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Session:
Effects of Global Climate Change on the Foundations and Applications of Environmental Toxicology and Chemistry

Abstract Title:
Mechanistic toxicology in the face of global climate change.

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Abstract: (note: 2500 character limit including spaces)

To incorporate effects of global climate change (GCC) into regulatory assessments of chemical risk, damage and restoration needs, an understanding is needed of GCC effects on mechanisms of chemical toxicity and the implications of those effects when placed in context with GCC effects on chemical exposure and external environmental stressors on exposed biota. Effects on mechanisms of chemical toxicity include those acting on toxicokinetics of chemical absorption, distribution, metabolism and excretion, as well as those affecting toxicodynamic interactions between chemicals and target molecules. The former influences dose and duration of effective chemical exposure at the active site and the latter the responsiveness and resulting biochemical and physiological implications. Modification these factors by GCC can directly alter the toxicity of chemicals. Further implications of GCC include modifications of organisms' baseline physiological processes for coping with the external environment (water balance, thermoregulation, immune-endocrine-neurological systems), processes with distinct age, sex, and species specificities. Epigenetic modifications of gene expression due to climate-associated phenomena were some of the first of this class of DNA modifying effects whose extent is just beginning to be understood. Implications of GCC effects on chemical mechanisms of toxicity are important for both ecological and human health. Activation and detoxification of chemicals will vary directly with temperature in many poikilotherms. Selection of individuals or populations resistant to chemical effects can leave those adapted to elevated chemical exposure with

decreased ability to withstand the physical challenges of a GCC-modified environment. Physiological process critical to surviving temperature, hydration, nutrition and disease stresses will be particularly sensitive to even the slightest perturbations by chemicals when pushed to their functional limits. Alternatively, in animals living in GCC modified climates, increased investment in adaptation to GCC can lead to increased susceptibility to disease and other stressors that pose less of a threat to animals in less stressed conditions. Accounting for GCC effects on toxicity mechanisms will require an understanding of both the direct effects on chemical disposition and target interactions as well as how changes in an animal's environment will affect the susceptibility of, and response to, chemical exposure.

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