on which any chemicals strategy has to be based: education, innovation, circular economy and regulation. National governments must invest in these areas and create a responsible framework of action for chemicals management.

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