

EPA Grants: Systems-Based Research for Evaluating Ecological Impacts of Chemicals

One of the U.S. Environmental Protection Agency's priorities is to support research that will result in a better understanding of the vulnerability of organisms and ecosystems to chemical exposures. Recent scientific advances provide new approaches for evaluating how exposures to chemicals influence the health of ecosystems. EPA research in this area is developing and applying innovative approaches to improve the evaluation of ecological resilience and impact analyses.

Through the Science to Achieve Results (STAR) grant program, EPA is providing grant funding to six universities to complement its research in this area. The six recipients are developing and applying innovative methods and models to better understand and predict biological and ecological consequences of exposures to chemicals in environmental systems. The universities are researching how to apply different metrics, methods and models to characterize the interactions between spatial and temporal distribution of chemicals and ecological receptors and predict the consequences.

Research results will help improve risk assessments and decisions made to protect the environment.

EPA awarded grants to the following universities:

Harvard University

Award: \$651,708

Project Title: *Integrated Modeling Approaches to Support Systems-Based Ecological Risk Assessment*



Oregon State University's researchers are using zebrafish (pictured above).

Harvard University is researching how existing data and models can be integrated into a framework that links molecular initiating events to regulatory outcomes of interest. They will then apply the framework to demonstrate how it can be used to generate quantitative predictions of ecological impacts at scales relevant to policy and regulatory decisions.

Oregon State University

Award: \$798,661

Project Title: *System Toxicological Approaches to Define Flame Retardant Adverse Outcome Pathways*

Oregon State University is collaborating with North Carolina State to develop tools for risk assessors and chemical manufacturers to use to determine if developed chemical alternatives are safer than the chemical the alternative was designed to replace. Researchers are exposing adult zebrafish and zebrafish embryos to flame retardants, including those that have been phased out by EPA, those

companies manufacture now and those companies have proposed as alternatives to existing flame retardants. Researchers will bin flame retardants with similar chemical structures and biological profiles together in order to develop a model to compare the potential toxicity of chemical alternatives to existing chemicals.

University of California Santa Barbara

Award: \$800,000

Project Title: *Dynamical Systems Models Based on Energy Budgets for Ecotoxicological Impact Assessment*

The University of California Santa Barbara is developing new Dynamic Energy Budget (DEB) models to better understand how the effects of exposure to chemical stressors are expressed across levels of biological organization. Researchers are experimenting with the waterflea (*Daphnia*) and the estuarine fish (*Fundulus*) to determine how genomic data can be used in the

DEB models. They will use the new models to predict the point just before chemical stressors cause an organism or population to die. The models will help evaluate the likelihood of rescuing organisms and populations in a chronically polluted environment.

Michigan State University

Award: \$800,000

Project Title: *Developing of a Larval Fish Neurobehavior Adverse Outcome Pathway to Predict Effects of Contaminants at the Ecosystem Level and across Multiple Ecologically Related Taxa*

Michigan State University is using the adverse outcome pathway framework to predict effects of contaminants with different modes of action on neurobehavior of larval fish from three different species. Researchers will identify which adverse outcome pathways are common between species allowing predictions for ecologically relevant species from typical laboratory model species to the ecosystem level. The outcome will be an individual-based model that can be used to predict growth and survival at the ecosystem level for multiple ecologically related populations.

Texas Tech University

Award: \$347,509

Project Title: *A Bioenergetics-Based Approach to Understanding and Predicting Individual-to-Community-Level Ecological Effects of Manufactured Chemicals*

Texas Tech is developing a bioenergetics AOP framework that can translate the effects of manufactured chemicals from the individual, population and community-level. A majority of ecotoxicology studies are focused at levels of biological organization that are most conducive to empirical approaches – the individual and lower. However, the levels of biological organization that are most

relevant to environmental health and societal value are at the population level and higher (communities and ecosystems). Because energy is a universal ecological currency that reaches across levels of organization, a bioenergetics approach to understanding and predicting ecological effects of chemical stressors is a promising path forward.

Researchers are using a freshwater flea and snail species model along with two emerging contaminants, pyraclostrobin fungicide and perfluorooctane sulfonate, to develop and parameterize bioenergetics and population models to predict adverse ecological effects.

University of North Carolina, Wilmington

Award: \$399,884

Project Title: *Linking Biological Scales across Generations: An Estuarine and Marine Model for Measuring the Ecological Impact of Endocrine Disrupting Compounds*

The University of North Carolina is studying the effects of bifenthrin (insecticide) and levonorgestrel (pharmaceutical) on *Menidia beryllina* (Siverside fish) across three generations at the molecular, organism and population level. The research will result in an estuarine model for measuring the ecological impact of endocrine disrupting compounds.

Information about the Awards:

www.epa.gov/ncer/2014ecoimpacts

Information on EPA's Chemical Safety for Sustainability Research

www.epa.gov/research/chemicalscience/

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