

S C O O P

THE NEWSLETTER OF THE UNC SUPERFUND RESEARCH PROGRAM

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RESEARCH HIGHLIGHTS

NC State Scientist Teams Up with UNC to Improve Measurements of Chemicals in the Environment

Using a Mouse Population to Understand Effects of TCE in Humans

CORE PROFILE

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RESEARCH TRANSLATION HIGHLIGHT

Research Translation Core Builds SRP Trainees' Skills and Knowledge

The UNC SRP brings together a diverse group of more than 70 biomedical researchers, engineers, chemists, statisticians, experts in conventional and bioremediation, environmental modelers, graduate students and postdoctoral trainees. Together, we are achieving the program's goal to advance society's understanding of the human health and environmental risks associated with hazardous waste and to develop new environmental strategies and technologies for the cleanup of Superfund sites, thereby minimizing human and environmental risk.

NC State Scientist Teams Up with UNC to Improve Measurements of Chemicals in the Environment

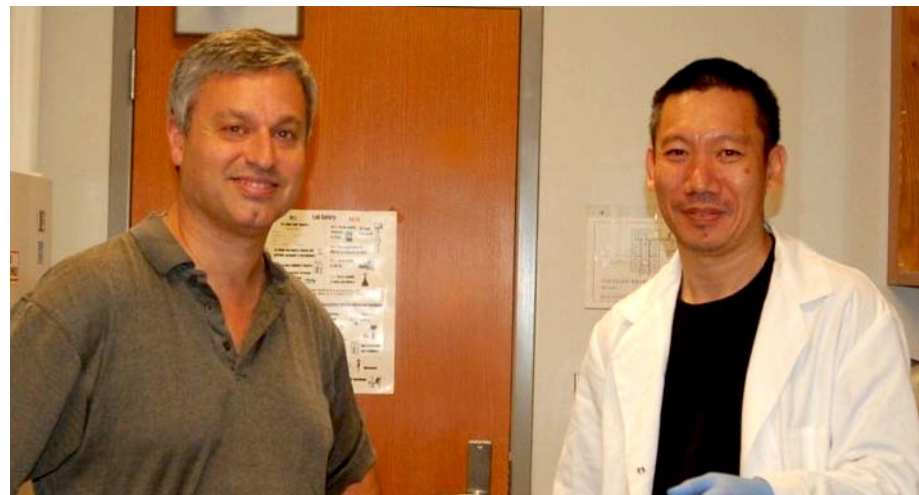
TO MEASURE THE LEVEL OF TOXIC CHEMICALS IN A RIVER OR

lake over several months, you could take weekly trips to collect samples and bring them back to a lab for testing. But those trips would be time-consuming and costly, and those periodic measurements wouldn't necessarily provide an accurate picture of the ecological and human health risks resulting from long-term exposure to toxic chemicals.

That's why N.C. State University scientist Damian Shea and his colleagues invented a "passive sampling device" that can sit in the water, soil or sediment and accumulate chemicals for weeks at a time, then be collected and brought back to the lab to determine average chemical levels over an extended period.

"A fish or a clam actively pulls in water through its gill membranes, filters that water, and accumulates chemicals in its system," Shea explained. "Using a passive sampling device, we can mimic this process and measure the organism's long-term exposure to a variety of organic chemicals."

Shea has teamed up with researchers at the UNC Superfund Research Program to improve the device so that it can detect even more chemicals that are commonly found at Superfund sites.



Dr. Damian Shea and Dr. Xin-Rui (Summer) Xia, Research Associate Professor (photo by Dana Haine)

"For our original device, we developed several fat-like polymers that act like an animal's fatty tissue, which accumulates fat-soluble chemicals. Through this SRP project, we are developing a mixture of polymers that will capture *both* fat-soluble *and* water-soluble chemicals such as pesticides and industrial chemicals found at many Superfund sites — so we can measure hundreds of organic chemicals, all with a single device. The project involves a lot of experimentation in the laboratory to test different polymer mixes, as well as field studies at nearby sites."

Shea, who studies the behavior of chemicals in the environment and how it relates to human and ecosystem health, hopes that this new technology will revolutionize the way people measure chronic exposure to organic chemicals. ●

Using a Mouse Population to Understand Effects of TCE in Humans

IN 2011, THE U.S. ENVIRONMENTAL PROTECTION AGENCY released a long-awaited human health risk assessment report on trichloroethylene (TCE), a widely used industrial solvent found at many Superfund sites, concluding that that the chemical is “carcinogenic in humans.”

EPA also identified a number of important knowledge gaps that remain. UNC Superfund Research Program scientist Ivan Rusyn and his research team are working to help regulators fill several gaps and inform future human health assessments of TCE and related chemicals.

“In the body, TCE gets broken down into metabolites, some of which are known to be toxic to the liver or kidney,” Rusyn explained. “We are developing methods to measure several metabolites in the same individual simultaneously. We’re using mouse samples, but the technology is potentially translatable to humans.”

Rusyn’s lab is also studying why different individuals who are exposed to a chemical react differently: some may develop disease and others may not. That inter-individual variability may not necessarily depend solely on how much chemical they were exposed to, but also on an individual’s genetic make-up or other biological factors.

To evaluate all of these variables, researchers must know each individual’s genetic map — a task that requires an intensive effort



*Hong Sik Yoo, PhD student in Dr. Ivan Rusyn’s lab
(photo by DDC International)*

in humans. That’s why Rusyn is conducting this research using inbred mouse strains, developed to be genetically identical within each strain while maximizing genetic differences between strains. “By exposing mice from within and across strains to the same dose of TCE, we can see if there are different effects. If so, we can potentially identify specific genes that may be responsible for this variability. Then we can apply the knowledge to test susceptibility in a human population.”

Rusyn is conducting similar studies on a related chemical, tetrachloroethylene (perc), a dry cleaning solvent that is also found at many Superfund sites and classified by EPA as a probable human carcinogen. ●

Chemistry Core Provides Cutting-edge Support for SRP Projects

UNC SUPERFUND RESEARCH PROGRAM PROJECTS REQUIRE

tremendous expertise in the highly specialized fields of synthetic and analytical chemistry. When SRP investigators need this state-of-the-art science they turn to the Chemistry Core, a team of chemists who work in partnership with each investigator to achieve their project's goals. Often this support involves developing new assays and synthesizing chemicals found at Superfund sites or providing high sensitivity analysis of DNA.

UNC's Chemistry Core has been consistently recognized for excellence in external reviews. One reason, said Core Director Louise Ball, is the Core's commitment to continually attaining higher degrees of sensitivity in analysis, making it possible to analyze even smaller quantities of materials, or detect even lower levels of chemicals.

"We just received an NIH grant to purchase a new triple-quadruple mass spectrometer system, a highly sensitive new device that could increase our capacity to detect chemicals by a factor of 10, maybe even as much as 100 in some cases," said Ball.

The other area of particular strength, Ball noted, is that Core chemists have developed the ability to create chemicals labeled with unnatural, stable isotopes, so that they can be tracked as they move

*Dr. Louise Ball,
Chemistry Core
(photo by
Regina McCoy)*

through a system. For example, UNC scientists have taken a naturally occurring form of carbon that has a molecular weight of 12 and substituted a carbon with a weight of 13, then replaced all of the C-12 molecules with C-13 in a group of polycyclic aromatic hydrocarbons (PAHs).

Researchers can add those labeled PAHs to cultures of bacteria in contaminated soil. As bacteria consume the PAHs they incorporate the C-13 into their own DNA, allowing investigators to track which bacteria are most active in degrading the toxic PAHs.

The Chemistry Core also provides opportunities for UNC trainees to work on SRP projects while strengthening their technical skills in chemical synthesis or analytical chemistry. ●



Research Translation Core Builds Trainees' Skills and Knowledge

THIS SPRING, SRP TRAINEES PARTICIPATED IN SEVERAL

exciting programs planned by the Research Translation Core (RTC), two of which are described here. In February, students had the opportunity to learn from Helen Chickering, a veteran broadcast journalist and advisory board member at UNC's Medical and Science Journalism Program, how to develop an "elevator speech" describing their research during a unique science communications workshop. The workshop, intended to help students develop their science communication skills and practice conveying scientific concepts to a lay audience, was a first for a majority of participants. "This was a valuable experience ... it helped us find new ways to describe our work and gave us an opportunity to get immediate feedback from our peers and from experts," noted one participant.

In March, SRP trainees participated in a two-day short course titled *Superfund 101* and learned about the processes involved in identifying and remediating the nation's worst hazardous waste sites through EPA's Superfund Program. Programming included an exploration of the policy and legal issues involved in the Superfund process, from discovery of a site through listing on the National Priorities List, remediation and eventual delisting. Students were also introduced to the concept of environmental justice as it relates to Superfund sites in NC.



Luis Flores (right), Remedial Project Manager with US EPA Region 4, explains the history of the Ward Transformer Superfund site to SRP Trainees and guests (photo by Dana Haine)

A highlight of the short course was the on-site tour of the Ward Transformer Superfund site near the RDU airport with a follow-up discussion on community involvement with Superfund sites. Students valued learning about the relevance of their research in the context of the overall Superfund program, with one noting: "I liked that so many areas of the Superfund program were discussed: environmental justice, policy, history of the sites, and specific case studies." Trainee activities will resume in the fall of 2012, with a focus on activities associated with the Superfund Research Program Annual Meeting scheduled for October 21–24 in Raleigh, NC. ●

SAVE THE DATE!

August 7–8, 2012

Connecting Research and Practice: A Dialogue between ATSDR and the NIEHS Superfund Research Program

**ATSDR's Chamblee Campus
Atlanta, Georgia**

This meeting is jointly organized by the Superfund Research Program, including direct involvement from NIEHS, UNC, University of Kentucky, Michigan State and Louisiana State Universities, and ATSDR. This event will provide an opportunity for cross-pollination between SRP and ATSDR ; as ATSDR personnel learn about cutting-edge research from SRP scientists, SRP scientists will learn more about ATSDR's research and informational needs related to Superfund.



SUPERFUND SCOOP

This newsletter is published by the UNC-Chapel Hill Superfund Research Program, with funding from grant number P42-ES005948 from the National Institute of Environmental Health Sciences, NIH.

JAMES A. SWENBERG
Program Director
919.966.6139
james_swenberg@unc.edu

KATHLEEN GRAY
Research Translation Leader
919.966.9799
kathleen_gray@unc.edu

FREDERIC PFAENDER
Research Translation Co-Leader
919.966.3842
fred_pfaender@unc.edu

LAURA ERTEL AND SARAH YELTON, *Writers*
REGINA MCCOY, *Design/Layout: CHAI Core, funded by the Nutrition Obesity Research Center and the Nutrient Assessment Facility Core*



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