Biennial Report

1999–2001

Department *of* Environmental Health

School of Public Health & Community Medicine University of Washington

TABLE OF CONTENTS

COVER

Totemic Theory #3 ©2000 by Bill & Clarissa Hudson, courtesy of Stonington Gallery, Seattle, WA. The front cover and section divider pages depict details from this 6-foot-tall, three-dimensional, acrylic-on-canvas totem pole. The image elements are derived from Alaskan Native artist Clarissa Hudson's button blankets. (*photos: Kathy Sauber*)

WHO WE ARE ...

PEOPLE AND PROGRAMS

Organizational Chart

Chair
Assistant Chair for Outreach
Administrator

Academic Programs

Environmental Health Technology

Industrial Hygiene and Safety

Occupational and Environmental Medicine

Toxicology

Undergraduate Major

Student Services

Graduate Program Office

Undergraduate Program Office

Community Services

Biocontaminant Laboratory

Environmental Health Laboratory

Field Research and Consultation Group

Molecular Biology/ Biomarkers Laboratory

Centers & Institutes

Center for Ecogenetics and Environmental Health
• Community Outreach and Education Program

Center for Chemically Related Illness

EPA NW Research Center for Particulate Air Pollution & Health

Institute for Risk Analysis and Risk Communication
• Consortium for Risk Evaluation with Stakeholder Participation
• Child Health Center
• Center for the Study and Improvement of Regulation

International Scholars in Occupational and Environmental Health

NW Center for Occupational Health and Safety
• Continuing Education Program

Occupational Epidemiology & Health Outcomes Program

Pacific Northwest Agricultural Safety & Health Center

Policy Analysis and Program Evaluation Initiative

Superfund Basic Research Program

UW OSHA Education Center

Toxicology graduate students Jing Shao (right) and Francesca Noel Hudson work in the lab

Kathy Sauber

Entering a new millennium

Fresh challenges for a new era

During the 1999–2001 biennium, as we crossed the centuries and millennia, we also made some important transitions within our Department and School. We can now look back and assess changes that we were anticipating two years ago.

In 1999, Dr. Pat Wahl was beginning her tenure as dean of the School of Public Health and had just launched a multiyear development plan. She has led an effort to identify priorities for research, teaching and service, and to strengthen ties with the public health practice community in Washington state and the region. In June 2000, Dr. Dave Kalman became chair of the Department of Environmental Health and joined the school in expanding internal programs and external partnerships.

This period saw major national changes in health issues, environmental concerns, and political leadership. While the public continues to be concerned about protection of health and preservation of environmental quality, we need to make sure that the benefits of our interventions are evident and meaningful to average citizens. We need to connect our theoretical work with tangible public health benefits and balance our research with other social and personal needs.

The five feature stories in this report describe some of our efforts. Five alumni profiles illustrate how our students are making a difference in the broader world.

The twin revolutions in molecular genetics and digital technology continue to reshape our lives, challenging us with new problems to manage, from computer viruses to ethical dilemmas about the proper use of biotechnology. At the same time, these technologies offer previously unimagined access to information, communication tools, and medical benefits.

The academic world is struggling to adjust to these changes. While "lifelong learning" has always been a part of our values as scholars and teachers, this model of educational development is emerging as a personal and social imperative. How will it change the way we teach, do research, and provide services?

Our Department has a distinctive orientation to many of these questions. Since legislation was enacted in 1963, the Department has received support from funds paid by employers and workers into the industrial insurance fund, appropriated biennially by the state Legislature. The intent was that some portion of workers' compensation funds go toward preventing future occupational injuries and disease. The law also provided for an advisory committee with members from state agencies; business, labor, and medical associations; and other University departments to review our Department's programs (see page 56 for a list of current members).

This mandate to provide teaching, conduct research, and offer services related to the safety and health of Washington workers and employers has shaped our growth and continues to influence our activities. Our connection with real-world problems places us in a position to be among the first to recognize and respond to change.

As we enter the new millennium, we aim to expand and improve the societal benefits of our work, recognizing that external partners are essential in this undertaking. We encourage readers whose imaginations are engaged by this report to contact us and join in future efforts in environmental and occupational health.

Our mission

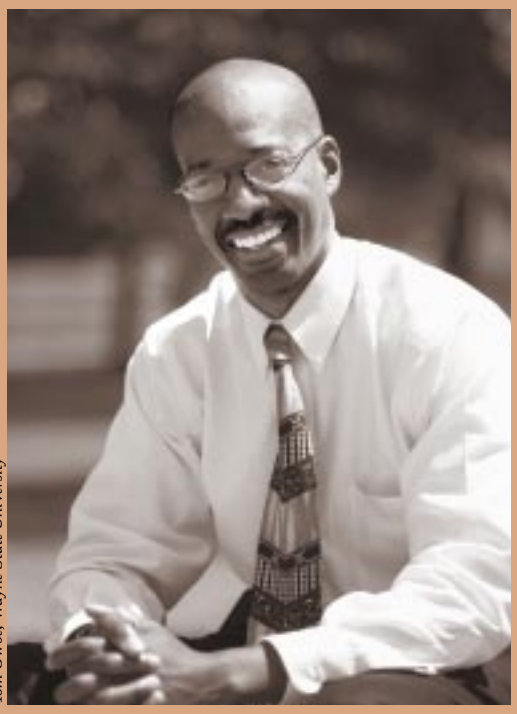
To identify agents in the environment and the workplace that affect human health

To elucidate their mechanisms

To develop strategies for confronting their effects

To share the knowledge obtained

In addressing this public health mission, our goal is to promote excellence in education and research.



Tom Owoc, Wayne State University

James Blessman MD, MPH

Director

Division of Occupational Medicine

Wayne State University

Class of 1989

Master of Public Health (MPH)

Occupational & Environmental Medicine

practicing preventive medicine

James Blessman decided to specialize in occupational medicine out of a frustration that he couldn't do enough for his patients as an internal medicine trainee. "I was often called to see individuals with end-stage organ damage; they were asking me to help, and for the most part it was too late," he recalls. "This led me to the preventive medical specialty, occupational medicine." He found out about occupational medicine "late in the game," but was fortunate enough to get accepted in two programs, one in Chicago and the University of Washington.

A Michigan native, he packed himself and his then-pregnant wife into a too-small Honda hatchback and headed west. He wasn't disappointed.

"I was able to rub elbows with many of the individuals who were actually writing in the field" such as Linda Rosenstock, Scott Barnhart, and Bill Daniell. "Coming from a community hospital, this was a big deal to me." He was also impressed by the quality of the other candidates in the program. His class included Joel Kaufman and Matt Keifer, both now on the DEH faculty. "My colleagues were an inspiration then and continue to be to this day," James recalls.

After graduating from the residency program in 1989, he returned to Detroit and joined the faculty of Wayne State University. In 1996, he was asked to serve as the medical director for City of Detroit employees. Under his direction, the city has saved $20 million in occupational safety and health costs in the past five years. Last year, Wayne State made him director of the Division of Occupational Medicine and interim residency director for the occupational medicine residency program.

He is board certified in internal medicine and occupational medicine. His research specialties are low back pain and occupational stress. "Needless to say my life is currently very exciting and I feel blessed and honored to serve in the capacity that I do." He encourages medical residents and graduate students to find a balance in their lives. He has been married 16 years and has four children, is active in his church, and plays bass guitar.

His advice to those currently in training includes: "enjoy your stay; you are working with a good group of individuals who will likely be able to open doors for you in the future." He considers preventive medicine a "noble field that requires that your efforts be focused." He cautions residents not to expect instant gratification, because people "don't know that they have not developed problems because of your efforts."

He would urge today's students to develop skills in "learning how to learn quickly" and effective communication. In occupational medicine, information is changing rapidly "and you need to know how to keep pace with it." He has found that "there is little that you can do by yourself; you have to be able to work effectively with others."

ALUMNI PROFILE

Our department

In the Department of Environmental Health, we identify, seek to understand, and help manage the effects of the environment on human health by ...

- evaluating and controlling workplace hazards
- maintaining a safe supply of food and drinking water
- discovering the mechanisms of occupationally and environmentally related diseases
- improving methods for treatment and disposal of solid and toxic wastes
- researching how the environment interacts with genetics to influence human health
- studying how environmental chemicals affect the health of children
- educating the next generation of occupational and environmental health professionals

Academic programs

See Department's organizational chart on page 2

Environmental Health Technology students learn to identify major sources of contamination in water, air, soil, and food and take appropriate prevention, control, and communication measures. Students may achieve a Master of Science degree. One PhD pathway is also suitable for Technology program students.

Industrial Hygiene and Safety students study health hazards found in the workplace, such as chemicals, airborne particles, noise, vibration, ergonomic factors, and safety hazards. They learn to recognize these hazards, evaluate the possible health risks, and implement effective control measures. The program offers a PhD degree and two Master of Science tracks: industrial hygiene and safety/ergonomics.

The Occupational and Environmental Medicine residency trains physicians in occupational and environmental medicine through clinical, didactic, and practicum components. The program is accredited by the Accreditation Council for Graduate Medical Education and leads to a Master of Public Health and board eligibility in Occupational Medicine.

The Toxicology program focuses its study on the adverse effects of chemical exposures on human health, and engages in basic and applied research on the molecular, genetic, and biochemical mechanisms underlying these effects, together with the behavioral consequences and risk analyses associated with environmental and workplace toxicant exposures. Both master's and doctoral degrees are offered.

The Department's Undergraduate program offers two Bachelor of Science degree paths. One focuses on sanitary hazards associated with drinking water, wastewater, food, housing, and insects and rodents. The other focuses on chemical and physical hazards associated with indoor and outdoor air, water, soil, and the workplace.

Other Departmental Programs

Service Programs

The Field Research and Consultation Group conducts field-based research and provides occupational and environmental health and safety consultation to companies that request assistance. Consultants observe work practices, collect samples or other data, obtain laboratory analyses, and, in some cases, coordinate medical examinations. Consultations include a final report summarizing findings of worksite evaluations and recommendations for controlling workplace exposures. The Field Group also works with companies to design and evaluate effective control strategies. These services are funded by the state's Medical Aid and Accident Funds.

The Environmental Health Laboratory provides chemical analytical services to Washington's employers, labor groups, and governmental organizations. It also performs chemical analyses and provides consultation related to occupational and environmental health to researchers within the University. The Laboratory has been accredited by the American Industrial Hygiene Association since 1977.

Centers and Institutes

The Center for Ecogenetics and Environmental Health (CEEH), funded by the National Institute of Environmental Health Sciences (NIEHS), pulls together more than 50 faculty from 18 UW departments to study how environmental factors interact with genetics to influence diseases such as cancer, birth defects, asthma, and chronic neurological diseases. A key focus is to understand how different people metabolize drugs and chemicals, which can affect their disease susceptibility or resistance. The Center, in collaboration with the Institute for Public Health Genetics, supports a research and outreach effort that addresses the ethical, legal, and social issues related to the collection and use of genetic information.

Within the CEEH, the Community Outreach and Education Program (COEP) helps the public understand how genetic and environmental factors interact to produce disease. COEP's projects include:

- A curriculum that uses environmental health sciences as a framework to integrate science, social studies, and English. Students share their experiences through statewide videoconferences.
- Statewide distribution of a School to Work curriculum, which raises awareness of health and safety issues for working teenagers. The goal of this collaborative project between the Department of Environmental Health and the Washington state Department of Labor and Industries is to work with teachers statewide to prevent work-related injuries in teenagers.
- Community partnerships, including a collaboration with the Shoalwater Bay Tribe to develop a shellfish monitoring management plan.

Center for Ecogenetics and Environmental Health

CEEH

Center for Chemically Related Illness, part of the Occupational and Environmental Medicine program, seeks to offer the best diagnosis and treatment of patients with chemically related illness, improve public understanding of such illness, and conduct research on this topic. Patients are usually referred through the workers' compensation system.

The EPA Northwest Research Center for Particulate Air Pollution and Health (PM Center) is one of five in the country funded by the EPA. The Center addresses health effects of particulate matter air pollution. Its researchers are from the departments of Environmental Health, Atmospheric Sciences, Biostatistics, and Civil and Environmental Engineering (UW and Washington State University). The PM Center emphasizes partnerships with the Puget Sound Clean Air Agency, Environmental Protection Agency Region 10, Washington state Department of Ecology, and the US Centers for Disease Control and Prevention.

The Institute for Risk Analysis and Risk Communication (IRARC) works to improve risk assessment methods and the scientific foundations supporting risk assessments. Three research programs fall under IRARC:

> The Center for Child Environmental Health Risks Research is funded by the US Environmental Protection Agency (EPA) and NIEHS to further knowledge of children's susceptibility to toxicants.
>
> The Consortium for Risk Evaluation with Stakeholder Participation (CRESP) works with the US Department of Energy (DOE) to advance cost-effective cleanup of the nation's nuclear weapons production facility waste sites. A goal is to give affected parties a greater understanding of the scientific and technical basis of environmental management decisions.
>
> The Center for the Study and Improvement of Regulation is funded by Carnegie Mellon University to merge the study of pollution, risk, public health, technology, economics, organizations, and history to improve environmental health and safety regulations.

The International Scholars in Occupational and Environmental Health is a training program based in the Occupational and Environmental Medicine program. The Center is funded by the National Institutes of Health through the Fogarty International Center and NIEHS and by NIOSH. It supports research and training partnerships with faculty and scientists in Vietnam, Thailand, Nicaragua, and Costa Rica.

The Northwest Center for Occupational Health and Safety is one of 16 education and research centers funded by the National Institute for Occupational Safety and Health (NIOSH). It supports graduate and continuing professional education in industrial hygiene, safety, occupational medicine, and occupational health nursing. The Center serves as an educational resource for Washington, Oregon, Idaho, and Alaska.

PM CENTER

CRESP

PNASH

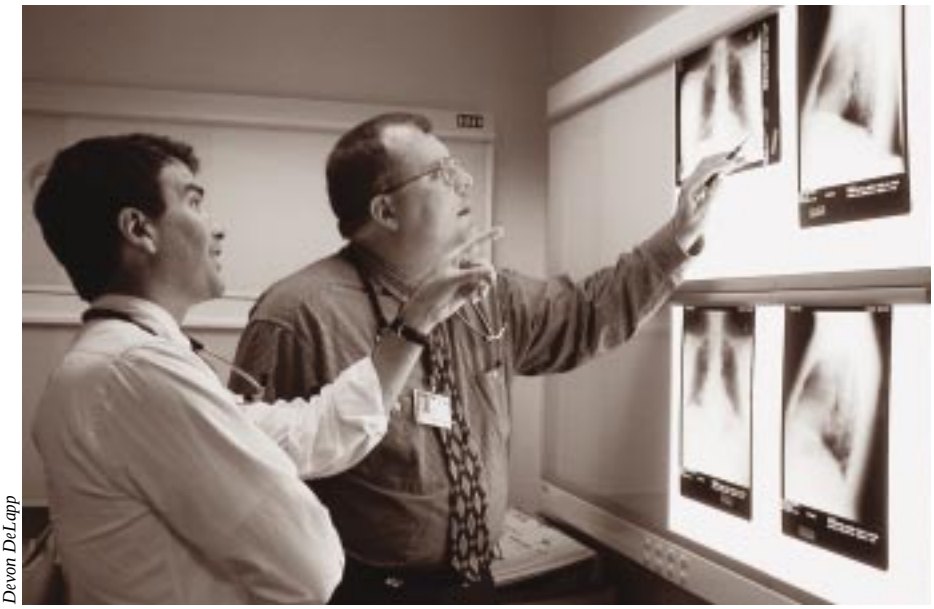
The Occupational Epidemiology and Health Outcomes Program conducts research to improve medical care, update treatment guidelines, and provide information on treatment outcomes to injured workers and their physicians.

The Pacific Northwest Agricultural Safety and Health Center (PNASH) conducts research, develops interventions, and provides professional education to improve the safety and health of Northwest workers in farming, fishing, and forestry. To meet these aims, Center researchers work closely with colleagues at Northwest universities and in collaboration with employers, labor, community organizations, and government agencies. The PNASH Center is funded by NIOSH and the state of Washington.

The Policy Analysis and Program Evaluation Initiative works closely with the state Department of Labor and Industries (L&I), and with business and labor to improve the quality of occupational safety and health policies and programs in Washington. An interdisciplinary team is assembled for each project, based on its needs. Research activities include focus groups, qualitative interviews, site visits, content analysis, program evaluations, and other consultation.

The Superfund Basic Research Program is a NIEHS-sponsored, interdisciplinary program involving faculty, staff, and graduate students from DEH, Civil Engineering, Biochemistry, Forestry, and Microbiology. The goals are to develop biological markers to assess people's exposure to toxicants and susceptibility to disease, to assess physiological damage in humans and wildlife, and to develop new technology to remediate contaminated sites.

The UW/OSHA Training Institute Education Center offers high-quality, hands-on training on standards mandated by the federal Occupational Safety and Health Administration (OSHA) and state agencies in Washington, Oregon, and Alaska. Training is offered via traditional classroom and distance learning technologies.



Devon DeLapp

David Bonauto, attending physician, and Paul Darby, resident, of the Occupational and Enviromental Medicine program examine patient x-rays

WHAT

WE DO ...

AND

WHOM

WE

SERVE

SACRED OBJECTS, SAFELY RETURNED

helping to preserve a cultural heritage

A century or more ago, anthropologists sought to preserve objects of Native American heritage using the best tools they had–preservatives based on compounds of arsenic, lead, and mercury. Today, museums are faced with having potential human health risks in their collections.

The toxicity of old pesticides has taken on a serious new meaning since the passage of the federal Native American Graves Protection and Repatriation Act. The 1990 act entitles Native American tribes to claim human remains, and funerary, sacred, or patrimonial objects (those that are part of their cultural inheritance) back from museums.

Ceremonial use

Dr. James Nason, professor of Anthropology and curator of Pacific and American Ethnology for the University of Washington's Burke Museum, was concerned about turn-of-the-century pesticide residues in the Burke's collections. As chair of repatriation operations for the Museum, he knew that many of the sacred objects might be put back into active ceremonial use. Ceremonies can last up to four days, with important roles performed by tribal elders who could be particularly susceptible to toxic effects.

"We had an obvious ethical–and probably legal–obligation to inform recipients of any potential hazard," he said. To detect and weigh the severity of the hazard, the Museum needed to find a non-destructive analytical testing procedure that would preserve sacred objects often made of leather, fur, feathers, or other perishable materials. The Burke turned to the Environmental Health Laboratory.

The lab's initial assistance focused on measuring arsenic, lead, and mercury contamination, using a hand-held x-ray fluorescence (XRF) spectrometer. The machine is so small and sensitive that it can take readings by only gently touching the artifact without causing harm. It is what is called a "non-destructive" testing method.

The spectrometer relies on the emission of characteristic x-rays from each element. The lab first ran calibration tests by adding known amounts of the toxic elements to surrogates for the artifacts, provided by Nason. Then the Museum tested about 400 artifacts. Nearly half had residues of arsenic, mercury, or both.

The next step was to determine how much pesticide residue might rub off, said Laboratory Director Rolf Hahne. The presence of arsenic, mercury, or lead alone doesn't necessarily pose a human health hazard. That depends on whether the pesticides are tightly bound into the artifact's structure, or if they can rub off on the skin and be absorbed or ingested, or if they can become dislodged and become airborne and inhaled.

The third step was drafting guidelines for contact with the object. Since the degree of handling varies from object to object, depending on ceremonial use, the guidelines described three levels of contact—infrequent, moderate, and frequent. Exposure guidelines were developed using the Agency for Toxic Substances and Disease Registry (ATSDR) minimal risk levels for arsenic and mercury, and EPA guidelines for lead.

Rolf Hahne

The hand-held spectrometer is so small it can be placed inside a basket

Tribal involvement

The Quinault Indian Nation, located on the Pacific coast near Grays Harbor, had been working with the Burke on the repatriation of eight sacred or ceremonial objects when the contamination was discovered. The objects include a drum, two rattles, an eagle-feather headdress, a sea otter sash, and a cedar-bark head ring.

The Tribe was motivated to mitigate the contamination—or make it less harmful—because "it was

Dr. James Nason of the Burke Museum and Leilani Cubby of the Quinault Nation clean pesticide residue from a ceremonial drum

inset: After a surface cleaning of this Quinault rattle, Dr. Nason will again test it with a handheld XRF spectrometer

Rolf Hahne

very important to us to bring these sacred objects home," said Guy Capoeman, a Quinault Nation council member and chairman of the Tribe's repatriation committee. "The University gave us a wonderful opportunity," he said. "They offered to give our staff training in how to clean artifacts, in case we get objects returned from other museums. We jumped right on that."

This summer, Leilani Cubby, the Quinault Nation's cultural coordinator, sat down with Nason to test and clean the objects. Of the eight Quinault artifacts, only one—the sea-otter sash—seems so permeated with mercury and arsenic that it probably can't be used ceremonially, Capoeman said.

If a ceremonial object tests positive for contamination, the Tribe has several choices, according to Nason. The Tribe could try cleaning the objects. It could use the artifacts for display and replication, but not for ceremonial use. Or it could allow ceremonial use, but require long sleeves or gloves to minimize skin contact. A less acceptable option would be for the Museum to use a sealant to trap

the residues. These ceremonial objects "are living things that are supposed to breathe," Nason said.

"The Burke and the (Laboratory) staff were more than willing to help us," Capoeman said. The relationship was so close and respectful that the Tribe wants to invite University staff to a ceremonial dinner when the objects are finally returned. The Tribe is in the final stages of federal approval, and hopes to finish the process this fall.

"The technology has helped us preserve a vital part of our heritage and culture," Capoeman said. "It was a blending of the new and the old that is helping us bring these objects home."

UW in the forefront

The UW has one of only four or five such analytical testing projects in North America, said Nason, who is involved in several national committees. "We know as much about this as anyone in the world and have far better data than most."

The joint work between the Laboratory and the Museum is continuing. They will work together to analyze exposure risk, and have requested grant support. The project started with arsenic and mercury, but unanswered questions remain about fumigants and organic pesticides used from the 1930s through 1950s.

More also needs to be known about whether subsurface contamination—pesticides that traveled deep into the wood of a rattle or the pores of a drum skin—can rise to the surface.

For further reading

Burke Museum: *http://www.washington.edu/burkemuseum/*

Environmental Health Laboratory: *http://depts.washington.edu/envhlth/cont_ed/ehlab.html*

Hahne R, Nason J. Evaluation of total and removable levels of arsenic, mercury, and lead in natural history museum artifacts as a preface to preparing guidance for the handling of repatriated artifacts. American Industrial Hygiene Conference & Expo, June 2001, New Orleans. *http://www.aiha.org/abs01/01exp2.html*

National NAGPRA database: *http://www.cast.uark.edu/other/nps/nagpra/*

Seifert SA, Boyer LV, Odegaard N, Smith DR, Dongoske KE. Arsenic contamination of museum artifacts repatriated to a Native American tribe. JAMA 2000 May 24–31;283(20):2658–2659

Zappala JL. Artifacts being returned to Quinault Indian Nation. Daily World, Aberdeen, WA. Feb 23, 2001. *http://www.thedailyworld.com/daily/2001/Feb-23-Fri-2001/news/news3.html*

Chilkat blanket, Tlingit
catalog #1999-97/210

Cedar bark basket, Tsimshian
catalog #2.5E556

Vest, Sioux
catalog #2.0E117

Courtesy of the Burke Museum of Natural History & Culture

Kathy Sauber

Ann Wawrukiewicz MS

Indoor Air Program Coordinator
EPA Region 10

Class of 1997
Master of Science (MS)
Environmental Health
Technology

a concern for people and the air they breathe

Ann Wawrukiewicz has found her ideal job—one that puts her desire to help people together with her fascination with indoor air quality. As indoor air program coordinator for Region 10 of the US Environmental Protection Agency, she answers questions from the public about mold, asthma, carbon monoxide, and volatile organic compounds.

She works with schools to assess and improve their indoor air quality, and organizes workshops for the community. "I have always found indoor air quality just plain interesting," she says. The public contact and fieldwork allow her to see the direct results of her work.

The EPA's indoor air program is a nonregulatory outreach and education program. Ann's territory extends through Washington, Oregon, Idaho, and Alaska.

Ann first became involved with EPA as a part-time volunteer intern during the summer between her first and second years in the Technology graduate program. She spent some of her time with the indoor air program and found that "I liked the subject from the start." She was hired into an EPA enforcement job after graduation, but kept her interest in indoor air. Last year, her current job opened and "it was really a perfect fit."

Her UW coursework provided a good general background in the health effects of indoor and outdoor air pollution. She regularly uses the skills she learned in exposure assessment and risk assessment courses when she needs to evaluate someone's potential indoor exposures. Information from her industrial hygiene classes helps her "immeasurably" in the field. She feels the strong general knowledge she gained in the program makes it easier to "distill out the key points of the subjects into language a nonscientist can understand."

The most important thing she learned in graduate school was critical thinking. "In my job, so much information passes by my desk, and a lot of it comes from people who have a product to sell. It's really important for me to look behind that and figure out if this is something that will help people or make their air quality worse." Her professors in Environmental Health emphasized taking an analytical and critical approach to articles and information, "and it serves me really well today."

She took a broad range of classes, including those in her Technology major and Industrial Hygiene and Safety, plus public affairs and environmental law courses outside the Department. The range of classes, combined with a practical thesis project, gave her a broad base of knowledge and experience. "This approach isn't for everyone, but I'm really glad I took advantage of the variety."

From her position inside a federal agency, Ann considers DEH graduates to be solid candidates for entry-level positions. She also sees them moving easily into indoor air quality jobs at state and county health departments, and nonprofit agencies such as the American Lung Association.

ALUMNI PROFILE

BEYOND THE LABORATORY WALLS

listening to community stakeholders

Researchers in the Department's largest center, the Center for Ecogenetics and Environmental Health (CEEH), reached beyond the controlled environments of their laboratories last year to engage in challenging discussions of racial disparity, poverty, and pollution.

At the request of the National Institute of Environmental Health Sciences (NIEHS)—part of the National Institutes of Health and the major federal funding source for environmental health sciences research and community outreach—the CEEH hosted a regional Town Meeting. Dr. Kenneth Olden, director of the NIEHS, and a half dozen of his key staff came to Seattle for the event. This was the fourth NIEHS-sponsored Town Meeting, and the first in the Pacific Northwest.

Planning for the Town Meeting took researchers to the Yakima valley, tribal lands, and industrial neighborhoods, said Associate Professor Thomas Burbacher, director of the Center's Community Outreach and Education Program (COEP).

As a result of the process, the CEEH expanded its outreach program in new directions. The Center, based in the DEH and funded by NIEHS, already had a seven-year track record with school outreach. Through the Town Meeting, the Center began working with community groups that had more complex agendas.

Environmental justice was a key theme of community testimony at the Town Meeting—*Healthy Environments, Healthy Communities*—which was held September 29–30, 2000 at Mount Zion Baptist Church in Seattle and attended by more than 200 people. The two-day event included workshops, discussion circles, an open microphone session, and presentations by more than 20 community groups, youth groups, and tribal nations.

Mary Levin

top to bottom: Eric Dinh, YMCA EcoLeaders; Yolanda Sinde, CCEJ; Carol Dansereau, Washington Toxics Coalition

Community Issues

Workshops and discussion circles brought researchers, legislators, and community members together to discuss health risks of pesticides to agricultural workers and their families, contamination of seafood by marine toxins and chemical pollutants, hazardous waste sites, culturally appropriate research strategies, and links between indoor and outdoor air pollution and asthma.

Community members urged investigators to become advocates for disease prevention, not just providers of scientific data. "We want to see decisions based not on risk assessment but on prevention," said Carol Dansereau of the Washington Toxics Coalition. "We need community-based research, not community-placed research. We're being studied to death," Yolanda Sinde of the Community Coalition for Environmental Justice (CCEJ) told researchers at the Town Meeting. "We do need research," Sinde added, "but we also need action once we get the information. We need researchers to work with the communities to find solutions to the problems as well."

Faculty members Rich Fenske, Dave Eaton, Matt Keifer, and Tom Burbacher listen to Judith Vega describe the needs of various constituencies at a planning meeting in the Yakima valley

inset: Dr. Kenneth Olden, director of NIEHS

Joel Levin; inset: Mary Levin

While he was in town, Olden met with members of the Shoalwater Bay Tribe and visited Seattle's South Park neighborhood, which has a high percentage of low-income and minority residents, and high levels of air, noise, and chemical pollution from freeways, airports, and industry.

"I acquire a sense of urgency by hearing people testify at these meetings," said Olden. "So-called intractable environmental problems can be solved through investment in fundamental science and new technologies," he said. "Ultimately, the American people have to decide how many cases of cancer or Parkinson's disease are acceptable."

That sense of urgency has led to action by NIEHS and CEEH staff. In the months following the Town Meeting, center staff began work on several community projects.

Shoalwater Bay project

In collaboration with the Shoalwater Bay Tribe on the Washington coast, the CEEH has requested funds from the NIEHS to develop a Shellfish Monitoring Management Plan. "We're looking at the overall health of the bay, using shellfish as our medium," said Garry Burns, the Tribe's environmental director. Information from the study will provide a foundation for future work addressing the high rate of pregnancy loss among members of the Shoalwater Tribe. The grant application was a direct result of the Town Meeting, specifically the opportunity to meet with Olden, said Burns. "We had a very productive meeting with him face-to-face."

Youth network

CEEH staff organized a videoconference that allowed students from across Washington state to participate in the Town Meeting. The videoconference project, called the Youth Network for Healthy Communities, was so popular that it has become a continuing project. By summer 2001, 18 middle and high

school teachers and their classes had participated in three conferences. "Students researched environmental health issues in their communities, ranging from impacts of Superfund sites to the health effects of wildfires, the environmental impact of diesel power generators, and *E. coli* bacteria," said COEP Curriculum Manager Jonathan Sharpe.

Health justice network

As a result of the Town Meeting, CEEH staff became actively involved in this coalition, which is committed to addressing health justice issues, such as disparities associated with race, class, and ethnicity. The coalition is planning a conference for January 2002, and members have begun presenting workshops on health disparity in Washington state, said COEP Manager Chetana Acharya.

Healthy schools roundtable

CEEH staff participated in the planning of the Healthy Schools Roundtable, organized by the Institute of Children's Environmental Health and EPA (Region 10) with the goal of finding ways to better protect children's environmental health in schools. Roundtable participants included state agencies, parents and parent-teacher organizations, educator and school administrator organizations, indoor air experts and activists, and state representatives.

Healthy futures project

COEP staff are working with the Institute for Children's Environmental Health to involve young people throughout Puget Sound in researching environmental health issues.

For further reading

Community Coalition for Environmental Justice Web site, *http://www.ccej.org/*

Community Outreach and Education Program Web site, *http://depts.washington.edu/ceeh/Outreach/outreach.html*

DEH Town Meeting Web site, *http://depts.washington.edu/townmeet/*

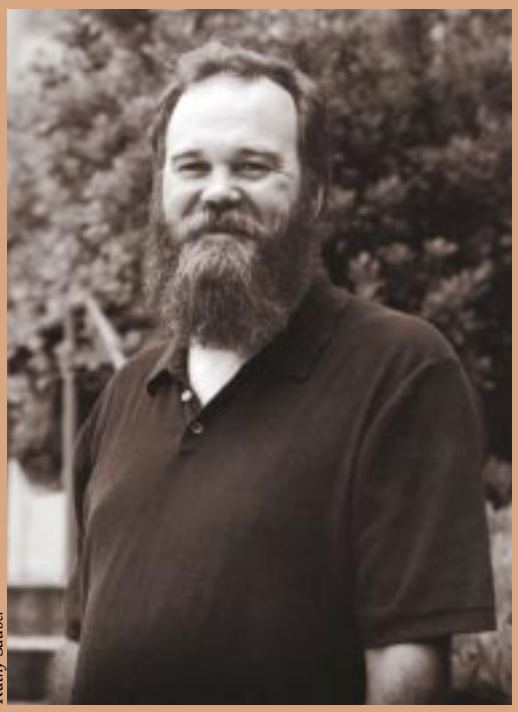
Freeman, K. Center attacks core issues in land of apples *and* Seattle town meeting targets environmental justice. Environ Health Perspect 2000; 108(12):A554–558. *http://hpnet1.niehs.nih.gov/docs/2000/108–12/niehsnews.html*

NIEHS Town Meeting Web site, *http://www.niehs.nih.gov/od/tnhome.htm*

Washington Toxics Coalition Web site, *http://www.watoxics.org/*

Kris Freeman

Charlie Cunniff of the Environmental Coalition of South Seattle explains community concerns to US Congressman Jim McDermott, Ken Olden, and Dave Eaton



Kathy Sauber

Walt Rostykus CPE, CSP, CIH

Vice President, Humantech, Inc

Class of 1982

Master of Science in Public Health (MSPH)

Environmental Health and Sanitation, Industrial Safety

a global perspective on workers' health

Walt Rostykus' job is to make the workplace safe for the people who work there. Specifically, his role at Humantech, a Michigan-based engineering and consulting firm, is to assist large companies with the implementation and delivery of effective ergonomics programs.

Ergonomics addresses the interaction of people and their environment, or the practice of fitting the workplace and tools to the person doing work. In his experience, to develop an ergonomics program, Walt has found it important to understand a corporation's culture and values.

Walt enjoys applying environmental health science to real needs and situations encountered in the workplace, and making the end result intuitive and usable by the client. "For me the constant change and challenge keeps it interesting." He loves the opportunity to "work with good people, do good things, travel, and constantly be learning."

After his graduation from UW, Walt worked for Hewlett Packard and Compaq Computers, managing environmental health and safety programs within corporate worldwide organizations.

His UW training gave him insight about the integration and overlap of the disciplines of Industrial Hygiene, Occupational Health Nursing, Occupational Medicine, Occupational Safety, and Environmental Health.

The other valuable skill he learned at UW is writing. He encourages students to take courses in communication, marketing, organizational effectiveness, project management, and international politics. "Practice your presentation skills. You'll need them," he advises.

Within Environmental Health, he urges students to take a broad range of class subjects. "Don't limit yourself to one discipline. For example, get a balance of exposure to IH (industrial hygiene), safety, and environmental health topics." He suggests students gain as much real-world experience as possible by volunteering for field projects, and pursuing an internship or a part-time position related to environmental health.

Once graduates enter the work force, he encourages them to find a mentor to provide feedback and coaching. A good goal is to obtain professional certification within five years after completing school, he said.

Walt believes students should think globally, and pick up an understanding of occupational and environmental issues, approaches, and standards in other countries. "Take a foreign language. It will come in handy." Emerging opportunities include addressing issues with distant workers, the service sector, high turnover, global standards, and an aging workforce.

His final bit of advice is to "maintain a hobby or activity, and find a way to escape the stresses of work." His hobbies include hiking, sailing, kayaking, scuba diving, mountain biking, hot air ballooning, and home brewing.

ALUMNI PROFILE

BREATHING SAFELY IN THE DUSTY TRADES

international efforts to prevent silica disease

Silicosis is one of the oldest known occupational diseases, yet in certain occupations and certain parts of the world, silica dust continues to shorten the lives of workers. Several Department of Environmental Health researchers are involved in national and international efforts to better understand and control silica exposure.

Cancer potential

Fine dusts containing silica from industrial sources such as quarries, ceramics, and construction materials can cause silicosis, a scarring of the lungs. In the past 15 years, several researchers, including the Department's Professor Harvey Checkoway, have become concerned that even low-level silica exposures can cause lung cancer. During the late 1980s and early 1990s, Checkoway directed an epidemiological study of lung cancer and silicosis risks in the diatomaceous earth industry in southern California. Diatomaceous earth is a light, fragile siliceous material used in water and beverage filters.

The study team included DEH co-investigators Nicholas Heyer (now at Battelle), Paul Demers (now at the University of British Columbia), and Associate Professor Noah Seixas. The study found strong dose-response trends for silicosis and for deaths from lung cancer and nonmalignant respiratory diseases. Data from the diatomaceous earth study have since been used by the National Institute for Occupational Safety and Health (NIOSH) to make risk assessments for lung cancer and silicosis, the results of which may eventually be incorporated into the Occupational Safety and Health Administration's (OSHA's) occupational standard setting.

Tanongsak Yingratanasuk

Stone carvers in Thailand work with hand tools

In 1996, the International Agency for Research on Cancer (IARC) invited Checkoway to serve on its working group to review evidence for the cancer-causing potential of silica. He chaired its epidemiology subcommittee. The IARC review concluded that crystalline silica from occupational exposures is carcinogenic to humans. The most convincing evidence was for lung cancer.

Construction safety

Silica exposures are greater in construction than in any other American industry. The Department's Mary Ellen Flanagan is part of a nationwide effort to develop a database of silica exposures for workers during specific construction tasks. Rock drilling, sand blasting, concrete cutting, and demolition of concrete and masonry structures generate silica dust.

The database could be used as OSHA develops new construction standards in response to the IARC findings. Researchers generally need a large database of exposure information to get beyond "what's the exposure?" to "what's the solution?" said Flanagan, who did much of the database design for a team from the American Conference of Governmental Industrial Hygienists (ACGIH).

Her database, which is now maintained at West Virginia University, includes more than 500 samples, with information on tasks, tools, indoor or outdoor environment, and control measures. By next year it should be available to contributing researchers on the World Wide Web.

Flanagan is part of the department's Field Research and Consultation Group, which has

Mary Ellen Flanagan

A mason cuts concrete block at a Seattle construction site

inset: Tanongsak Yingratanasuk (third from left) presents his research to Drew Brodkin, Scott Barnhart, and Noah Seixas of the DEH faculty

Tanongsak Yingratanasuk

worked with labor and management in several construction trades to reduce silica exposure. The group has conducted controlled studies at the International Masonry Institute in Seattle and conducted field studies at job sites.

Masons and bricklayers were happy to participate in the study "because we have been exposed so much," said Mark Maher of the Masonry Institute. "We want to have a healthy, long-term workforce, and we want our workers to enjoy a long retirement." He described the Field Group research as "a real win-win thing" that provides the University a place to do its research, and the masons an opportunity to have their questions answered.

That has happened in several trades in the construction industry, Seixas said. "The industry came to us. They recognized that they had a problem, and it was one the Department could address through training and research."

The industry has a voice in developing the Department's continuing education courses, such

as a recent class entitled "Current Issues in Construction Safety," which addressed silica control.

Asian miners & stonecutters

The International Scholars in Occupational and Environmental Health program has brought two researchers from southeast Asia to campus to do silica research, and has trained others in Vietnam and Thailand.

Tanongsak Yingratanasuk, director of the Industrial Hygiene program at Burapha University in Thailand, studied in Seattle the past two years, earning his Master of Science degree in Industrial Hygiene and Safety under Seixas' direction. His thesis was an assessment of lung diseases and silica exposure at a stone carving company in Thailand.

Phan Hong Son, of Vietnam's National Institute of Occupational and Environmental Health, is on campus now, studying silicosis incidence in his country using a geographic information system (GIS). He is also working on a chest radiology grant with Associate Professor Scott Barnhart.

Although many Asian countries have adopted occupational health and safety standards, some lack the technology to conduct workplace evaluations, said Associate Professor Matthew Keifer, director of the UW's International Scholars program. "We are giving the countries the information they need to make the workplace safer," he said.

The International Scholars program is funded by NIOSH and by two programs within the National Institutes of Health: the Fogarty International Center and the National Institute of Environmental Health Sciences (NIEHS).

For further reading

Becker P, Flanagan ME, Akladios M. Development of an ACGIH construction industry silica exposure database overview. Applied Occup Environ Hyg. 2001;16(8):781-783.

Checkoway H, Heyer NJ, Demers PA, Breslow NE. Mortality among workers in the diatomaceous earth industry. Brit J Ind Med 1993;50:586-597.

Checkoway H, Heyer NJ, Seixas NS, et al. Dose-response associations of silica with non-malignant respiratory disease and lung cancer mortality in the diatomaceous earth industry. Am J Epidemiol 1997;145:680-688.

Checkoway H, Hughes JM, Weill H, Seixas NS, Demers PA. Crystalline silica exposure, radiological silicosis, and lung cancer mortality in diatomaceous earth industry workers. Thorax 1999;54:56-59.

Continuing Education Web site, *http://depts.washington.edu/ehce*

Croteau G. The effect of local exhaust ventilation control on dust exposures during masonry activities. Master's thesis 2000, University of Washington.

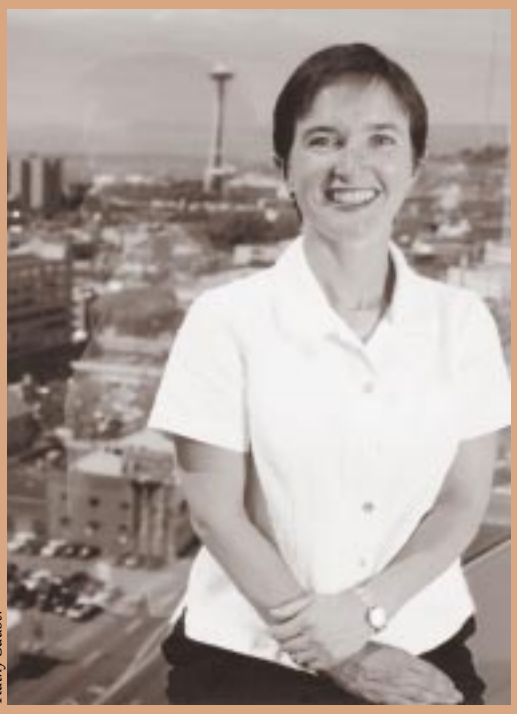
International Agency for Research on Cancer (IARC). Evaluation of Carcinogenic Risks to Humans. Silica, some silicates, coal dust, and para-aramid fibrils. Volume 68. Lyon, France: IARC Publications, 1997.

Majar, M. Respirable dust and silica exposure assessment in construction tasks. Master's thesis 2001, University of Washington. *http://depts.washington.edu/ envhlth/news/abstract01/abstracts_majar.html*

National Institute for Occupational Safety and Health, 1996. NIOSH Alert: Preventing silicosis and deaths in construction workers. DHHS (NIOSH) Publication No. 96-112.

Rice F, Park R, Stayner L, Smith R, Gilbert S, Checkoway H. Crystalline silica exposure and lung cancer mortality in diatomaceous earth industry workers: a quantitative risk assessment. Occup Environ Med 2000;58:38-45.

Yingratanasuk T. An assessment of lung diseases and silica exposure in a stone carving company in Chonburi Province, Thailand. Master's thesis 2001, University of Washington. *http://depts.washington.edu/ envhlth/news/abstract01/abstracts_yingratanasuk.html*



Kathy Sauber

Sally Thompson DVM, PhD

Staff Scientist II

Targeted Genetics Corporation

Class of 1996

Doctor of Philosophy (PhD)

Toxicology

using biotechnology to conquer disease

As a staff scientist and toxicologist at Targeted Genetics Corp., Sally Thompson's job is to evaluate the safety of gene therapy products that could change the lives of people with genetic diseases such as cystic fibrosis and hemophilia.

A preclinical toxicologist, she conducts safety evaluations of gene therapy products and works with the Food and Drug Administration on product development. One of the appeals of the rapidly changing field of biotechnology is that she is constantly learning.

After receiving her PhD in 1996, she began working as a research scientist at another Seattle biotechnology company. She moved to Targeted Genetics two years ago.

Sally had a Doctor of Veterinary Medicine degree when she entered the PhD program in Toxicology. She worked in Terry Kavanagh's laboratory, analyzing the effects of oxidative stress on the immune system and on development. She used mouse models to understand how the immune system responds to low doses of methylmercury.

She considers teamwork to be one of the most important things that she learned at the Department of Environmental Health. She found the Kavanagh lab to be a "cohesive group" that worked well together on a daily basis and on grant-preparation deadlines. She also benefited from the diversity of research taking place in the Department. At Targeted Genetics, her work team includes scientists in a variety of disciplines and corporate partners, who have exposed her to the business side of biotechnology.

She sees a bright future for research scientists in biotechnology, both locally and worldwide. Now in a position to recruit staff scientists at Targeted Genetics, she has some suggestions for the Department's current graduate students. One is to get a perspective of the whole animal model, including physiology, rather than focusing solely at the molecular level. Her second suggestion is to focus on writing and presentation skills. "Get as much writing and reviewing experience as you can." A third suggestion is to balance work and life outside of work.

Sally has found a job where she can work part-time, allowing her to spend four days each week with her two sons. With her husband and sons, she enjoys fishing, playing baseball, going to Mariners games, and hanging out on the beach. "I have to admit the one thing that I enjoy most about working part time is that we can take a leisurely walk to the local library once a week," she adds.

ALUMNI PROFILE

PARTICULATE AIR POLLUTION

measuring how much air pollution gets indoors

We've all heard the warnings on bad-air days—young children, the elderly, and those with respiratory problems are asked to stay indoors. Does that really protect them? Research projects from Assistant Professor Sally Liu's laboratory are challenging that conventional wisdom by investigating how the air quality inside the homes of susceptible people correlates with outdoor air quality and health effects.

Liu is working under two grants from the US Environmental Protection Agency (EPA), which has the goal of protecting the public–especially sensitive populations–from exposure to harmful air pollution.

Policy making

When the EPA set its standard for fine particulate matter ($PM_{2.5}$) in 1997, critics said it was over-protective, not based on sound science, and questioned whether sensitive populations were really exposed to the dirty air, because their health problems forced them to stay inside. The EPA didn't know much about exposures of such people or the exact health effects of fine particulates, Liu said.

Her study recruited elderly subjects (average age 75) with heart and lung problems, children with asthma, and healthy elderly controls—107 in all—and studied them over one to three 10-day periods. Her study is the largest of its kind funded by the EPA.

The research subjects wore monitors to measure their personal exposure to fine particulate matter, nitrogen dioxide, sulfur dioxide, organic chemicals, and other components of air pollution. They each kept an activity diary, recording what they were doing every 15 minutes, and a pollution event diary, recording when they cooked, if they burned the toast, whether the windows were open, and whether they vacuumed, burned candles, or built a wood fire. They also recorded how well they felt each day and which medications they took.

The study took place from fall 1999 through spring 2001. The project team included environmental scientists, engineers, pulmonologists, chemists, toxicologists, and biostatisticians from the University of Washington, Washington State University, Lawrence Berkeley National Laboratories, and agencies such as the state Department of Ecology, Puget Sound Clean Air Agency, and EPA. Much of the fieldwork was done by departmental graduate students and about two dozen undergraduates.

Researchers took health and employment histories, daily urine and breath samples, pulmonary function tests, pulse readings, blood pressure, blood oxygen-saturation levels, and electrocardiograms. They also measured air quality inside and outside the house, and measured the air exchange rate in the home using a tracer chemical.

The hypothesis was that higher exposures to particulate matter and organic compounds from combustion would be associated with measurable differences in cardiovascular tests and symptoms.

Devon DeLapp

Lab manager Tim Gould sets up a sampler to measure ozone and sulfur dioxide

Early findings

Early findings showed a correlation between poor air quality and symptoms. "We saw lower heart rate variability on bad PM (particulate matter) days," Liu said, "but we can't really say exactly what caused the health effects." Professor Dan Luchtel is conducting toxicological tests with a special mouse model that is similar to elderly humans with cardiovascular problems to better understand the trigger mechanisms. Departmental researchers, headed by Professor Dave Kalman, are also doing biomarker studies with the urine samples to better understand how much of the

Research Technician Christine Sleeman checks the flow rate of air sampling systems

inset: Research subjects wear monitors to measure their personal exposure

Devon DeLapp; inset: Liz Tuttle

outdoor pollution gets inside homes and into human bodies.

Air quality measurements showed that indoor air could be as bad as that outdoors. Small particles that were generated outside in the atmosphere found their way indoors. The smallest particles, those that cause the greatest health concern because they are breathed deeper into the lungs, behave almost like gases and closing the windows and doors doesn't keep them out. Nearly half (44%) of the personal exposures came from outdoors. "We see infiltration on bad air days. People are told to stay inside, but that may not be enough to prevent exposure," Liu said.

Health recommendations

About half the elderly subjects lived in single-family homes and half in senior housing. Pollutant exposures were generally lower for those who lived in senior housing where meals were served in a central dining room. Continuous readout air quality monitoring showed dramatic spikes when people cooked or ran vacuum cleaners. This information suggests that senior citizens with severe heart or respiratory illnesses might consider moving to housing that provides meals and housekeeping services, so they could leave the apartment during vacuuming.

While the second-year data are still being analyzed, the first year's findings can be useful to

EPA. "Our goal is to give EPA a good indication of what sources to control in a regulation, and what components in the PM the regulatory agency should focus on," Liu said. Already, researchers have identified the most important outdoor particulate and indoor pollution sources and how much they contribute to poor air quality.

Kalman identified another ground-breaking aspect of the study. "For the first time, we are expecting to describe how particularly vulnerable individuals experience their environment, in quantitative and statistical terms. This will enable policy makers to consider not only regulations to protect the general public, but also to understand how additional protection for those at highest risk might be achieved." He suggested that additional efforts may have to be made to control in-home sources of air pollution.

For further reading

Box M. Exposure to particulate matter among older adults with chronic obstructive pulmonary disease: Relation between personal, indoor, and outdoor concentrations. Master's thesis, University of Washington, 2000. *http://depts.washington.edu/envhlth/news/abstract/abstracts_box.html*

Goswami E. Spatial characteristics of fine matter and nitrogen dioxide in Seattle: identifying representative monitoring sites. Master's thesis, University of Washington, 2001. *http://depts.washington.edu/envhlth/news/abstract01/abstracts_goswami.html*

Mar TF, Norris GA, Koenig JQ, Larson TV. Associations between air pollution and mortality in Phoenix, 1995–1997. Environ Health Perspect 2000;108:347–353.

Norris G, YoungPong SN, Koenig JQ, Larson TV, Sheppard L, Stout JW. An association between fine particles and asthma emergency department visits for children in Seattle. Environ Health Perspect 1999;107:489–493.

Norris G, Larson T, Koenig J, Claiborn C, Sheppard L, Finn D. Asthma aggravation, combustion, and stagnant air. Thorax. 2000 Jun;55(6):466–70.

Sheppard L, Kaufman J. Sorting out the role of air pollution on asthma incidence. Epidemiology 2000;11:100–101.

Yu O, Sheppard L, Lumley T, Koenig JQ, Shapiro GG. Effects of ambient air pollution on symptoms of asthma in Seattle-area children enrolled in the CAMP study. Environ Health Perspect 2000;108:1209–1215.

Liz Tuttle

Outdoor and indoor air quality are compared at a private home

Keri Berger

Tanya MacFarlane BS, BA, RS

Environmental Health Specialist
Registered Sanitarian
Bremerton-Kitsap Country Health District

Class of 2000
Bachelor of Science (BS) Environmental Health
Bachelor of Arts (BA) Zoology
Undergraduate Program

a passion for public health

Tanya MacFarlane's job is to protect the health of residents and vacationers on the Kitsap Peninsula, including tracking down the sources of disease outbreaks. She is passionate about her work.

She inspects restaurants, schools, festival booths, summer camps, and swimming pools. In addition, she teaches food safety classes, food manager certification classes, and safety classes for pool operators. She works as a consultant to a Native American tribe, and investigates food-borne illnesses and complaints from the community. "My personal challenge is to become the best communicator I possibly can. I particularly enjoy helping food workers find procedures for preparing food that keeps the food safe throughout the process."

Sometimes her job requires her to be a detective, investigating the source of food-borne illness. She uses the time-honored who-what-when-where-why-and-how technique to find out who got sick, what they ate, and when. Food-borne illness can often be easily identified by knowing the food consumed, the incubation period, and the symptoms and duration of the illness. However, positive identification requires follow-up laboratory identification.

Although only a year out of school, Tanya has become involved in professional activities as editor of the Washington State Environmental Health Association's newsletter. She also chairs the publications committee for the association's annual educational conference.

She began work in Kitsap County in April 2000, only a month after finishing her coursework. She had already gained experience as a sanitarian through an internship with Public Health Seattle-King County. She also worked as a research assistant in the Department's Environmental Health Technology program, doing air sampling.

Tanya found the Department's undergraduate classes to be specific and practical. Many of her instructors had worked as sanitarians and offered "a tremendous amount of information about the field." As an undergraduate she learned to do a restaurant inspection, a pool inspection, and a rodent/housing survey.

She also learned communication skills, and discovered that the quality of her work is "directly proportional to my ability to listen, observe, speak, write, and demonstrate." She encourages students not to be shy about talking with their instructors. "I found that each one was available for one-on-one interaction." She also encourages students to take advantage of internship possibilities.

"The area of environmental health is so huge that you can make your experience whatever you want it to be, so be creative," she advises. "Complete a research project. Get a job as a research assistant and work with professors and graduate students on a project that you feel passionate about. Do two internships if you have the time."

ALUMNI PROFILE

PROBING GENETIC VARIATIONS

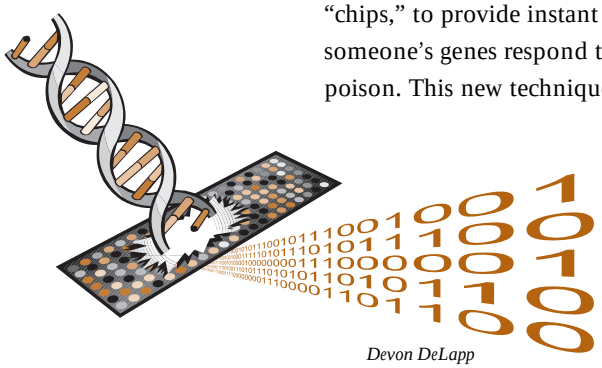
microarrays: more genetic information faster

Suppose your doctor wanted to try a promising new medicine, but wasn't sure how you would respond. Suppose your job involved exposure to a chemical that causes reactions in only a small percentage of people, and you wanted to know if you would be one of them.

Your genetic makeup may determine how well you respond to a new medicine or whether a chemical exposure will make you sick. Professor Curt Omiecinski and his laboratory colleagues are studying the interrelationships of toxicology with genetics.

Genes and the environment

The human genome consists of about 3 billion bases, or building blocks of DNA, Omiecinski said. Although people share a high degree of genetic similarity, everyone's genetic code is different. Genetic variation at the level of single base changes between common genes is termed a single nucleotide polymorphism, or SNP (pronounced "snip"). SNPs and other types of genetic alterations likely contribute to differences in the way individuals respond to chemical exposures or their risk of suffering from adverse drug reactions. To predict an individual's chemical response profile, researchers need to understand how the body processes the chemical and how the "genetic fingerprint" of the individual affects these processes.



Devon DeLapp

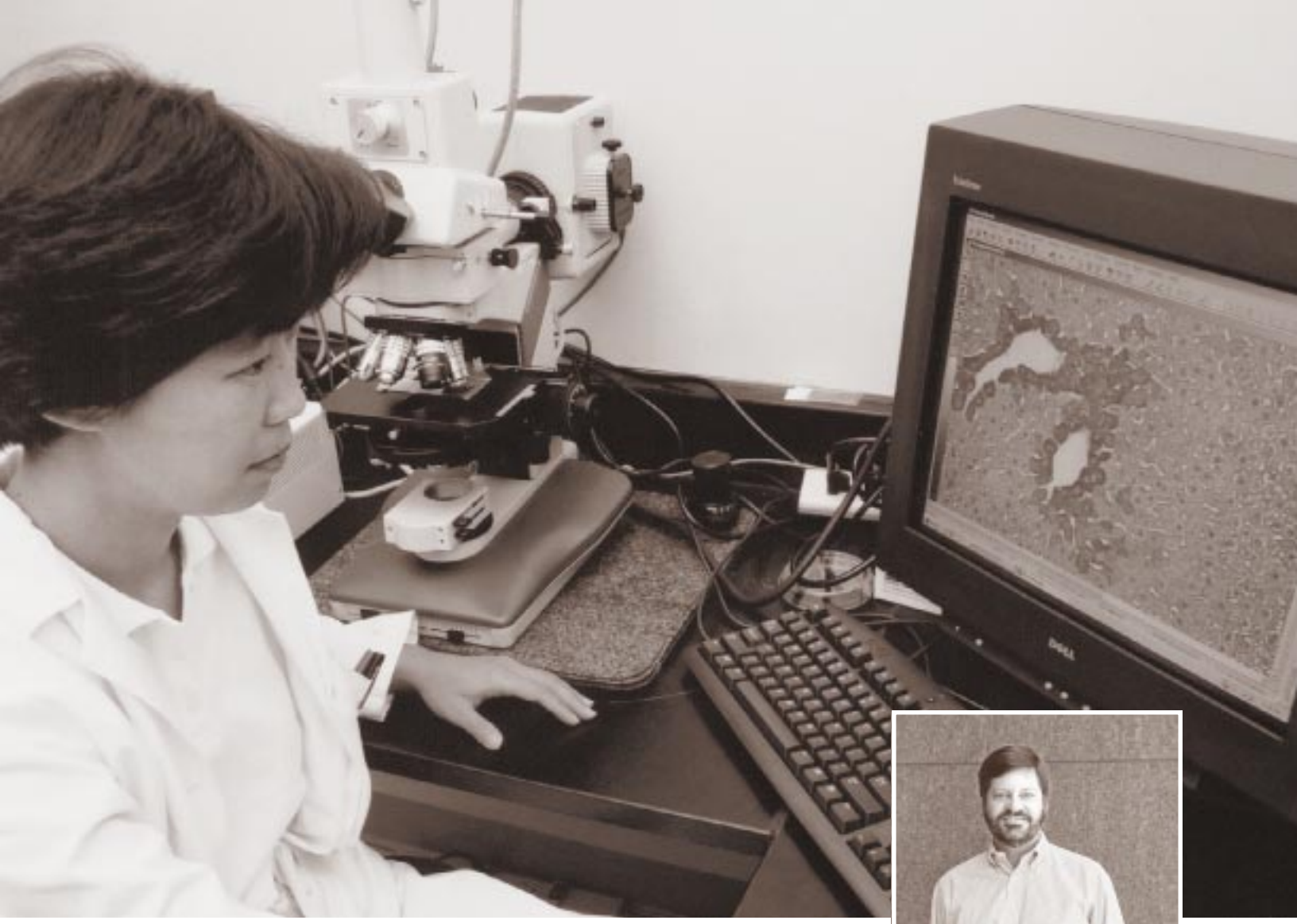
The laboratory has characterized polymorphisms (different forms) based on single nucleotide changes in several different enzymes that help the body break down and eliminate poisons. For example, they have discovered SNPs in an enzyme system termed epoxide hydrolase–actually a family of enzymes that metabolize certain cancer-causing chemicals. The laboratory has also worked with researchers in the UW medical genetics program and discovered SNPs in an enzyme named paraoxonase, which is responsible for metabolizing certain pesticides and neurotoxins.

Omiecinski is director of the Department's Toxicology program and also directs the biomarker laboratory, which is an arm of the DEH Center for Ecogenetics and Environmental Health. Epidemiological studies are being conducted to determine potential associations of these genetic variants with diseases such as lung cancer and Parkinson's.

Together with collaborators from other parts of DEH, Epidemiology, and the Fred Hutchinson Cancer Research Center, the Department's molecular biomarker laboratory is working to examine individual differences in genetics and how they affect relative risks of environmentally associated diseases.

Microarrays

Professor Omiecinski is using DNA microarrays or "chips," to provide instant information about how someone's genes respond to a particular drug or poison. This new technique is a powerful method that enables the lab to study the phenomenon of genetic variation as it relates to an individual's ability to detoxify chemical substances. A cell exposed to a poison may start producing large quantities of enzymes used to break down toxic substances or to repair DNA. Our genes control enzyme production. By tracking certain enzymes it is possible to determine how a cell's genes react to a particular exposure. Previously, investigators could examine changes in the enzyme production, or expression, of just one or a few genes at a time, Omiecinski said.



Postdoctoral Fellow Tao Wang uses a fluorescence microscope to study enzyme activity in mouse liver cells

inset: Curt Omiecinski, director of the Department's Toxicology program

Kathy Sauber; inset: Joel Levin

The new microarray technique can show the expression of thousands of genes simultaneously–potentially the entire human genome–in response to an exposure.

The chip testing procedure involves the use of small glass slides that contain robotically applied arrays of up to 50,000 densely packed spots of DNA. Each spot represents sequences from a different gene. The microarrays can be "probed" with various RNA samples collected from cells or tissues that have been subjected to chemical or drug treatment. The RNA samples are labeled with colored fluorescent dyes and incubated with the DNA arrays to determine which genes are expressed (turned on) and how they respond to a particular exposure. A gene that is active will glow on the slide. The more active it is, the brighter it will glow. The biological picture is captured as binary data that computers can analyze. The Omiecinski laboratory has been using microarray experiments to study environmental chemicals that act as gene inducers, increasing gene expression in liver cells. The liver is the body's pri-

mary organ for detoxifying or metabolizing chemical substances. Understanding the impact of gene inducers could help researchers and physicians predict how someone will respond to a drug or chemical.

The future

In addition to the cultured cell approaches, the DNA microarray technology may eventually replace animal tests, which are now used to evaluate the safety or toxicity of chemicals and drugs.

The overall scientific area encompassed by these genomic approaches as they apply to toxicology is termed "toxicogenomics." Together with the other investigators in the DEH Toxicology program, Omiecinski is engaged in a variety of toxicogenomic strategies to advance basic science with the ultimate goal of better predicting risks and outcomes of chemical exposures.

For further reading

Beck NB, Sidhu JS, Omiecinski CJ. Baculovirus vectors repress phenobarbital-mediated gene induction and stimulate cytokine expression in primary cultures of rat hepatocytes. Gene Therapy. 7:1274–83, 2000.

Fretland AJ, Omiecinski CJ. Epoxide hydrolases: biochemistry and molecular biology. Chem-Biol Interac 129:41–59, 2000.

Molecular biomarker laboratory Web site: *http://depts.washington.edu/ceeh/ServiceCores/SC2/SC2.html*

National Human Genome Research Institute: Microarray Project Web site. *http://www.nhgri.nih.gov/dir/Microarray/main.html*

Omiecinski CJ. Epoxide Hydrolase. In: Metabolic Drug Interactions, Levy RH, Thummel KE, Trager WF, Hansten PD, Eichelbaum M, eds. Lippincott Williams & Wilkins, Philadelphia, PA: pp. 205–216, 2000.

Omiecinski CJ, Remmel RP, Hosagrahara VP. Concise review of the cytochrome P450s and their roles in toxicology. Tox Sci 48:151–156, 1999.

Omiecinski laboratory Web site: *http://faculty.washington.edu/cjo/*

Sandberg M, Hassett C, Adman ET, Meijer J, Omiecinski CJ. Identification and functional characterization of human soluble epoxide hydrolase genetic polymorphisms. J Biol Chem 275:28873–81, 2000.

Schilter B, Andersen MR, Acharya C, Omiecinski CJ. Activation of cytochrome P450 gene expression in the rat brain by phenobarbital-like inducers. J Pharmacol Exp Ther 294:916–22, 2000.

Sidhu JS, Liu F, Boyle SM, Omiecinski CJ. PI3K inhibitors reverse the suppressive actions of insulin on CYP2E1 expression by activating stress-response pathways in primary rat hepatocytes. Mol Pharmacol 59:1138–46, 2001.

Where we've been ...

and where we're going

THE HEALTH OF ENVIRONMENTAL

A forward-looking retrospective

Our first biennial report two years ago had an image of a cell on the cover, emphasizing the scientific nature of our work. This time we feature a contemporary Native American artist, Clarissa Hudson, who uses her Tlingit heritage in innovative and thought-provoking ways. The new possibilities from creative uses of traditional elements mirrors our approach to the content of this report—in which we seek to find new opportunities to make a difference using both established and emerging public health science.

Continuing achievements

Students

During the last two years, 29 students received undergraduate degrees, 38 MS degrees, 6 MPH degrees, and 5 PhDs. The outstanding undergraduate students were Leonard Di Toro in 2000 and Shireen Assaf in 2001. The outstanding graduate students were Ed Doran in 2000 and Francesca Noel Hudson in 2001. Twenty-one papers were published by students in academic journals. Many other students received honors, which are summarized on pages 39 and 40.

New educational initiatives

A five-year training grant has been awarded to the Department of Environmental Health and the Department of Health Services for a joint graduate program in occupational health services research. The program offers doctoral and postdoctoral training and students will be able to participate in research conducted in the Occupational Epidemiology and Health Outcomes program.

We have reworked our PhD offering in the Industrial Hygiene track to apply more broadly to recognition, assessment and management of hazardous exposures to chemical, biological, and physical agents, in both industrial and nonindustrial settings. This change acknowledges the shift in the nature of work in the United States, and the general lessening of distinctions between workplace and community environmental health issues. We have also reshaped the Environmental Health pathway in the Master of Public Health degree program to better respond to the needs of nonphysician professionals who seek additional training in Environmental Health. Both new curricula will be offered to students during the 2001–2003 biennium.

Faculty

Three faculty members were promoted in the biennium: Drew Brodkin to Associate Professor, Lianne Sheppard to Research Associate Professor, and Janice Camp to Senior Lecturer. Three more achieved tenure: Joel Kaufman, John Kissel, and Noah Seixas. Dr. Peter Johnson, a University of California, Berkeley-trained engineer with interests in ergonomics and repetitive motion injury, was recruited to the Industrial Hygiene and Safety faculty after a multiyear search effort. Dr. Steven Guffey, a veteran member of the industrial hygiene faculty, left in 2000 to take a senior position with West Virginia University's Industrial and Management Systems Engineering program. Two faculty searches are currently under way, one to replace Dr. Guffey and one to add a specialist in water and water supply issues to the Environmental Health Technology faculty.

Faculty who were honored include Dr. Zhengui Xia, completing her term as Sheldon Murphy Assistant Professor, with significant research success to her credit; Curt Omiecinski, succeeding Dr. Lucio Costa as Toxicology program director; Dr. John Kissel, elected to head the International Society for Exposure Analysis (ISEA); Dave Eaton, becoming president of the Society of Toxicology; and Janice Camp serving as president of the Pacific Northwest section of the American Industrial Hygiene Association. Additional faculty honors are summarized on page 40.

HEALTH

Staff

Among the 100+ classified and professional staff in the Department, many received awards and honors. Marcy Harrington received the DEH staff outreach award in 2000 and Kathy Hall received it in 2001. Collin White received the Department's outstanding staff service award in 2000 and Adrienne Hidy received it in 2001. Further honors are summarized on page 40.

Research

We continue to be awarded multi-investigator programs and centers. The start of the biennium saw the launch of the EPA Northwest Center for Particulate Air Pollution and Health. This Center, one of five established nationally, is conducting research to better understand the relationship between air quality and public health.

In collaboration with the Fred Hutchinson Cancer Research Center, a new Toxicogenomic consortium will study how genes respond and adapt to environmental toxicants, and the ways that these genetic responses can cause environmentally-related diseases. A goal of the consortium is to develop new techniques for using and analyzing microarrays, "gene chips" that can analyze hundreds or thousands of genes simultaneously. Three other large program grants, CRESP (funded by the US Department of Energy), the Pacific Northwest Agricultural Safety and Health center (PNASH), and the UW Superfund Basic Research Program (funded by NIEHS) were successfully renewed. The Department's research on children and pesticides was widely covered by local and national media.

Facts & figures

Growth continued in departmental funding from all sources in the past biennium. Fueled by research grants, our overall budget was up

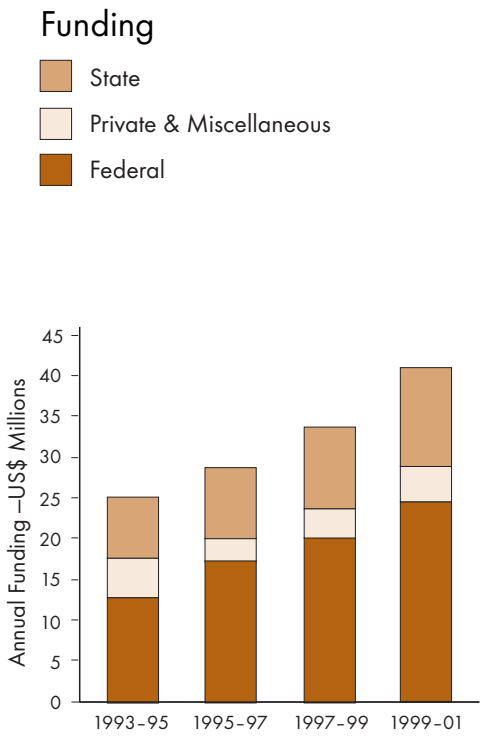


Figure 1. *DEH funding trends, 1993–2001*

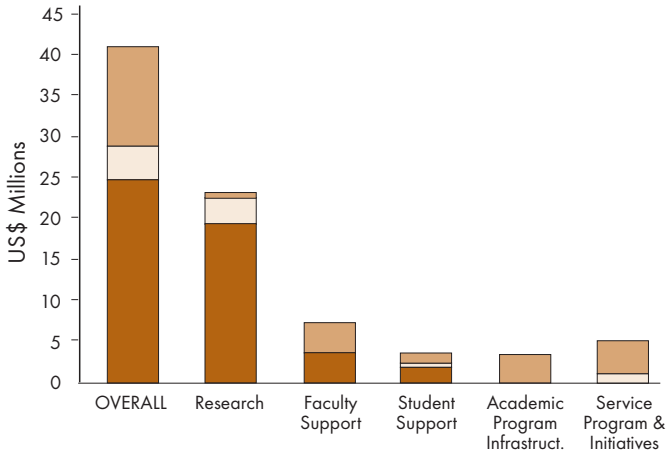


Figure 2. *Budget distribution by activity, 1999–2001 biennium*

slightly more than 22% from the 1997–1999 total, one of biggest expansions in our Department's history. As Figure 1 shows, federal sources of departmental support (primarily competitive research grant programs) account for about 60% of our total support, up from 50% in 1993–1995. From 1997–1999 to 1999–2001, state funds, including funding from the University and funds from the Washington state industrial insurance system (Medical Aid and Accident funds) declined from 26% to 25% of our total support base. Use of these funds is shown in Figure 4.

Patterns of how departmental support originates and how it is used are not much changed from the previous biennium. As Figures 2 and 3 A/B show, federal funds are dominant in research and student support activities, while state funds are major elements of academic programs, teaching, service programs, and service project efforts. Uses of state funds provided by the industrial insurance system were essentially unchanged from 1997–1999. The combination of service programs and special initiatives rose from 30% of all Medical Aid and Accident funding in 1997–1999 to 36% in 1999–2001.

Recent initiatives

Service

In the past biennium, we have emphasized the following areas: greater dialogue with external groups, particularly those linked to our worker protection mission; a more interactive process for setting funding priorities for departmental service initiatives; and greater use of distance learning technologies and on-site contract courses. We developed a certificate program to make our educational offerings more accessible to working safety and health professionals.

Through these activities, we let others know about our mission and programs, and learned more of their needs and interests. The goal of working more closely with employers, workers, regulators, consultants, and safety and health professionals was the focus of considerable activity in the past two years. Department Chair Dave Kalman and Assistant Chair for Outreach Sharon Morris have met with representatives from many labor, trade, and professional associations in the state. They and other faculty have met with several key groups that address workplace safety and health issues.

We increasingly combine our service, teaching, and research missions to the mutual benefit of clients, students, and researchers. For example, an employer requested that we assess noise exposure on his construction sites. This became a class project, giving many students experience in the field and giving the employer a comprehensive noise assessment report. He and other employers subsequently requested that we assess silica exposure at construction sites and make recommendations for controlling exposures. The experience gained during these projects and the history of access to the worksites enabled us to compete successfully for a federal grant to conduct further research in this area.

With counterparts at the Department of Labor and Industries, we organized a summit in September 1999, which brought together departmental faculty and staff with program leaders and other professionals at L&I. This review of collaborative efforts increased interaction between the two departments. One outcome is the planned creation of a certificate program in industrial hygiene, intended to allow working industrial hygiene staff to upgrade their training and credentials while staying employed.

Departmental faculty, Labor and Industries, and the Departmental Advisory Committee (members are listed on page 56) participated in an 18-month process to evaluate programs conducted with Medical Aid and Accident funds and develop priorities for new initiatives. After reviewing nine projects, it was agreed to end funding for two, to continue four as before, to expand three others, and to propose two new activities.

New technologies

Another theme is the transformation of communications wrought by the digital revolution. It is clear that this revolution will continue to change how we as educators and knowledge seekers transfer information, knowledge, and even skills. We have begun to participate in these changes. For example:

- Our OSHA Training Institute Education Center is becoming a national leader in offering courses to enable employers and workers to meet federal and state safety and health standards. We have been a pioneer in offering courses using distance-learning technologies, including two-way video-conferencing and online courses.

- Within hours of the 2001 Nisqually earthquake, our Web site was able to respond by offering a free online course, entitled "Surviving an Earthquake."

- We have begun to offer our departmental newsletters and many other informational products on the Web, allowing wide on-demand public access. *http://depts.washington.edu/envhlth/info/publications.html*

- In June 2001, a Web site (*http://www.firesmokehealth.org)* was established to share information on the hazards of smoke from forest and agricultural fires. It provided information on smoke in community air as well as guidance during the Northwest fires in August and September. Without electronic access and transfer, such an effort would have taken months rather than weeks to accomplish.

- On a smaller scale, but convenient for us, quarterly meetings between leaders in

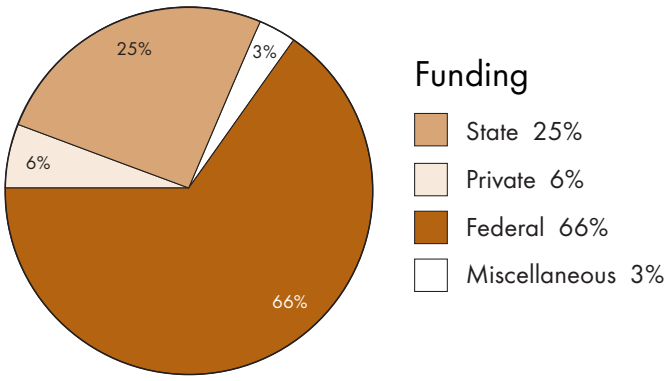


Figure 3A. *Budget sources 1999–2001*

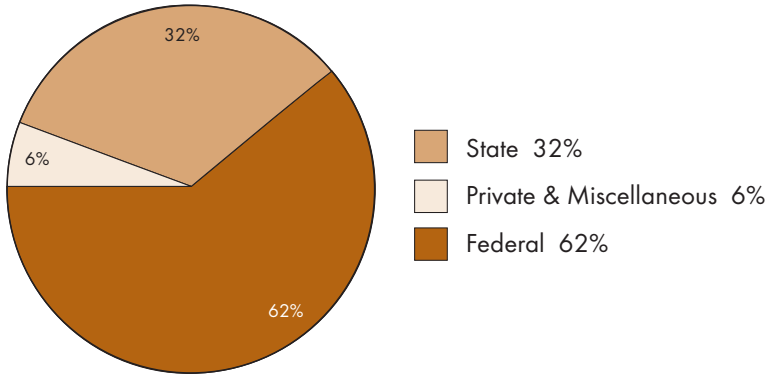


Figure 3B. *Departmental student support, 1999–2001 (6% of total budget)*

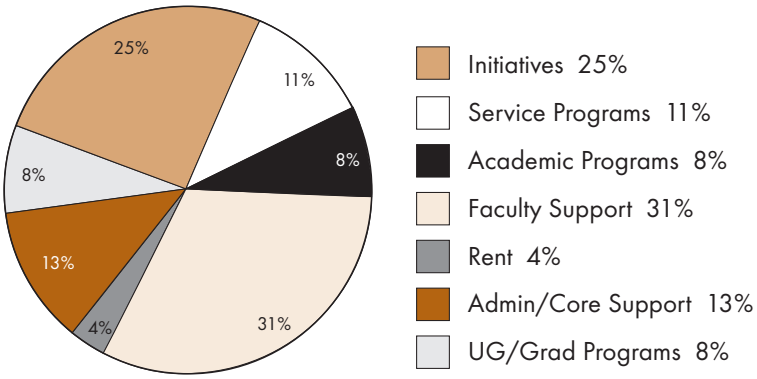


Figure 4. *Use of state Medical Aid and Accident funds, 1999–2001*

our Department and the Department of Labor and Industries, which have historically alternated between Olympia and Seattle, are now often held by videoconference.

Looking ahead

During the next biennium, we look forward to making progress on several fronts. Our educational mission will continue to have high priority as we look forward to new recruitment efforts that will attract ever more capable students to our programs. We will also continue to develop electronic communications as an instructional tool.

Two academic programs will be the special focus of departmental review and possible enhancement: the undergraduate program and the graduate program in Occupational and Environmental Medicine. These programs are challenged by the changing realities of their respective missions. Undergraduates need broad and versatile skills balanced with an orientation to the practical requirements of employment as an environmental health practitioner. Occupational medicine programs across the country are struggling to address the significant unmet demand for OM-trained physicians while coping with the economic pressures created by the reshaping of the health care industry.

Outreach and communication with our external constituent groups will remain a top priority. We will continue to meet with interested groups and develop activities and opportunities for responding to emerging needs.

Departmental resources will receive careful planning and review. We are hoping to improve the quality and quantity of our space for teaching, research, and other scholarly activities in the coming biennium to keep pace with programmatic and faculty growth.

In conclusion

The Department of Environmental Health has enjoyed a high level of success in the past two years. Despite that success, we continue to recognize the need to make sure that the research we conduct, the students we educate, and the services we provide meet the needs of the changing environment in which we live. This is the exciting nature of our world, which we invite you to share.

—Dave Kalman

Facts

and ...

Figures

1999–2001

Joel Levin

Char'ryse Birge receives her bachelor's degree in June 2001

DEGREES CONFERRED

UNDERGRADUATE

1999–2001

SUMMER 1999

Trung Ngoc Bui
Tiffany G. Harris

AUTUMN 1999

Shaelin A. Fetters
Kennethia R. Ishman
Cynthia S. Marshall

WINTER 2000

Keriya Adem
Tanya L. MacFarlane

SPRING 2000

Nora Chen
Eugenia Colby
Leonard Di Toro
Katia F. Harb
Angela L. Harkins
Phebe A. Mason
Laurette M. Rasmussen
Melissa A. Spencer
Andrew J. Torres

SUMMER 2000

Amanda Pearl Rehr
Chris Peter Rowe

AUTUMN 2000

Berhan Bahre Beraki

WINTER 2001

Vanessa J. Bussiere

SPRING 2001

Shireen Said Assaf
Chester L. Baldwin III
Char'ryse Juadel Birge
David Allen Braungardt
Mark Nicholas Ghezzi
Wendy Jean Kirchoff
Karen Masakane
Christopher David Miele
Kenton Anthony Wise

Graduate

Degrees: Master of Science (MS), Master of Public Health (MPH), and Doctor of Philosophy (PhD). Graduate Programs: Industrial Hygiene and Safety (IH&S), Environmental Health Technology (Tech), Toxicology (Tox), Occupational and Environmental Medicine (OccMed), Preventive Medicine (PrevMed). Faculty preceptor (*italics*)

Summer 1999

Arnold Bunyaviroch, MPH (OccMed) A systematic evaluation of methods for evaluating hearing impairment. (*Bill Daniell*)

Dianne Knutson, MS (IH&S) A biological monitoring survey of organophosphate pesticide exposure among children residing in two communities in the Seattle Metropolitan Area. (*Richard Fenske*)

Maria Aileen Mendoza, MS (Tox) Effects of methyl-mercury on the cell cycle of mouse fibroblasts of different p21 and p53 genetypes. (*Elaine Faustman*)

Stephanie Pingree, MS (Tox) Effects of 2,3-dimercapto-1-propanesulfonic acid (DMPS) on tissue and urine mercury and porphyrin levels of methyl mercury-exposed rats. (*James Woods*)

Susan Swan, MS (IH&S) Systematic evaluation of hearing conservation plans–A pilot project. (*Bill Daniell*)

Debra Winterton, MS (Tech) Polymorphisms as biomarkers for inhaled sulfur dioxide in subjects with asthma sensitivity. (*Jane Koenig*)

Eva Wong, MS (Tech) Use of children's activity patterns in dermal soil exposure assessment. (*John Kissel*)

Autumn 1999

Golan Kedan, MS (Tech) Comparison of estimated aggregate exposure to organophosphate pesticides with biomonitoring for urinary diakylphosphate metabolites among children. (*Richard Fenske*)

Denise Koch, MS (Tech) Longitudinal biological monitoring study of organophosphate pesticide exposure among children living in an agricultural community. (*Richard Fenske*)

Michael Rosato, MS (Tox) Multiparameter analysis of surface receptor expression and cell cycle progression in peripheral blood lymphocytes. (*Elaine Faustman*)

Spring 2000

Julie Christine Adams, MS (Tech) A physiologically based toxicokinetic model of xylene inhalation exposure in Caucasian men and a correlation study of individual kinetic and anthropometric parameters. (*David Kalman*)

Gerry Croteau, MS (IH&S) The effect of local exhaust ventilation control on dust exposures during masonry activities. (*Noah Seixas*)

Douglas O. Johns, MS (IH&S) The effect of varying concentrations of chemical mixtures containing toluene and methyl isobutyl ketone on the accuracy of collection in passive and active samplers. (*Michael Morgan*)

Nancy Judd, MS (Tox) Estimates of human exposure to PCBs and associated health risks from dietary seafood consumption. (*David Kalman*)

Karen Marienau, MS (PrevMed) Evaluation of the feasibility of a retrospective study design to investigate the risk of spontaneous abortion and exposure to nitrates in drinking water: a pilot study. (*Harvey Checkoway*)

Claire A. Olsovsky, MS (IH&S) An electromagnetic field exposure assessment of airline ground crew workers: A comparison of metrics. (*Steve Guffey*)

Diane Yoder, MS (Tech) Agricultural injuries among adult Hispanic farm workers. (*Matthew Keifer*)

Summer 2000

Michelle Bell, MS (IH&S) A pilot study to evaluate the methodology of collecting and analyzing vectors and disease agents of Lyme Disease and human ehrlichoses. (*Chuck Treser*)

David Bonauto, MPH (OccMed) A telephone survey of work and injuries in teenage agricultural workers in an eastern Washington community. (*Matthew Keifer*)

Michael Box, MS (IH&S) Exposure to particulate matter among older adults with chronic obstructive pulmonary disease: Relation between personal, indoor, and outdoor concentrations. (*Sally Liu*)

Cynthia Curl, MS (Tech) Organophosphorus pesticide exposure in children of agricultural families in the lower Yakima Valley. (*Richard Fenske*)

Ed Doran, PhD (IH&S) Measuring and modeling dermal absorption of pesticide residues. (*Richard Fenske*)

Barbara Faville, MS (IH&S) Validation of five checklists used to assess risk factors associated with musculoskeletal disorders of the upper extremities.(*Michael Morgan*)

Jiho Huang, MPH (OccMed) Traffic counts and emergency department visits for childhood asthma. (*Carl A. Brodkin*)

Matthew McQueen, MS (Tox) The role of oxidative stress in nuclear Factor-kappaB activation in arterial endothelial and kidney epithelial cell lines. *(James Woods*)

Gary Palcisko, MS (Tech) Children's exposure to lead and arsenic in orchard soils. (*John Kissel*)

Keone Pang, MS (IH&S) Field evaluation of a multiple beam sampling strategy for OP-FTIR spectrometer monitoring. (*Michael Yost*)

Emily Schneider, MS (Tox) Effects of sodium arsenite on the cell cycle of primary rat midbrain neuroepithelial cells. *(Elaine Faustman)*

Autumn 2000

Alma Maria Cárdenas, MS (Tox) The effects of prenatal methanol exposure on simple and choice reaction time in nonhuman primates. *(Tom Burbacher*)

Cecile Krejsa, PhD (Tox) Activation of glutamate-cysteine ligase in lymphocytes. (*Terrance Kavanagh*)

Thomas Lewandowki, PhD (Tox) Toxicokinetic and toxico-dynamic modeling of the effects of methyl mercury on development of the embryonic rat midbrain. (*Elaine Faustman)*

Amy M. Scanlon, MS (Tox) The effect of vitamin C on glutathione depletion in A549 cells after exposure to ozone. (*Jane Koenig*)

Shengli Shi, MS (Tox) Effects of glutamate-cysteine ligase overexpression on DNA damage and survival raters in HEPA-1 cells. (*Terrance Kavanagh*)

Hongbin Xiao, MS (Tech) Evaluation of passive samplers for monitoring six aldehyde compounds. (*Sally Liu*)

Winter 2001

Hailing Lu, PhD (Tox) The effect of inorganic lead on DNA synthesis in 1321N1 human astrocytoma cells: Roles of protein kinase C and mitogen activated protein kinases. (*Lucio Costa*)

Jeffery Thompson, MPH (OccMed) Occupational history taking by family practitioner physicians. (*Carl A. Brodkin*)

Spring 2001

Nilo Arnaiz, MPH (OccMed) Genetic factors in the development of an asthma-like condition while employed in an aluminum smelter potroom. (*Joel Kaufman*)

Anne Caughlan, MS (Tox) Apoptosis: A novel endpoint for chlorpyrifos-induced neurotoxicity. (*Zhengui Xia*)

Emily Goswami, MS (Tech) Spatial characteristics of fine particulate matter and nitrogen dioxide in Seattle: identifying representative monitoring sites. (*Sally Liu*)

Julia Hoeft, MS (Tox) A biologically-based dose-response model for ethanol-induced developmental neurotoxicity. (*Elaine Faustman*)

Kimquy Kieu, MPH (OccMed) Demographics of hoarders in Seattle/King County. (*Chuck Treser*)

Maria Majar, MS (IH&S) Respirable dust and silica exposure assessment in construction tasks. (*Noah Seixas*)

Hongxia Wang, MS (Tech) The cardiopulmonary effects of 300 ppb NO_2 on healthy subjects. (*Jane Koenig*)

Carolyn Whitaker, MS (IH&S) Accuracy of construction worker recall of tasks for epidemiological exposure assessment to noise. (*Noah Seixas*)

Lori Winnemuller, MS (IH&S) The validity of supervisor assessments in identifying ergonomic risk factors. (*Joel Kaufman*)

Tanongsak Yingratanasuk, MS (IH&S) An assessment of lung diseases and silica exposure in a stone carving company in Chonburi Province, Thailand. (*Noah Seixas*)

Kathy Sauber

AWARDS & HONORS

STUDENTS

Francesca Noel Hudson was the Department's outstanding graduate student in 2001

Erika Abel, PhD student, Toxicology
Achievement Rewards for College Scientists award, 1999

Shireen Assaf, undergraduate student
Department's outstanding undergraduate student, 2001

George Astrakianakis, PhD student, IH&S
Scholarship from the Pacific NW Section of the American Industrial Hygiene Association, 2000; Stockhausen scholarship, 2001; TSI Inc./Arthur J. Abrams Endowed Scholarship from the American Industrial Hygiene Foundation, 2001

Lynn Bekris, MS student, Toxicology
Achievement Rewards for College Scientists award, 1999

Michael Box, MS student, IH&S
First-place poster at the National Environmental Health Association, 1999

Stephanie Carter, PhD student, IH&S
Stockhausen scholarship, 2000

Leonard Di Toro, undergraduate student
Department's outstanding undergraduate student, 2000

Ed Doran, PhD student, IH&S
Department's outstanding graduate student, 2000

Katia Harb, MS student, IH&S
Scholarship from the Pacific Northwest Section, American Industrial Hygiene Association, 2000

Julia Hoeft, MS student, Toxicology
Achievement Rewards for College Scientists award, 2001

Francesca Noel Hudson, PhD student, Toxicology
Department's outstanding graduate student, 2001

Doug Johns, PhD student, IH&S
Stockhausen scholarships, 2000, 2001; Achievement Rewards for College Scientists award, 2000

Wendy Kirchoff, undergraduate student
Scholarship from the Association for Women in Science–Seattle Chapter, 2000; Fellowship from US Department of Energy, 2000

STUDENTS *(continued)*

Robert Leo, MS student, IH&S
Stockhausen scholarship, 2000

Hailing Lu, PhD student, Toxicology
Metal Specialty Section award at Society of Toxicology annual meeting, 2001

By Pham, medical student working with Matthew Keifer
Excellence in research award, Western Medical Student Research Forum, 2000

Ming Tsai, PhD student, IH&S
Achievement Rewards for College Scientists award, 2000

Carolyn Reeb Whitaker, MS student, IH&S
Best presentation or poster by a student, Occupational Epidemiology Committee, American Industrial Hygiene Conference and Exposition, 2001; best presentation or poster by a student, Graduate Student Poster Session Review Committee, American Industrial Hygiene Conference and Exposition, 2001; Stockhausen scholarship, 2000; Scholarship from the Pacific Northwest Section of the American Industrial Hygiene Association, 1999

Kyung Ehi Zoh, MS student, IH&S
Scholarship from the Pacific Northwest Section of the American Industrial Hygiene Association, 2000

FACULTY & STAFF

Dianne Botta
Department's nominee for the UW Distinguished Staff Award, 2000–2001

Janice Camp
School of Public Health faculty community award, 2000; President, Pacific Northwest Section, American Industrial Hygiene Association, 1999–2000; Washington State Association of Occupational Health Nurses, Treasurer, 1999–2000

David Eaton
President, Society of Toxicology, 2001–2002; Fellow (Elected), Academy of Toxicological Sciences, 2000; National Academy of Sciences/ National Research Council committee to review the scientific basis for EPA's proposal to lower the drinking water standard for arsenic

Jean Garber
Department's nominee for the UW Distinguished Staff Award, 1999–2000

Richard Gleason
Construction Safety Trainer of the Year award, Puget Sound Construction Safety Summit Association, 2000; DEH distinguished lecturer award, 1999

Kathy Hall
International award of excellence, Society for Technical Communication, 2000; DEH staff outreach award, 2000–2001

Marcy Harrington
DEH staff outreach award, 1999–2000

Adrienne Hidy
DEH distinguished staff service award, 2000–2001

Matthew Keifer
National Academy of Sciences/ National Research Committee, subcommittee on methyl bromide, 1999–2000; DEH faculty outreach award, 2000–2001

John Kissel
President-elect of the International Society of Exposure Analysis, 2001

Jane Koenig
Community service award, School of Public Health and Community Medicine, 1999

Sally Liu
Elected councilor of the International Society of Exposure Analysis, 2001

Michael Morgan
Distinguished Industrial Hygienist Award, Pacific Northwest Section, American Industrial Hygiene Association, 1999; 0utstanding teacher award, School of Public Health and Community Medicine, 2000

Jan Oberdoerster
Best poster, Neurotoxicology Specialty Section, Society of Toxicology, 2000

Curt Omiecinski
Burroughs Wellcome Fund Toxicology Scholar Award, 1995–2000

Cathy Schwartz
International award of excellence, Society for Technical Communication, 2000

Noah Seixas
DEH faculty outreach award, 1999–2000

Charles (Chuck) Treser
President, Association of Environmental Health Academic Programs, 2000

Collin White
Department's outstanding staff service award, 2000

Zhengui Xia
Burroughs Wellcome Fund for New Investigator Award in Toxicology, 1999-2000

Kathy Sauber

FACULTY

bottom row (l to r): Zhengui Xia, Terry Kavanagh, Dave Kalman (Chair), Sally Liu, Sharon Morris; 2nd row (l to r): Rolf Hahne, Joel Kaufman, Curt Omiecinski, Jane Koenig, Janice Camp; 3rd row (l to r): Bill Daniell, Jack Hatlen (emeritus), Mike Morgan, Dan Luchtel, Harvey Checkoway; 4th row: Chuck Treser, Gerald van Belle; Noah Seixas, Peter Johnson, John Kissel

Scott Barnhart, MD, MPH, is an Associate Professor (primary appointment in the School of Medicine). He directed the Occupational and Environmental Medicine program until his appointment in 1999 as medical director of Harborview Medical Center. One area of research is the natural history of asbestos-related lung disease, including possible protective effects of beta-carotene and vitamin A. A second project is control of silicosis in developing nations. A third area of investigation is use of a public health approach to reduce occupational hazards on Department of Energy sites.

Carl A. (Drew) Brodkin, MD, MPH, an Associate Professor of Internal Medicine and Environmental Health, (primary appointment in Internal Medicine) teaches in the Occupational & Environmental Medicine program. His research involves health effects of organic solvents and asbestos, including solvent-related liver disease and occupational pulmonary epidemiology. He has served on the Board of the Association of Occupational and Environmental Clinics since 1993, and was president in 1997. He was appointed to the American Thoracic Society Committee to update the 1986 ATS statement on "the diagnosis of nonmalignant diseases related to asbestos." He is a coeditor for the Second Edition of the Textbook of Occupational and Environmental Medicine (Saunders & Co).

Thomas M. Burbacher, PhD, is an Associate Professor in the Toxicology program and deputy director of the Department's Center for Child Environmental Health Risks Research. His research focuses on the effects of prenatal or early postnatal exposure to environmental pollutants on central nervous system development. His current projects include studies aimed at

Rick Neitzel

Associate Professor Noah Seixas at a strategy session for research into noise-induced hearing loss

examining: the cognitive and sensory effects of prenatal methylmercury exposure in aged monkeys; the effects of prenatal exposure to methanol on sensory and cognitive development; and the effects of early pesticide exposure on brain development in rodents. In 1999, he was appointed to the National Academy of Sciences review panel on the effects of methylmercury exposure on children's health, which issued its report in 2000.

Janice Camp, MSN, MSPH, is a Senior Lecturer in the Industrial Hygiene and Safety program and director of the Field Research and Consultation Group. Her research interests include field industrial hygiene and safety, ergonomics, and program evaluation. Ms. Camp, a Certified Industrial Hygienist, is past president of the Pacific Northwest Section of the American Industrial Hygiene Association.

Harvey Checkoway, PhD, is a Professor in the Occupational and Environmental Medicine program. His research interests include occupational and environmental risk factors for cancer, dust-related lung diseases, and neurological disorders. Increasingly, his research has incorporated biomarkers of exposure, response, and genetic susceptibility. Recent projects include a study of silica, silicosis, and lung cancer among diatomite industry workers; semen quality among lead smelter workers; environmental exposures and genetic variations in Parkinson's disease; and cancer risks among textile workers.

Lucio G. Costa, PhD, is a Professor in the Toxicology program. His area of research is neurotoxicology, particularly the study of the cellular, biochemical, and molecular mechanisms involved when toxicants affect the nervous system. His laboratory uses *in vivo, in vitro,* and cell culture systems, as well as biochemical, molecular, and imaging techniques. Research projects include the effects of alcohol and lead on brain cells, and studies on the toxicity of pesticides and on genetic predisposition to neurotoxicity. He has published more than 170 articles in peer-reviewed journals and contributed dozens of book chapters and other publications.

William Daniell, MD, MPH, is an Associate Professor in the Occupational and Environmental Medicine program. His research interests involve noise-induced hearing loss, carpal tunnel syndrome, and the utility of workers' compensation data for research and intervention purposes. Past research includes neuropsychological consequences of occupational chemical exposures, particularly organic solvents, and multiple chemical sensitivity syndrome.

David L. Eaton, PhD, is a Professor in the Toxicology program and Associate Dean for Research in the UW School of Public Health and Community Medicine. He has published more than 80 research papers, contributed to 23 books, and written a dozen articles explaining toxicological principles to the general public. He directs a training program for elementary and secondary educators and is President of the Society of Toxicology. His research specialty is chemical carcinogenesis, focusing on how enzymes in the liver activate and detoxify carcinogenic chemicals. He directs the Center for Ecogenetics and Environmental Health, which brings together more than 50 UW investigators to study how small differences in human genes (polymorphisms) can influence susceptibility to toxic substances in the environment. The Center is funded by the National Institute of Environmental Health Sciences (NIEHS).

Elaine M. Faustman, PhD, is a Professor in the Toxicology program, director of the Institute for Risk Analysis and Risk Communication, and director of the Center for Child Environmental Health Risks Research. Her long-range aim is to identify biochemical and molecular mechanisms of developmental toxicity. Because 70% of human birth defects have an unknown cause, she wants to identify preventable causes, focusing on several types of pollutants including pesticides (organophosphates, benzimidazoles) and metals such as lead and methylmercury. During 1999–2001, she chaired a National Academy of Sciences panel that developed approaches for incorporating new molecular and

developmental biological findings into risk assessment. She is an elected fellow of the American Association for the Advancement of Science. Dr. Faustman has published more than 73 papers in peer-reviewed journals and a dozen book chapters and other publications.

Richard A. Fenske, PhD, MPH, is a Professor in the Industrial Hygiene and Safety program, and director of the Pacific Northwest Agricultural Safety and Health Center, one of nine such centers supported by the National Institute for Occupational Safety and Health. He is also deputy director of the Center for Child Environmental Health Risks Research. He researches new methods for assessing workplace and community exposures and risks. This work has included development of a quantitative fluorescent tracer technique for characterizing dermal exposure during pesticide applications, evaluation of risks associated with residential pesticide use, and community-based biological monitoring of children's exposure to pesticides. He teaches courses in exposure assessment and environmental risk analysis. He is a member of the EPA Science Review Board for pesticide science policy, an advisor to the National Cancer Institute's Agricultural Health Study, and a member of the NIOSH Implementation Team for the National Occupational Research Agenda.

Gary M. Franklin, MD, MPH, is a Research Professor in the Occupational and Environmental Medicine program and in the Department of Neurology, and is the medical director of the Washington State Department of Labor and Industries. His research interests include the epidemiology and outcomes of treatment for occupational injury, occupational and environmental diseases of the nervous system, health services research, and health policy.

Jack Hatlen, MS, is an Associate Professor Emeritus in the Environmental Health Technology program. His research specialties include environmental sanitation practices in public health agencies, environmental health planning and management, and workforce education and development. He is the first executive director of the newly formed Association of Environmental Health Academic Programs.

Peter Johnson, PhD, is an Assistant Professor in the Industrial Hygiene program, specializing in ergonomics. He earned his doctorate in Bioengineering from the University of California-Berkeley and has worked as a researcher at the National Institutes of Occupational Health in the United States, Sweden, and Denmark. He is developing and validating an exposure assessment system for measuring multiple physical risk factors during computer work, working on a large-scale study to measure and characterize officeworkers' exposure to upper-extremity hazards, and developing tools for exposure assessment of physical risk factors. He is also developing methods to measure occupationally-related muscle fatigue using electrical stimulation of the muscle.

David A. Kalman, PhD, is Department Chair and Professor in the Environmental Health Technology program. His research focuses on chemical issues, such as hazardous properties of materials, environmental fate and transport; environmental quality assessment; hazard management; and occupational and community exposure assessment, especially using biomarkers of exposure. Active research areas include: assessment of exposures to atmospheric particulates including wood smoke; exposures and effects of arsenic in drinking water, diet, and soil; and nonoccupational pesticide exposure.

Joel Kaufman, MD, MPH, is an Associate Professor in the Department's Occupational and Environmental Medicine program. He has a joint appointment with General Internal Medicine and an adjunct appointment in Epidemiology. His research activities fall into three areas: epidemiology of occupational and environmental asthma; surveillance and prevention of occupational illnesses and injuries, including lead poisoning and occupational skin disorders; and occupational and environmental factors in cardiovascular disease. He is past-president of the Northwest Association of Occupational and Environmental Medicine.

Terrance J. Kavanagh, PhD, is an Associate Professor in the Toxicology program. His research interests include free radical biology and oxidative stress, and the effects of chemicals on diseases of aging, including cancer, atherosclerosis, pulmonary fibrosis, Parkinson's disease, and Alzheimer's disease. His laboratory assesses the role of the free radical scavenger glutathione (GSH) and the antioxidant enzymes catalase, superoxide dismutase, and glutathione peroxidase in preventing free radical injury. Another research interest involves assessing the role of genetic polymorphisms in these enzymes in free-radical-mediated diseases.

Matthew C. Keifer, MD, MPH, is an Associate Professor and interim director of the Occupational and Environmental Medicine program. He joined the faculty after serving as project epidemiologist for CARE in Nicaragua, where he participated in health surveillance and development activities related to pesticide exposures and health effects. His activities pertain to studies of pesticide health effects on humans. He is codirector of the Pacific Northwest Agricul-

tural Safety and Health Center, one of nine agricultural centers in the US funded by NIOSH. He is also director of the Fogarty International Center funded International Scholars in Occupational and Environmental Health.

John Kissel, PhD, is an Associate Professor and director of the Environmental Health Technology program. His research interests include pathways of human exposure to environmental contaminants in soils. Exposure factor data collected by Dr. Kissel and his students and staff are cited in EPA guidance documents and used in cleanup decisions at Superfund sites. He also investigates community exposures to pesticides and currently serves on the EPA Science Advisory Panel for the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Dr. Kissel is an active member of the International Society of Exposure Analysis and the Society for Risk Analysis. He has authored or coauthored more than 25 papers in scientific journals.

Jane Q. Koenig, PhD, is a Professor in the Toxicology program. Her research interests are the respiratory health effects of air pollution, especially the responses of susceptible individuals, such as those with asthma or other chronic respiratory diseases. She is involved in three general areas of research: controlled laboratory studies using human subjects; field or epidemiological studies evaluating respiratory health in populations exposed to fine particulate matter from wood smoke or other sources in their neighborhoods; and assessment of physical or chemical changes in cultured human epithelial cells after air pollutant exposure. She has published more than 60 peer-reviewed journal articles, and directs the EPA particulate matter research center at the UW.

L.-J. Sally Liu, ScD, is an Assistant Professor in the Environmental Health Technology program. She earned her doctorate in 1994 from Harvard University's School of Public Health and has published about a dozen papers in peer-reviewed journals and two book chapters. She is the principal investigator of several exposure assessment projects. Two studies are currently funded by the US EPA to assess particulate matter exposure and health effects among high-risk subpopulations in the US Northwestern region. She is also the principal investigator of an exposure assessment technology transfer project, jointly sponsored by the US EPA and the Taiwan EPA.

Daniel L. Luchtel, PhD, is a Professor in the Toxicology program. His research projects include the effects of gaseous air pollutants (ozone, nitrogen dioxide, and sulfur dioxide) on cultured human nasal epithelial cells and primate bronchial epithelial cells; toxicology of carbon/graphite fibers used in advanced composite materials by the aerospace industry; and mucociliary clearance as a defense mechanism in the lung. He has developed new ways of preserving and fixing mucous cells with ultrarapid freezing and freeze-substitution. He is also interested in the applications and techniques of microscopy. He has published more than 50 papers in peer-reviewed publications.

Lee Monteith, MS, is a Senior Lecturer Emeritus in the Industrial Hygiene and Safety Program. Mr. Monteith, a Certified Industrial Hygienist, is a member of the Air Sampling Instruments Committee and the Gas and Vapor Detection Systems Committee, American Industrial Hygiene Association and a liaison between the two committees. He is a Diplomate member of the American Academy of Industrial Hygiene. His research interests include the adsorption process in passive dosimeter badges, methods for the measurements of glove permeation, and methods for the detection and measurement of trace compounds in the environment. In October 2000, he visited ten occupational health groups in China to exchange information as part of a delegation from the American Conference of Governmental Industrial Hygienists and People to People Ambassador Program.

Michael S. Morgan, ScD, is a Professor in the Industrial Hygiene and Safety program and director of the Department's undergraduate program. He holds adjunct appointments in the Departments of Civil Engineering and Chemical Engineering at UW. Dr. Morgan is a Certified Industrial Hygienist. His main academic interest is in respiratory physiology and inhalation toxicology. He measures and models the pharmacokinetics of industrial solvent exposures, and studies the performance of personal protective equipment used with solvents. He also studies lead exposures in the construction industry, particularly among demolition workers. He chairs the Biological Exposure Indices Committee of the American Conference of Governmental Industrial Hygienists. In 1999, he was appointed to the National Research Council's Committee on Air Quality in Passenger Cabins of Commercial Aircraft. He has published more than 40 papers in peer-reviewed journals.

Sharon L. Morris is a Senior Lecturer in the Occupational and Environmental Medicine program and the Department's Assistant Chair for Community Outreach, as well as associate director of the Pacific Northwest Agricultural Safety and Health Center. Her research interests include occupational safety and health policy and program evaluation, and she directs the Department's Policy Analysis and

Program Evaluation Initiative. She serves on the Board of Scientific Counselors of the National Institute for Occupational Safety and Health; the Innovations Task Force of the Washington Department of Labor and Industries; the Governor's Industrial Safety and Health Advisory Board; and the NIOSH NORA Economic and Social Consequences Committee.

Curtis J. Omiecinski, PhD, is a Professor and director of the Toxicology program. He is also an Adjunct Professor in the Department of Pharmacology. His research program in molecular toxicology seeks to understand genetic factors and regulatory mechanisms that underlie susceptibilities of individuals to toxic effects associated with chemical exposures. These studies are largely focused on the cytochrome P450 and epoxide hydrolases, enzymes that metabolize many environmental substances of concern. He is an editorial board member of several scientific journals, and has served as Associate Editor of both Toxicology and Applied Pharmacology and Toxicological Sciences, official journals of the Society of Toxicology. He received the Society's Zeneca Award in 1998 and the Burroughs Wellcome Fund Toxicology Scholar Award, 1995-2000. He has published over 70 peer-reviewed articles and numerous book chapters, reviews and other technical reports. Dr. Omiecinski's research program in toxicogenetics is supported by several NIH grants together with the Burroughs Wellcome Fund.

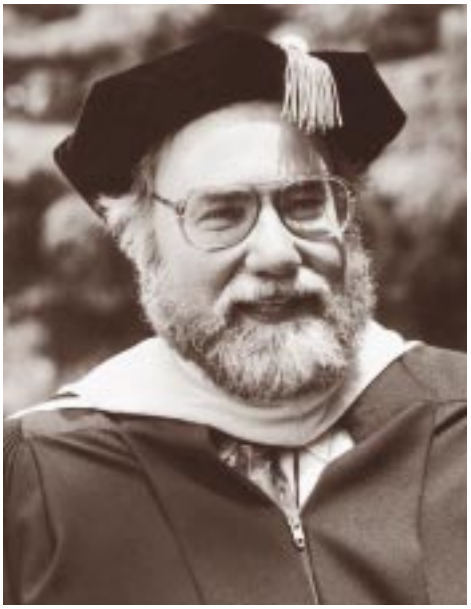
Mansour Samadpour, PhD, is an Assistant Professor in the Environmental Health Technology program. He is trained in microbiology and food science. Recent projects include source analysis for fecal coliforms in relation to shellfish beds and public water supply; molecular epidemiology of food-borne outbreaks; and prevalence and implications of food-borne pathogens in public food supplies. His laboratory specializes in rapid identification of sources of outbreaks of infectious diseases and the microbiology of food, water, wastewater, and air. He received a group recognition award from US Food and Drug Administration in 1997 for his team's work in solving the *E. coli* identification problem in the Odwalla apple juice case.

Noah S. Seixas, PhD, is an Associate Professor in the Industrial Hygiene and Safety program and graduate program director. Dr. Seixas is a Certified Industrial Hygienist and a member of the editorial board of the American Industrial Hygiene Association Journal. He also serves on the AIHA Occupational Epidemiology Committee. His interests are in the quantification of exposure for occupational epidemiology, especially agents affecting the respiratory tract. Current research efforts include a prospective study of noise-induced hearing damage among construction workers, assessment of irritant gas exposures during aluminum smelting and their relationship to respiratory tract infection, exposure assessment for women textile workers in Shanghai, China, and methods of controlling exposure to dust during construction tasks. Dr. Seixas also works closely with the local construction community evaluating the effectiveness of educational and organizational programs.

Elizabeth (Lianne) Sheppard, PhD, is a Research Associate Professor in the Occupational and Environmental Medicine Program with a joint appointment in Biostatistics. Her applied work focuses on air pollution health effects and occupational epidemiologic studies. Her biostatistical research interests emphasize estimation of health effects from environmental and occupational exposures, and incorporating group information in epidemiologic studies.

Charles D. Treser, MPH, is a Senior Lecturer in the Environmental Health Technology program. His interests include administrative law and process applied to environmental health, and vector control and housing. Current research projects include several projects through the NW Center for Public Health Practice to develop a regional network of state and local public health agencies and academic institutions focused on current issues of public health workforce development. He is also spearheading a national effort to produce a practical manual on housing and health for environmental health practitioners. He is

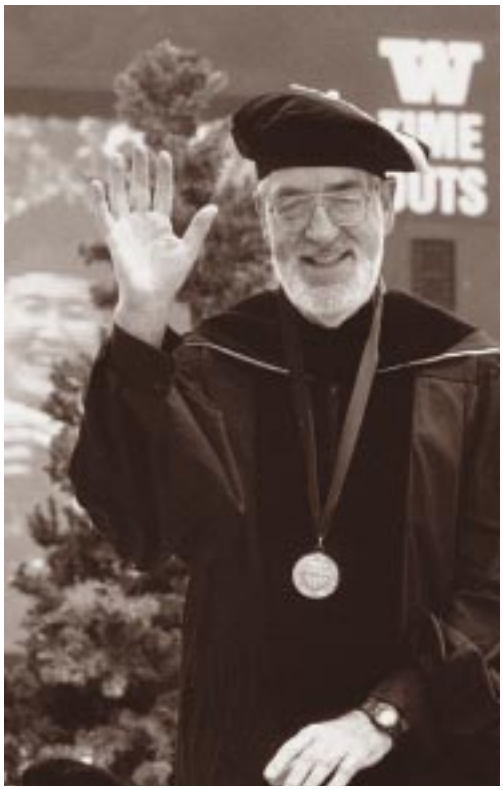
Chuck Treser, undergraduate advisor and commencement marshal, at June 2001 graduation ceremonies



Joel Levin

president of Association of Environmental Health Academic Programs; and principal investigator on a cooperative agreement between AEHAP and the CDC National Center for Environmental Health designed to improve Environmental Health practice through promoting and strengthening EH academic programs.

Gerald van Belle, PhD, a Professor in the Environmental Health Technology program (joint with Biostatistics), was department Chair from 1990 to 1998. His research specialties include design of experiments, data characterization, and analysis with particular emphasis to neurodegenerative diseases and environmental studies. He is the principal investigator for the core in Biostatistics, Epidemiology, and Statistical Genetics of the UW Alzheimer Disease Research Center. He also researches the effects of air pollution on health, particularly the link between daily fluctuations in air pollution levels and morbidity and mortality statistics. He is a member of the Research Committee of the Health Effects Institute, Boston, a board member of the Mickey Leland National Urban Air Toxics Research Center, Houston, and a member of the Food and Drug Administration's Peripheral and Central Nervous System Drug Advisory Committee. He is the author or coauthor of more than 100 papers and coauthor with L. Fisher of the Wiley book, Biostatistics: A Methodology for the Health Sciences.



Joel Levin

Professor Gerald van Belle at 2001 commencement ceremonies

James S. Woods, PhD, MPH, is a Research Professor in the Toxicology program. His research focuses on the molecular mechanisms of toxicity of heavy metals such as mercury, arsenic, and lead, with interest in changes in metabolism of porphyrins as biomarkers of metal exposure and toxicity. He also conducts epidemiological studies of metal toxicity in human populations, including a study to determine the potential health risks to children of dental amalgam fillings containing mercury. He is past president of the American Board of Toxicology and of the Pacific Northwest Association of Toxicologists. He has served on numerous national and international advisory committees to evaluate human health risks from metal exposures. He has published more than 100 papers in peer-reviewed journals in addition to numerous book chapters and review articles.

Zhengui Xia, PhD, is Assistant Professor in the Toxicology program. She has published 20 papers, mostly on the mechanisms for regulating apoptosis, a form of programmed cell death. During development, apoptosis helps remove cells that are produced in excess, have developed improperly, or are no longer needed. In adults, apoptosis removes cells that are potentially dangerous, such as viral infected cells, genetically damaged cells, or toxin-damaged cells. Dr. Xia studies the role of chemical toxins such as sodium arsenite and pesticides on apoptosis. Abnormal apoptosis has been implicated in various diseases, such as cancer, autoimmune disorders, Huntington's disease, Alzheimer's disease, and stroke. Dr. Xia's research has been supported by the Sheldon Murphy assistant professor endowment and NIH. She is also a recipient of the Burroughs Wellcome new investigator award.

Michael G. Yost, PhD, is an Associate Professor and director of the Industrial Hygiene and Safety program. His research interests include optical remote sensing of chemicals in the environment, and physical agents in the workplace such as noise, vibration, and electromagnetic radiation. Dr. Yost is a member of the Bioelectromagnetics Society (BEMS) and the American Conference of Government Industrial Hygienists (ACGIH). He is developing new tools for exposure assessment, such as Optical Remote Sensing (ORS) methods that use electromagnetic radiation (such as lasers, UV, visible, or infrared light) to rapidly identify and measure contaminants. He is developing new types of sampling methods, such as a heart rate controlled sampling pump and instruments for measuring solvent concentrations in exhaled breath samples using infrared spectroscopy.

Former faculty

Peter Breysse, MPH, *Associate Professor Emeritus*

Lee Doolittle, PhD, *Associate Professor Emeritus*

Stanley Freeman, MS, *Senior Lecturer Emeritus*

Joseph P. Geraci, PhD, *Retired Associate Professor*

Steven Guffey, PhD, *Former Associate Professor*

Jack Hatlen, MS, *Associate Professor Emeritus*

Richard Hibbard, *Lecturer Emeritus*

Kenneth Jackson, PhD, *Professor Emeritus*

Goldy Kleinman, MA, *Lecturer Emeritus*

Lee Monteith, MS, *Senior Lecturer Emeritus*

N. Karle Mottet, MD, *Professor Emeritus (Joint with Pathology)*

Ahmad Nevissi, PhD, *Retired Research Associate Professor*

Maurice Robkin, PhD, *Professor Emeritus*

John Wilson, MD, ScD, *Professor Emeritus*

Part-time & visiting faculty

Richard Gleason, MSPH, *Lecturer*

Vincent Gregory, *Visiting Lecturer*
CEO-Emeritus, Rohm and Haas Company

Rolf Hahne, PhD, *Lecturer, Part Time*

David Lenning, *Lecturer*

Crispin Pierce, PhD, *Lecturer, Part Time*

Kate Stewart, MS, *Lecturer*

Eira Viikari-Juntura, MD PhD, *Visiting Professor*

Postdoctoral fellows

Nilo Arnaiz

Theo Bammler

Federica Bordi

Sean Boyle

Jane Cavanaugh

Sanders Chai

Sandra Chang

Pandora Christie

Paul Darby

Adrian John Fretland

Kerstin Gross-Steinmeyer

Shih-Ling Hsuan

Kimquy Kieu

Eugene Kim

Wan-Fen Li

Lidong Lu

Therese Mar

Gabrielle Morris

Stacey Newsome

Christopher David Simpson

Jeffery Sullivan

Tao Wang

Auxiliary Faculty

Leonard Altman, MD, *Clinical Professor*
Joint with Medicine (Primary Appointment), Oral Biology

Harriet Ammann, PhD, *Affiliate Assistant Professor*
Washington state Department of Health, Office of Environmental Assessment Services

Steven Bao, *Affiliate Assistant Professor*
Washington state Department of Labor and Industries

Stanley Bigos, MD, *Adjunct Professor*
Spine Research Clinic, Harborview

Denis Bourcier, PhD, *Affiliate Associate Professor*
Environmental Engineering, Boeing Defense and Space Group

Jeanine L. Bussiere, *Affiliate Associate Professor*
Director of Pharmacology and Toxicology at Immunex

John Calcagni, MD, *Clinical Instructor, Richland*

Stephen Cant, *Affiliate Assistant Professor*
Industrial Safety and Health, Washington state Department of Labor and Industries

Martin Cohen, ScD, *Affiliate Assistant Professor*
SHARP, Washington state Department of Labor and Industries

Jon Counts, DrPH, *Clinical Assistant Professor*
Assistant Secretary, Washington state Department of Health

David Covert, PhD, *Adjunct Research Professor*
Civil Engineering, Atmospheric Sciences

Stanley Curtis, PhD, *Affiliate Professor*
Fred Hutchinson Cancer Research Center

Foppe DeWalle, PhD, *Affiliate Professor*
Delft, The Netherlands

Frank Dost, DVM, ATS, *Affiliate Professor*
Veterinary Sciences, Freeland, WA

Robert Dreisbach, MD, PhD, *Clinical Professor*
Professor Emeritus (Pharmacology), Stanford University

Charles Easterberg, MS, *Clinical Instructor*
UW Environmental Health and Safety

Diana Echeverria, PhD, *Affiliate Associate Professor*
Battelle Human Affairs Research Centers

Alan Fantel, PhD, *Adjunct Research Professor*
Department of Pediatrics

Bruce Fowler, PhD, *Visiting Associate Professor*
University of Maryland School of Medicine

Steven Gilbert, PhD, *Affiliate Associate Professor*
President, SNBL-USA, Director, Institute of Neurotoxicology and Neurological Disorders

Timothy Gilmore, MD, *Clinical Assistant Professor*
Group Health Cooperative

Gary Goodman, MD, *Clinical Associate Professor*
Joint with Medicine (Primary Appointment), Swedish Tumor Institute

Samuel Hammar, MD, *Clinical Professor*
Joint with Pathology (Primary Appointment)

John Holland, MD, MPH, *Clinical Assistant Professor*
Joint with Orthopaedics (Primary Appointment)

Scott Iverson, PhD, *Adjunct Associate Professor*
Industrial Engineering

Damir Janigro, PhD, *Adjunct Research Associate Professor*
Neurological Surgery

James Karr, PhD, *Adjunct Professor*
Department of Zoology

Ronald Kathren, PhD, *Affiliate Associate Professor*
US Transuranium and Uranium Registries
Washington State University, Richland

Philip Landrigan, MD, *Clinical Professor*
Director, Division of Environmental and Occupational Medicine, Mt. Sinai Medical Center, New York

Timothy Larson, PhD, *Adjunct Professor*
Department of Civil Engineering

Joellen Lewtas, PhD, *Affiliate Professor*
US EPA, Region 10

Roseanne Lorenzana, PhD, *Affiliate Assistant Professor*
US EPA, Region 10

Donald Malins, PhD, *Affiliate Professor*
Pacific Northwest Research Foundation

Thomas Martin, MD, MPH, *Adjunct Associate Director, Toxicology Services, Emergency Medicine, UW*

Roscoe Moore, PhD, *Affiliate Associate Professor*
Office of International Health, Rockville, MD

Karen Morris-Fine, PhD, *Affiliate Assistant Professor*
The Boeing Company

Michael Muhm, MD, MPH, *Clinical Associate Professor*
The Boeing Company

Gilbert Omenn, MD, PhD, *Affiliate Professor*
Executive Vice President for Medical Affairs, University of Michigan

Carl Osaki, MSPH, *Clinical Associate Professor*
Retired director of Environmental Health Services, Seattle-King County Department of Public Health

Stanley Pier, PhD, *Affiliate Associate Professor*
Consultant

Bradley Prezant, MSPH, *Affiliate Instructor*
Prezant and Associates

Susan Sama, PhD, *Affiliate Assistant Professor*
SHARP, Washington state Department of Labor and Industries

Ruth Sechena, *Clinical Assistant Professor*
Associate Medical Director, Washington state Department of Labor and Industries

Barbara Silverstein, PhD, MPH, *Affiliate Associate Professor*
SHARP Program, Washington state Department of Labor and Industries

Michael Silverstein, MD, MPH, *Affiliate Associate Professor (Joint with Health Services)*
Assistant Director for WISHA Services, Washington state Department of Labor and Industries

Patricia Sparks, MD, *Clinical Associate Professor*
Consultant, occupational and environmental medicine and clinical toxicology

Peregrin Spielholz, *Affiliate Associate Professor*
Washington state Department of Labor and Industries

Henry L. Stockbridge, *Clinical Assistant Professor*
Medical Director for Washington state Department of Labor and Industries

Timothy Takaro, MD, *Clinical Assistant Professor*

Wayne Turnberg, MSPH, *Affiliate Instructor*
Washington state Department of Ecology

Philip Watanabe, PhD, *Affiliate Professor*
Retired director of health services, Dow Chemical Company

Stephen Whittaker, PhD, *Affiliate Assistant Professor*
SHARP Program, Washington state Department of Labor and Industries

Paul Williams, MD, *Clinical Associate Professor*
Northwest Asthma and Allergy Center, Mount Vernon

Helmut Zarbl, PhD, *Affiliate Associate Professor (Joint with Pathology)*
Fred Hutchinson Cancer Research Center

Joel Levin

SELECTED PUBLICATIONS

This list includes books, articles, and reviews in professional journals. It does not include book chapters, letters, technical reports, or conference presentations. Departmental investigators are bold-faced.

Martia Majar, Carolyn Whitaker, and Robert Leo receive their master's degrees in June 2001

Abrams L, **Seixas N,** Robins T, Burge H, Muilenberg M, **Franzblau A.** Characterization of metalworking fluid exposure indices for a study of acute respiratory effects. Appl Occup Environ Hyg 2000;15:492–502.

Alexander BH, Checkoway H, Nagahama SI, Domino KB. Cause-specific mortality risks of anesthesiologists. Anesthesiology 2000;93:922–930.

Alexander BH, Franklin GM, Fulton-Kehoe D. Comparison of fatal and severe nonfatal traumatic work-related injuries in Washington State. Am J Ind Med 1999;36:317–325.

Altman GB, Gown AM, **Luchtel DL,** Baker C. RANTES production by cultured primate endometrial epithelial cells. Am J Reprod Immunol 1999;42:168–174.

Andersen ME, Conolly RB, **Faustman EM,** Kavlock RJ, Portier CJ, Sheehan DM, Wier PJ, Ziese L. Quantitative mechanistically based dose-response modeling with endocrine-active compounds. Environ Health Perspect 1999;107 (suppl 4):631–638.

Arnaiz N, Lakshminarayan S. Hypertrophic osteoarthropathy in images in pulmonary medicine. Clin Pulmonary Med 2001; 8:196–198.

Balduini W, Cattabeni FM, **Costa LG** (eds.). Tossicologia. (Italian edition of Casarett and Doull's Toxicology: The Basic Science of Poisons. C. Klaasen, ed.). EMSI, Roma, 1999.

Bammler TK, Abel EL, Eaton DL. Metabolism of methyl parathion by glutathione S-transferases in vitro. Chem Biol Interact 2001;133 (SI):231–233.

Bammler TK, Slone DH, Eaton DL. Effects of dietary oltipraz and ethoxyquin on aflatoxin B1 biotransformation in non-human primates. Toxicol Sci 2000;54:30–41.

Band PR, Le ND, Fang R, **Astrakianakis G,** Bert J, Keefe A, Krewski D. Cohort cancer incidence among pulp and paper mill workers in British Columbia. Scand J Work Environ Health 2001;27:113–119.

Bartell SM, Ponce RA, Sanga RN, Faustman EM. Human variability in mercury toxicokinetics and steady state biomarker ratios. Environ Res 2000;84:127–132.

Bartell SM, Ponce RA, Takaro TK, Zerbe RO, **Omenn GS, Faustman EM.** Risk estimation and value-of-information analysis for three proposed genetic screening programs for chronic beryllium disease prevention. Risk Anal 2000;20:87–99.

Bartell SM, Takaro TK, Ponce RA, Hill JP, Faustman EM, Omenn GS. Risk assessment and screening strategies for beryllium exposure.Technology 2000;7:241–249.

Beck NB, Omiecinski CJ. Lack of modulation by phenobarbital of cyclic AMP levels or protein kinase A activity in rat primary hepatocytes. Biochem Pharmacol 1999;58:1109–1114.

Beck NB, Sidhu JS, Omiecinski CJ. Baculovirus vectors repress phenobarbital-mediated gene induction and stimulate cytokine expression in primary cultures of rat hepatocytes. Gene Ther 2000;7:1274–1283.

Becker P, **Flanagan ME,** Akladios M. Development of an

ACGIH construction industry silica exposure database overview. Appl Occup Environ Hyg 2001;16:781–783.

Bogdanffy MS, Daston G, Faustman EM, Kimmel CA, Kimmel GL, Seed J, Vu V. Harmonization of cancer and noncancer risk assessment: proceedings of a consensus-building workshop. Toxicol Sci 2001;61:18–31.

Brodkin CA, Moon JD, Camp J, Echeverria D, Redlich CA, Willson RA, Checkoway H. Serum hepatic biochemical activity in two populations of workers exposed to styrene. Occup Environ Med 2001;58:95–102.

Burbacher TM, Grant KS. Methods for studying nonhuman primates in neurobehavioral toxicology and teratology. Neurotoxicol Teratol 2000;22:475–486.

Burbacher T, Shen D, Grant K, Sheppard L, Damian D, Ellis S, Liberato N. Reproductive and offspring developmental effects following maternal inhalation exposure to methanol in non-human primates. Res Rep Health Eff Inst 1999;Oct:i-ii, 1–117;119–33.

Burch JB, Reif JS, Noonan CW, Yost MG. Melatonin metabolite levels in workers exposed to 60-Hz magnetic fields: work in substations and with 3-phase conductors. J Occup Environ Med 2000;42:136–142.

Burgess JL, Kovalchick DF, Harter L, Kyes KB, Lymp JF, Brodkin CA. Hazardous materials events: evaluation of transport to health care facility and evacuation decisions. Am J Emerg Med 2001;19:99–105.

Burgess JL, Kovalchick DF, Kyes KB, Thompson JN, Barnhart S. Hyperventilation following a large-scale hazardous-materials incident. Int J Occup Environ Health 1999;5:194–197.

Burgess JL, Kovalchick DF, Lymp JF, Kyes KB, Robertson WO, Brodkin CA. Risk factors for adverse health effects following hazardous materials incidents. J Occup Environ Med 2001;43:558–566.

Burgess JL, Morrissey B, Keifer MC, Robertson WO. Fumigant-related illnesses: Washington State's five-year experience. Clin Toxicol 2000;38:7–14.

Carozza SE, Wrensch M, Miike R, Newman B, Olshan AF, Savitz DA, Yost M, Lee M. Occupation and adult gliomas. Am J Epidemiol 2000;152:838–846.

Catlin MC, Guizzetti M, Costa LG. Effect of ethanol on muscarinic receptor-induced calcium responses in astroglia. J Neurosci Res 2000;60:345–355.

Catlin MC, Kavanagh TJ, Costa LG. Muscarinic receptor-induced calcium responses in astroglia. Cytometry 2000;41:123–132.

Cavanaugh JE, Ham J, Hetman M, Poser S, Yan C, Xia Z. Differential regulation of mitogen-activated protein kinases ERK1/2 and ERK5 by neurotrophins, neuronal activity, and cAMP in neurons. J Neurosci 2001;21:434–443.

Chai SK, Robertson WO, Takaro T, Hagopian A, Beaudet N, Sechena R, Martin T, Simpson L, Barnhart S. Pediatric environmental health: perceptions from a survey questionnaire. Int J Occup Environ Health 2001;7:37–43.

Chan GC, Lernmark U, Xia Z, Storm DR. DNA elements of the type 1 adenylyl cyclase gene locus enhance reporter gene expression in neurons and pinealocytes. Eur J Neurosci 2001;13:2054–2066.

Cheadle A, Wickizer TM, Franklin G, Cain K, Joesch J, Kyes K, Madden C, Murphy L, Plaeger-Brockway R, Weaver M. Evaluation of the Washington State Workers' Compensation Managed Care Pilot Project II: medical and disability costs. Med Care 1999;37:982–993.

Checkoway H, Franzblau A. Is silicosis required for silica-associated lung cancer? Am J Ind Med 2000;37:252–259.

Cheesman MJ, Kneller MB, Kelly EJ, Thompson SJ, Yeung CK, Eaton DL, Rettie AE. Purification and characterization of hexahistidine-tagged cyclohexanone monooxygenase expressed in *Saccharomyces cerevisiae* and *Escherichia coli*. Protein Expr Purif 2001;21:81–86.

Claiborn CS, Finn D, Larson TV, Koenig JQ. Windblown dust contributes to high $PM_{2.5}$ concentrations. J Air Waste Manag Assoc 2000;50:1440–1445.

Clark CM, Sheppard L, Fillenbaum GG, Galasko D, Morris JC, Koss E, Mohs R, Heyman A, and the CERAD Investigators. Variability in annual mini-mental state examination score in patients with probable Alzheimer disease. Arch Neurol 1999;56:857–862.

Clayton D, Campbell MJ, Longford NT, Armstrong B, Richardson S, Rushton L, Raab GM, Quinn M, Nelder JA, Bland M, Macfarlane A, Dryden IL, Smith RI, Berhane K, Thomas DC, Cotton JW, Coull BA, Mezzetti M, Ryan LM, Cowles K, Cox C, Cox LH, Gupta S, Hosmane BS, Gurrin LC, Pettitt AN, Saez M, Sheppard L, Lumley T. Combining evidence on air pollution and daily mortality from the 20 largest US cities: a heirarchical modelling strategy. J R Statist Soc A 2000;163:284–302.

Cohen MA, Kaufman JD. Latex sensitivity in Washington State acute care hospitals. AAOHN J 2000;48:297–304.

Costa LG. The emerging field of ecogenetics. NeuroToxicology 2000;21:85–90.

Costa LG, Guizzetti M, Lu H, Bordi F, Vitalone A, Tita B, Palmery M, Valeri P, Silvestrini B. Intracellular signal transduction pathways as targets for neurotoxicants. Toxicology 2001;160:19–26.

Costa-Mallen P, Checkoway H, Fishel M, Cohen AW, Smith-Weller T, Franklin GM, Swanson PD, Costa LG. The *Eco*RV genetic polymorphism of human monoamine oxidase type A is not associated with Parkinson's disease and does not modify the effect of smoking on Parkinson's disease. Neurosci Lett 2000;278:33–36.

Costa-Mallen P, Costa LG, Smith-Weller T, Franklin GM, Swanson PD, Checkoway H. Genetic polymorphism of dopamine D2 receptors in Parkinson's disease and interactions with cigarette smoking and MAO-B intron 13 polymorphism. J Neurol Neurosurg Psychiatry 2000;69:535–537.

Denovan LA, Lu C, Hines CJ, Fenske RA. Saliva biomonitoring of atrazine exposure among herbicide applicators. Int Arch Occup Environ Health 2000;73:457–462.

Diaz D, Krejsa CM, White CC, Keener CL, Farin FM, Kavanagh TJ. Tissue specific changes in the expression of glutamate-cysteine ligase mRNAs in mice exposed to methylmercury. Toxicol Lett 2001;122:119–129.

Dieguez-Acuna FJ, Ellis ME, Kushleika J, Woods JS. Mercuric ion attenuates nuclear factor-kappaB activation and DNA binding in normal rat kidney epithelial cells: implications for mercury-induced nephrotoxicity. Tox Appl Pharmacol 2001;173:176–187.

Dieguez-Acuna FJ, Woods JS. Inhibition of NF-kappaB-DNA binding by mercuric ion: utility of the non-thiol reductant, tris(2-carboxyethyl)phosphine hydrochloride (TCEP), on detection of impaired NF-kappaB-DNA binding by thiol-directed agents. Toxicol In Vitro 2000;14:7–16.

Dills RL, Zhu X, Kalman DA. Measurement of urinary methoxyphenols and their use for biological monitoring of

wood smoke exposure. Environ Res 2001;85:145–158.

Dionne CE, Von Korff M, Koepsell TD, Deyo RA, Barlow WE, Checkoway H. A comparison of pain, functional limitations, and work status indices as outcome measures in back pain research. Spine 1999;24:2339–2345.

Dionne CE, Von Korff M, Koepsell TD, Deyo RA, Barlow WE, Checkoway H. Formal education and back pain: a review. J Epidemiol Community Health 2001;55:455–468.

Doran EM, Yost MG, Fenske RA. Measuring dermal exposure to pesticide residues with attenuated total reflectance Fourier transform infrared (ATR–FTIR) spectroscopy. Bull Environ Contam Toxicol 2000;64:666–672.

Eaton DL. Biotransformation enzyme polymorphism and pesticide susceptibility. NeuroToxicology 2000;21:101–112.

Eaton DL, Costa LG. Profiles in toxicology: Sheldon D. Murphy. Toxicol Sci 2000;57:191–192.

Egeland GM, Ponce R, Knecht R, Bloom NS, Fair J, Middaugh JP. Trace metals in ancient hair from the Karluk Archaeological Site, Kodiak, Alaska. Int J Circumpolar Health 1999;58:52–56.

Engel LS, Checkoway H, Keifer MC, Seixas NS, Longstreth WT, Scott KC, Hudnell K, Anger WK, Camicioli R. Parkinsonism and occupational exposure to pesticides. Occup Environ Med 2001;58:582–589.

Epstein E, Wu N, Youngberg C, Croteau G. Controlling dust and bioaerosols at a biosolids composting facility. Biocycle 2001; 42:50–54.

Epstein E, Wu N, Youngberg C, Croteau G. Dust and bioaerosols at a biosolids composting facility. Compost Sci Util 2001; 9:250–255.

Farag AM, Goldstein JN, Woodward DF, Samadpour M. Water quality in three creeks in the backcountry of Grand Teton National Park, USA. J Freshwater Ecol 2001;16:135–143.

Farin FM, Hitosis Y, Hallagan SE, Kushleika J, Woods JS, Janssen PS, Smith-Weller T, Franklin GM, Swanson PD, Checkoway H. Genetic polymorphisms of superoxide dismutase in Parkinson's disease. Mov Disord 2001;16:705–707.

Faustman EM, Silbernagel SM, Fenske RA, Burbacher TM, Ponce RA. Mechanisms underlying children's susceptibility to environmental toxicants. Environ Health Perspect 2000; 108(suppl 1):13–21.

Fenske RA. Dermal exposure: a decade of real progress (editorial). Ann Occup Hyg 2000;44:489–491.

Fenske RA, Kissel JC, Lu C, Kalman DA, Simcox NJ, Allen EH, Keifer MC. Biologically based pesticide dose estimates for children in an agricultural community. Environ Health Perspect 2000;108:515–520.

Fenske RA, Lu C, Simcox NJ, Loewenherz C, Touchstone J, Moate TF, Allen EH, Kissel JC. Strategies for assessing children's organophosphorus pesticide exposures in agricultural communities. J Expo Anal Environ Epidemiol 2000;10:662–671.

Fenske RA, Simcox NJ, Camp JE, Hines CJ. Comparison of three methods for assessment of hand exposures to azinphos-methyl (guthion) during apple thinning. Appl Occup Environ Hyg 1999;14:618–623.

Figueroa-Masot XA, Hetman M, Higgins MJ, Kokot N, Xia Z. Taxol induces apoptosis in cortical neurons by a mechanism independent of Bcl-2 phosphorylation. J Neurosci 2001;21:4657–4667.

Finn D, Rumburg B, Claiborn C, Bamesberger L, Siems WF, Koenig J, Larson T, Norris G. Sampling artifacts from the use of denuder tubes with glycerol based coatings in the measurement of atmospheric particulate matter. Environ Sci Technol 2001;35:40–44.

Flanagan ME, Zaferatos NC. Appropriate technologies in the traditional native American smokehouse: Public Health considerations in tribal community development. Am Indian Cult Res J 2000;24:69–93.

Franklin GM, Fulton-Kehoe D, Bradley C, Smith-Weller T. Outcome of surgery for thoracic outlet syndrome in Washington State workers' compensation. Neurology 2000;54:1252–1257.

Freeman K. Center attacks core issues in land of apples. Environ Health Perspect 108:A554–556.

Fretland AJ, Omiecinski CJ. Epoxide hydrolases: biochemistry and molecular biology. Chem Biol Interact 2000;129:41–59.

Frumkin H, Letz R, Williams PL, Gerr F, Pierce M, Sanders A, Elon L, Manning CC, Woods JS, Hertzberg VS, Mueller P, Taylor BB. Health effects of long-term mercury exposure among chloralkali plant workers. Am J Ind Med 2001;39:1–18.

Fulton-Kehoe D, Franklin G, Weaver M, Cheadle A. Years of productivity lost among injured workers in Washington State: modeling disability burden in workers' compensation. Am J Ind Med 2000;37:656–662.

Fulton-Kehoe D, Hamman RF, Baxter J, Marshall J. A case-control study of physical activity and non-insulin dependent diabetes mellitus (niddm): the San Luis Valley Diabetes Study. Ann Epidemiol 2001;11:320–327.

Furlong CE, Li WF, Richter RJ, Shih DM, Lusis AJ, Alleva E, Costa LG. Genetic and temporal determinants of pesticide sensitivity: role of paraoxonase (*PON1*). NeuroToxicology 2000;21:91–100.

Furlong CE, Li WF, Brophy VH, Jarvik GP, Richter RJ, Shih DM, Lusis AJ, Costa LG. The *PON1* gene and detoxification. NeuroToxicology 2000;21:581–588.

Gallagher EP, Sheehy KM, Janssen PL, Eaton DL, Collier TK. Isolation and cloning of homologous glutathione *S*-transferase cDNAs from English sole and starry flounder liver. Aquat Toxicol 1999;44:171–182.

Gardner JL, Bammler TK, Mannervik B, Gallagher EP. Characterization of a peptide antibody toward hGSTA4-4. Chem Biol Interact 2001;133(SI):63–67.

Ghatan S, Larner S, Kinoshita Y, Hetman M, Patel L, Xia Z, Youle RJ, Morrison RS. p38 MAP kinase mediates Bax translocations in nitric oxide-induced apoptosis in neurons. J Cell Biol 2000; 150:335–347.

Gloyd S, Chai S, Mercer MA. Antenatal syphilis in sub-Saharan Africa: missed opportunities for mortality reduction. Health Policy Plan 2001;16:29–34.

Goldstein BD, Erdal S, Burger J, Faustman EM, Friedlander BR, Greenberg M, Leschine TM, Powers CW, Waishwell L, Williams B. Stakeholder participation: experience from the CRESP program. Environ Epidemiol Toxicol 2000;2:103–111.

Goldstein BD, Powers C, Moore J, Faustman EM. CRESP: a new approach to stakeholder-responsive, cost-effective research. Eur J Oncol 1999;4:537–540.

Graves AB, Rosner D, Echeverria D, Yost M, Larson EB. Occupational exposure to electromagnetic fields and Alzheimer disease. Alzheimer Dis Assoc Disord 1999;13:165–170.

Guffey SE, Flanagan ME, van Belle G. Air sampling at the chest and ear as representative of the breathing zone. AIHAJ 2001; 62:416–27.

Guffey SE, Simcox N, Booth DW, Hibbard R, Stebbins A. Hard

metal exposures. Part 1: Observed performance of three local exhaust ventilation systems. Appl Occup Environ Hyg 2000; 15:331–341.

Guizzetti M, Catlin M, Costa LG. Effects of ethanol on glial cell proliferation: relevance to the Fetal Alcohol Syndrome. Pediatric Path Mol Med 1999;18:433–443.

Guizzetti M, Costa LG. Activation of phosphatidylinositol 3 kinase by muscarinic receptors in astrocytoma cells. Neuroreport 2001;12:1639–1642.

Guizzetti M, Costa LG. Muscarinic receptors, protein kinase C isozymes and proliferation of astroglial cells: effects of ethanol. NeuroToxicology 2000;21:1117–1122.

Guizzetti M, Costa LG. Possible role of protein kinase C zeta in muscarinic receptor-induced proliferation of astrocytoma cells. Biochem Pharmacol 2000;60:1457–1466.

Guthrie KA, Sheppard L. Overcoming biases and misconceptions in ecological studies. J R Statist Soc A 2001;164:141–154.

Hai DN, Chai SK, Chien VC, Keifer M, Takaro T, Yu J, Son PH, Trung LV, Barnhart S. An occupational risk survey of a refractory brick company in Ha Noi, Viet Nam. Int J Occup Environ Health 2001;7:195–200.

Hashmonay RA, Natschke DF, Wagoner K, Harris DB, Thompson EL, Yost MG. Field evaluation of a method for estimating gaseous fluxes from area sources using open-path Fourier transform infrared. Environ Sci Technol 2001;35:2309–2313.

Hashmonay RA, Yost MG. Innovative approach for estimating fugitive gaseous fluxes using computed tomography and remote optical sensing techniques. J Air Waste Manag Assoc 1999;49:966–972.

Hashmonay RA, Yost MG. Localizing gaseous fugitive emission sources by combining real-time optical remote sensing and wind data. J Air Waste Manag Assoc 1999;49:1374–1379.

Hetman M, Cavanaugh JE, Kimelman D, Xia Z. Role of glycogen synthase kinase-3beta in neuronal apoptosis induced by trophic withdrawal. J Neurosci 2000;20:2567–2574.

Hetman M, Kanning K, Cavanaugh JE, Xia Z. Neuroprotection by brain-derived neurotrophic factor is mediated by extracellular signal-regulated kinase and phosphatidylinositol 3-kinase. J Biol Chem 1999;274:22569–22580.

Hetman M, Xia Z. Signaling pathways mediating anti-apoptotic action of neurotrophins. Acta Neurobiol Exp (Warsz) 2000;60:531–545.

Hooton TM, Scholes D, Stapleton AE, Roberts PL, Winter C, Gupta K, Samadpour M, Stamm WE. A prospective study of asymptomatic bacteriuria in sexually active young women. N Engl J Med 2000;343:992–997.

Hudson FN, Kavanagh TJ. Cloning and characterization of the proximal promoter region of the mouse glutamate-L-cysteine ligase regulatory subunit gene. Biochim Biophys Acta 2000;1492:447–451.

Jackson LA, Keene WE, McAnulty JM, Alexander ER, Diermayer M, Davis MA, Hedberg K, Boase J, Barrett TJ, Samadpour M, Fleming DW. The role of cross-contamination in 4 chain restaurant-associated outbreaks of *Escherichia coli* O157:H7 in the Pacific Northwest. Arch Intern Med 2000;160:2380–2385.

Jarvinen K, Pietarinen-Runtti P, Linnainmaa K, Raivio KO, Krejsa CM, Kavanagh T, Kinnula VL. Antioxidant defense mechanisms of human mesothelioma and lung adenocarcinoma cells. Am J Physiol Lung Cell Mol Physiol 2000;278:L696–L702.

Jinneman KC, Weagant SD, Johnson JM, Abbott SL, Hill WE, Tenge BJ, Dang NL, Ramsden R, Omiecinski CJ. A large insertion in the Shiga-like toxin 2 gene (stx(2)) of an Escherichia coli O157 : H7 clinical isolate. Int J Food Microbiol 2000;57:115–124.

Johnson DB, Eaton DL, Wahl PW, Gleason C. Public health nutrition practice in the United States. J Am Diet Assoc 2001;101:529–534.

Johnson PW, Hagberg M, Hjelm EW, Rempel D. Measuring and characterizing force exposures during computer mouse use. Scand J Work Environ Health 2000;26:398–405.

Keifer MC. Effectiveness of interventions in reducing pesticide overexposure and poisonings. Am J Prev Med 2000;18(4 suppl):80–89.

Kim E, Kalman D, Larson T. Dry deposition of large, airborne particles onto a surrogate surface. Atmos Environ 2000; 34:2387–2397.

Kirchner SC, Hallagan SE, Farin FM, Dilley J, Costa-Mallen P, Smith-Weller T, Franklin GM, Swanson PD, Checkoway H. Mitochondrial ND1 sequence analysis and association of the T4216C mutation with Parkinson's disease. NeuroToxicology 2000;21:441–446.

Kirlin WG, Cai J, Thompson SA, Diaz D, Kavanagh TJ, Jones DP. Glutathione redox potential in response to differentiation and enzyme inducers. Free Radic Biol Med 1999;27:1208–1218.

Kissel J, Fenske R. Improved estimation of dermal pesticide dose to agricultural workers upon reentry. Appl Occup Environ Hyg 2000;15:284–290.

Kissel JT, Franklin GM. Treatment of myasthenia gravis: a call to arms [editorial]. Neurology 2000;55:3–4.

Koenig JQ. Air pollution and asthma. J Allergy Clin Immunol 1999;104:717–722.

Koenig JQ. Human Health Effects of Air Pollutants. Kluwer Academic, Norwell, MA, 2000.

Krejsa CM, Schieven GL. Detection of oxidative stress in lymphocytes using dichlorodihydrofluorescein diacetate. Methods Mol Biol 2000;99:35–47.

Krieger JW, Song L, Takaro TK, Stout J. Asthma and the home environment of low-income urban children: preliminary findings from the Seattle-King County Healthy Homes Project. J Urban Health 2000;77:50–67.

Krovat BC, Tracy JH, Omiecinski CJ. Fingerprinting of cytochrome P450 and microsomal epoxide hydrolase gene expression in human blood cells. Toxicol Sci 2000;55:352–360.

Kyes KB, Wickizer TM, Franklin G, Cain K, Cheadle A, Madden C, Murphy L, Plaeger-Brockway R, Weaver M. Evaluation of the Washington State Workers' Compensation Managed Care Pilot Project I: medical outcomes and patient satisfaction. Med Care 1999;37:972–981.

Lee GM, Neutra RR, Hristova L, Yost M, Hiatt RA. The use of electric bed heaters and the risk of clinically recognized spontaneous abortion. Epidemiology 2000;11:406–415.

Levy D, Lumley T, Sheppard L, Kaufman J, Checkoway H. Referent selection in case-crossover analyses of acute health effects of air pollution. Epidemiology 2001;12:186–192.

Levy D, Sheppard L, Checkoway H, Kaufman J, Lumley T, Koenig J, Siscovick D. A case-crossover analysis of particulate matter air pollution and out-of-hospital primary cardiac arrest. Epidemiology 2001;12:193–199.

Li W, Costa LG, Richter RJ, Hagen T, Shih DM, Tward A, Lusis AJ, Furlong CE. Catalytic efficiency determines the *in-vivo*

efficacy of PON1 for detoxifying organophosphorus compounds. Pharmacogenetics 2000;10:767–779.

Liang L, Evens C, Lazoff S, Woods JS, Cernichiari E, Horvat M, Martin MD, DeRouen T. Determination of methyl mercury in whole blood by ethylation-GC-CVAFS after alkaline digestion-solvent extraction. J Anal Toxicol 2000;24:328–332.

Liu LJS, Dills RL, Paulsen M, Kalman DA. Evaluation of media and derivatization chemistry for six aldehydes in a passive sampler. Environ Sci Technol 2001;35:2301–2308.

Liu LJ, Krahmer M, Fox A, Feigley CE, Featherstone A, Saraf A, Larsson L. Investigation of the concentration of bacteria and their cell envelope components in indoor air in two elementary schools. J Air Waste Manag Assoc 2000;50:1957–1967.

Lu C, Fenske RA, Simcox NJ, Kalman DA. Pesticide exposure of children in an agricultural community: evidence of household proximity to farmland and take home exposure pathways. Environ Res 2000;84:290–302.

Lu C, Knutson DE, Fisker-Andersen J, Fenske RA. Biological monitoring survey of organophosphorus pesticide exposure among preschool children in the Seattle metropolitan area. Environ Health Perspect 2001;109:299–303.

Lu H, Guizzetti M, Costa LG. Inorganic lead stimulates DNA synthesis in human astrocytoma cells: role of protein kinase Calpha. J Neurochem 2001;78:590–599.

Luderer U, Burgess JL, Polifka JE, Robertson WO. Calls on reproductive and developmental toxicants to a regional poison center. Vet Human Toxicol 1999;41:42–46.

Luderer U, Morgan MS, Brodkin CA, Kalman DA, Faustman EM. Reproductive endocrine effects of acute exposure to toluene in men and women. Occup Environ Med 1999;56:657–666.

Lumley T, Sheppard L. Assessing seasonal confounding and model selection bias in air pollution epidemiology using positive and negative control analyses. Environmetrics 2000;11:705–717.

Maines MD, Costa LG, Reed DJ, Sassa S, Sipes IG. Current Protocols in Toxicology. John Wiley, New York, 1999.

Mar TF, Norris GA, Koenig JQ, Larson TV. Associations between air pollution and mortality in Phoenix, 1995–1997. Environ Health Perspect 2000;108:347–353.

McConnell R, Delgado-Tellez E, Cuadra R, Torres E, Keifer M, Almendarez J, Miranda J, El-Fawal H, Wolff M, Simpson D, Lundberg I. Organophosphate neuropathy due to methamidophos: biochemical and neurophysiological markers. Arch Toxicol 1999;73:296–300.

Moate TF, Lu C, Fenske RA, Hahne RMA, Kalman DA. Improved cleanup and determination of dialkyl phosphates in the urine of children exposed to organophosphorus insecticides. J Anal Toxicol 1999;23:230–236.

Moceri VM, Kukull WA, Emanual I, van Belle G, Larson EB. Early-life risk factors and the development of Alzheimer's disease. Neurology 2000;54:415–420.

Moceri VM, Kukull WA, Emanual I, van Belle G, Starr JR, Schellenberg GD, McCormick WC, Bowen JD, Teri L, Larson EB. Using census data and birth certificates to reconstruct the early-life socioeconomic environment and the relation to the development of Alzheimer's disease. Epidemiology 2001;12:383–389.

Monnet-Tschudi F, Zurich M, Schilter B, Costa LG, Honegger P. Maturation-dependent effects of chlorpyrifos and parathion and their oxygen analogs on acetylcholinesterase and neuronal and glial markers in aggregating brain cell cultures. Toxicol Appl Pharmacol 2000;165:175–183.

Moolgavkar SH, Hazelton W, Luebeck G, Levy D, Sheppard L. Air pollution, pollens, and admissions for chronic respiratory disease in King County, Washington. Inhal Toxicol 2000;12:1 57–171.

Morgan MS, Schaller KH. An analysis of criteria for biological limit values developed in Germany and in the United States. Int Arch Occup Environ Health 1999;72:195–204.

Namgung U, Xia Z. Arsenic induces apoptosis in rat cerebellar neurons via activation of JNK3 and p38 MAP kinases. Toxicol Appl Pharmacol 2001;174:130–138.

Namgung U, Xia Z. Arsenite-induced apoptosis in cortical neurons is mediated by c-Jun N-terminal protein kinase 3 and p38 mitogen-activated protein kinase. J Neurosci 2000;20:6442–6451.

Neitzel R, Seixas NS, Camp J, Yost M. An assessment of occupational noise exposures in four construction trades. Am Ind Hyg Assoc J 1999;60:807–817.

Nelson KC, Carlson JL, Newman ML, Sternberg P, Jones DP, Kavanagh TJ, Diaz D, Cai J, Wu M. Effect of dietary inducer dimethylfumarate on glutathione in cultured human retinal pigment epithelial cells. Invest Ophthalmol Vis Sci 1999; 40:1927–1935.

Newman LA, Wang X, Muiznieks IA, Ekuan G, Ruszaj M, Cortellucci R, Domroes D, Karscig G, Newman T, Crampton RS, Hashmonay RA, Yost MG, Heilman PE, Duffy J, Gordon MP, Strand SE. Remediation of trichloroethylene in an artificial aquifer with trees: a controlled field study. Environ Sci Technol 1999;33:2257–2265.

Nichols BG, Woods JS, Luchtel DL, Corral J, Koenig JQ. Effects of ozone exposure on nuclear factor-kappaB activation and tumor necrosis factor-kappaB expression in human nasal epithelial cells. Toxicol Sci 2001;60:356–362.

Norris G, Larson T, Koenig J, Claiborn C, Sheppard L, Finn D. Asthma aggravation, combustion, and stagnant air. Thorax 2000;55:466–470.

Nothstein GL, Hahne RMA, Spence MW. Evaluation of the cost-effectiveness of various passive monitors and active monitors for industrial hygiene sampling. AIHAJ 2000;61:64–68.

Oberdoerster J, Guizzetti M, Costa LG. Effect of phenylalanine and its metabolites on the proliferation and viability of neuronal and astroglial cells: possible relevance in maternal phenylketonuria. J Pharmacol Exp Ther 2000;295:295–301.

Omiecinski CJ, Hassett C, Hosagrahara V. Epoxide hydrolase: polymorphism and role in toxicology. Toxicol Lett 2000;112–113:365–370.

Orman JF, Mendez AJ, Lymp J, Kavanagh TJ, Halbert CL. Reduction in apolipoprotein-mediated removal of cellular lipids by immortalization of human fibroblasts and its reversion by cAMP: lack of effect with Tangier disease cells. J Lipid Res 1999;40:1769–1781.

Ou YC, White CC, Krejsa CM, Ponce RA, Kavanagh TJ, Faustman EM. The role of intracellular glutathione in methylmercury-induced toxicity in embryonic neuronal cells. NeuroToxicology 1999;20:793–804.

Pappas GP, Herbert RJ, Henderson W, Koenig J, Stover B, Barnhart S. The respiratory effects of volatile organic compounds. Int J Occup Environ Health 2000;6:1–8.

Park DY, Fessler JA, Yost MG, Levine SP. Tomographic reconstruction of tracer gas concentration profiles in a room with the use of a single OP-FTIR and two iterative algorithms: ART and PWLS. J Air Waste Manag Assoc 2000;50:357–370.

Patterson RE, Eaton DL, Potter JD. The genetic revolution: change and challenge for the dietetics profession. J Am Diet Assoc 1999;99:1412–1420.

Pierce RH, Campbell JS, Stephenson AB, Franklin CC, Chaisson M, Poot M, Kavanagh TJ, Rabinovitch PS, Fausto N. Disruption of redox homeostasis in tumor necrosis factor-induced apoptosis in a murine hepatocyte cell line. Am J Pathol 2000;157:221–236.

Pingree SD, Simmonds PL, Rummel KT, Woods JS. Quantitative evaluation of urinary porphyrins as a measure of kidney mercury content and mercury body burden during prolonged methylmercury exposure in rats. Toxicol Sci 2001;61:234–240.

Pingree SD, Simmonds PL, Woods JS. Effects of 2,3-dimercapto-1-propanesulfonic acid (DMPS) on tissue and urine mercury levels following prolonged methylmercury exposure in rats. Toxicol Sci 2001;61:224–233.

Ponce RA, Bartell SM, Wong EY, LaFlamme D, Carrington C, Lee RC, Patrick DL, Faustman EM, Bolger M. Use of quality-adjusted life year weights with dose-response models for public health decisions: a case study of the risks and benefits of fish consumption. Risk Anal 2000;20:529–541.

Ponce RA, Wong EY, Faustman EM. Quality adjusted life years (QALYs) and dose-response models in environmental health policy analysis: methodical considerations. Sci Total Environ 2001;274:79–91.

Poser S, Impey S, Trinh K, Xia Z, Storm DR. SRF-dependent gene expression is required for PI3-kinase-regulated cell proliferation. EMBO J 2000;19:4955–4966.

Quintana PJE, Samimi BS, Kleinman MT, Liu LJ, Soto K, Warner GY, Bufalino C, Valencia J, Francis D, Melbourne H, Hovell MH, Delfino RJ. Evaluation of a real-time passive personal particle monitor in fixed site residential indoor and ambient measurements. J Expo Anal Environ Epidemiol 2000;10:437–445.

Rice FL, Park R, Stayner L, Smith R, Gilbert S, Checkoway H. Crystalline silica exposure and lung cancer mortality in diatomaceous earth industry workers: a quantitative risk assessment. Occup Environ Med 2001;58:38–45.

Robinson JP, Fulton-Kehoe D, Martin DC, Franklin GM. Outcomes of pain center treatment in Washington State workers' compensation. Am J Ind Med 2001;39:227–236.

Rochon YP, Kavanagh TJ, Harlan JM. Analysis of integrin (CD11b/CD18) movement during neutrophil adhesion and migration on endothelial cells. J Microsc 2000;197:15–24.

Romieu I, Trenga C. Role of nutrition in environmental lung disease. Semin Resp Crit Care Med 1999;20:581–590.

Rosenfeld PE, Henry CL, Dills RL, Harrison RB. Comparison of odor emissions from three different biosolids applied to forest soil. Water Air Soil Pollut 2001;127:173–191.

Salazar MK, Connon C, Takaro TK, Beaudet N, Barnhart S. An evaluation of factors affecting hazardous waste workers' use of respiratory protective equipment. AIHAJ 2001;62:236–245.

Salazar MK, Takaro TK, Connon C, Ertell K, Pappas G, Barnhart S. A description of factors affecting hazardous waste workers' use of respiratory protective equipment. Appl Occup Environ Hyg 1999;14:470–478.

Salazar MK, Takaro TK, Ertell K, Gochfeld M, O'Neill S, Connon C, Barnhart S. Structure and function of occupational health services within selected Department of Energy sites. J Occup Environ Med 1999;41:1072–1078.

Samadpour M. Outbreak of *Salmonella* serotype Muenchen infections associated with unpasteurized orange juice. MMWR Morb Mortal Wkly Rep 1999;48:582–585.

Sandberg M, Hassett C, Adman ET, Meijer J, Omiecinski CJ. Identification and functional characterization of human soluble epoxide hydrolase genetic polymorphisms. J Biol Chem 2000;275:28873–28881.

Sasser LW, Croteau GA, Metzler B. A survey of commercial food waste recovery programs. Resource Recycling 1999;18:9–12.

Schilter B, Andersen MR, Acharya C, Omiecinski CJ. Activation of cytrochrome P450 gene expression in the rat brain by phenobarbital-like inducers. J Pharmacol Exp Ther 2000;294:916–922.

Schmaling KB, Afari N, Barnhart S, Buchwald DS. Medical and psychiatric predictors of airway reactivity. Respir Care 1999; 44:1452–1457.

Seixas NS, Cohen M, Zevenbergen B, Cotey M, Carter S, Kaufman J. Urinary fluoride as an exposure index in aluminum smelting. AIHAJ 2000;61:89–94.

Sharpe JF, Eaton DL, Marcus CB. Digital toxicology education tools: education, training, case studies, and tutorials. Toxicology 2001;157:141–152.

Sheppard L, Damian D. Estimating short-term PM effects accounting for surrogate exposure measurements from ambient monitors. Environmetrics 2000;11:675–687.

Sheppard L, Levy D, Checkoway H. Correcting for the effects of location and atmospheric conditions on air pollution exposures in a case-crossover study. J Expo Anal Environ Epidemiol 2001;11:86–96.

Sheppard L, Kaufman J. Sorting out the role of air pollutants in asthma initiation (editorial). Epidemiology 2000;11:100–101.

Sidhu JS, Liu F, Boyle SM, Omiecinski CJ. PI3K inhibitors reverse the suppressive actions of insulin on CYP2E1 expression by activating stress-response pathways in primary rat hepatocytes. Mol Pharmacol 2001;59:1138–1146.

Sidhu JS, Omiecinski CJ. Insulin-mediated modulation of cytochrome P450 gene induction profiles in primary rat hepatocyte cultures. J Biochem Mol Toxicol 1999;13:1–9.

Siitonen T, Alaruikka P, Mantymaa P, Savolainen ER, Kavanagh TJ, Krejsa CM, Franklin CC, Kinnula V, Koistinen P. Protection of acute myeloblastic leukemia cells against apoptotic cell death by high glutathione and gamma-glutamylcysteine synthetase levels during etoposide-induced oxidative stress. Ann Oncol 1999;10:1361–1367.

Simcox NJ, Camp J, Kalman D, Stebbins A, Bellamy G, Lee IC, Fenske R. Farmworker exposure to organophosphorus pesticide residues during apple thinning in central Washington State. Am Ind Hyg Assoc J 1999;60:752–761.

Simcox NJ, Lofgren D, Leons J, Camp J. Silica exposure during granite countertop fabrication. Appl Occup Environ Hyg 1999;14:577–582.

Simcox NJ, Stebbins A, Guffey S, Atallah R, Hibbard R, Camp J. Hard metal exposures. Part 2: Prospective exposure assessment. Appl Occup Environ Hyg 2000;15:342–353.

Spielholz P, Silverstein B, Morgan M, Checkoway H, Kaufman J. Comparison of self-report, video observation and direct measurement methods for upper extremity musculoskeletal disorder physical risk factors. Ergonomics 2001;44:588–613.

Sweeney C, Farrow DC, Schwartz SM, Eaton DL, Checkoway H, Vaughan TL. Glutathione *S*-transferase M1, T1, and P1 polymorphisms as risk factors for renal cell carcinoma: a case control study. Cancer Epidemiol Biomarkers Prev 2000;9:449–454.

Takaro TK, Arroyo G, Brown GD, Brumis SG, Knight EB. Community-based survey of maquiladora workers in Tijuana and Tecate, Mexico. Int J Occup Environ Health 1999;5:313–315.

Takaro TK, Ertell K, Salazar MK, Beaudet N, Stover B, Hagopian A, Omenn G, Barnhart S. Barriers and solutions in implementing occupational health and safety services at a large nuclear weapons facility. J Healthc Qual 2000;22:29–37.

Thompson B, Coronado G, Puschel K, Allen E. Identifying constituents to participate in a project to control pesticide exposure in children of farmworkers. Environ Health Perspect 2001;109(suppl 3):443–448.

Thompson JN, Brodkin CA, Kyes K, Neighbor W, Evanoff B. Use of a questionnaire to improve occupational and environmental history taking in primary care physicians. J Occup Environ Med 2000;42:1188–1194.

Thompson SA, White CC, Krejsa CM, Diaz D, Woods JS, Eaton DL, Kavanagh TJ. Induction of glutamate-cysteine ligase (gamma-glutamylcysteine synthetase) in the brains of adult female mice subchronically exposed to methylmercury. Toxicol Lett 1999;110:1–9.

Thompson SA, White CC, Krejsa CM, Eaton DL, Kavanagh TJ. Modulation of glutathione and glutamate-L-cysteine ligase by methylmercury during mouse development. Toxicol Sci 2000; 57:141–146.

Tiffany-Castiglioni E, Ehrich M, Dees L, Costa LG, Kodavanti PRS, Lasley SM, Oortgiesen M, Durham HD. Bridging the gap between *in vitro* and *in vivo* models for neurotoxicology. Toxicol Sci 1999;51:178–183.

Trenga CA, Koenig JQ, Williams PV. Dietary antioxidants and ozone-induced bronchial hyperresponsiveness in adults with asthma. Arch Environ Health 2001;56:242–249.

Turner JA, Franklin G, Turk DC. Predictors of chronic disability in injured workers: a systematic literature synthesis. Am J Ind Med 2000;38:707–722.

Ulrich CM, Bigler J, Velicer CM, Greene EA, Farin FM, Potter JD. Searching expressed sequence tag databases: discovery and confirmation of a common polymorphism in the thymidylate synthase gene. Cancer Epidemiol Biomarkers Prev 2000;9:1381–1385.

Ulrich CM, Yasui Y, Storb R, Schubert MM, Wagner JL, Bigler J, Ariail KS, Keener CL, Li S, Liu H, Farin FM, Potter JD. Pharmacogenetics of methotrexate: toxicity among marrow transplantation patients varies with the methylenetetrahydrofolate reductase C677T polymorphism. Blood 2001;98:231–234.

van Belle G, Arnold A. Reliability of cognitive tests used in Alzheimer's disease. Stat Med 2000;19:1411–1420.

van Belle G, Griffith WC, Edland SD. Contributions to composite sampling. Environ Ecol Stat 2001;8:171–180.

Vasiliou V, Buetler T, Eaton DL, Nebert DW. Comparison of oxidative stress response parameters in newborn mouse liver versus Simian Virus 40 (SR40)-transformed hepatocyte cell lines. Biochem Pharmacol 2000;59:703–712.

Vicini P, Pierce C, Dills RL, Morgan MS, Kalman DA. Individual prior information in a physiological model of $^{2}H_{8}$-toluene kinetics: an empirical Bayes estimation strategy. Risk Anal 1999;19:1127–1134.

Wahlstrom J, Svensson J, Hagberg M, Johnson PW. Differences between work methods and gender in computer mouse use. Scand J Work Environ Health 2000;26:390–397.

Wang C, Bammler TK, Guo Y, Kelly EJ, Eaton DL. *Mu*-class GSTs are responsible for aflatoxin B_1-8,9-epoxide-conjugating activity in the nonhuman primate *Macaca fascicularis* liver. Toxicol Sci 2000;56:26–36.

Wei M, Guizzetti M, Yost M, Costa LG. Exposure to 60-Hz magnetic fields and proliferation of human astrocytoma cells *in vitro*. Toxicol Appl Pharmacol 2000;162:166–176.

Wetter DC, Daniell WE, Treser CD. Hospital preparedness for victims of chemical or biological terrorism. Am J Public Health 2001;91:710–716.

Wickizer TM, Franklin G, Plaeger-Brockway R, Mootz RD. Improving the quality of workers' compensation health care delivery: the Washington State Occupational Health Services Project. Milbank Q 2001;79:5–33.

Wickizer TM, Lessler D, Franklin G. Controlling workers' compensation medical care use and costs through utilization management. J Occup Environ Med 1999;41:625–631.

Winterton DL, Kaufman J, Keener CV, Quigley S, Farin FM, Williams PV, Koenig JQ. Genetic polymorphisms as biomarkers of sensitivity to inhaled sulfur dioxide in subjects with asthma. Ann Allergy Asthma Immunol 2001;86:232–238.

Wong EY, Shirai JH, Garlock TJ, Kissel JC. Adult proxy responses to a survey of children's dermal soil contact activities. J Expo Anal Environ Epidemiol 2000;10:509–517.

Wong EY, Shirai JH, Garlock TJ, Kissel JC. Survey of selected activities relevant to exposures to soils. Bull Environ Contam Toxicol 2000;65:443–450.

Wong ST, Trinh K, Hacker B, Chan GCK, Lowe G, Gaggar A, Xia Z, Gold GH, Storm DR. Disruption of the Type III Adenylyl Cyclase Gene leads to peripheral and behavioral anosmia in transgenic mice. Neuron 2000;27:487–497.

Woods JS, Kavanagh TJ, Corral J, Reese AW, Diaz D, Ellis ME. The role of glutathione in chronic adaptation to oxidative stress: studies in a normal rat kidney epithelial (NRK52E) cell model of sustained upregulation of glutathione biosynthesis. Toxicol Appl Pharmacol 1999;160:207–216.

Wrensch M, Yost M, Miike R, Lee G, Touchstone J. Adult glioma in relation to residential power frequency electromagnetic field exposures in the San Francisco Bay area. Epidemiology 1999;10:523–527.

Wu CF, Yost MG, Hashmonay RA, Park DY. Experimental evaluation of a radial beam geometry for mapping air pollutants using optical remote sensing and computed tomography. Atmos Environ 1999;33:4709–4716.

Yagle K, Lu H, Guizzetti M, Moller T, Costa LG. Activation of mitogen-activated protein kinase by muscarinic receptors in astroglial cells: role in DNA synthesis and effect of ethanol. Glia 2001;35:111–120.

Yamada H, Matsunaga H, Tsuji K, Matsumoto S, Yamamoto M, Ishii Y, Omiecinski CJ, Oguri K. Sequence analyses of CYP2B genes and catalytic profiles for P450s in Qdj:Sprague-Dawley rats that lack response to the phenobarbital-mediated induction of CYP2B2. J Pharmacol Exp Ther 2000;295:986–993.

Yu O, Sheppard L, Lumley T, Koenig JQ, Shapiro GG. Effects of ambient air pollution on symptoms of asthma in Seattle-area children enrolled in the CAMP study. Environ Health Perspect 2000;108:1209–1214.

Zurich MG, Honegger P, Schilter B, Costa LG, Monnet-Tschudi F. Use of aggregating brain cell cultures to study developmental effects of organophosphorus insecticides. NeuroToxicology 2000;21:599–606

ACKNOWLEDGMENTS

DEH ADVISORY COMMITTEE

President, Washington State Labor Council
represented by Al Link, Secretary-Treasurer

President, Association of Washington Business
represented by Michael Muhm, MD, The Boeing Company

Dean, UW College of Engineering
represented by Mary Lidstrom, PhD, Associate Dean

President, Washington State Medical Association
represented by Tim Gilmore, MD, Group Health Cooperative

Director, Washington state Department of Labor and Industries
Gary Moore

Secretary, Washington state Department of Health
Mary Selecky

Dean, UW School of Public Health and Community Medicine
Patricia Wahl, PhD

BIENNIAL REPORT TEAM

Advisory committee

Jean Garber, *Administrator*

Kathy Hall, *Senior Editor*

Adrienne Hidy, *Representative from Centers*

Jenny Holder, *Librarian*

Dave Kalman, *Chair*

Sharon Morris, *Assistant Chair for Community Outreach*

Cathy Schwartz, *Graphic Designer*

Kipling West, *Editorial Assistant*

Contributors

Kris Freeman, Jennifer Grant, Shannon Kirkpatrick, Jane Koenig, Diane Morgan, Rory Murphy

Financial support, not only from federal and state funds, but also from private corporations such as Wallace Research Foundation, Jenner & Block, and Goodrich Corporation, has also been vital to our growth.

t·committees·groups· acknowledgments ·teamwork·contributors·financial suppor

This publication is online at
http://depts.washington.edu/envhlth/

Printed on recycled paper using
vegetable-based inks

The soulcatcher, logo of the School of Public Health and Community Medicine, is a northwest coast Indian symbol of physical and mental well-being (artist: Marvin Oliver)

University of Washington
School of Public Health and Community Medicine
Department of Environmental Health
F-461 Health Sciences Center
Box 357234
Seattle, WA 98195-7234
Phone (206) 543-6991
Fax (206) 616-0477
E-Mail *ehadmin@u.washington.edu*
Web site *http://depts.washington.edu/envhlth*