

Abstract : Tackling Complex Problems: Combined Exposures and Mixtures Research at the National Toxicology Program

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People are exposed daily to complex and dynamic mixtures, and determining the health effects associated with these exposures presents significant challenges. In 2011, the National Institute of Environmental Health Sciences (NIEHS) held a workshop titled “Advancing Research on Mixtures: New Perspectives and Approaches for Predicting Adverse Human Health Effects,” which brought together experts from toxicology, epidemiology, statistics, exposure science, and risk analysis to identify and discuss major knowledge gaps in mixtures research. Subsequently, the NIEHS Strategic Plan (2012-2017) included addressing “how combined environmental exposures affect disease pathogenesis” as a priority area for research (Goal 4), and a trans-NIEHS Combined Exposures and Mixtures Working Group was formed to guide and prioritize NIEHS mixtures efforts. Based on conclusions from the 2011 workshop and in response to Goal 4 of the Strategic Plan, the National Toxicology Program (NTP) has developed multiple mixtures-based projects to advance our understanding of mixtures and their effects on human health. These projects are directed at three major challenges: 1) decreasing uncertainty in component-based risk assessments that utilize individual chemical data to estimate health effects from mixtures, 2) developing approaches to evaluate the health effects of whole, complex mixtures, and 3) using knowledge of systems biology to inform our understanding of health effects from exposure to mixtures. Research programs aimed at addressing these focus areas include polycyclic aromatic compounds, botanical dietary supplements, and environmental mixtures that contribute to cancer development.