AUT 2009/WIN 2010

DEPARTMENT OF ENVIRONMENTAL AND OCCUPATIONAL HEALTH SCIENCES

environmental health news

OUR DEPARTMENT IS ABOUT... CLEAN AIR

Research done in our department at the University of Washington benefits the state and beyond.

Photo: Gerry Croteau

INVESTMENTS IN PUBLIC HEALTH

Researchers in our department aim to better understand and help manage occupational health risks and the effects of the environment on human health. In this issue of *Environmental Health News*, we:

- Announce our participation in a climate change study and describe how its findings can be used to develop effective public health interventions.
- Explain how research on air pollution's effect on human health provides scientific evidence for federal and state legislation, such as the US Environmental Protection Agency's proposed ozone limits.
- Highlight the federal stimulus package that supports training opportunities for students, teachers, and state workers, and that contributes to advancing environmental health research.
- Showcase the impacts of continued federal and state investment in critical programs, such as the Superfund Research Program and the OSHA training program.
- Share the results of projects that deliver occupational health resources to Washington state workers.

IMPACTS

...OF CLIMATE CHANGE ON HEALTH IN THE PACIFIC NORTHWEST

Last December, President Barack Obama met with other world leaders to discuss one of this century's most important dilemmas—climate change—because of its inevitable consequences, such as eroding natural resources and adverse effects on human health.

Researchers predict that the impacts of climate change will vary from community to community across the country and the globe. Our department is working with leaders and policy makers to better understand potential future conditions in the Pacific Northwest, and to determine practices we can set in place now to avoid worst-case scenarios.

Last year, the Climate Impacts Group at the University of Washington (UW) released the most complete and up-to-date findings on the impacts of climate change in our region. Professors Michael Yost and Richard Fenske, Adjunct Assistant Professor Catherine Karr, and Research Scientist Cole Fitzpatrick were among the scientists who assessed public health concerns associated with climate change projections, and, in particular, the rates of illness and mortality with increased temperatures and worsening air quality.

Relatively short but intense heat waves over the last 30 years have been responsible for hundreds of deaths in the United States and Canada and thousands of deaths in Europe. Climate change projections suggest these events will become more frequent, more intense, and longer lasting in the 21st century. Some speculate the highest impact will be in cities that currently have milder summers, less air conditioning, and higher population density, which are all characteristic of the Pacific Northwest.

Fenske, acting chair of our department, was senior author of the climate change report section that documented higher levels of mortality during heat events in the greater Seattle area over the past 25 years. The authors also predicted significantly more heat- and air pollution-related deaths in Washington state in the years to come.

Preparing for climate change is essential at the state and local level because today's choices will have long-term consequences. Significant time is required to develop and implement changes that may reduce the future impacts of climate change.

Last fall, the Centers for Disease Control and Prevention (CDC) awarded a team of UW researchers from our department, Health Services, and Atmospheric Sciences nearly one million dollars over the next three years. The researchers will work with local communities to study health risks that will likely occur in the next 35 years and to develop strategies for how communities might reduce those risks.

"The information people hear about health impacts of climate change tends to be broad and without solid evidence," said Fenske. "The public is told that these health impacts are occurring or are likely to occur in the near future. And the claims leave the public apprehensive, but with no clear direction on how to prepare."

The evidence-based forecast of health impacts will "empower public health officials to develop specific plans of action to prevent health risks associated with climate change," said Fenske, who will lead the CDC-funded project with Susan Allan, director of the UW Northwest Center for Public Health Practice and associate professor in the Department of Health Services.

According to Allan, "People are more likely to take action to protect health when they have data specific to their own community."

Allan noted that local communities will be active partners in shaping the research from the first stages of the project. "We want to make sure the particular risks and circumstances of the different groups in the community are included as part of modeling and community discussions."

For further reading

The Washington Climate Change Impacts Assessment Conference Executive Summary: *http://cses.washington.edu/cig/files/waccia/wacciaexecsummary.pdf* ■

...OF SCIENTIFIC EVIDENCE TO SUPPORT PROPOSED OZONE LIMITS

This year, the US Environmental Protection Agency (EPA) proposed strengthening national ground-level ozone limits. Ozone at ground level is one of the major air pollutants characteristic of large urban centers. High concentrations of ozone are caused by human activities, in particular, the combustion of gasoline- or diesel-fuel engines that run cars, trucks, and ships. The EPA's action would replace the primary and secondary standards set in 2008, which were criticized for not offering enough protection to human health or vegetation by many stakeholders, including the EPA's Clean Air Scientific Advisory Committee.

Professor Sverre Vedal, a pulmonary physician and epidemiologist in our department, serves on the committee's Ozone Review Panel. He says scientific evidence clearly documents ozone's impact on human lung function, countering charges from oil and gas industry representatives that the EPA's move to strengthen the standard "lacks scientific justification." Exposure to air pollutants has been linked to a number of serious health problems, including asthma and cardiovascular disease. According to the EPA, lowering the ozone limit from 75 parts per billion to 70 parts per billion will yield billions of dollars in health benefits by helping to reduce hospital and emergency visits, premature deaths, and missed work and school days.

In addition to changing the primary standard that targets public health, the 2010 proposal introduced a secondary standard designed to protect sensitive vegetation and ecosystems. Vedal noted that the secondary standard is a vital addition. Continued exposure to ground-level ozone reduces plant growth and increases susceptibility to disease, which can detrimentally affect agricultural productivity.

Compliance with the proposed standards will be a problem for many areas of the United States. In Washington, Enumclaw was cited last year by the state's Department of Ecology for ozone levels that exceeded the current standard of 75 parts per billion. If the standard is set at 70 parts per billion, King County and other areas of the Puget Sound will likely fail to attain this level, and Spokane and Portland-Vancouver will be added to the nonattainment list if the standard is set at 60 parts per billion. Failing to comply with EPA standards triggers costly development of detailed plans to attain compliance in the future and could result in loss of federal funding.

In our department, research on air pollution and its impact on human health is ongoing and central to the Multi-Ethnic Study of Atherosclerosis and Air Pollution (MESA-Air), the National Particle Components Toxicity (NPACT) Initiative, and the Disease Investigation through Specialized Clinically Oriented Ventures in Environmental Research (DISCOVER) Center, which among its projects includes experiments to study cardiovascular responses to diesel exposure. These efforts, in addition to faculty participation on key scientific committees, will continue to help inform policy and regulations that are based on sound science.

For further reading

Nadadur SS, Miller CA, Hopke PK, Gordon T, Vedal S, Vandenberg JJ, Costa DL. The complexities of air pollution regulation: The need for an integrated research and regulatory perspective. *Toxicol Sci* 2007;100(2): 318–27. ■

Photos: Kathy Hall; top of page: ©2010 www.photos.com

STIMULUS FUNDS

INVESTMENT IN ENVIRONMENTAL AND OCCUPATIONAL

Thanks to the American Recovery and Reinvestment Act (ARRA), signed into law by President Barack Obama in February 2009, the University of Washington has received nearly $200 million in economic stimulus awards targeted at creating new jobs, retaining current jobs, and advancing public health research to stimulate future growth. Our department received more than $400,000 from the federal stimulus package, which is being used to train students, teachers, and Washington state workers.

Green jobs

Ten percent of the national ARRA budget was allocated to expand and adopt clean energy initiatives and to foster job creation in this area. By the end of 2009, nearly ten months after ARRA's inception, the Council of Economic Advisers estimated that the funds disseminated have directly saved or created approximately 52,000 clean energy jobs and supported another 11,000 jobs throughout the economy. They expect new opportunities to increase substantially as ARRA spending on energy and conservation rises.

"Green-collar" or "green" jobs have been gaining nationwide attention. They are occupations that are environmentally friendly and involve manufacturing and constructing materials that minimize or avoid waste, pollution, or greenhouse gas emissions. Examples of green jobs include building, installing, and maintaining energy-efficient resources, such as wind turbines and solar panels.

Agencies, such as the National Institute for Occupational Safety and Health (NIOSH), caution that as traditional job fields become "greener," careful and purposeful safeguards must be put in place for workers to ensure their safety and health. Workers involved in green jobs, such as building wind turbines, should be as well protected from hazards as those constructing a multi-story building.

In our department, an ARRA supplement supports the Continuing Education (CE) program's efforts to train workers enrolled in the Seattle Vocational Institute Pre-Apprenticeship Construction Training program who are preparing for jobs that involve green building and energy retrofits. CE staff have developed curriculum with consortium partners, the University of California (UC)-Los Angeles and UC-Berkeley, to teach workers about green building systems, health and safety hazards, prevention strategies, and green chemistry.

Green chemistry is one of the "design out" strategies, which is part of "Prevention through Design," a movement led by a number of federal agencies, including the US Environmental Protection Agency (EPA). By initially "designing out" or minimizing hazards and risks in new occupations, injuries and illnesses can be prevented. For example, green chemistry consists of using and producing chemicals and chemical processes that reduce waste products, have nontoxic components and improved efficiency, and thereby reduce or eliminate negative environmental impacts.

As workers are being trained for green jobs, our department's faculty and staff are identifying and addressing critical health and safety issues, so that workers can recognize and better protect themselves from potential hazards.

In February, CE began offering health and safety courses to students preparing to work in green jobs. To teach the courses, CE is partnering with Sellen Construction, a leader in sustainable practices that worked on criteria with the US Green Building Council for the Leadership in Energy and Environmental Design (LEED) green projects certification. Marcia Baker, UW Professor of Earth and Space Sciences, is also a collaborator and instructor. ■

HEALTH OPPORTUNITIES FOR WORKERS

Research experience for future workforce

In the last 50 years, environmental health responsibilities have significantly expanded. Skilled professionals are needed to adequately respond to complex environmental health conditions that affect millions of people. And yet, "ample evidence indicates that the environmental public health workforce is too small to meet its responsibilities," stated the Centers for Disease Control and Prevention in its 2003 report, "National Strategy to Revitalize Environmental Public Health Services."

Between 1998 and 2008, environmental sciences graduate degree programs at 40 accredited schools of public health had a 20% decrease in the number of students earning advanced degrees, according to the Association of Schools of Public Health. To help better prepare and retain students in the field, our department has developed the Environmental Health Research Experience Program, a nine-week, summer internship that offers select undergraduates first-hand experience in the laboratories of leading environmental and occupational health researchers. This program targets outstanding students from disadvantaged or underrepresented groups and offers them a stipend to complete a substantial research project.

Students work with researchers who are investigating environmental and occupational health issues. For example, in 2009, two students investigated the prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) in urban areas and on Puget Sound recreational beaches. MRSA is an opportunistic pathogen that is spread via contact with infected surfaces or persons, and it has become a major health concern in hospitals and in communities.

Another student collected air filter samples from firefighters in Georgia performing prescribed burns. Woodsmoke is made up of a variety of different gases and particles, which makes it difficult to assess exposures to specific components of concern, such as 2.5 micrometers or smaller particles. The student was testing the accuracy of a woodsmoke biomarker to assess the firefighters' occupational exposures.

This program is supported by a five-year grant from the National Institute of Environmental Health Sciences. With a supplemental grant from ARRA, the 2010 summer program will be able to fund a total of 10 trainees and two science educators from other colleges.

For further reading

Executive Office of the President Council of Economic Advisers: *http://www.whitehouse.gov/sites/default/files/microsites/100113-economic-impact-arra-second-quarterly-report.pdf*

DEOHS Continuing Education Program: *http://osha.washington.edu*

Environmental Health Research Experience Program: *http://depts.washington.edu/ehug/ehrep/* ■

2009 Environmental Health Research Experience undergraduates (l to r): Kelsey Smith, Luke Swart, Ann Roubal, Ashley Hammerbeck, Mehak Ahluwalia, Mark Crippen, Dominique Bibbin

Photos
right: Sarah Fish
above: ©2010 www.photos.com

I to r: Elementary school teacher Teresa Sherwood, graduate student Josh Pan, and Professor Zhengui Xia in the lab. *Photo: Elizabeth Sharpe*

ARRA FUNDS SCIENCE EDUCATION

Using ARRA funding, Professor Zhengui Xia hired elementary school teacher Teresa Sherwood to work in her laboratory during summer 2009. Sherwood gained laboratory-based research experience and was able to take this training back to the classroom.

Sherwood has been an educator for four years, and currently teaches first grade at Lowell Elementary School in Seattle. She explains that students in her class are "fairly undifferentiated in terms of their skills and predilections." Therefore, as a teacher, she has an important role in preparing students early in life for careers. Her experience in Xia's laboratory wasn't about teaching the neurobiology concepts she learned to her students. Rather, she found the experience valuable because she learned research skills and how scientists collaborate.

She hopes to apply the collegial method used by the UW scientists in her classroom. She feels the method creates a community where people are willing to take risks and work with their peers to come up with answers to problems. "When students are struggling, they can talk about it or say they don't understand and work together to create solutions," says Sherwood. "We're used to working alone, but working together is also important to advance learning." ■

UW SUPERFUND

The US Environmental Protection Agency (EPA) is responsible for protecting the environment and public health from hazardous pollutants. Yet, contaminants still show up in our rivers, in fish, and even in us. For example, the lower Duwamish River, which is used by several species of Pacific salmon, is on the EPA Superfund National Priority List for remediation activities. Due to the river's pollution levels, the Washington State Department of Health advises against eating crab, shellfish, and most kinds of fish from these waters.

The Comprehensive Environmental Response, Compensation, and Liability Act, commonly referred to as "Superfund," was passed in 1980 to enforce the cleanup of hazardous waste sites. The EPA administers the program, in cooperation with state and tribal governments. Alaska, Washington, Idaho, and Oregon have 250 designated Superfund sites. Some of the waste site chemicals are not new, but persist in the environment for a long time.

How to effectively monitor these chemicals found at Superfund sites and to determine the risk these substances pose to human, animal, and environmental health is critical to targeting public health interventions. The National Institute of Environmental Health Sciences (NIEHS) provides funding for university-based research through the Superfund Research Program (SRP), whose twofold mission is to conduct research into human and environmental hazards associated with Superfund chemicals and to develop methods for remediating toxic exposures.

In 2009, NIEHS renewed funding for the SRP housed in our department and directed by Professor Harvey Checkoway.

RESEARCH PROGRAM RE-FUNDED

This federal funding has supported our program's critical research on environmental pollutants for 23 years.

One of 15 nationally, the SRP at the University of Washington (UW) began in 1986 as a basic laboratory program to identify biomarkers that may reflect chemical exposures, biological damage, or an increased susceptibility to disease or injury in humans. Later, SRP's emphasis shifted to applying basic research in real-life settings, namely, the effects of neurotoxicants, or chemicals that affect the nervous system, on human health and the environment. In humans, the amount of exposure to these chemicals can trigger a range of effects, from commonly occurring and reversible symptoms, such as dizziness or headaches, to irreversible nervous system damage that can result in debilitating neurodevelopmental disorders or chronic neurodegenerative diseases, such as parkinsonism.

Mixtures of environmental chemicals are present in local Superfund sites, such as the lower Duwamish waterway. Several species of Puget Sound salmon encounter low levels of pesticides and toxic trace metals during their migrations from fresh to salt water. Although some compounds are at levels not considered harmful, they can still interfere with the salmon's ability to detect predators and prey and to locate their natal streams. Professor Evan Gallagher, deputy director of the UW SRP, is studying how certain Superfund pollutants interfere with salmon olfaction, which is the method salmon use to detect chemical cues in the water.

Using a combination of molecular biology and biochemical and physiological methods, his research team is developing biomarkers that can identify salmon populations undergoing olfactory injury in polluted environments. These biomarkers will also be able to delineate areas where salmon may be at risk of olfactory injury during their migrations.

The work being done by Gallagher and other SRP researchers will be used to develop genetic, ecological, and engineering methods to monitor environmental exposures, identify species and individuals at risk, and ultimately to reduce the risk of adverse biological outcomes associated with chemical exposures.

SRP researchers share relevant research findings and work with community and tribal groups who are concerned about hazardous waste. These include groups affiliated with the lower Duwamish waterway, Bunker Hill in Idaho, and the Midnite Mine on the Spokane Indian Reservation. SRP also works with various regional non-profits, which are involved in cleaning up hazardous waste sites in and near their impacted communities.

In another project, scientists are investigating the role of two genes (PON1 and PON2) in various neurodegenerative diseases, including Parkinson's disease and cholinesterase inhibition from pesticide exposure in farm workers. Depression of the enzyme cholinesterase by certain pesticides can affect the normal transmission of nerve signals and result in continuous stimulation of the nervous system, manifested as muscle twitching, hypersecretion, nausea, and headaches. PON1 and PON2 are also enzymes, and play an important role in breaking down certain pesticides into less toxic forms.

Checkoway and Associate Professor Jing Zhang (UW Department of Pathology) lead other SRP projects. They are conducting research on a cohort of professional welders. Checkoway is involved with an epidemiological study to assess the effects of chronic exposure to manganese and other metals with risk, severity, and progression of clinically determined parkinsonism. Zhang is developing blood plasma biomarkers of parkinsonism among the welders, which may ultimately be used for early disease detection and prevention. Research Professor Stuart Strand (UW School of Forest Resources) is directing a project that develops poplar trees that are able to remove solvents and neurotoxic pesticides from the soil.

Ongoing research and outreach will ultimately contribute to an improved understanding of risks posed by hazardous waste chemicals.

For further reading

UW Superfund Research Program:
http://www.superfund.washington.edu
National Institute of Environmental Health Sciences:
http://www.niehs.nih.gov/research/supported/srp/index.cfm ■

Aerial view of the Duwamish River in Seattle and a warning sign posted by the Washington State Department of Health

Photos: Dcoetzee, www.wikipedia.org; Washington State Department of Health

TAKING CARE OF THOSE who take care of us

Photo: Jeannette Murphy, St. Luke's Rehabilitation Institute, Spokane, Washington

Healthcare workers and fire and rescue personnel provide vital services to our communities. Healthcare workers care for the sick, the injured, the old or infirm, while fire and rescue personnel protect our loved ones and keep them out of harm's way. Like any other occupation, these two come with their own sets of workplace risks. But unlike other job risks, injuries to individuals in these occupations may affect their ability to care for and protect the public.

With support from Washington State Department of Labor & Industries (L&I) Safety and Health Investments Project (SHIP) grants, our researchers teamed up with Washington state organizations and agencies to develop resources to reduce work-related risks associated with these two occupations.

Safe patient handling

Manual handling of patients, lifting or transferring them, is potentially hazardous to healthcare workers as well as to their patients. The L&I Safety and Health Assessment and Research for Prevention (SHARP) program investigated issues related to safe patient handling in healthcare in response to a request from the Washington State House of Representatives Commerce and Labor Committee.

SHARP found a close relationship between patient and staff safety. The number of patients who are older, heavier, and have more serious illness is increasing. Patient injury, such as from falls or skin scrapes, can result from manual patient handling mishaps.

Inadequate resources or procedures to properly lift patients can also harm the healthcare worker. In 2003, the number of workers' compensation claims for back injuries from hospitals and nursing homes was nearly four times higher than claims for back injuries from all other sectors combined. SHARP reports that nursing staff have among the highest back and shoulder injury rates of any occupational group in Washington state.

In recognition of the risks that healthcare professionals face, a 2006 Washington state law required acute care hospitals to implement a safe patient handling program. The law also prescribes necessary equipment and provides hospitals with a tax credit for patient handling equipment purchases.

A Safe Patient Handling Steering Committee made up of representatives from hospitals, health care unions, and SHARP was formed to assist hospitals. Our Continuing Education (CE) program worked with the committee to organize a 2008 conference, "Creating a Culture for Safe Patient Handling." Subsequently,

under a SHIP grant, CE redesigned a central online resource website and created a downloadable manual, *Best Practices for Safe Patient Handling*, to assist Washington hospitals in implementing cost-effective patient handling programs that protect both patients and healthcare employees.

Safe breathing air

Self-Contained Breathing Apparatus (SCBA) is essential personal protective equipment used by firefighters and rescue personnel. When fire and smoke in a burning building make the air unsuitable to breathe, firefighters wear SCBA, a face mask coupled with a tank of compressed air. It is also used for protection from toxic fumes or an oxygen-deficient atmosphere. Divers use a slightly different apparatus to accommodate breathing in deep-water operations.

Equipment failure is relatively rare, considering the number of times that SCBA is used. Yet, a technical report issued by the US Fire Protection Service in 2001 cautions that SCBA can fail and recommends that equipment be regularly inspected, maintained, and upgraded. Federal regulations enforced by the Occupational Safety & Health Administration (OSHA) require breathing air tanks to be tested quarterly and when any breathing air system is modified. Many fire departments test their own tanks using commercial measurement kits. Oxygen, carbon monoxide, carbon dioxide, condensed oil, and water content are all measured.

Water content can become a significant issue for rescue teams working in colder climates. Under typical conditions, breathing air from the tank cools when it expands and is released through the regulator. Water vapor may then condense, and if the temperature of outside air is cold enough, the condensed water can freeze, slowly build up, and ultimately block the valve's release of air.

OSHA requires the water content to be less than 24 parts per million (ppm), or even lower, depending on the outside temperature where the tank is used. Our Environmental Health Laboratory (EH Lab) has been testing breathing air for 30 years. Accredited by the American Industrial Hygiene Association, the EH Lab offers a wide range of services in analytical chemistry and instrumentation to Washington state organizations and agencies. Submitted air samples frequently failed to pass because the measured water vapor content exceeded OSHA standards.

With funding from a SHIP grant, EH Lab staff worked with four fire departments in Snohomish county, Yakima, and on Camano Island, and with the Global Diving & Salvage, Inc. in Seattle to test six different commercial measurement kits.

Water vapor is the most difficult component of breathing air to analyze accurately. Frequently, failure to pass the water vapor requirement is caused by the sampling itself, concludes EH Lab Director Russell Dills. He explains that sampled breathing air can be easily exposed to ambient air, which holds a great deal more water vapor than the sample itself, and thus can contaminate the sample and distort the final measurement. For example, air on a typical 50°F day could hold anywhere between 7,600 and 12,300 ppm of water vapor.

Dills found a great deal of variety in the commercially available methods used to collect and measure breathing air samples. He plans to develop best practices guidelines to help agencies and organizations better identify the quality and competency of kits used to measure compressed breathing air.

For further reading

Safe Patient Handling in Washington state: *http://www.washingtonsafepatienthandling.org/*

OSHA respiratory protection standards: *http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=12716&p_table=standards* ■

Photo: Marc Beaudreau

FOCUS ON FACULTY

AGE FRIENDLY WORKPLACE ADVOCATE MICHAEL SILVERSTEIN

Clinical Professor Michael Silverstein has been collaborating with our department's researchers and students since 2001.

He says it is "energizing to work with bright students who don't want to merely listen; they also want to engage." Silverstein finds gratification in seeing former students in successful careers. Kenneth Scott (MPH, Environmental and Occupational Health, 2009) is now at the Mountain and Plains Education and Research Center at the University of Colorado in Denver. Another student, Yolanda Sanchez, received a joint MPA/MS degree from our department and the Daniel J. Evans School of Public Affairs in 2007. She now works for the US Environmental Protection Agency.

In December 2009, Silverstein participated in a regional forum to showcase an innovative training workshop called "Designing the Age Friendly Workplace" that will better prepare labor unions, industry, and private practice for an aging workforce. The number of people who continue working after the age of 65 has increased significantly, and many companies have not developed programs or policies to address the challenges particular to a graying workforce, explains Silverstein. As workers age, chronic conditions become more prevalent and physical limitations increase. Due in part to these physiological changes, the numbers of severe injuries on the job increase with age.

With this curriculum, funded by the Washington State Department of Labor and Industries (L&I) Safety and Health Investments Project, Silverstein was able to apply research findings to practice settings.

Silverstein says, "I have spent most of my career doing front-line public health work. That's what drives me—addressing problems at their base, on the ground."

Also involved in developing the curriculum were faculty members Steven Hecker and Kate Stewart and former Curriculum Manager and alumnus Kenneth Scott as well as L&I partners Rick Goggins, Sharon Drozdowsky, Bruce Coulter, and Lena Wang.

Silverstein recently accepted the position of Assistant Director of the Division of Occupational Safety and Health (DOSH) at L&I. DOSH is the state equivalent of the federal Occupational Safety and Health Administration. The state agency oversees workplace safety and health in Washington state by developing, implementing, and enforcing regulations. He headed the same division from 1997 to 2005.

Percent increase in employment by age and sex in the past 30 years (1977–2007) *Source: US Bureau of Labor Statistics*

For further reading

Designing the Age Friendly Workplace:
http://www.agefriendlyworkplace.org/ ■

Photo: Letty Limbach

MY (FIRST) 30 YEARS IN NEUROTOXICOLOGY

by Lucio G. Costa

above: Lucio Costa's lab, l to r: Khoi Dao, Kathryn VanDeMark, Pam Roque, Marina Guizzetti, Lucio Costa, Daniella Pizzurro, Gennaro Giordano, Jing Chen, and Candice Suping

EDITOR'S NOTE:
Professor Lucio Costa delivered the UW School of Public Health's (SPH) Winter 2010 Distinguished Faculty Lecture. This story was originally published in the SPH's February E-news.

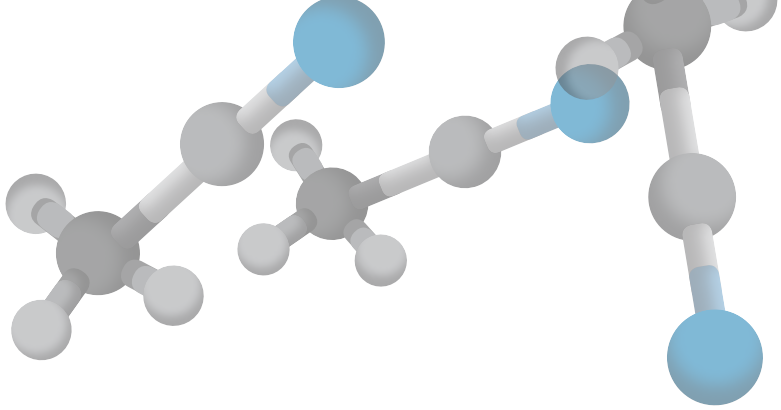
After a degree in Pharmacology at the University of Milan, and the then-mandatory year in the Italian army, I chose a postdoctoral offer from the University of Texas in Houston over a more lucrative one from a multinational pharmaceutical industry. I have never regretted it, as it was the start of my career in neurotoxicology. In Houston, I was asked to understand why animals may become tolerant to the neurotoxic effects of organophosphorus insecticides. We[1] discovered that this was due, to a great extent, to a decrease in the number of cholinergic muscarinic receptors (the proteins that bind the neurotransmitter acetylcholine) in brain and peripheral tissues. This project started my interest in the nervous system and how it may be adversely affected by chemicals.

Neurotoxicology—the study of substances that harm nerve cells and the underlying mechanisms—has a primary role in toxicology: most chemicals known to be toxic to humans are neurotoxic; the standards for exposure (both occupational and environmental) to several chemicals are often driven by neurotoxic effects; and neurotoxic chemicals may contribute to neurodevelopmental disorders (lead and methylmercury are the two most famous examples), as well as to neurodegenerative disorders, such as Parkinson's disease. Neurotoxicity issues are also associated with substances of abuse (alcohol, drugs), side effects of pharmaceuticals, global pesticide poisonings, and exposure to natural neurotoxins or environmental contaminants. Neurotoxicology thus offers a myriad of possible avenues of research projects of great scientific interest and relevance for public health.

Since my arrival at the University of Washington in 1983, I have been involved in a number of projects in the field of neurotoxicology. A central focus of my research has been the mechanisms involved in neurotoxic effects on both the mature and the developing nervous system, such as our studies with ethanol. It is well known that exposure to alcohol *in utero* may be associated with fetal alcohol syndrome (FAS), initially described by several UW investigators. My work on cholinergic muscarinic receptors led

—continued on page 12

[1] I once heard that there are three types of "we": the normal we (= us), the royal we (= I), and the scientist's we (= they). None of the work summarized in this article would have been possible without the hard work of students and research scientists in my laboratory and the precious and indispensable collaboration of many colleagues. Space limitations are the only reason they are not mentioned.



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to investigations of signal transduction pathways activated by these receptors, and their modulation by chemicals. The serendipitous discovery of an enhanced signaling during the so-called brain growth spurt, a period of brain development that is particularly sensitive to the toxic effects of ethanol, spurred the hypothesis that interactions of alcohol with the cholinergic system may underlie at least some of its developmental neurotoxicity.

We found strong correlations between ethanol's ability to cause microencephaly, or a small brain, which is a hallmark of FAS, and inhibition of muscarinic receptor signaling. We have subsequently shown that this biochemical effect of alcohol is particularly pronounced in astrocytes, characteristic star-shaped cells in the brain and spinal cord, by inhibiting the action of acetylcholine at muscarinic receptors in astrocytes. Ethanol impairs their proliferation and their ability to foster neuronal differentiation, thus providing some mechanistic basis for some of the effects of alcohol seen in *in vivo* exposure.

Other projects over the years have involved figuring out the mechanisms behind the neurotoxicity of formamidines (a family of insecticides/acaricides), the marine toxin domoic acid, and polybrominated diphenyl ether flame retardants, an emerging class of widespread environmental pollutants.

A second area of my research has been the development and validation of biomarkers, or indicators of exposure and susceptibility to toxicants. An example of these studies is our work with acrylamide, a chemical whose polymers are used in the treatment of drinking water and waste water; in the manufacture of glues, paper, and cosmetics; as well as in research laboratories. Acrylamide is also produced in some foods prepared at high temperatures. Acrylamide is known to induce peripheral neuropathy, a form of neurotoxicity that involves damage to the vast communications network that transmits information from the central nervous system to the rest of the body.

In our research, we identified adducts (or combinations) of acrylamide to hemoglobin and discovered a metabolite of acrylamide (glycidamide) that is most likely involved in its carcinogenic effects. We then validated these measurements in animals and, later, in a group of workers in an acrylamide-producing factory in China. Our findings indicated that hemoglobin adducts of acrylamide are an excellent indicator of cumulative exposure to this chemical and can identify, as well as predict, potential neurotoxicity.

Years later, some observations that we did not follow up at that time—the presence of hemoglobin adducts of acrylamide in unexposed animals and humans—opened the field to studies on acrylamide formation in food and its possible risks for humans.

Biomarkers of susceptibility, which often reflect genetic polymorphisms, *i.e.,* genetic variations in certain individuals, are an additional area of my research. One project is focusing on paraoxonase (PON1), a polymorphic enzyme that is involved in the metabolism of certain organophosphates (a class of insecticide that was originally synthesized during World War II). PON1 also plays an important role in lipid metabolism and hence, in cardiovascular diseases. Individuals with a "low activity" PON1 enzyme would be expected to be more sensitive to the neurotoxicity of certain insecticides. Our more than 25 years of collaborative work with Research Professor Clem Furlong (UW Departments of Medicine [Division of Medical Genetics] and Genome Sciences) have led to the molecular characterization of PON1 and demonstrated its role in modulating the neurotoxicity of certain organophosphorus insecticides.

For further reading

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Photo: Adrian Purser, www.wikipedia.org

HP GIFT SUPPORTS VIRTUAL KEYBOARD STUDY

In the near future, the keyboard as our fingers know it may feel very different. The popularity of touchscreen phones with virtual keyboards is one indication that new designs may replace traditional desktop keyboards. What will these different keyboards mean ergonomically? With a gift from the Ergonomics Research & Development Program at Hewlett-Packard (HP), a research team led by Associate Professor Peter Johnson is piloting one of the first ergonomics studies to evaluate ways people use touchscreen devices and how the device's design may influence an individual user's comfort and efficiency.

Johnson has a longstanding relationship with HP, as well as Microsoft and Logitech. He says the gift from HP is a result of previous work he and his research team have done for the company to assist with the design and evaluation of various new keyboards and computer mice.

Touchscreen devices can mimic typing by having the user lightly tap on the virtual keyboard keys, and they also allow a wider variety of hand gestures, such as a swipe to roll the text down or close an application. The researchers engineered tools to accurately measure the ergonomic impact of operating a touchscreen virtual keyboard. Based on these measurements, they are studying how to optimize the design of a touchscreen keyboard to match the user. They are also investigating the physical and performance trade-offs between using keyboards with keys and using virtual keyboards.

An advantage of the touchscreen keyboard is the size scalability of the virtual keys, Johnson explains. The current one-size-fits-all computer keyboard may not be the best fit for everyone. Their studies have shown that smaller sized devices put less strain on women and children's wrists, arms, and shoulders.

The research team also includes Exposure Sciences master's student Margaret Hughes, bioengineering undergraduate Lavi Aulck, researcher Erin Stamper (MPH, Environmental and Occupational Health, 2009) and Senior Fellow Charlotte Lewis. ■

JAMES WOODS *CONTRIBUTING TO THE DIALOGUE:* H1N1 FLU VACCINE

Last year, the World Health Organization announced that a pandemic of the H1N1 flu was underway. Health officials urged everyone to get vaccinated. The vaccine that the Federal Drug Administration licensed has been criticized because the multi-dose vials contain thimerosal, a mercury-containing compound that is used as a preservative to prevent bacterial and fungal growth. It is also used during vaccine production to inactivate certain organisms and toxins and to maintain a sterile production line.

EH News talked to Research Professor James Woods, a toxicologist, about thimerosal in vaccines.

Q: Why not use another preservative?

A: Thimerosal is very effective. It does not reduce the potency of the vaccines that it protects and does not decompose as other preservatives can.

Q: What is the concern about using thimerosal?

A: Mercury in any form is toxic to the brain, kidney, and other organs if given in high enough dosage and/or for prolonged periods. People are concerned about thimerosal in vaccines because children receive many inoculations during the first months of life, and before 2001, most of these vaccines contained thimerosal as a preservative.

Q: Has research shown a link between thimerosal and autism?

A: Research to date shows no significant association between thimerosal exposure and autism. However, it remains to be determined whether mercury exposure at a critical time of neurological development might increase the risk of developing autism or other developmental disorders in genetically susceptible children.

Q: Should parents avoid having their children vaccinated from multi-dose vials?

A: No. The health risks of not being vaccinated for H1N1 or other infectious diseases greatly outweigh any risks that might possibly be associated with vaccines themselves. ■

TRIBAL RIGHTS AND FISH CONSUMPTION WORKSHOP

by Alison Scherer and Elaine M. Faustman

Participants in the Tribal Rights and Fish Consumption Workshop discussed relevant studies, shared lessons learned, and determined key issues in Washington state.

Photo: Sarah Fish

Fish consumption rates are frequent drivers for making water quality decisions in our region, such as determining cleanup standards. However, current rates are much lower than the amount of fish native groups once consumed as part of their traditional heritage and diet. Less fish are available to these groups because rivers, lakes, and marine waters may be contaminated and access to water resources may be limited. As a result, decisions based on current fish consumption rates do not accurately reflect the needs of these communities.

Fish in the Pacific Northwest represent an essential cultural, spiritual, nutritional, and ceremonial resource for tribes. Tribal perspectives and tribal government contexts are needed to inform state and federal government-level decisions. Rarely, however, do tribal government representatives and scientists—including fisheries biologists, toxicologists, ecologists, and nutritionists—sit side-by-side and consider the challenging issues inherent in the relationship between tribal rights and fish consumption.

That changed in August 2009 when dozens of academicians, government agency representatives, environmental advocates, private-sector individuals, and students from Washington, Oregon, Idaho, and Alaska attended the "Tribal Rights and Fish Consumption Workshop: Issues and Opportunities for the Pacific Northwest" at the University of Washington (UW). Twenty-seven of the participants represented 14 tribes.

The workshop covered legal, cultural, and health dimensions of tribal rights and fish consumption and highlighted efforts that have successfully incorporated needs of local tribal groups in the development of cleanup standards for contaminated waters. Sponsors and participants also contributed resources related to tribal rights and fish consumption to the workshop's website: *http://depts.washington.edu/tribalws/index.php?doc=home.*

The workshop was sponsored by the UW Institute for Risk Analysis and Risk Communication, the UW Pacific Northwest Center for Human Health and Ocean Studies, and the Research Translation and Outreach Core of the UW Superfund Research Program. ■

WESTERN MIGRANT STREAM FORUM

Better Health for Hispanic Communities in Idaho

Professor Matthew Keifer and Pacific Northwest Agricultural Safety and Health Center (PNASH) Research Coordinator Rachel Schwartz described a unique educational outreach project at the February 2010 Western Migrant Stream Forum sponsored by the Northwest Regional Primary Care Association. The meeting in Seattle brought together researchers, clinicians, and public health professionals to discuss policies, clinical issues, and outreach and educational practices that impact farmworker health, and in particular, migrant farmworker health.

Keifer and Schwartz are project evaluators for the Idaho Partnership for Hispanic Health, which works to improve the health and well-being of Hispanics in two rural communities in southwest Idaho. At the forum, they showcased Compañeros en Salud or Partners in Health, an educational wellness program taught by Ignacio Cornejo and Martha Saldivar. The aim of the project is to improve nutrition and increase physical activity in order to lower the participants' risk of metabolic syndrome, indicated by a combination of conditions that include obesity, high blood pressure, and elevated glucose.

More than 500 participants have been pre-enrolled in the project. Results from the first pilot of 10 families were promising, and showed that participants were increasing their exercise as well as consumption of fruits and vegetables while decreasing consumption of fried and junk food. Fifty-three percent of the surveyed family members moved from suboptimal to optimal health.

The Idaho Partnership for Hispanic Health is a collaboration among PNASH, the Mountain States Group, and the Centro de Comunidad y Justicia. The partnership works with the Idaho Commission on Hispanic Affairs, Weiser Memorial Hospital, and Elmore Medical Center. Funding for the project was provided by the National Center on Minority Health and Health Disparities, which is part of the National Institutes of Health. ■

ANNUAL AGRICULTURAL SAFETY DAY

The Pacific Northwest Agricultural Safety and Health Center staffed educational booths for agricultural workers at the Annual Agricultural Safety Day on March 3, 2010, in Yakima, Washington. Pictured below is PhD student Jenna Armstrong, who is using florescent tracer, an educational tool to show workers how pesticide contamination can occur and to help workers evaluate their practices and protective equipment to reduce exposure. *Photo: Elizabeth Sharpe*

SPANISH-LANGUAGE OSHA-10 CLASSES OFFERED

The benefit of teaching the class in Spanish is that the men don't hesitate to ask questions.

Javier Sarmiento has been a carpenter in Seattle for more than 12 years, and has seen more than his fair share of accidents. He attests to the importance of health and safety practices in the workplace. Now he is teaching newly offered Spanish-language health and safety courses for the Pacific Northwest Occupational Safety and Health Administration (OSHA) Training Center (*http://osha.washington.edu*), the only authorized OSHA training facility in our four-state region: Alaska, Idaho, Oregon, and Washington.

During his career and long before he started teaching, Sarmiento took OSHA courses through his union's apprenticeship program. The OSHA courses made a difference in his profession, he explains, showing him ways to prevent injuries, such as using safety glasses and hard hats, wearing boots, and connecting harnesses.

In 2008, he completed OSHA 500, which prepares experienced construction safety professionals to teach the 10- and 30-hour voluntary compliance courses in construction safety and health. Then in November 2008, he began teaching OSHA-10 classes in Spanish to day laborers from Casa Latina, a Seattle-based non-profit education and employment office. The two-day course provides participants with a 10-hour OSHA card.

Javier Sarmiento *Photo: Elizabeth Sharpe*

Sarmiento says the workers from Casa Latina are receptive to the course content and interested in his experience. The benefit of teaching the class in Spanish, he says, is that the men don't hesitate to ask questions. In their native language, the men receive explanations they can more easily understand.

"They feel more confident after they have asked questions," Sarmiento says.

Offered on average every three months, the authorized OSHA-10 health and safety course in Spanish came from materials Carlos Dominguez, a research coordinator in our department, compiled and substantially edited. Dominguez says he was careful to make the materials accessible to different literacy levels. He and a third instructor, Bruce Millies, also help teach during the two-day course.

Dominguez explains that participants are able to engage and contribute their personal experiences working in the United States as well overseas.

Within two weeks after the 10-hour OSHA safety and health construction course, Dominguez follows up with each of the participants, asking them questions and observing their work.

He is pleased with what he finds: the workers recognize unsafe situations and pinpoint common hazards. These trained workers were more likely to take action to reduce workplace risks, such as carrying safety and personal protective equipment with them or asking for them. Dominguez says his follow-up observations show that training can raise awareness and change behavior concerning workplace safety. He cautions that the training is still limited in its ability to reduce hazards encountered by day laborers, whose work makes them particularly vulnerable to injuries on the job. ■

people & places

David Kalman, professor and chair, is on sabbatical through June 2010, and Professor **Richard Fenske** is the department's acting chair. Fenske has been the associate chair and also directs the Pacific Northwest Agricultural Safety and Health Center (PNASH).

Christopher Simpson was promoted to associate professor. **Victor Van Hee** (MPH, Occupational and Environmental Medicine, 2007) accepted a joint appointment as assistant professor in our department; his primary appointment is in the Department of Medicine. **Sara Dubowsky Adar** also accepted a joint appointment as assistant professor; her primary appointment is in the Department of Epidemiology. **John Garland** was appointed affiliate professor, and **Sheela Sathyanarayana** was appointed adjunct assistant professor; her primary appointment is in the Department of Pediatrics. **Andy Dannenberg** was appointed clinical professor.

From August to November, Professor **Sverre Vedal** participated in a faculty exchange at the University of Bergen in Norway, where he used survey data to study the possible relationship between occupational exposure and certain lung diseases.

Professor **Lianne Sheppard** received the Genentech Professorship in Biostatistics.

Professor **Michael Rosenfeld** was named chair of the National Institutes of Health's committee on Atherosclerosis and Inflammation of the Cardiovascular System.

Lecturer **Richard Gleason** was awarded the Lifetime Safety and Health Leadership Award from the Puget Sound Safety Summit, an alliance of government, management, and labor groups who develop methods and solutions to improve workplace safety.

Professor **Evan Gallagher** became the director of the department's Toxicology program. **Susan Inman** is the new undergraduate program manager and **Sean Schmidt** is the new manager of our Northwest Center for Occupational Health and Safety Education & Research Center (NW Center).

In August, Professor **John Kissel** presented on dermal absorption at the Workshop on Semi-Volatile Organic Compounds in the Residential Environment at the Indoor Air Institute in North Carolina. Associate Professor **Peter Johnson** presented at the World Congress of the International Ergonomics Association in Beijing, China. At the NIOSH Agriculture, Forestry, Fishing Workshop held in Cincinnati, Ohio, PNASH participants Professor **Matthew Keifer,** Program Manager **Marcy Harrington,** Research Industrial Hygienist **Kit Galvin,** and Affiliate Professor **John Garland** presented and led discussion sessions.

Professor **Elaine Faustman,** assisted by Research Manager **Eric Vigoren,** co-taught a course on chemical risk evaluation in Abuja, Nigeria, in collaboration with the International Union of Toxicologists, Nigeria's National Agency for Food and Drug Administration and Control, and Aiida-4 Medical Consultants, Inc. Faustman also served on a scientific organizing committee for the World Congress on Alternatives and Animal Use in the Life Sciences in Rome, Italy, where **Xiaozhong Yu,** director of IRARC's laboratory research and public health translation, participated in a session on reproduction, development, and fertility.

In September, Senior Lecturer **Charles Treser** helped deliver a course to home-care practitioners at the Idaho Healthy Housing Conference in Boise. At the University of Kansas Medical Center, Professor **David Eaton** was invited to speak at the 2009 Annual John Doull Symposium. He spoke on


Stacey Holland


Monica Leibrant


Jessica Rush


Sarah Fish

I to r: Richard Fenske, Elizabeth Kilcline, Susan Inman, Richard Gleason

people & places continued

"Modulation of aflatoxin-DNA binding by phytochemicals in human hepatocytes." Affiliate Professor **Curtis Omiecinski** also spoke at the symposium. PNASH Outreach Director **Helen Murphy** participated in the Western States Occupational Network Meeting held in Denver, Colorado, which aimed to build state-based occupational epidemiology and surveillance capacity.

In October, the **NW Center** sponsored a workplace violence workshop at the Washington State Governor's Industrial Safety and Health Conference. **Darren Linker,** manager of the School-to-Work program, helped coordinate an interactive all-day workshop for nearly 80 high school students.

Also in October, at the Centers for Disease Control and Prevention (CDC)-sponsored National Environmental Public Health Conference in Atlanta, Georgia, Industrial Hygienist **Nancy Beaudet** presented on pediatric environmental exposures, and **Tania Busch Isaksen**, a PhD student in the Environmental and Occupational Hygiene program, presented on climate change and sustainability work performed in Washington state environmental health departments.

At the Washington State Department of Agriculture Farmworker Education Program in Yakima, Professor **Fenske** presented his results on air monitoring for pesticide exposure, and Research Scientist **Maria Tchong-French** presented a Spanish-language session on practical pesticide safety.

Samantha Kantrowitz, a master's student in Toxicology, interned at the CDC over the summer through the Environmental Health Officer Junior Commissioned Officer Student Training and Extern Program and the Summer Undergraduate Program in Environmental Health.

Rad Cunningham, a student in the concurrent Environmental and Occupational Health MPH/MPA degree program, spent the summer working with unionized trash pickers from squatter communities in Asuncion, Paraguay, on an environmental and occupational health assessment.

Last August, Research Scientist **Rick Neitzel** (PhD, Environmental and Occupational Hygiene, 2009) presented on exposure estimation techniques at the International Conference on Innovations in Exposure Assessment in Boston, Massachusetts. In October, Neitzel presented on occupational noise exposure assessment at the EuroNoise conference in Edinburgh, Scotland. His research on mass transit noise was featured in the September 2009 edition of *Seattle Metropolitan* magazine.

Julie Wagner, a master's student in the Occupational and Environmental Exposure Sciences program, received a Green Steward Award from the National Oceanic and Atmospheric Administration, where she interned as an environmental specialist.

Elizabeth Kilcline, a master's student in Environmental Health, received our department's 2009 Top Scholar Award, which is funded through the UW Graduate School.

In October, Research Scientist **Diane Ceballos** received a scholarship at the Pacific Northwest Section–American Industrial Hygiene Association's Northwest Occupational Health Conference in Vancouver, Canada, where she also presented her research on best glove practices for car painters. Ceballos also presented on painters' health and safety in Leavenworth, Washington, to the Autobody Service Association.

Jennifer Krenz, a master's student in Environmental and Occupational Health, received a travel scholarship to the American Public Health Association Annual Meeting in Philadelphia, Pennsylvania. In the winter, Krenz worked in Cambodia on a project led by Associate Professor **William Daniell** to evaluate a pesticide-use reduction program.

Undergraduate students **Kendra Broadwater** and **Alyssa Vivas** received scholarships from the Washington State Environmental Health Association. In addition, Vivas was awarded a Mary Gates Research Scholarship for her research on adverse outcomes associated with placental abruption in Peruvian women.

Susan Inman

Courtesy of Alyssa Vivas

I to r: Kendra Broadwater, Alyssa Vivas

Members of the Nicaraguan Ministry of Work Subcommission. Nicaragua is the first developing country to include ergonomics as a part of its occupational health and safety laws, legislation that Lecturer Kate Stewart (3rd from right) helped influence. In April, Stewart and Affiliate Professor Barbara Silverstein talked with the Minister of Work in Laos, who has requested information on how to legislate ergonomics, using the Nicaraguan law as a model. *Photo: Courtesy of Kate Stewart*

Rachel Fischer, a senior fellow trainee in the Occupational and Environmental Medicine program, did a clinical rotation in Brunei, a small country on the north coast of Borneo in Southeast Asia.

Master's students **Jessica Kocian** and **Alexander Domesle** won Presidential Management Fellowships. The federal service program attracts students interested in pursuing positions in public policy.

In March at the Alaska Governor's Safety and Health Conference, Research Industrial Hygienist **Venetia Runnion** presented HexChEC, a video training package to raise awareness of welders' potential exposures to chrome 6, which was developed by the Field Research and Consultation Group. Also at the conference, PhD student **Ryan Blood** presented results of a study on occupational vibration exposures experienced by a crew of snow removal operators from the City of Valdez Public Works Department; the department won a Governor's Safety Award of Excellence for its proactive approach to protecting its workforce.

Announcements & Upcoming Events

Our department released the 2010 department calendar and the 2007–2009 biennial report. To view the biennial report online, please visit *http://depts.washington.edu/envhlth/biennial_report/biennial_report_07_09/*. For a print copy of the 2010 calendar or the biennial report, e-mail *esharpe@u.washington.edu* or call 206-685-6737.

On April 9–11, our faculty, staff, and students illustrated important research underway in our department at the *Paws on Science: Huskies Weekend at the Pacific Science Center* through interactive, hands-on activities.

On May 21, Student Research Day, an event showcasing the research of graduating master's students, will be held in Room 316 of the UW South Campus Center. From 12:30 to 1:20 pm, the event will feature five student presentations, each representing one of our degree programs. Then, from 1:30 to 3:00 pm, all graduating master's students will present posters. Attendance at one or both sessions is welcome. Refreshments will also be served. Please call the graduate program office at 206-543-3199 or e-mail *ehgrad@u.washington.edu* for more information.

On June 21–22, the 2010 Symposium on Air Pollution and Cardiovascular Disease will be held in the UW Tower. Organized by our Disease Investigation through Specialized Clinically Oriented Ventures in Environmental Research (DISCOVER) Center and the NW Center, this symposium will bring together investigators to discuss how air pollution may cause cardiovascular disease. To register, visit *http://www.airpollutioncvd2010.com* ■

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UNIVERSITY of WASHINGTON

Department of Environmental and Occupational Health Sciences
Box 357234
Seattle, Washington 98195-7234

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THE FINE print

We've changed. With our joint Aut 2009/Win 2010 issue, *Environmental Health News* is pleased to showcase a revised design, which reflects a new "family" of departmental print and online materials. *EH News* still brings you news of important research and educational activities in environmental and occupational health. For more in-depth coverage, we have modified and added new sections. A new section called "Contributing to the Dialogue" focuses on better understanding current issues through our faculty's expertise.

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Box 357234
Seattle, WA 98195-7234
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E-mail: *esharpe@u.washington.edu*

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