Evolutionary, multigenerational and epigenetic effects of pollutants: providing scientific support to long-term ERA

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Natural organisms, populations and species are currently facing a severe acceleration of environmental change. Human activities, among which the continuous release of potentially toxic substances into the environment, contribute significantly to this phenomenon. There is growing evidence that environmental change has consequences that can extend beyond exposed generations and may involve trans-generational responses as well as rapid micro-evolutionary processes. Furthermore, biological responses may also depend on population genetic status and evolutionary history, and on phylogenetic constraints. Assessing pollutant driven selection in the field is extremely difficult, due to confounding factors that also shape the distribution of genetic diversity within and among populations. This explains why it is still so difficult to integrate evolutionary indicators into ecological risk assessment (ERA). Nevertheless, evidence for trans-generational and evolutionary impact of pollutants is accumulating across a diversity of systems, and this reality cannot be ignored in future assessment procedures (see SETAC Meeting sessions on these topics, from 2008; see also Ecotoxicology Special Issues, 2011 and 2013). Current approaches in population genomics increase the power to investigate and dissect adaptation at the molecular level, which have proven to be relevant to address eco-evolutionary issues, including in an ecotoxicological context. However, scientific conclusions, be they drawn from the most sophisticated approaches, still need to be tested for their relevance to ERA, which would ideally require a dialog from the early stages between scientists and stakeholders (see EVOGENERATE work group of SETAC ERA AG). Therefore, it becomes urgent to acquire tools and methods to measure, anticipate, and even predict trans-generational and evolutionary ecotoxicological effects, as well as to understand their consequences for ecosystems, including species distribution and persistence. These tools should provide scientific guidance to support optimized decision making, through a sustainable trade-off between human demand on and conservation of natural resources. We are inviting scientists from Academia, Industry and State Environmental Agencies to present studies mainly focalized on the following issues: 1. Trans-generational vs evolutionary responses: specific consequences, how to disentangle them from observed phenotypic effects? Results from original research in genetics and epigenetics are expected here. 2. Applicability of evolutionary concepts: what would be a "good" evolutionary indicator for decision makers? 3. Population genomics and System biology: understanding adaptive responses across generations through a mechanistic angle, from molecular processes to higher levels of organization. 4. Phylogenetic signal in species sensitivity: improving assessment of species sensitivity, identifying phylogenetic components of, -and constraints on lineage response.

Keywords: evolutionary ecotoxicology, epigenetics, multigenerational impact, adaptive response to pollutants

SESSION TYPE: Platform, Poster Spotlight and Poster

ADVISORY GROUP: Ecological Risk Assessment Advisory Group – Work group: EVOGENERATE