Systems Biology, Adverse Outcome Pathways, and Ecotoxicology in the 21st Century

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While many definitions of systems biology exist, the majority of these contain most (if not all) of the following elements: global measurements of biological molecules to the extent technically feasible, dynamic measurements of key biological molecules to establish quantitative relationships among them, and experimental designs which perturb the system in specific ways to determine these relationships. This presentation will discuss how these components can be used to develop a model for disease based on an interconnected network of molecular-, cellular-, and organism-level events. Such disease networks can serve as the framework for a network-based description of mode of action or adverse outcome pathway. Approaching the problem from this perspective provides a biologically-based mechanism for incorporating other factors affecting risk such as species relative susceptibility, life stage relative sensitivity, and other influences on the health of individuals or populations. Expanding this concept to include networks of populations, communities, and ecosystems potentially provides a framework for building multi-scale models to predict the effects of chemicals on the environment. It also enhances the ability of more traditional biological modeling approaches to lay the groundwork for toxicity pathway-based risk assessment in ecotoxicology. The approach will be illustrated by analysis of global transcriptional networks in response to endocrine disrupters in the fathead minnow (Pimephales promelas).
[This abstract does not necessarily reflect the views of the Environmental Protection Agency.]