

CROSS-ORD POST-DOCTORAL FELLOWSHIP PROGRAM

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PROGRAM OVERVIEW

The EPA's Office of Research and Development (ORD) is comprised of several different laboratories and centers which share the common goal of providing research that can be applied to better protect the environment and human health. Partnerships and collaboration between labs and centers serve as an effective mechanism for the exchange of ideas and the understanding of research perspectives between related scientific disciplines. In the summer of 2005, EPA-ORD initiated a new cross-ORD post-doctoral fellowship program, which is designed to promote greater collaboration between ORD's labs and centers. After a nation-wide search, the cross-ORD post-doctoral fellows were selected in both the human health and ecosystems research areas and assigned primary, secondary, and tertiary mentors based upon the interdisciplinary nature of their specific research focus. Each cross-ORD post-doctoral fellow developed a detailed research plan jointly with his or her mentors. These research plans outlined collaborative research projects to be conducted during the four year fellowship, along with the anticipated impact that each project would have on supporting the mission of the EPA. Research topics of the nine cross-ORD fellows include: 1) Computational systems biology modeling to predict toxicological mechanisms (Michael Breen), 2) Characterization of environmental exposures and associated health risks in aging populations (Doug Johns), 3) Applications of exposure analysis tools in environmental epidemiology (Mary Johnson), 4) Building realistic biologically-based pharmacokinetic models for predicting susceptibility in aging populations (Janice Lee), 5) Molecular modeling of the interaction between environmental chemicals and targets for chemical toxicity (Melissa Pasquinelli), 6) Predictive ecological niche modeling in aquatic systems (Kristina McNyster), 7) Quantifying key drivers of change in the built environment and their interaction with changes in the natural environment (Johns Thomas), 8) Biotic responses to hydrologic alteration in suburban headwater streams and potential for storm water mitigation (Allison Roy), and 9) Effectiveness of best management practices in mitigating storm water runoff and water quality (Yu Zhang). In addition to providing excellent interdisciplinary scientific training for the post-doctoral fellows, it is anticipated that the findings of each of these projects will result in the publication of several peer-reviewed journal articles. EPA envisions that this program will foster further collaboration between the different ORD labs and centers, thereby leading to more focused research strategies and a better understanding of the relationships between environmental pollution, exposure, and human and ecological health.

Doug Johns
Mentors: Bob Sawinski, Jackie Moya, Tom McCully, Vernon Benignus, NCEA, Washington, DC

Research Goal: Provide a more complete understanding of environmental exposures and the associated health risks in aging populations.

Anticipated Outcomes:
• Develop an Exposure Factors handbook for the aging
• Conduct a large scale review and analysis of age-related changes in phase I, phase II, and antioxidant enzyme activities
• Develop a PBPK model to predict the kinetic behavior of specific neurotoxicants in older adults

This research will provide information that can be used by risk assessors to characterize age-related changes in exposure to environmental chemicals, and understand how the aging body responds to toxic stressors

Janice S. Lee
Mentors: Chris Cooper, Mike Dorris, Mike Toranzo, NHEERL, NERL, Research Triangle Park, NC

Research Goal: Improve pharmacokinetic models of the aged by incorporating genomic information on the differences in xenobiotic metabolism gene expression between young and old populations.

Anticipated Outcomes:
• Identification of common and disparate changes in AMEs during aging between tissues and across species
• Integration of AME gene expression behavior in PBPK models of different age groups that will predict toxicity in different subpopulations

John Thomas
Mentors: Mike Strain, Anna Giambardi, Jim Wickham, NCEA, Washington, DC; NERL, Research Triangle Park, NC; NHEERL, Cincinnati, OH

Research Goal: Quantify key drivers of change in the built environment and their interaction with changes in the natural environment.

Anticipated Outcomes:
• Socioeconomic Evaluation of Watershed Recovery
• Baseline Assessment of Watershed Recovery
• Validation of Climate-Sensitive Natural Amenities
• Integrated Climate Land Use Scenario

Allison Roy
Mentors: Bill Shuster, Ken Fritz, Tony Clark, David Winters, NERL, NERL, Cincinnati, OH; NHEERL, Convals, OH

Research Goal: Characterize the hydrological and ecological effects of urbanization on headwater streams.

Anticipated Outcomes:
• Develop a mechanistic mathematical model of stream ecosystem alteration by hydrologic alteration in suburban headwater streams and potential for storm water mitigation
• Provide baseline for restoring headwater streams
• Evaluate the potential for stream ecosystem restoration via stormwater management

Michael Breen
Mentors: Roy Ghisla, Inaki Chaves, NCCCT, NERL, Research Triangle Park, NC

Research Goal: Develop and apply mechanistic mathematical models to predict the biological effects of environmental chemical exposure.

Anticipated Outcomes:
• Improve our understanding of the dynamic dose-response behavior at the molecular level for risk assessment with endocrine disruptors
• Identify and test new molecular biomarkers that are indicative of the ultimate adverse effects from endocrine disruptors

Melissa Pasquinelli
Mentors: Jim Rainwater, Susan Lewis, NCCCT, NHEERL, NERL, Research Triangle Park, NC

Research Goal: Develop and apply molecular modeling tools in order to facilitate the assessment of mechanisms for chemical toxicity.

Anticipated Outcomes:
• Improve the predictive ability of screening tools for chemical toxicity by integrating molecular modeling with complementary experimental and computational approaches, which will then be used to categorize and prioritize chemicals for further testing
• Improve systems biology models by integrating quantities that are cofunctional with molecular modeling methods, such as the areas of metabolism of pyrethroid chemicals

Kristina McNyster
Mentors: Bruce Jones, Tony Clark, Henry Walker, James Wickham, Bill Strain, Henry Lee, Lester Team, NHEERL, Convals, OH; NERL, Lake Mead, NV; NERL, Washington, DC; NERL, Research Triangle Park, NC; NHEERL, Convals, OH; NHEERL, Nashville, OH; NCEA, Washington, DC

Research Goal: Develop spatially explicit models of biotic conditions in aquatic systems.

Anticipated Outcomes:
• Determine best methods for predictive modeling of species distributions in stream systems
• Integrate point-sampled and landscape-level data in predictive ecological niche modeling analysis in freshwater systems
• Develop ecological data sets for use in spatially explicit modeling in estuarine systems

Mary Johnson
Mentors: Lucas Nease, Haik Oskanov, NHEERL, NERL, Research Triangle Park, NC

Research Goal: Develop spatially explicit models of biotic conditions in aquatic systems.

Anticipated Outcomes:
• Improve connections between traditional exposure assessment and epidemiological paradigms

Yu Zhang
Mentors: William Shuster, Haik Thurston, Matthew Haberling, Kenneth Fritz, NERL, Cincinnati, OH; NHEERL, Cincinnati, OH

Research Goal: Effectiveness of best management practices in mitigating storm water runoff and water quality.

Anticipated Outcomes:
• Physically based modeling framework for projecting the impacts of BMPs with readily available GIS data as input
• Guidelines for decision making concerning the BMPs given uncertainties stemming from the variability and trends of climate

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