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Session Chairs: Daniel L. Villeneuve; Vincent J. Kramer; Natalia Garcia-Reyero

Title: Adverse Outcome Pathways: A Conceptual Framework to Support Ecotoxicology Research and Risk Assessment.

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Abstract: Ecological risk assessors face increasing demands to assess more chemicals, with greater speed and accuracy, and to do so using fewer resources and experimental animals. New approaches in biological and computational sciences are being developed to generate mechanistic information and build predictive models that can help meet these challenges. However, to effectively use these new tools and information to support chemical assessments, there is a need for effective translation of this information into endpoints meaningful to ecological risk--effects on survival, development and reproduction in individuals and, by extension, impacts on populations. Here we present a framework designed for this purpose, the adverse outcome pathway (AOP). An AOP is a conceptual construct that portrays existing knowledge concerning the linkage between a direct molecular initiating event and an adverse outcome at a level of biological organization relevant to risk assessment. The practical utility of AOPs for ecological risk assessment of chemicals will be illustrated using several case examples. The examples demonstrate how the AOP concept can focus toxicity testing in terms of species and endpoint selection, enhance chemical extrapolation, and support prediction of mixture effects. The examples also show how AOPs facilitate use of molecular or biochemical endpoints (sometimes referred to as biomarkers) for forecasting chemical impacts on individuals and populations. For understanding cause and effect across levels of biological organization within an ecotoxicological context, AOPs will help scientists working at different levels to better integrate their findings, by providing a consistent framework and terminology, and clarifying where key uncertainties lie. At the same time, it will help us maintain a connection to the individual and population level risks we wish to manage, even as our science and regulatory practice focuses more on the development and use of computational and *in vitro* tools.

Impact Statement: This paper presents a new conceptual framework we are defining as an Adverse Outcome Pathway" (AOP) that can be used for the translation of mechanistic toxicology information into endpoints meaningful to ecological risk. AOPs provide a useful structure within which existing knowledge can be organized, from which key uncertainties and research priorities can be identified, and through which we can improve predictive approaches needed to advance regulatory ecotoxicology.