Biennial Report

2001–2003

Department of Environmental and Occupational Health Sciences

SCHOOL OF PUBLIC HEALTH & COMMUNITY MEDICINE

UNIVERSITY OF WASHINGTON

Detroit Industry, North Wall, 1932–1933, Diego M. Rivera
Gift of Edsel B. Ford
Photograph © 2001 The Detroit Institute of Arts

Diego Rivera's Detroit Industry fresco cycle in the Detroit Institute of Arts' Rivera Court is considered the finest example of Mexican muralist work in the United States; Rivera considered it the most successful work of his career. Our cover shows a close-up portion of the north wall, which depicts the production of the 1932 Ford V8 engine. We have included other segments of the wall on the section dividers and back cover.

Photos on section headers: page 1, Joel Levin; page 9 and page 27, ©2004 www.photos.com; page 33, Joel Levin and Collin White

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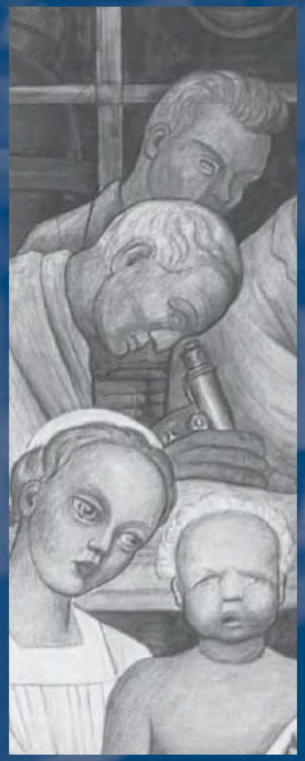
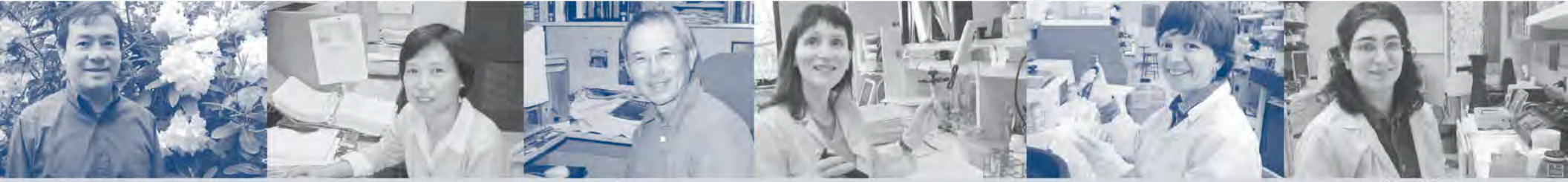
PEOPLE AND PROGRAMS





Devon DeLapp

Departmental staff (l to r) Alex Lu, Jianbo Yu, Neil Horike, Paola Costa-Mallen, Marina Guizzetti, and Zahra Afsharinejad

Chair
Assistant Chair for Outreach
Administrator

ACADEMIC PROGRAMS

Environmental Health

Industrial Hygiene and Safety

Occupational and Environmental Medicine

Toxicology

Master of Public Health in Environmental and Occupational Health

Bachelor of Science in Environmental Health

STUDENT SERVICES

Graduate Program Office

Undergraduate Program Office

SERVICE PROGRAMS

Environmental Health Laboratory

Field Research and Consultation Group

Occupational and Environmental Medicine Clinic

CENTERS, INSTITUTES, AND RESEARCH PROGRAMS

Center for Chemically Related Illnesses

Center for Ecogenetics and Environmental Health

EPA Northwest Research Center for Particulate Air Pollution and Health

Institute for Risk Analysis and Risk Communication

- *Center for Child Environmental Health Risks Research*
- *Center for the Study and Improvement of Regulation*

International Scholars in Occupational and Environmental Health

Northwest Center for Occupational Health and Safety

Occupational Epidemiology and Health Outcomes Program

Pacific Northwest Agricultural Safety and Health Center

Pediatric Environmental Health Specialty Unit

Policy Analysis and Program Evaluation Initiative

Superfund Basic Research Program

Toxicogenomics Consortium

UW/OSHA Training Institute Education Center

organizational chart

our department's new name

We officially changed our name to the Department of Environmental and Occupational Health Sciences on February 1, 2003

The former Department of Environmental Health officially became the Department of Environmental and Occupational Health Sciences on Feb. 1, 2003. We believe the new name better describes three aspects of our program:

- the scope of research, teaching, and service activities
- the close relationship between our environmental and occupational health missions
- the connection between our basic and applied science research programs

Our department's name change doesn't suggest a separation of environmental health and occupational health, but rather highlights common issues, methods, and research interests.

As both aspects of our field have evolved, experimental methods and questions asked by environmental and occupational health scientists have become similar. Both perspectives are needed as we face increasingly complex public health problems.

Since environmental laws of the 1970s and 1980s led to the cleanup of the worst contamination, toxicologists have shifted their focus to the effects of chronic low-level exposures to pollutants. They have recognized that mechanisms and effects of toxicants at high-level exposures are different from mechanisms and effects following low-level exposures.

Workplaces are changing as well. Instead of acute poisonings, we are often seeing more subtle changes that affect worker health. These lower levels require more sensitive assessment methods to characterize exposures and begin early intervention to prevent injury.

Though our name has changed, our mission remains the same:

- 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.

Our name change is part of a larger effort to increase our communication with external clients and partners. We have added activities and events to our outreach effort, including the Workplace Safety and Health Partnership Committee representing employers and workers in Washington state.

In this report of our activities for the 2001–2003 biennium, you will read about several of our cross-disciplinary research and outreach projects, and exciting ways that we have pushed the frontiers of our traditional disciplines. These projects range from Eastern Washington to Southeast Asia, and from basic to applied science—using our research findings to inform populations such as construction workers, parents, and small business owners.

You will read about several of our graduates, who are involved with the worldwide computer industry, policy-making, and the aftermath of 9/11. You also will read about the research of our most recent graduates, and the latest activities of our faculty and staff.

Please join us as we describe many facets of our department in this—our third—biennial report.

alumni 1998

Bachelor of Science,
Environmental Health

Michael Box, BS, MS

US Public Health Service officer, US Coast Guard; Master of Science in Industrial Hygiene and Safety, University of Washington 2000

Courtesy of M. Box

KEEPING THE RESCUERS SAFE

The US Coast Guard has 42 units providing search and rescue, law enforcement, and environmental protection services in Northern California. All involve potentially hazardous work.

Lieutenant Michael Box, an alumnus of our undergraduate and master's programs, is responsible for the health and safety of more than 3,000 Coast Guard personnel in that region. He is based in the only remaining military treatment clinic in the greater San Francisco Bay area.

As a Safety and Environmental Health Officer, he supervises, plans, budgets, and implements an environmental health, safety, and industrial hygiene program. While at the University of Washington (UW), Box spent two summer internships with the Indian Health Service and one with the National Institute for Occupational Safety and Health (NIOSH). After graduating, he became an officer in the US Public Health Service, detached to the Coast Guard in Alameda, California.

One of his assignments was to find better ways for the crews of 47-foot motor lifeboats and helicopters to communicate with each other during noisy rescue operations. His work led to recommendations for improved communications gear and hearing protection, which are currently being field tested.

Anyone who has been to Northern California's coast is familiar with foghorns. That romantic sound, however, can be hazardous to the lookouts on Coast Guard cutters. Box researched and implemented communication head-sets that permit the lookouts to hear distant signals, communicate with the bridge, and benefit from hearing protection.

On another project, he evaluated asbestos exposures during brake removal, cleaning, and inspection, which led to an improvement in standard operating procedures for mechanics.

In addition to occupational health, he confronts environmental health problems, such as resolving a recurring indoor air quality problem caused by groundwater intrusion at a housing unit.

Box loves the variety of his work and says he never has a boring day. He is involved in many areas of environmental health, safety, industrial hygiene, and ergonomics. Many of his assignments take him into the field.

He appreciates the fieldwork opportunities he had at the UW. He worked with Associate Professor Sally Liu on research involving particulate air pollution and older adults with chronic obstructive pulmonary disease.

Box encourages departmental graduates to think about careers in the Public Health Service. Its environmental health officers work in the Indian Health Service, the Centers for Disease Control and Prevention, the Agency for Toxic Substances and Disease Registry, NIOSH, the Food and Drug Administration, the Department of Agriculture, the Environmental Protection Agency, the Bureau of Prisons, the National Park Service, the National Institutes of Health, and the Coast Guard.

our department

PROGRAMS, CENTERS, AND INSTITUTES

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

- evaluating and controlling workplace hazards
- investigating issues of food and water safety
- 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

Environmental Health students learn to identify major sources of contamination in water, air, soil, and food, and take appropriate prevention, control, and communication measures. Students may earn a Master of Science (MS) or a Doctor of Philosophy (PhD) degree.

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 MS tracks: industrial hygiene and safety/ergonomics.

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

The **Toxicology** program focuses on the adverse effects of chemical exposures on human health. It 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 toxic exposures in the environment and workplace. Both master's and doctoral degrees are offered.

The new **Master of Public Health** program is designed to enhance communication and understanding between the scientific and health policy worlds. In contrast to the MS degree programs, which are measurement-oriented and specialized, the MPH degree provides a broader perspective on environmental and occupational health with emphasis on applications and policy implications.

Through the **Bachelor of Science** program in Environmental Health, students learn to identify, prevent, and control environmental factors that can damage human health. The program is flexible, providing a grounding in environmental health sciences and an emphasis in one of four interest areas: biological sciences, physical sciences, medical professions, or environmental health practice.

Center for Ecogenetics and Environmental Health

EPA Northwest Research Center for Particulate Air Pollution and Health

Pacific Northwest Agricultural Safety and Health Center

Pediatric Environmental Health Specialty Unit

OTHER PROGRAMS

Service Programs

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

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 data, obtain laboratory analyses, coordinate medical examinations, and make recommendations for controlling workplace exposures. Priority is given to serving small businesses whose problems are not readily addressed by the private sector.

The Occupational and Environmental Medicine Clinic offers treatments based on comprehensive testing, baseline exposure screening programs, and medical monitoring. The clinic at Harborview Medical Center provides treatment for work-related health conditions such as asthma, asbestosis, musculoskeletal injuries, hearing loss, and contact dermatitis.

Centers and Institutes

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

The Center for Ecogenetics and Environmental Health (CEEH), funded by the National Institute of Environmental Health Sciences (NIEHS), studies how environmental factors interact with genetics to influence diseases. A key focus is to understand how different people metabolize drugs and chemicals, which can affect their susceptibility or resistance to disease. The center, in collaboration with the Institute for Public Health Genetics, also addresses the ethical, legal, and social issues related to genetic information.

Within the CEEH, the **Community Outreach and Education Program** (COEP) is working to address environmental health issues in the most affected communities in the Pacific Northwest, and to increase public understanding of how individual susceptibilities such as genetics and age interact with environmental factors to produce disease. COEP's projects include:

- using environmental health sciences as a framework to integrate science, social studies, and English in secondary school curricula
- statewide distribution of a School to Work curriculum, to raise awareness of health and safety issues for working teenagers
- community partnerships, including the Environmental Justice Needs Assessment project, which identifies the environmental health concerns that are most relevant to recent immigrants and refugee populations, and determines the best solutions

The EPA Northwest Research Center for Particulate Air Pollution and Health is one of five in the country funded by the Environmental Protection Agency (EPA)

that address health effects of particulate air pollution. The center's partners include Washington State University, the Puget Sound Clean Air Agency, EPA 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), which works to improve risk assessment methods and the scientific foundations supporting risk assessments, has two research programs:

- **The Center for Child Environmental Health Risks Research** is funded by the US EPA and NIEHS to further knowledge of children's susceptibility to toxicants
- **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 (Fogarty) program is a training program based in the Occupational and Environmental Medicine program. The program is funded by the National Institutes of Health through the Fogarty International Center and NIEHS, and by the National Institute for Occupational Safety and Health (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 NIOSH. It supports graduate and continuing professional education in industrial hygiene, safety, occupational medicine, and occupational health nursing. The center serves Washington, Oregon, Idaho, and Alaska.

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. Center researchers work closely with colleagues at northwestern universities and with employers, labor, community organizations, and government agencies. The PNASH center is funded by NIOSH and the state of Washington.

The Pediatric Environmental Health Specialty Unit has assembled a team of experts including pediatricians, emergency medicine physicians, toxicologists, and other environmental health specialists to consult with health care providers, government officials, educators, and families on health risks associated with environmental exposures.

The Policy Analysis and Program Evaluation Initiative works closely with the state Department of Labor and Industries, and with business and labor to improve the quality of occupational safety and health policies and programs in Washington.

The Superfund Basic Research Program is an NIEHS-sponsored, interdisciplinary program among our department, Civil Engineering, Biochemistry, Forestry, and Microbiology. Its goals are to develop biological markers to assess people's exposure to toxicants and susceptibility to disease, assess physiological damage in people and wildlife, and develop technology to clean up contaminated sites. Its outreach core is engaged in activities with communities affected by hazardous waste sites. Additionally, the outreach core has developed educational materials related to the health effects of hazardous waste.

The Fred Hutchinson Cancer Research Center/University of Washington **Toxicogenomics Consortium** uses microarray technology to study the ways that toxic substances can affect how genes are expressed in cells. Changes in gene expression are thought to be important events in many environmentally related diseases. The consortium supports research to develop and refine microarray analysis techniques, and conducts studies on the health effects of specific toxicants, including methylmercury and organophosphate pesticides.

The UW/OSHA Training Institute Education Center offers 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 through traditional classroom and distance learning technologies.

alumni 1989

Master of Science, Toxicology

Catherine Karr, MS, MD, PhD candidate

Gavin Sisk

Doctoral candidate, UW Department of Epidemiology; General Academic Pediatric Fellow, University of Washington; Pediatric Consultant, UW Pediatric Environmental Health Specialty Unit

CHILDREN'S HEALTH MEETS ENVIRONMENTAL HEALTH

Catherine Karr has found a niche in what she calls the "very small cadre" of scientists with special expertise in child health and environmental health.

A combination of degrees in toxicology and medicine, and graduate study in epidemiology allows her to address children's environmental health from the individual patient level (as a physician) and the public health level (as a researcher).

Her background allows her to translate the often-uncertain findings of science into meaningful information for families and health-care providers who need to make crucial decisions involving children. She finds her hybrid specialty "somewhat novel and rich with new discovery."

As a pediatric fellow, she has undertaken a large epidemiologic study of the impact of ambient air pollution on infant bronchiolitis. She also supervises and teaches pediatric residents at the University of Washington (UW) Physicians Pediatric Clinic–Roosevelt.

As a consultant in the Pediatric Environmental Health Specialty Unit (PEHSU) at Harborview, she responds to queries from families and health-care providers about potential health problems associated with environmental exposures in children.

After receiving her toxicology degree at the UW, she moved to Washington, DC to work for a public interest group on pesticide issues. She returned to Washington state as one of the first toxicologists hired at the newly developed Safety and Health Assessment and Research Program (SHARP) at the state Department of Labor and Industries in 1990.

She returned to graduate school in the Epidemiology Department of the School of Public Health and Community Medicine to refine her research skills. Based on an interest in individual—as well as population—health, she entered UW Medical School and completed a pediatric residency at Seattle Children's Hospital and Regional Medical Center.

She sought a career where she could integrate her interests in pediatrics, environmental health, and epidemiologic research. She hopes to provide leadership as a pediatrician with an environmental health specialty. In July, she will join the faculty in Pediatrics at the UW and continue building a Northwest resource in pediatric environmental medicine.

She found that her experience in our department, where she studied insecticide exposure in farmworkers under Lucio Costa's guidance, provided a "valuable foundation for each further step of training." Colleagues in our department have served as key mentors throughout her career. Associate Professor Joel Kaufman currently chairs her dissertation committee.

Our department exposed her to the interdisciplinary nature of environmental exposure impacts on health, which she has carried forward with her doctoral studies.

She would recommend that today's students take advantage of the excellent opportunities for mentorship in our department and develop relationships with as many faculty and scientific staff as possible.

Because of high public interest, she says, there is a demand for those with expertise in children's environ-mental health.

what we do...

AND WHOM WE SERVE

our profession

WHO WE ARE AND WHERE WE ARE GOING

Gavin Sisk; stamp: US Postal Service

We are in the midst of a technological revolution that will dramatically change the field that our graduates enter. We have asked two of our senior faculty to reflect on the past and the future of occupational and environmental hygiene.

Elaine Faustman and Mike Morgan

Inset: Dr. Alice Hamilton

Michael Morgan, ScD, Professor
Industrial Hygiene and Safety Program

Our professional societies have spent several years of hand wringing over what to call ourselves, yet the historical name may be the best fit. "Hygiene" refers to actions taken to achieve and preserve human health. These actions are taken by individuals on their own behalf, by employers and employees for the benefit of groups, and by society and government for us all.

Despite its misunderstanding by the public, the word "hygiene" is clearly the best single term to describe our activity. We should get over this anxiety about the title of occupational or environmental hygienist, and move on. There is much work still to be done.

THE PAST

The field began with the work of Alice Hamilton, a young energetic physician who was appointed by the governor of Illinois in 1911 as the state's first industrial health inspector. Before then, Illinois and nearly all other states had focused on industrial accidents, neglecting workplace exposures to agents causing illness. Hamilton pioneered the familiar approach we take today in practicing occupational and Environmental Hygiene—recognition, evaluation, environmental hygiene—

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SCIENTIFIC FRONTIERS USING GENOMIC DATA

Elaine M. Faustman, PhD, Professor
Toxicology Program

Devon DeLapp

Hannah-Malia Viernes, a research technologist, prepares to genotype 96 samples in the Functional Genomics Laboratory

On 25 April 1953, in an article in *Nature,* James Watson and Francis Crick described the entwined embrace of two strands of deoxyribonucleic acid (DNA). In doing so, they provided the foundation for understanding molecular damage and repair, replication and inheritance of genetic material, and the diversity and evolution of species.

In 2003, 50 years after the discovery of DNA's double helix structure by Watson and Crick, scientists announced that they had decoded the underlying genomic sequences that provide the blueprint for human development.

Our department has several initiatives and centers devoted to using this genetic information to further public health.

The genome project has helped us understand how different individuals and populations respond to environmental and occupational exposures—and how these differences can affect health over time.

Genomic information can help bridge the gap between environmental and occupational hygienists. Historically, we have computed exposure, and then linked it with internal dose, biological effects, and ultimately with clinical disease. New techniques allow us to identify early effects at previously unimagined levels of sensitivity. This allows us to understand how genes and proteins respond to exposures (gene expression) much earlier in the disease process.

Here are two examples of how genomic information has revolutionized our field:

Human Variability. In some cases, a single genetic variation (polymorphism) can result in disease, such as Huntington's disease or cystic fibrosis. However, for most diseases, multiple genetic and environmental factors contribute to the overall risk. In our department, the Center for Ecogenetics and Environmental Health (CEEH), funded by the National Institute of Environmental Health Sciences (NIEHS), is researching how genomic information can help define susceptible populations. This center focuses on understanding how the interplay between genes and environment can result in disease.

For example, it wouldn't matter whether someone carried a sensitive genotype or a resistant one if no exposure were to occur. But, when an exposure occurs, the individual with the resistant genotype will have some increase in risk, perhaps two-fold, while the individual carrying the sensitive genotype could have a four- or even ten-fold increase in risk. Such genetic susceptibilities have been defined for environmental and occupational toxicants such as benzene or beryllium. Identifying how genetic factors combine with environmental factors can allow us to determine ample margins of safety for workers and the public.

These situations pose profound ethical, legal, and social challenges. How to use genetic information about sensitive genotypes in the workplace in a way that is nondiscriminatory—yet health-protective—is just one such challenge. Such research is taking place in multi=disciplinary programs, such as University of Washington's Public Health Genetics program and CEEH's Ethical, Legal, and Social Implications (ELSI) program. We have also organized a series of interactive conferences with Environmental Protection Agency Region 10, pairing agency and academic researchers, to discuss how and when genomic information can inform policy and regulation.

Exposure and Early Response. A technique called "gene expression microarrays" allows us to monitor tens of thousands of genes simultaneously. Gene expression can be driven by an individual's cellular makeup, and by external environmental and occupational agents. We can

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MORGAN *continued from page 10*

recognition, evaluation, and control of exposures to chemical, physical, and biological agents of disease.

Once she completed an inspection, Hamilton would spend many hours with the plant owner reviewing her findings and explaining the connection between exposure and disease. She preferred a gentle means of persuasion to threats of regulation. Personal communication of the facts and a series of carefully considered recommendations were Hamilton's primary tools. While she focused on exposures to lead and silica, Hamilton's contributions to our general approach today have justified her informal title as the founder of Occupational Hygiene, at least in North America.

Gavin Sisk

This is what measuring instruments looked like before nanotechnology evolved

Here are other highlights in the century-long history of the field:

- the reduction of lead in the environment
- the reduction of silica-related lung disease in workers
- the recognition and control of several cancer-causing agents in the workplace such as vinyl chloride monomer
- the steady reduction in water-borne infections and food-borne illnesses in the general public

THE PRESENT

Before we pat ourselves on the back for jobs well done, we should take a closer look at how we pursue our familiar mantra of "recognition, evaluation, and control." Think of this as a tug-of-war between employees on one end of the rope, and the employer on the other. The hygienist's job is to assure that neither side draws the other into the abyss.

The occupational or environmental hygienist works at the center of contention between two imperatives: the need to protect the public from harmful agents, and the need to maintain industrial productivity and sustain a standard of living. In our part of the world the contending forces remain nearly in balance, but in the developing nations they may be grossly out of balance. Hygienists have a crucial role to play in fostering this balance. Here are three keys to success.

Education, or a firm grounding in the underlying natural sciences and mathematics. This foundation allows us to impart knowledge to our successors.

Commitment, or the Three P's: perseverance, patience, and passion. Hamilton was among the first to demonstrate the

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A GENOMICS PRIMER

Cells are the fundamental working units of every living system. All the instructions needed to direct their activities are contained within the chemical **DNA** (deoxyribonucleic acid).

The **DNA sequence** is the arrangement of base pairs along the DNA strand (e.g., ATTCCGGA). This order spells out the instructions to create a particular organism with unique traits. A **polymorphism** is a common variation or mutation in DNA.

The **genome** is an organism's complete set of DNA. The **genotype** refers to the instructions or code therein. Except for mature red blood cells, all human cells contain a complete genome. DNA in the human genome is arranged into 24 **chromosomes**—physically separate molecules that range in length from about 50 million to 250 million base pairs.

US Department of Energy Genomics: GTL Program, http://doegenomicstolife.org

Each chromosome contains many **genes,** the basic physical and functional units of heredity. Genes are specific sequences of bases that encode instructions on how to make proteins. The human genome is estimated to contain 30,000 genes.

Proteins perform most life functions and make up most cellular structures. Proteins are large, complex molecules made up of smaller subunits called **amino acids.**

Genomic tools are available that allow us to follow this genetic information in individuals by following the specific **expression** of genes and proteins. The latest tools allow us to follow the expression of tens of thousands of genes.

—Adapted from US Department of Energy genome program, the National Cancer Institute, and Northwestern University's biochem glossary

FAUSTMAN *continued from page 11*

now monitor these changes in concert with physiological or pathological changes.

Numerous projects are underway to classify how chemicals affect "signature" profiles of gene expression. A large project in the NIEHS environmental genome project is evaluating the types of gene expression patterns that are produced by environmental and occupational chemicals.

Ideally, this would help us identify hazards before we adopt widespread use of new compounds. In the past, we have studied populations with high occupational exposures to a chemical and extrapolated these data to determine risks at relatively low environmental levels. The new techniques could provide a continuum between these levels of assessment.

Our department is part of an NIEHS-funded Toxicogenomic Consortium that conducts this type of investigation. The consortium is seeking better ways of applying this genomic information to answer public health questions.

Pathologists have been successful in using genomic information to better understand tissue pathology. For example, gene expression profiles can be used to identify distinct types of lung and breast tumors, and this genetic information has been used to determine the best chemotherapy options.

A GENOMIC REVOLUTION

When I was a graduate student, I can remember my excitement at being able to look at the expression of a single gene. The genome project now allows me to look at tens of thousands of genes simultaneously. The challenge is to harness this technique to advance the frontiers of environmental and occupational health.

FOR FURTHER READING

Center for Ecogenetics and Environmental Health *http://depts.washington.edu/ceeh/*

Nature. The double helix—50 years. Vol. 421, No. 6921 (23 January 2002) *http://www.nature.com/nature/insights/6921.html*

NIEHS Environmental Genome Project *http://www.niehs.nih.gov/envgenom/home.htm*

Science. A history of the human genome project. (16 February 2001) *http://www.sciencemag.org/cgi/content/full/291/5507/1195*

Toxicogenomics Research Consortium *http://www.niehs.nih.gov/dert/trc/fhcrc/home.htm*

US Department of Energy Genome Programs. Genomics and its impact on science and society: The human genome project and beyond. *http://www.doegenomes.org/*

Watson, JD & Crick, FHC. Molecular structure of nucleic acids. A structure for deoxyribose nucleic acid. *Nature* 171, 737-738 (1953)

Microarrays for simultaneous analysis of tens of thousands of samples at Oak Ridge National Laboratory (US Department of Energy Genomics GTL Program)

traits that underlie professional commitment. As educators, our task is to recognize commitment in our students, and to encourage and nurture it. Students in occupational or environmental hygiene should understand that more is being asked of them than mere mastery of scientific principles.

Public trust. I see this as the greatest challenge to the survival and growth of hygiene as a respected profession. I offer some suggestions on how to gain and keep the public trust:

- Use scientific data wisely: in dealing with a contentious situation, we should make certain we have all of the data available, that the data were obtained according to recognized scientific methods (and subject to peer review), and that we are aware of any shortcomings in the data.
- Be objective: we should strive to present an unbiased, neutral evaluation of the situation, again based upon the available scientific information. "Black-and-white" issues where one contender is clearly in the wrong and the other in the right are rare.
- Be accessible: our job is to manage the contention between groups, and to do so requires us to communicate with all sides on a schedule that will often seem unreasonable. However, developing an effective rapport with our audiences can pay very big dividends, and we always get to rest later.

We need to consider our audience carefully when we speak. It is especially important that we not assume that the audience cannot understand the technical aspects of the problem. I must admit to making this mistake myself more than once, and always to my regret. The general lesson I have learned is that we regularly underestimate the ability of the public to understand health-related issues. There is clearly room for improvement in our communication skills.

THE FUTURE

Three areas hold promise for the future of occupational hygiene:

Biomarkers and Biological Monitoring

What are the pharmacokinetic (relating to the disposition of drugs in the body: their absorption, distribution, metabolism, and elimination) and pharmacodynamic (relating to drug action) relationships among biological markers, exposures, and health over time? Can biomarkers of susceptibility and early biological effects be used to control occupational illness? How can we account for nonoccupational exposures? This work is erasing the boundary between occupational and environmental exposure.

We are developing molecular marker techniques to predict individual susceptibility, which raises ethical issues. Could these predictions be used to discriminate against susceptible individuals?

How can we make these technologies more acceptable to employees and employers? We have less invasive ways of sampling biomarkers, such as exhaled breath, which is a convenient way of extracting a representation of the components of arterial blood.

Nanoscience and Nanotechnology

How can we exploit the rapid miniaturization of chemical monitoring instruments to characterize chemical exposure and risk, and benefit employees and employers? We now have gas chromatographs that fit in the pocket, and sensors that can be placed on or under the skin to measure blood chemistry.

Public Health Genetics

What role do genetic polymorphisms play in associations with work exposures? How can we communicate this information? How can we use it? Universities in the United States have generally determined that it is premature to institute programs for genetic counseling of workers, yet that day is coming. Again, how do we safeguard people's rights?

As I noted in my opening, there is much work still to be done. A combination of old-fashioned skills and new tools will carry us far.

—This is excerpted from Morgan's keynote address and panel presentation at the 10th anniversary celebration of the School of Occupational and Environmental Hygiene at the University of British Columbia in April 2003

FOR FURTHER READING

Hamilton A. *Exploring the Dangerous Trades: The Autobiography of Alice Hamilton*. 1943. (Reprinted, Boston: Northeastern University Press, 1953, AIHA Press, 1995).

Sicherman B. *Alice Hamilton: A Life in Letters*. Cambridge, MA: Harvard University Press, 1984.

Master of Public Health

alumni 1986

John P. Holland, MD, MPH

Principal, Holland Associates, Inc.; President, American College of Occupational and Environmental Medicine (2003–2004)

Kathy Sauber

THE FUTURE OF OCCUPATIONAL MEDICINE

John Holland takes a broad view of prevention, grounded in economics as well as occupational medicine.

"As the one medical specialty that focuses on workers, workplaces, and the environment," he said, "we in occupational and environmental medicine are in a unique position to contribute to the health and productivity of workers, the organizational success of employers, and the environmental challenges of a complex world."

As president of the American College of Occupational and Environmental Medicine, Holland initiated a series of corporate occupational medicine courses that focused on prevention and disease management programs, health status and health-care quality measures and cost containment.

In his inaugural address to the association, he outlined the challenges to his field. "On a scientific level we are faced with the rapid and continuous expansion of scientific knowledge and technology. The physical environment where we work and live is constantly changing, presenting challenges such as emerging infectious diseases and unrecognized hazards from new technological processes. The economic and political environment also presents constant challenges, including the increasing need to present economic justifications and demonstrate short-term returns on investment for all of our professional activities.

"Although we face many challenges, occupational and environmental medicine has many strengths. We have a broad range of knowledge about occupational and environmental exposures and conditions, disease processes, clinical care, and health-care management."

Holland's career has emphasized the connection between occupational and environmental health issues. He is the medical consultant for a community medical monitoring program in Ruston and North Tacoma, near the former ASARCO copper smelter. Residents are tested twice a year for lead and arsenic levels. The program, which has been in existence since 1996, gives him a chance to discuss health concerns related to historical environmental contamination of soil in the area.

He also is an occupational medicine consultant to private employers and the Washington state Department of Labor and Industries, the state Department of Corrections, and the US Public Health Service. He is an assistant clinical professor in our department and the Department of Orthopaedics and Sports Medicine.

He believes his MPH from the University of Washington gave him a strong foundation in occupational health, population medicine, and health services. The department's emphasis on community involvement and lifelong learning for professionals is "something I have tried to incorporate in my own career over the years." The spirit of collegiality among students and faculty "has perhaps helped shape and enrich my career as much as any other factor. Many of the professional friendships I formed as a graduate student in the department have continued."

Occupational medicine, he said, has the potential to improve the health of workers, workplaces, and the environment.

tracking
CHILDREN'S PESTICIDE EXPOSURES

*'Bye, mom. Goin' out to play. * slam**

Kai Elgethun shows a child the GPS readings from his vest

Inset: Washington is the nation's second largest potato growing state

Kathy Sauber; inset: USDA ARS

Children are active, curious, and unpredictable, which made it difficult for scientists to accurately assess their exposure to agricultural pesticides until a University of Washington research team developed a tracking system built right into the children's clothes.

They developed wearable global positioning system (GPS) sensors that allow researchers to track the time children spend in pesticide-affected areas, particularly when aerial spraying takes place near their homes and playgrounds.

In farming communities, homes and playgrounds are often located near where crops are sprayed. Some crops, such as potatoes, are sprayed with crop-dusting aircraft, which lay down an aerial cloud that can drift, even on a calm day. Washington ranks second to Idaho in US potato production, making this an important exposure. Exposures to children are of concern because of the ways pesticides are believed to affect their growing bodies.

One problem with estimating children's pesticide exposures has been the difficulty in tracking the time they spend in pesticide-affected areas. Wearable GPS sensors may provide a practical research tool for time-location analysis.

TIME-LOCATION ANALYSIS

The time-location analysis project began in 1999 when graduate student Kai Elgethun came to work with Professors Rich Fenske and Mike Yost in the Pacific Northwest Agricultural Safety and Health Center. Part of his funding came from the Center for Children's Environmental Health Risks Research, which investigates the risks to children from exposure to agricultural pesticides. Elgethun had worked with Allan Felsot, an environmental toxicologist with Washington State University's Tri-Cities campus in Richland, who has become a project collaborator.

Elgethun brought with him a fascination for maps and spatial relationships. "Maps provide a tangible way for a lay person to understand what's going on," he said, making them an important tool in risk communication. His arrival coincided with improvements in GPS technology that allowed more precise monitoring of location. Children could now be tracked to within three meters, which can show whether they are indoors or out, or in the yard or playground. Velocity can also be calculated from GPS, showing whether a child is on foot, riding a bike, or traveling in a car. Differences in velocity on foot could indicate differences in breathing rate, adding another layer of exposure data.

GPS AND GIS

The global positioning system can track a child's movements, which can be overlaid on a Geographic Information System (GIS) map. Concentrations of pollutants can also be overlaid, and can be synchronized with the time a child was in the area. Local weather conditions can be factored in to predict the fate and transport of the pollutant.

In theory, all of this should work well together. In reality, it wasn't easy to design a wearable GPS transmitter that would be acceptable to finicky kids. Researchers became clothing designers, sewing radio transmitters into vests and overalls. The fashions were first tested with children of faculty and staff. Bib overalls were "a big failure," Elgethun recalls. Boys liked the vests better, but girls would wear them only if they could decorate them with stickers of butterflies and stars.

Then the researchers faced technical challenges in positioning the antennae correctly across a child's shoulders and finding vests that were breathable enough to wear in summer in Eastern Washington.

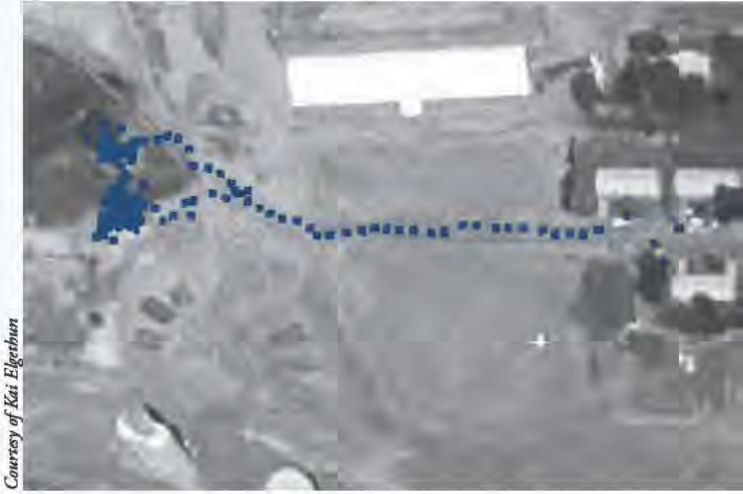
FINDINGS

Once those hurdles were overcome, the vests provided useful information. More than 50 children were tested. They spent time at the neighborhood playground, which prompted researchers to test for pesticide on the playground equipment (they found some residues). They didn't find pesticides in the houses, meaning that it was safe to keep kids indoors during spraying.

One surprise was how many times during the day kids go in and out of the house. "Only GPS could capture that," Elgethun said, because questionnaires just can't capture the "erratic, unpredictable behavior" of children.

Researchers found that pesticide drift was minimal immediately after spraying. A surprising finding was volatilization from the midday sun. This was the first time this phenomenon had been evaluated in a human exposure study.

The types of pesticides used on potatoes break down quickly in the environment, so exposures are of concern only for a few days. The farmers had applied the pesticides correctly, Elgethun said, and by following simple recommendations, parents can protect their children from exposure.



Courtesy of Kai Elgethun

In this photo, a girl leaves her house (far right), and walks to the playground (left) where she plays. The long white building is a potato storage shed.

RECOMMENDATIONS

- Keep children inside during aerial spraying
- Keep the windows shut (air conditioning is effective)
- Turn the air conditioner to "recirculate" mode
- Bring the kids inside if the weather warms up later in the day after spraying

FOR FURTHER READING

Elgethun K, Fenske RA, Yost MG, Palcisko GJ. "Time-location analysis for exposure assessment studies of children using a novel global positioning system instrument," *Environmental Health Perspectives* 111(1):115, January 2003.

glassblowers

KEEP AN EYE ON SAFETY

Greg Englesby was part of the first wave of glass artists who settled near Puget Sound in the late 1960s and early 1970s and established the region as a center of artistic glassblowing.

He learned that art comes with a price. After 35 years of gazing into furnaces, Englesby has developed cataracts from infrared radiation, a condition known as "glassblower's cataract." Englesby, who now works at the Glass Eye Studio in Ballard, considers himself lucky. Working conditions "used to be a lot worse," he said. "We didn't know what we were doing."

Today he and other glassblowers have a much better understanding of the health hazards associated with their art. Glass Eye Studio has installed glare shields, ventilation

Russell Johnson, Museum of Glass; inset: Gavin Sisk

Ben Cobb, glassblower at the Museum of Glass hot shop in Tacoma

Inset: Goblets on display at the Glass Eye studio

Cathy Schwartz

Greg Englesby

systems, and wet-process grinders, and buys glass already colored so artists don't have to mix dry metal powders, said president Dale Leman.

In the summer of 2002, the studio wanted to update its respiratory protection program and requested a consultation from the Department of Environmental and Occupational Health Sciences' Field Research and Consultation Group (Field Group). Leman first heard about the Field Group's Gerry Croteau, a research industrial hygienist, through a glassblower who is also a metal artist. Croteau had consulted with the Seattle Metals Guild on exposure and ventilation issues.

Croteau measured dust, noise, and chemical exposures at Glass Eye. He found the exposures to be well within acceptable workplace limits, but suggested continued use of respirators for short-term tasks such as chemical mixing and cleaning the bag house (an air pollution control system). He also suggested ear protection for noisy tasks such as grinding. He was also concerned that cadmium was sometimes used in colorants.

Artists can find resource books that describe the various chemicals used in the arts and their potential health effects, Croteau said, but their actual risk is determined by the duration and level of exposure. There has been little research on exposures in the arts, which is one reason Croteau is so interested.

"If you look at the long list of compounds that artists use, you might think there is a serious health risk," he said, "but for many of the compounds used, the potential for exposure appears to be minimal."
For example, one health and safety reference book for metalworking indicates that "toxic metal fumes from enamel ingredients may emanate from kilns." However, initial monitoring results, as well as a review of the melting and boiling point of metals used in enamels, suggest that the exposures from this activity might be very low.

Duration is another factor that affects the overall exposure level. The exposure of an artist, who may spend only a few minutes mixing chemicals, is considerably lower than that of a factory worker, who may be exposed all day. In addition, many studios, even small, home-based ones, have ventilation systems and other methods for reducing exposure levels, Croteau said.

That just makes business sense to the Glass Eye's Leman. He wants to hire and retain the best glassblowers. All have been with his studio for at least two years, and some for 20 years or more.

Cameron Tower, the studio's safety officer, called the Glass Eye a "really great building for glassblowing." Safety improvements to ventilation and cooling systems have controlled life-threatening hazards such as silica exposure and heat stroke, he said. The hazards that still remain include burns and cuts. Lately, the studio has made preventing eye injuries a priority.

TEACHING STUDENTS

In Tacoma, two of the department's graduate students helped the Museum of Glass develop a safety curriculum for visiting middle and high school students.

Each spring and fall for three weeks, the students visit the Museum of Glass to experience art through the lens of science. *Science of Art* curriculum units are generated for each week, supporting themes from special exhibitions. After classroom preparation, students tour the museum, focusing on their curriculum's exhibition. They visit the hot shop to see glassblowing, participate in art activities, and watch a video of artists in action.

Chetana Acharya

Graduate student Marley Shoaf describes the hazards of glassblowing to visiting students at the Museum of Glass in Tacoma

Graduate student Marley Shoaf spent last summer creating one of these *Science of Art* curricula on the environmental and occupational hazards of glass blowing. She also had the opportunity to present health and safety information to visiting students.

Shoaf worked closely with the docent at the hot shop, telling the students about the health and safety precautions the artists were taking. Her lecture supported what the

Gavin Sisk; vase Cathy Schwartz

Safety glasses protect the vision of glass-blowers Chi Saephanh (left) and Phengsack Meuangkhot at the Glass Eye Studio

students had learned in the classroom before their visit. "I did independent research on the occupational hazards of glassblowing, created a curriculum, and then presented to the students on the hot shop floor. It was a great experience," she said.

Another graduate student, Katie Toepel, showed a video on the occupational hazards of glassblowing, then facilitated discussion on what the students saw as good and bad safety practices.

Susan Warner, director of education at The Glass Museum, anticipates future collaborations with our department's Community Outreach and Education Program (COEP). Chetana Acharya, COEP manager, said she hopes future graduate students have the opportunity to integrate art and science, create *Science of Art* curricula, and engage students at the museum.

FOR FURTHER READING

Arts, Crafts, Theatre, and Safety (ACTS)
http://www.caseweb.com/acts/

Health and Safety in the Arts database
http://www.ci.tucson.az.us/arthazards/

Ramazzini, Bernardino (1713). *Diseases of Workers: De Morbis Artificum*. Translated from the Latin by Wilmer Cave Wright. New York: Hafner Publishing Co., 1964

Rossol, Monona (2001). *The Artist's Complete Health and Safety Guide*, Third Edition. New York: Allworth Press

UW Community Outreach and Education Program
http://depts.washington.edu/ceeh/Outreach/outreach.html

UW Field Research and Consultation Group
http://depts.washington.edu/frcg

AN ANCIENT CRAFT

The hazards of glassblowing have been known for centuries. In the 18th century, Bernardino Ramazzini—considered the father of occupational medicine—described working conditions in glass factories, including those on the island of Murano near Venice.

In the days before electronically controlled furnaces, glassblowers were subjected to "the violent heat of the fire and the addition of certain minerals sometimes used for coloring glass objects," he wrote. Before ultraviolet goggles were developed, "their eyes have to meet the full force of the fire, and those watery discharges…might well be tears shed for their unhappy lot." Despite these hazards, Ramazzini considered glassblowers to be among the most prudent workers, because they typically took summers off and retired at 40.

alumni 1996

Master of Science
Industrial Hygiene

Carrie Sadovnik, MS

Industrial Hygienist, New York City Department of Health and Mental Hygiene, Environmental Disease Prevention

Courtesy of C. Sadovnik

PREPARING FOR TERRORIST THREATS

UW graduate Carrie Sadovnik, the former Carrie (Carrel) Loewenherz, is part of the team that prepares New York City for terrorist events.

Sadovnik, an industrial hygienist, was hired by New York City's health department as part of a federally funded team that would respond to potential environmental health impacts associated with terrorist events.

Many of the team's efforts also support day-to-day health department functions such as environmental risk assessment and data interpretation, education, and surveillance. The team also responds to environmental emergencies such as last year's major power outage.

Nearly a decade ago, she entered our department's master's program with an interest in environmental conservation and botany and an assumption that she would study environmental toxicology. Not far into the program, she realized that the needs of people—as well as ecosystems—are affected by human activities.

Sadovnik studied with Professor Richard Fenske and, as an intern, helped the city of Tacoma write its sewer utilities' process safety management plan. She worked full-time for Tacoma, then joined The Boeing Co. At the Boeing Everett facility, she provided industrial hygiene services to a plant with 30,000 employees, dozens of warehouses, hundreds of shops, and thousands of cryptic acronyms. She found the job a "perfect training ground for a fledgling industrial hygienist," but recalls that "my first couple of months were dizzying."

In 1999, she returned to our department's Field Research and Consultation Group (Field Group), which she called "a great combination of traditional industrial hygiene fieldwork, report writing, and research." She worked with supervisors, managers, and business owners who really wanted to do the right thing and protect their workers, but lacked the means to do it. "Puget Sound businesses should count themselves lucky to have such an amazing resource as the Field Group," she said.

She moved to New York City in 2000 and worked for the New York Committee for Occupational Safety and Health (NYCOSH), a nonprofit organization that provides free training and technical services to unions and community-based organizations. "I had to pay close attention to ensuring the integrity of my science while still acting as a worker advocate," she said. She also taught in Cornell University's School of Industrial and Labor Relations.

The World Trade Center attacks gave her job new meaning, she recalls. Suddenly "respirator fit testing" was a household word and discussions on the nuances of air quality could be heard on every subway platform.

As a NYCOSH industrial hygienist, she toured the World Trade Center site a week after the attacks at the request of a union local, inspected downtown work locations, and advised on various environmental health concerns. This experience helped prepare her for her current job, helping the city's Department of Health address environmental health crises caused by terrorist attacks and other emergencies.

Her University of Washington training, which included coursework in epidemiology and biostatistics, prepared her to work with other public health professionals. She encourages students to "take all opportunities to get experience in the field; don't pass up any internship opportunities."

trouble in paradise

HOW A DELICACY CAN MAKE COOKS SICK

As tourists stroll through the morning market in Chonburi province, Thailand, spicy aromas waft from kitchens where "rice in the bamboo," a traditional delicacy, is simmering. Cooks have been up since before dawn, mixing rice with coconut milk, sugar, beans, and other ingredients, then stuffing the mixture into bamboo shoots. They cook it slowly over an open fire of coconut shells and wood.

It's a signature dish of Thailand, Vietnam, Laos, Cambodia, Malaysia, Burma, and other countries where bamboo is abundant. Some 40 kitchens in Chonburi province alone cook about 10,000 of them a day. Chonburi province, where Burapha University is located, is a beach resort town. Tourists like to take the bamboo tubes home.

The hidden hazard in this paradise is the smoke from those open fires. It is both an occupational hazard and an environmental nuisance. Nobody yet knows the health effects for the workers in these small, family-owned businesses.

The answer is likely to come from the research of Tanongsak Yingratanasuk, director of the Industrial Hygiene program at Burapha University. Yingratanasuk (known to colleagues as "Nok") is a 2001 graduate of the University of Washington's Industrial Hygiene and Safety program, and he has exported some of our department's ideas, methods, and programs to Thailand.

food for thought; thought for food

Tanongsak Yingratanasuk. Statue: Rolf Hahne

The stages of cooking with bamboo shoots, a method used in Thailand

From the Environmental Health Laboratory, Nok learned to develop biomarkers for wood smoke exposure. By measuring metabolites in urine samples, scientists can calculate a person's recent exposure to wood smoke and separate wood-smoke exposure from other pollutants, such as vehicle exhaust. Nok is collaborating with Assistant Professor Chris Simpson to apply these biomarkers to the types of cooking fires used in Thailand.

Borrowing a model from our department's Field Research and Consultation Group, Nok has set up an industrial hygiene consultation service for small businesses that aren't covered by other health services.

With support from Associate Professor Matthew Keifer and the International Scholars in Occupational and Environmental Health program, Nok has set up a regional center of excellence in exposure assessment and occupational hygiene in Thailand. This center will train local professionals, with a focus on silicosis and noise-induced hearing loss. Cottage industries are their top research priority.

Nok's master's thesis was about respiratory health and silica exposure among stone carvers. On his return to Thailand, he provided industrial hygiene and epidemiological training for local health professionals. Together they set up silicosis surveillance and health service programs for Thai stone carvers and stone crushing mill workers.

INTERNATIONAL SCHOLARS

The International Scholars in Occupational and Environmental Health program is funded by the Fogarty International Center of the US National Institutes of Health (NIH), the National Institute for Occupational Safety
and Health (NIOSH), and the National Institute of Environmental Health Sciences (NIEHS). It has three functions:

- sending academic consultants to countries such as Thailand
- sponsoring continuing education courses such as a scientific conference on occupational and environmental health in Vietnam
- bringing colleagues from Southeast Asia and Central America to the UW for short courses or graduate work

The UW has several partner universities, including the National and Technological universities in Costa Rica, the National Autonomous University of Nicaragua, and Burapha University in Thailand.

Burapha University offers more than 50 programs of study at the undergraduate and graduate level. Its Faculty of Public Health was established in 1993 with three programs: Industrial Hygiene and Safety, Environmental Health, and Health Education and Health Behavior. In 1997, it started a continuing education program in public health to provide human resource development for public health personnel.

FOR MORE INFORMATION

International Scholars in Environmental Health
http://depts.washington.edu/isoeh
Burapha University Faculty of Public Health
http://www.buu.ac.th/webeng/pbhealth.html

recipe

RICE IN THE BAMBOO

1 cup of glutinous rice (sticky rice)
1 1/2 cup of coconut milk (add a little water if the coconut milk is too thick)
2 spoons of sugar
a pinch of salt
2 spoons of black beans (optional)
a thick shoot of bamboo
charcoal for the fire

1. Cut the bamboo shoot into 10–12 inch lengths (you need the joint to contain the ingredients). You may use other kinds of containers, such as metal, but it will not be traditional.
2. Soak glutinous rice and black beans in water for at least 5 hours (to make them softer to cook).
3. Put the rice and beans into the bamboo shoots (1/3 of the shoot's length).
4. Mix sugar and salt with coconut milk, stirring well until dissolved. Pour the mixture into the shoots.
5. Cover the open end of the bamboo shoot with aluminum foil.
6. Place the shoots upright on the ground and surround them with charcoal (good for a backyard barbecue party or camping or boy/girl scout jamboree) or in the oven for about 2–3 hours or until the rice is cooked (be careful of fire hazard—the bamboo shoot may burn).
7. Hammer the joint to break open the stuffed rice inside the bamboo and enjoy eating!

reporting BACK TO INDUSTRY

Nicole Irby; Inset: Rick Neitzel

In many industries, it's common knowledge that long-time workers are hard of hearing. Some jobs involve higher exposures to noise and therefore are more damaging to workers' hearing. Two University of Washington research teams have spent the past five years studying which industries, trades, and tasks are most harmful.

In addition to publishing their findings in academic journals, the researchers have developed booklets that will take their recommendations onto the shop floor or construction site where workers and managers can use them. This is part of the department's mandate to work with employers and workers in Washington state to prevent industrial and occupational disease.

Earlier studies by Bill Daniell, an associate professor in occupational and environmental medicine, showed a sharp rise in the number of hearing loss claims to the state's workers' compensation system (see 1997–99

Sebrina Somers

working with employers and workers in Washington state to prevent industrial and occupational disease

Carpenters, operating engineers, and masonry restoration workers have high noise exposures as do all trades in the construction industry

biennial report). Various industries have approached our department for help in reducing these costs and preserving workers' hearing.

There are several types of occupational hearing loss. Acute traumatic loss comes from a single event such as an explosion, sudden pressure change, or physical trauma. Short-term, or temporary, hearing loss can occur after brief exposures to very high levels of noise (such as a loud concert) and goes away after a recovery period of hours to days. Chronic occupational hearing loss—which is permanent and irreversible—is usually caused by long-term, repeated exposure to loud noise, but has also been linked to chemical exposure. Metals such as lead, organic mercury, and manganese, and organic solvents such as carbon disulfide, trichloroethylene, styrene, and toluene have been implicated.

Many people imagine everything would go quiet if they lost their hearing. Unfortunately, one of the most annoying things about occupational hearing loss is that it is often accompanied by tinnitus, or ringing in the ears. Hearing loss can cause social isolation. Employees with hearing loss are at risk if they can't hear warning signals. They also may find it hard to communicate with coworkers.

Daniell's study found that chronic occupational hearing loss costs Washington employers more than $50 million a year through workers' compensation claims, and the number of claims increased 12-fold between 1984 and 1998.

WASHINGTON INDUSTRY

Daniell first became interested in occupational hearing loss when he noticed the abrupt upturn in workers' compensation claims. Over the past five years, his team has studied 10 industries, starting with a pilot project conducted in foundries.

The research team (Milton Eng, Robert Leo, Sebrina Somers, Sue Swan, and David Yu) selected eight industries with high rates of hearing loss claims. The team evaluated noise exposures and hearing conservation programs at seven to ten work sites in each industry. Researchers interviewed 76 managers and 1557 employees, measured full-shift noise exposures of 983 employees using personal dosimeters, and observed hearing protector use by 876 workers.

Nearly every workplace was noisy enough to require a hearing conservation program, yet only half of observed employees used hearing protection when they should have. Interviews showed that workers are more aware and more likely to use hearing protection when management is involved in the program.

Researchers reviewed hearing test records and found that in one industry, road construction, nearly 40% of workers had hearing loss that was moderately severe or worse.

CONSTRUCTION WORK

"We have amassed and analyzed a huge database on noise levels in 11 construction trades," said Noah Seixas, professor of industrial hygiene and safety. "Now we can put those findings to work for the workers."

His research team, which included Susan Brower, Bryan Goldman, Rick Neitzel, Sebrina Somers, and a number of graduate students, found that all trades and most tasks—even eating lunch or cleaning up—often exposed workers to enough noise to warrant hearing protection. Yet workers reported using hearing protection—earplugs or muffs—less than half of the time they were exposed at levels that could be damaging.

Sue Swan

Workers in the metal fabrication industry, such as this machinist monitoring a lathe, face exposure to damaging levels of high frequency noise

Workers in the noisiest trades were operating engineers and cement masons; in the quietest, sheet metal workers and insulation workers. Operating engineers had the highest use of hearing protection and cement masons the lowest.

WHY THE LOW USE?

Both studies found low usage of hearing protection in some noisy environments. But why?

Previous researchers have found that construction workers' biggest fear was that they wouldn't hear warning shouts or signals, such as the back-up beep of a truck. They were more concerned about the immediate dangers of construction work than about the long-term threat of hearing loss. They also thought earmuffs or plugs would be uncomfortable to wear all day, and they feared looking foolish to coworkers.

Seixas has become interested in behavioral research to

WORKPLACES STUDIED

Industries

Foundries
Fruit and vegetable processing
Heavy gauge metal fabrication
Lumber milling
Machine shops
Printing
Pulp and paper production
Road construction
Sheet metal fabrication
Wood product manufacturing

Construction trades

Bricklayers
Carpenters
Cement masons
Electricians
Insulation workers
Ironworkers
Laborers
Operating engineers
Masonry restoration workers
Sheet metal workers
Tile setters

You can download the construction trade reports at *http://depts.washington.edu/occnoise*

better understand why knowledge doesn't always translate into safe behavior. By understanding these barriers, he hopes to develop a more effective prevention program for construction workers.

IS IT FROM WORK?

There is no question that construction workers are exposed to harmful levels of noise at work, but what about their off-the-job activities, such as playing loud music or riding motorcycles?

Seixas' team followed construction workers to measure their off-the-job noise exposures, then compared these levels to their noise exposure at work. The noise levels associated with off-the-job activities were almost always much lower than levels experienced during construction work, meaning that non-work activities present much less risk of hearing damage than work activities for most people.

RECOMMENDATIONS

- Earmuffs or plugs with a noise reduction rating of 14 to 20 decibels often offer enough protection for many workers, yet let warning sounds come through. Unfortunately, employers often provide hearing protectors with the highest protection available (33 decibels), which may prevent workers from being able to communicate and hear important sounds.
- The employer should provide at least two—preferably more—types of hearing protectors free to workers who are exposed to high noise levels.
- Individual fitting and training on hearing protectors should be part of a company's hearing loss prevention program. It should be done every year or two.
- Employers with a hearing loss prevention program are required to provide annual training, which should be supplemented with training throughout the year.
- Employers should make sure employees can identify areas and tasks where hearing protection is required.
- Supervisors and managers should serve as role models, wearing hearing protectors in noisy areas, even on short visits.

Trade	% of 8-hour work shifts > 85 decibels	% of time > 85 decibels hearing protection used
Sheet Metal Worker	11%	66%
Insulation Worker	18%	14%
Tilesetter	20%	12%
Electrician	20%	18%
Bricklayer	26%	49%
Masonry Restoration	37%	56%
Carpenter	40%	43%
Ironworker	40%	13%
Laborer	44%	NA
Cement Mason	46%	8%
Operating Engineer	46%	70%
All Trades	34%	39%

Noah Seixas

Noise levels and hearing protection use in construction trades

where we've been...

AND WHERE WE'RE GOING

Master of Science
Environmental Health

alumni 1994

Joe Johnson, MS

Environmental Regulatory Manager, Microsoft

Eric Reader, Chasing Plastic Magazine

#44 Joe Johnson defending in the finals of the 2002 World Ultimate Championships in Honolulu. His team won.

INTERNATIONAL ENVIRONMENTAL POLICY

In the fall of 2000, Joe Johnson was the first environmental professional hired at Microsoft. Since then, he has expanded his job beyond its original "compliance manager" aspect into the policy arena. He now manages a group of three people.

He tracks worldwide environmental regulations that affect Microsoft products and business operations, and implements compliance strategies to address these requirements. Most Americans are unaware of European or Asian regulations, such as restrictions on use of heavy metals in product packaging and consumer electronics, and Johnson often gets a surprised reaction when people hear what he does at Microsoft.

Among other things, he has helped to manage and reduce the company's overall "environmental footprint." Given the size of Microsoft's operations worldwide, he feels this is an opportunity to make a positive impact on the environment.

After finishing his master's degree under the guidance of Associate Professor John Kissel, Johnson was hired by The Boeing Co. in a "design-for-environment" program to reduce the use of hazardous substances in metal-finishing operations.

He moved on to manage Boeing's remediation projects under state and federal waste management regulations, such as the Resource Conservation and Recovery Act (RCRA) and Superfund. He managed several local sites at the Duwamish River and Boeing Field, and others across the United States. He moved briefly into consulting, but "when Microsoft called with the opportunity to get in front of the cleanup issue instead of chasing behind, I took it."

He finds that working at Microsoft "can be a lot like grad school—you need to be dedicated to and passionate about your work, or you won't succeed." The hours are equally long, but the pay is a lot better, he quipped.

He encourages students to "take time to discover what truly motivates you, then begin visualizing work that will allow you to express that motivation." It could take awhile to get there, he cautions, even a decade or more, but "the clearer you are, the faster it can happen."

He sees expanding opportunities to do environmental work in industry with the evolution of standards for corporate social and environmental responsibility. He encourages students interested in this field to "check out what's happening and learn about it."

Johnson has always enjoyed playing sports, and was a member of the 1982 US national and 1983 world championship teams in Ultimate Frisbee. While in grad school, his masters division teams won the 1992 national and 1994 world (and University of Washington intramural) championships. He has since added the 2000 and 2001 national and 2002 world masters titles.

partnership

RESEARCH, TEACHING, AND OUTREACH

The past decade has seen a blurring of the line between environmental issues and occupational issues, as conditions in workplaces and in homes and communities have become more similar

Partnership is the theme of our third biennial report, and the first report issued under our new name, Department of Environmental and Occupational Health Sciences. This theme is reflected in our choice of cover art, a selection from the well-known fresco panels painted by Diego Rivera in 1932 on the walls of a court inside the Detroit Institute of Arts. The mural depicts the vital and exuberant teaming of worker with coworker, and human with machine in a hopeful vision of the possibilities of the industrial age. Our current sensibilities are much more cautious, reflecting awareness of the hazards, as well as the benefits, of modern technology.

Consider the close relationship between environmental and occupational issues. The past decade has seen a blurring of the line dividing these categories, as conditions in workplaces and in homes and communities have become more similar. Examples of hazards affecting both workers and community members are found in this report, such as pesticide and noise exposures.

It no longer goes without saying that we emphasize workplace issues along with those based in community settings. By adding "occupational health" to our name we make explicit our department's historical focus and commitment to workplace safety and health. Our name change conveys an important message.

It acknowledges that, while most people are familiar with a wide range of environmental issues, they may be unfamiliar with the term "environmental health." Incorporating "sciences" into our name clarifies that the life sciences and physical sciences are defining characteristics of our department and that our primary approaches are scientific. We hope that our new name better conveys our identity as a department.

Another name change came when we dropped "Technology" from the graduate program in Environmental Health. This change reflects the broader range of legal and social issues facing this field.

With these name changes, we challenge ourselves to better communicate with the world at large, and with our counterparts in Washington business, labor, government, and academia.

CONTINUING ACHIEVEMENTS

Our academic programs continue to thrive. In 2002, our training and research funding from the National Institute for Occupational Safety and Health (NIOSH) was renewed. This will allow the NIOSH-funded Northwest Center for Occupational Safety and Health to continue to provide financial support for graduate education, educational outreach including continuing education of safety and health professionals, and hazardous substances training.

We have continued our annual career day, which provides the opportunity for our students to talk with alumni and friends of our department about career options, and student research day, which celebrates the accomplishments of our graduate student researchers with featured talks, poster session, and a reception.

FACTS AND FIGURES

Fueled by research grants, our overall budget was up slightly more than 12% from the 1999–2001 total, continuing the steady

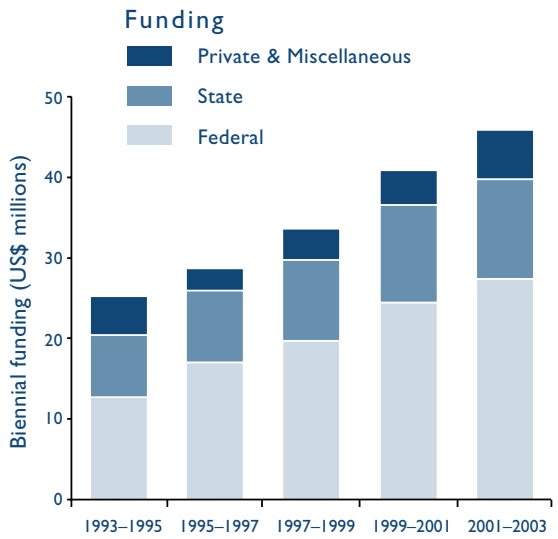


Figure 1. Funding trends, 1993–2003

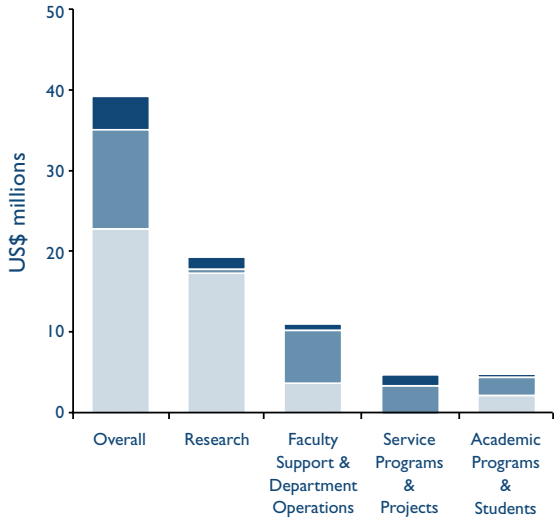


Figure 2. Budget distribution by activity, 2001–2003 biennium

growth of the past decade. When combined with funds derived from indirect costs on grants, federal sources of departmental
support account for about two thirds of our total operations, up from about half in 1993–1995 (see figure 1). We also obtained more private and miscellaneous support, accounting for 12% of our budget in the most recent biennium. Since 1999, state support has been essentially level, except for about 2% growth to cover scheduled salary increases. This includes funding from the University and the Washington state industrial insurance system (Medical Aid and Accident funds).

The ability to combine state and federal resources to fund our interrelated teaching, research, and service missions is essential to the success of our department. These resources help us educate the next generation of leaders in occupational and environmental health, such as those alumni profiled in this report. These combined funds pay for faculty to mentor students in the classroom, the laboratory, and the field; and support the staff involved in recruitment, admissions, and advising (see figure 2). For example, the cost of tuition, fees, stipends and assistantships for our graduate students is spread among faculty research grants, program training, and state funds.

Another example is our ability to conduct research on safety and health problems in Washington. Projects may begin with a federal research grant, as was the case with the studies on noise in construction described on pages 24–26. In addition to publishing scientific papers on their research findings, our researchers used state funds to translate that information into booklets targeted to each of the trades studied. Much of this work is accomplished with Medical Aid and Accident funds. Conversely, some of our projects begin as an employer consultation request supported by our state funds, such as one on silica exposure that became the basis for a federal grant to study the problem in greater depth.

Note: Figure 1 includes indirect costs on grants that are not shown in figure 2. The smaller budget total in figure 2 better reflects our actual operations.

NEW EDUCATIONAL INITIATIVES

During the biennium, our department's undergraduate program, leading to a Bachelor of Science degree in Environmental Health, was significantly restructured. Redefined core requirements allow additional flexibility in selection of courses. The program saw its enrollment double in 2002–2003, primarily as a result of broadened faculty involvement and additional staff support. This trend, if continued, should assure public agencies and private companies in the state a continuing source of needed environmental health specialists.

We started a program called Puget Sound Occupational and Environmental Medicine Grand Rounds. This is a series of dinner meetings with an occupational medicine speaker, cosponsored with the Northwest Association for Occupational and Environmental Medicine. This series provides an opportunity for the region's occupational and environmental medicine practitioners to talk about developments in their field.

Another initiative was the concurrent master's degree program with the Daniel J. Evans School of Public Affairs. This program will train professionals who can understand both the science and policy sides of an issue. The concurrent degrees will allow students to expand

their knowledge in each area of study while they develop a specialty. Students will be able to complete a Master of Public Affairs (MPA) and a Master of Science (MS) or Master of Public Health (MPH) in three years, rather than the four that would be necessary if the degrees were earned separately. The first concurrent degree student was accepted in autumn 2002.

Our department has created a second MPH degree, which will address general principles of environmental health, with more emphasis on applications and policy implications than our more research-oriented Master of Science degree. The new degree provides real-world experience through 120 hours of practicum and offers a choice between writing a thesis or completing a program project. This two-year program admitted its first class in autumn 2002. Until now, our department's only MPH option required a doctoral degree and had the greatest appeal to physicians in the Occupational and Environmental Medicine residency program. The new MPH option is open to applicants with relevant undergraduate degrees.

We are collaborating with the School of Public Health's Department of Health Services on a Doctor of Philosophy (PhD) program in occupational health services research. Core faculty comes from both departments, with students taking four courses in our department and receiving their degree from Health Services. Students conduct research projects on occupational health care delivered through the workers' compensation system, working with our department's Occupational Epidemiology and Health Outcomes program. They also have opportunities to conduct field-based studies with local agencies and companies.

Our PhD program in Environmental and Occupational Hygiene (formerly known as Industrial Hygiene and Safety) has been revised to apply to both industrial and nonindustrial settings. This change acknowledges the lessening of distinctions between workplace and community environmental health issues.

FACULTY

Faculty continue to serve in leadership roles in their fields. Professor David Eaton completed a term as president of the Society for Toxicology. Associate Professor John Kissel was president of the International Society for Exposure Analysis (ISEA), a group that also awarded Associate Professor Sally Liu the Joan Daisey Award for outstanding contributions by a young scientist to the study of exposure analysis. Professor Michael Morgan was announced as the first editor-in-chief of the new *Journal of Occupational and Environmental Hygiene,* a new publication founded by the two leading industrial hygiene professional groups to replace their previously separate journals.

There were several changes in our faculty. Sally Liu and Zhengui Xia were promoted to associate professor. Terry Kavanagh, Noah Seixas, and Michael Yost were promoted to full professor. Kavanagh also became director of the Toxicology program, replacing Professor Curt Omiecinski, who left for a position at Penn State University. Assistant Professor Mansour Samadpour and Associate Professor Drew Brodkin left our department to take positions in the private sector. Added to our faculty were two new assistant professors: Scott Meschke in the Environmental Health program and Chris Simpson in the Industrial Hygiene and Safety program. Matt Keifer, who now has a primary appointment as associate professor in our department, has accepted the position of graduate program coordinator.

Rick Gleason

We partner with companies such as Todd Pacific Shipyards. Left to right are graduate students Wenjie Zhu and NaTasha Johnson, Todd's Ron Sykes, and faculty member Janice Camp.

One of several key staff changes was the departure of Jean Garber as department administrator to become the administrator of the School of Dentistry, and the addition of Adrienne Hidy as administrator.

RESEARCH

Our department and the Fred Hutchinson Cancer Research Center are part of a new, federally funded, $37 million research consortium to study how genetic makeup affects an individual's response to various environmental agents. Such research will help answer puzzling questions

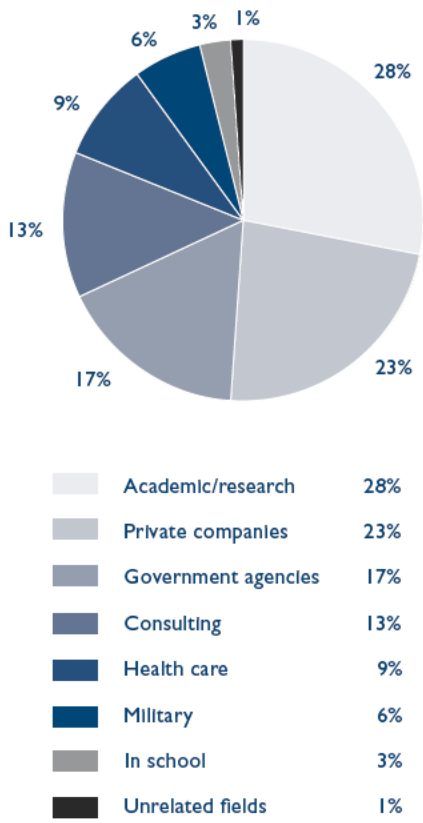


Figure 3. Where our graduate alumni work

such as why some people who have never smoked develop lung cancer, while others who have smoked heavily never show signs of the disease.

This new Toxicogenomics Consortium, a research collective involving academic institutions nationwide, is funded by the National Institute of Environmental Health Sciences (NIEHS). Researchers will use the tools of genomics to understand the mechanisms of environmentally induced disease processes. One goal is to develop techniques for using and analyzing microarrays, "gene chips" that can analyze hundreds or thousands of genes simultaneously.

We continue to be awarded multi-investigator programs and centers. The Environmental Protection Agency (EPA) funded the Northwest Center for Particulate Air Pollution and Health—one of five in the country—which conducts research to better understand the relationship between air quality and public health.

The Fogarty grant from the National Institutes of Health, which sponsors training for occupational medicine and environmental health leaders from less developed nations, was successfully renewed, as was the NIOSH center for agricultural safety and health.

STUDENTS

During the past two years, students received 12 undergraduate degrees, 26 MS degrees, four MPH degrees, and four PhDs. Outstanding graduate student awards went to Chang-Fu Wu in 2002 and Kai Elgethun in 2003. Many other students received honors, which are summarized on pages 36–37.

GRADUATES

Our success is measured in part by the achievements of our graduates, some of whom are featured in this report. A survey of our graduate student alumni (see figure 3) shows almost all of them working in their fields of speciality.

LOOKING AHEAD

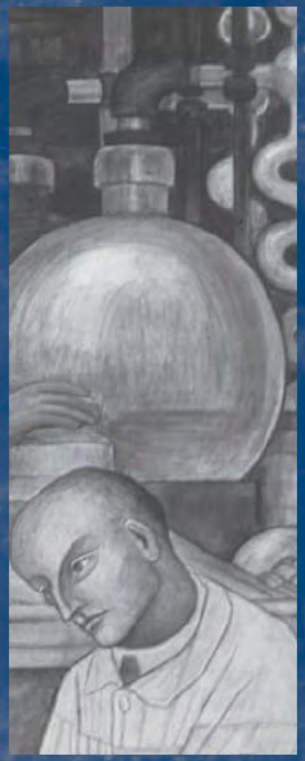
We are moving ahead to meet new challenges in the environmental and occupational health sciences, some of which are discussed by professors Michael Morgan and Elaine Faustman on pages 10–14. We are developing and using monitoring instruments that are small and portable, enabling us to assess exposures at low doses, or on active children (pages 16–17). We have new biological monitoring methods that allow us to determine health effects from exposures sooner and at lower doses than ever before. Advances in genomics allow us to understand better how environmental and occupational exposures affect the health of individuals and populations at a molecular level and permit us to identify susceptible populations.

As we advance the frontiers of science with these new technologies, we must continue to assure that our work furthers the public's health. As Professor Morgan points out, practicing and teaching good science is only one part of our job. We also have a special responsibility to gain and keep the public trust. This involves communicating with all sides of often-contentious issues and making our research understandable and useful to those we serve. We believe that combining the goals of sound science and excellence in teaching with our state service mission benefits the research community, our students, and our community partners.

—Dave Kalman, Chair

measures

OF ACCOMPLISHMENT 2001–2003



degrees CONFERRED

Francesca Noel Hudson (left) and Dolores Diaz received their doctorates (2002)

Inset (l to r): Gregory Frick and John Olson receive their master's degrees (2002)

Joel Levin

UNDERGRADUATE

SUMMER 2001

Shireen Assaf
Fion Lau

WINTER 2002

Jennie Nguyen
Phuong Nguyen

SPRING 2002

Stacy Andrewjeski
Ngoc-Thao Dang
Aneel Sandhu
Maria Tchong

SPRING 2003

Brien Brown
Brent French
Eva Miller
Joshua Witt

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 (EH), Toxicology (Tox), Occupational and Environmental Medicine (OccMed).* **Faculty Preceptors:** *(italics)*

SUMMER 2001

Christine Bellas, MS (Tox) Identification and characterization of a human glutathione S-transferase M2-2 variant *(David Eaton)*

Mark Burry, MS (Tox) Neurodevelopmental toxicity of toluene *(Lucio Costa)*

Dolores Diaz, PhD (Tox) Glutamate-cysteine ligase expression in the mouse *(Terrance Kavanagh)*

FALL 2001

Lynn Bekris, MS (Tox) Glutamate cysteine ligase levels in human peripheral blood lymphocytes *(Elaine Faustman)*

Francesca Noel Hudson, PhD (Tox) Regulation of the mouse glutamate-L-cysteine ligase modifier subunit gene *(Terrance Kavanagh)*

Robert Leo, MS (IH&S) Systematic observation of noise exposure and hearing protector use in worksites in two noisy industries *(William Daniell)*

Sarah Weppner, MS (EH) Farm exposures to deposited arsenic and lead on Vashon/Maury Island *(John Kissel)*

WINTER 2002

Milton Eng, MS (IH&S) Evaluation of hearing conservation awareness within high noise industries within Washington state *(William Daniell)*

Chunmei Fu, MS (Tox) Development of a transgenic mouse model to study the toxicity of particulate matter *(Daniel Luchtel)*

Susan Leaman, MS (Tox) Role of negative cell cycle regulators in ethanol inhibition of astroglial cell proliferation *(Lucio Costa)*

Rene Showlund, MS (EH) Transfer of pesticide residue to skin following contact with a contaminated surface *(John Kissel)*

Hossein Siahpush, MS (IH&S) Longitudinal study of asthma-like and other symptoms in aluminum smelter workers *(Joel Kaufman)*

Jeffrey Stewart, MS (IH&S) An evaluation of occupational exposures to biological hazards at three wastewater treatment plants in western Washington state *(Mansour Samadpour)*

SPRING 2002

Jordan Firestone, MPH (OccMed) Pesticides and Parkinson's disease, risk estimates from a case-control study *(Harvey Checkoway)*

Gregory Frick, MS (IH&S) Mixture component effects on passive diffusion monitor performance *(Michael Morgan)*

A. Nicole Irby, MS (IH&S) An assessment of noise frequency spectra associated with selected construction tasks *(Noah Seixas)*

Daniel Ratican, MS (IH&S) The distribution of methyl chloroform between sorbent surfaces of a dual stage passive monitor *(Michael Morgan)*

Chang-Fu Wu, PhD (IH&S) Applying optical remote sensing techniques to evaluate personal exposure *(Michael Yost)*

SUMMER 2002

Katia Harb, MS (IH&S) Cardiopulmonary effects of 300 ppb nitrogen dioxide in chronic obstructive pulmonary disease and asthma patients *(Jane Koenig)*

Stacey Newsom, MPH (OccMed) The effect of ambient air pollution on pulmonary exacerbations in the cystic fibrosis population *(Joel Kaufman)*

AUTUMN 2002

Stephen Cherne, MS (Tox) Signaling events involved in the inducible expression of nitric oxide synthase in rat kidney cells *(James Woods)*

John Olson, MS (IH&S) Non-occupational noise exposure and its contribution to noise dose in apprentice construction workers *(Noah Seixas)*

WINTER 2003

Francisco Dieguez, PhD (Tox) Role of nuclear factor-kappa B in the molecular toxicology of mercury in kidney and brain cells *(James Woods)*

Jenna Fisher, MS (Tox) Behavioral effects of early postnatal chlorpyrifos-oxon exposure in paraoxonase-1 knockout mice *(Thomas Burbacher)*

Carolyn Salazar, MS (IH&S) Evaluation of reliability and validity of the hand activity level (HAL) and the strain index for use in epidemiological studies *(Peter Johnson)*

SPRING 2003

Anca Bejan, MS (IH&S) Passive monitor performance under fluctuating solvent concentration and multiple solvent presence *(Michael Morgan)*

Joel Levin

2003 graduates. top row: Joshua Witt (left), Brien Brown, faculty member Chuck Treser (center); bottom row: Sakorn Marley (left), Laurie Young

Paul Darby, MPH (OccMed) Carbon monoxide mortality: Has accurate tracking come to an end? (*Matthew Keifer*)

Carrie Fields, MS (Tox) Measurement of $PM_{2.5}$ concentrations and cardiorespiratory health effects in adult subjects *(Jane Koenig)*

Bethany Katz, MS (EH) Evaluating the contribution of wood smoke to Seattle $PM_{2.5}$ using levoglucosan as a molecular tracer (*David Kalman*)

Thomas Olenchock, MS (IH&S) Cross shift changes in oto-acoustic emissions in relation to occupational noise exposure *(Noah Seixas)*

Thomas Sultze, MS (IH&S) Work on the edge: Factors affecting respirable dust exposures during concrete grinding *(Noah Seixas)*

James Terrio, MPH (OccMed) The effectiveness of the preplacement examination in identifying Army officers at risk for disability *(William Daniell)*

Amanda Zych, MS (EH) Identifying mosquito vector species in stormwater drainage ponds in King County, Washington *(Charles Treser)*

honors AND AWARDS

David Bates, emeritus chair of the External Science Advisory Committee for the Northwest Center for Particulate Matter and Health

Inset: Fanny Nugyen, graduate student

Kathy Hall; Inset: Janice Camp

STUDENTS

Erika Abel, PhD student, Toxicology
poster award, PANWAT conference, 2001

Hélène Barrus, PhD student, Toxicology
Achievement Rewards for College Scientists Foundation (ARCS) fellowship, 2003–2004

Paul Darby, MPH student, Occupational and Environmental Medicine
Occupational Physicians Scholarship Fund recipient, 2001–2002

Nicole DeFrank, PhD student, Toxicology
Achievement Rewards for College Scientists Foundation (ARCS) fellowship, 2002–2003

Kai Elgethun, PhD student, Industrial Hygiene
department's outstanding graduate student, 2003

Fabiola Estrada, MS student, Industrial Hygiene
scholarship, Pacific Northwest Section of the American Industrial Hygiene Association, 2002

Julia Gohlke, PhD student, Toxicology
Achievement Rewards for College Scientists Foundation (ARCS) fellowship, 2001–2002

Elizabeth Gribble, PhD student, Toxicology
Eli Lilly Women and Minority Travel Award, 2003; James C. Bradford Memorial Student Poster, Society of Teratology, 2003

Yingying Guo, PhD student, Toxicology
poster award, in vitro toxicology specialty section, Society of Toxicology, 2003

Noel Hudson, PhD student, Toxicology
poster award, PANWAT conference, 2001

Doug Johns, PhD student, Industrial Hygiene
Liberty Mutual Endowed Scholarship from the American Industrial Hygiene Foundation, 2002

NaTasha Johnson, MS student, Industrial Hygiene
scholarship, Pacific Northwest Section of the American Industrial Hygiene Association, 2002

Nancy Judd, MS student, Toxicology
award for her paper on beryllium analysis, Society for Risk Analysis, 2001

Samir Kelada, PhD student, Toxicology
School of Public Health & Community Medicine's Magnuson Scholars Award, 2003

Fanny Nguyen, undergraduate and MS student, Industrial Hygiene
Cindy Treser scholarship, Washington State Environmental Health Association, 2002; International Educational Program travel scholarship, Puget Sound Partners for Global Health, 2003

Jing Shao, PhD student, Toxicology
SOT travel award, 2003

Chang-Fu Wu, PhD student, Industrial Hygiene
department's outstanding graduate student, 2002

Meagan Yoshimoto, undergraduate student
Cindy Treser scholarship, Washington State Environmental Health Association, 2003; Greater Seattle Japanese Community Queen Scholarship Program First Princess, 2003

Jennifer Young, MS student, Industrial Hygiene
3M scholarship, 2003

Amanda Zych, MS student, Environmental Health
National Environmental Health Association/Association of Environmental Health Academic Programs/CDC National Center for Environmental Health's Student Paper Award, 2003

FACULTY AND STAFF

Nilo Arnaiz
Chest Foundation Clinical Research Trainee Award, 2001

Raja Atallah
Ethnic Heritage Council's Spirit of Liberty Award, 2002

David Bates
Order of Canada, 2002

Drew Brodkin
American Thoracic Society committee to update the 1986 ATS statement on the diagnosis of nonmalignant diseases related to asbestos

Susan Brower
departmental nominee, university's distinguished staff award, 2003

Harvey Checkoway
Board of Scientific Councilors, NIEHS National Toxicology Program, 2002; Chair, Workers' Family Protection Task Force for federally sponsored research on take-home exposures to workers' families, 2002

William Daniell
School of Public Health & Community Medicine's outstanding teaching award, 2002

Foppe de Walle
first-place environmental award from the European Union for investigation of carbon dioxide as a replacement of perchloroethylene in dry cleaning, 2002

David Eaton
president, Society of Toxicology 2001–2002; National Academy of Sciences/National Research Council subcommittee on Arsenic in Drinking Water; nominated for the UW Distinguished Graduate Mentor Award, 2002

Devon DeLapp

Samir Kelada, graduate student, does genetic research into the causes of Parkinson's disease

Richard Fenske
Institute of Medicine/National Academy of Sciences Committee to Review the Health Effects in Vietnam Veterans of Exposure to Herbicides

Mary Ellen Flanagan and **Gerry Croteau**
team outreach award, 2002

Gail Gilliland
staff service award, 2003

Rolf Hahne
staff outreach award, 2003

Kathy Hall and **Cathy Schwartz**
"best of show," international technical publications competition, Society for Technical Communication, 2003

Nancy Judd
staff outreach award, 2002; award for paper on beryllium analysis at the Society for Risk Analysis, 2001

Joel Kaufman
annual Alice Hamilton Memorial Lecture at the University of California, San Francisco, 2003

Shannon Kirkpatrick, Rory Murphy, Noah Seixas
UW's Graduate and Professional Student Senate (GPSS) Gold Star Department Award for Excellence in Student Service, 2002

John Kissel
president, International Society of Exposure Analysis, 2001

Jane Koenig
EPA Clean Air Science Advisory Committee

Sally Liu
elected counselor, International Society of Exposure Analysis, 2001

John Malool
distinguished safety award, Washington state Department of Agriculture's waste pesticide disposal team, 2003

Mike Morgan
National Research Council Committee on Air Quality in Passenger Cabins of Commercial Aircraft

Sharon Morris
faculty outreach award, 2003

Rick Neitzel
award for outstanding service, Puget Sound Area Construction Safety Summit, 2003

Richard Ramsden
staff service award, 2003

Becky Rooney
departmental nominee, university's distinguished staff award, 2002

Noah Seixas
Rohm and Haas Professor of Environmental Health, 2003–2007

Tim Takaro
faculty outreach award, 2002; nominated by NIOSH to participate in the president's advisory board on radiation and workers' health, 2001; selected for the Department of Energy/Department of Labor's physicians' panel for reviewing workers' compensation, 2001

Chuck Treser
Past Presidents' Award, National Environmental Health Association, 2002; Association of Environmental Health Academic Programs Board of Directors

Gerald van Belle
award for outstanding contributions to statistics and public health, American Public Health Association's Statistics Section, 2002

Mike Yost
nominated for the UW distinguished graduate mentor award, 2002

Gavin Sak

Some of our departmental faculty members pose for a group photograph outside the Roosevelt building

faculty

BRIEF BIOS

Scott Barnhart, MD, MPH, is a professor (primary appointment in the School of Medicine) and since 1999 has been medical director of Harborview Medical Center. He directed the Occupational and Environmental Medicine program from 1994 to 1999. 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 (DOE) sites.

Carl A. (Drew) Brodkin, MD, MPH, an associate professor of Internal Medicine and Environmental Health, (primary appointment in Internal Medicine) taught in the Occupational and 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. He was appointed to the American Thoracic

Society (ATS) Committee to update the 1986 ATS statement on "the diagnosis of non-malignant diseases related to asbestos." He is a coeditor for the Second Edition of the Textbook of Occupational and Environmental Medicine (Saunders & Co). He left in 2003 to go into private practice.

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 projects include studies aimed at 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.

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 occupational exposure assessment, ergonomics, and program evaluation. Ms. Camp, a certified industrial hygienist and certified occupational health nurse, is past president of the Pacific Northwest Section of the American Industrial Hygiene Association and the Washington State Association of Occupational Health Nurses.

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 pesticides on brain cells, and studies on genetic predisposition to neurotoxicity. He has published more than 200 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 current research interests primarily involve noise-induced hearing loss and the utility of workers' compensation data for research and intervention purposes. Past research includes neuropsychological consequences of occupational chemical exposures, particularly organic solvents, carpal tunnel syndrome, 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 past 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 the Center for Child Environmental Health Risks Research. Her long-range aim is to identify biochemical and molecular mechanisms of developmental and reproductive 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 and metals such as lead and methylmercury. Recently, she chaired a National Academy of Sciences (NAS) panel that developed approaches for incorporating new genomic, molecular, and developmental biological findings into risk assessment. She is an elected fellow of the American Association for the Advancement of Science and the Society of Risk Analysis. Dr. Faustman has published more than 90 papers in peer-reviewed journals and 25 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 (PNASH) Center, one of ten such centers supported by the National Institute for Occupational Safety and Health (NIOSH). 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 Environmental Protection Agency (EPA) Science Review Board for pesticide science policy, an advisor to the National Cancer Institute's Agricultural Health Study, and a member of the Institute of Medicine/NAS Committee to Review the Health Effects in Vietnam Veterans of Exposure to Herbicides.

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 (L&I). 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 program. His research specialties include environmental sanitation practices in public health agencies, environmental health planning and management, and workforce education and development. Another interest is the collection, treatment and disposal of community wastewaters.

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 office workers' 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 a professor in the Environmental Health 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, and exposures and effects of arsenic in drinking water, diet, and soil.

Joel Kaufman, MD, MPH, is associate professor and director of the 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: occupational and environmental factors in cardiovascular disease; epidemiology of occupational and environmental asthma; and surveillance and prevention of occupational illnesses and injuries, including lead poisoning and occupational skin disorders. He is past-president of the Northwest Association of Occupational and Environmental Medicine. He directs a research facility studying health effects of diesel exhaust, focusing on cardiovascular and pulmonary effects, and an epidemiological study of cardiovascular disease and air pollution.

Terrance J. Kavanagh, PhD, is a professor and director of 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 enzymes involved in its synthesis 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 director of the Occupational and Environmental Medicine residency program and the graduate program coordinator for our department. He joined the faculty after serving as project epidemiologist for CARE in Nicaragua, where he supervised health surveillance and development activities related to pesticide exposures and biological monitoring. His activities pertain to studies of agricultural and international occupational and environmental health and safety. He is co-director of the PNASH Center. He is also director of the International Scholars in Occupational and Environmental Health.

John Kissel, PhD, is an associate professor and director of the Environmental Health program. His research interests include pathways of human exposure to environmental contaminants in environmental media. 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 was president of the International Society of Exposure Analysis in 2002-2003. He has authored or coauthored about 30 papers in peer-reviewed 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 80 peer-reviewed journal articles, and directs the EPA particulate matter research center.

L.-J. Sally Liu, ScD, is an associate professor in the Environmental Health program. She earned her doctorate in 1994 from Harvard University's School of Public Health and has published more than 20 papers in peer-reviewed journals and several book chapters. Her research interests include air pollution exposure assessment in susceptible populations, risk assessment, and air pollution epidemiology. She is the principal investigator of several exposure assessment projects focusing on assessing hazardous air pollutants exposure and health effects among high-risk subpopulations in the Northwestern United States.

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 journals.

John Scott Meschke, PhD, is an assistant professor in the Environmental Health program, specializing in pathogens in the environment. He earned his doctorate in environmental microbiology from the University of North Carolina-Chapel Hill. His research focuses on environmentally transmitted pathogens, sampling and analysis methods, environmental fate and transport, quantitative microbial risk assessment, and engineered controls. He is involved in studies on the recovery and disinfection of a variety of Noroviruses on surfaces and the development of microarray-based methods for characterization of viruses.

Lee Monteith, MS, is a senior lecturer emeritus in the Industrial Hygiene and Safety program. He is a certified industrial hygienist, a member of the Air Sampling Instruments Committee of the American Conference of Governmental Industrial Hygienists (ACGIH) and the Gas and Vapor Detection Systems Committee of the AIHA, 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. He is author of two chapters in *Air Sampling Instruments for Evaluation of Atmospheric Contaminants*.

Michael S. Morgan, ScD, is a professor in the Industrial Hygiene and Safety program. He holds adjunct appointments in Civil Engineering and Chemical Engineering. 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 ACGIH. 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 and currently serves as editor-in-chief of the journal *Occupational and Environmental Hygiene*.

Sharon L. Morris is a senior lecturer in the Occupational and Environmental Medicine program and our department's assistant chair for community outreach. Her research interests include occupational safety and health policy and program evaluation, and she directs our department's Policy Analysis and Program Evaluation Initiative. She is involved in a study to evaluate the implementation of the Washington state ergonomics rule. She served on the Board of Scientific Counselors of the National Institute for Occupational Safety and Health; the Innovations Task Force of the Washington state L&I; and the Governor's Industrial Safety and Health Advisory Board, among other committees.

Curtis J. Omiecinski, PhD, was a professor and director of the Toxicology program, and an adjunct professor in the Department of Pharmacology. His research program in molecular toxicology focused on genetic factors and regulatory mechanisms that underlie susceptibilities of individuals to toxic effects associated with chemical exposures. 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. In the summer of 2003, Dr. Omiecinski left the UW to take the H. Thomas and Dorothy Willits Hallowell chair in the Department of Veterinary Sciences at Pennsylvania State University. He continues to serve as an affiliate professor in our department.

Mansour Samadpour, PhD, was an assistant professor in the Environmental Health program. His research 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. He left the UW in 2003 to pursue private interests.

Noah S. Seixas, PhD, is a professor in the Industrial Hygiene and Safety program. Dr. Seixas is a certified industrial hygienist and a member of the editorial board of the *American Industrial Hygiene Association Journal.* His interests are in the quantification of exposure for occupational epidemiology, and development of biologically relevant exposure metrics. His research efforts include a prospective study of noise-induced hearing damage among construction workers, assessment of irritant gas exposures during aluminum smelting, 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.

Christopher Simpson, PhD, is an assistant professor in the Industrial Hygiene and Safety program. His research interests involve the application of analytical chemistry to the development and application of analytical methods for assessment of human exposure to toxic chemicals in the workplace and the environment. Active research areas include development of biomarkers of exposure to wood smoke and diesel exhaust, use of organic molecular tracers for measurement and source apportionment of particulate air pollution, and measurement of biomarkers for reactive oxygen and reactive nitrogen species associated with exposure to particulate air pollution.

Charles D. Treser, MPH, is a senior lecturer in the Environmental Health program. His interests include administrative law and process applied to environmental health, and vector control and housing. He works with the Northwest 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 has also participated in a national effort to revise the basic housing inspection manual for environmental health practitioners. He is a past president of the Association of Environmental Health Academic Programs (AEHAP), and principal investigator on a cooperative agreement between AEHAP and the Centers for Disease Control (CDC) National Center for Environmental Health, designed to improve environmental health practice through promoting and strengthening environmental health academic programs.

Gerald van Belle, PhD, a professor in the Environmental Health program (joint with Biostatistics), was department chair from 1990 to 1998. His research specialties include design of experiments, data characterization, and analysis with emphasis to neurodegenerative diseases and environmental studies. He also studies the effects of air pollution on health, particularly the link between daily fluctuations in air pollution levels and morbidity and mortality statistics. A current interest is the investigation of characteristics of cognitive tests in neurodegenerative diseases by means of item response modeling. He is the author or coauthor of more than 100 papers and several books, including *Statistical Rules of Thumb* (2002). He serves on the External Scientific Advisory Committees of the National Environmental Respiratory Center, the Harvard Particulate Matter Research Center, and the University of Southern California NIEHS Center. He is also a member of the Food and Drug Administration's Peripheral and Central Nervous System Drug Advisory Committee.

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 additional 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 is founding president 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 an associate professor in the Toxicology program. She has published 38 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 (rotenone, chlorpyrifos) on apoptosis. Abnormal apoptosis has been implicated in various diseases, such as cancer, autoimmune disorders, Huntington's disease, Parkinson's disease, Alzheimer's disease, and stroke. Dr. Xia's research has been supported by the Sheldon Murphy assistant professor endowment and National Institutes of Health (NIH) grants. She is also a recipient of the Burroughs Wellcome new investigator award.

Michael G. Yost, PhD, is a 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 and the ACGIH. He is developing new tools for exposure assessment, such as Optical Remote Sensing (ORS) methods that use electromagnetic radiation (lasers, UV, visible, or infrared light) to rapidly identify and measure contaminants. He founded and directs the optical remote sensing lab, which is engaged in several research projects that apply these tools to environmental monitoring problems.

Joel Levin and Mary Levin; inset: Courtesy of Richard Gleason

Aerial view of Lake Washington and the UW Health Sciences complex where our department's administrative offices and many laboratories are located

inset: Richard Gleason, part-time lecturer, teaching a continuing education course

FACULTY EMERITUS

Peter Breysse, MPH, *Associate Professor Emeritus*

Lee Doolittle, PhD, *Associate Professor Emeritus*

Stanley Freeman, MS, *Senior Lecturer Emeritus*

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)*

Maurice Robkin, PhD, *Professor Emeritus*

John Wilson, MD, ScD, *Professor Emeritus*

PART-TIME AND VISITING FACULTY

Theo Bammler, PhD, *Acting Instructor*

Tania Busch, MPH, REHS, *Acting Instructor*

Richard Gleason, MSPH, *Lecturer*

Vincent Gregory, *Visiting Lecturer*

Rolf Hahne, PhD, *Lecturer*

David Lenning, *Lecturer*

Crispin Pierce, PhD, *Lecturer*

Kate Stewart, MS, *Lecturer*

POSTDOCTORAL FELLOWS

Nilo Arnaiz

Michelle Braun

Sanders Chai

Sandra Chang

Paul Darby

Shih-Ling Hsuan

Wan-Fen Li

Lidong Lu

Brian Thompson

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*

David Bonauto, MD, MPH, *Clinical Instructor Washington state Department of Labor and Industries*

Rosa M. Borders, MD, *Clinical Assistant Professor Hanford Environmental Health Foundation*

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

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

William Brady, MD, MPH, *Affiliate Assistant Professor Hanford Environmental Health Foundation*

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

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*

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*

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

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

Pamela Girres, MD, MPH, *Clinical Assistant Professor Group Health Permanente, Tacoma*

Barb Brooner

Kate Stewart, part-time lecturer, addresses a safety meeting at Lease Crutcher Lewis construction company

Angelika Grossman, DVM, *Affiliate Associate Professor Zymogenetics Inc.*

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

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

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

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 Professor*
The Boeing Company

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

Curt Omiecinski, PhD, *Affiliate Professor*
Veterinary Science, Pennsylvania State University

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

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

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

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

Larry Smick, DO, MSPH, *Clinical Assistant Professor,*
Hanford Environmental Health Foundation

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

Michael Weiss, MD, MPH, *Clinical Assistant Professor,*
St. Luke's Regional Medical Center, Boise, Idaho

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

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

Erika Abel (left) and Jing Shao (right) receiving their PhDs in Toxicology at commencement 2003

Joel Levin

selected publications

JULY 2001–JUNE 2003

This list includes books, book chapters, articles, and reviews in professional journals. It excludes letters, technical reports, or conference presentations. Departmental investigators are bold-faced.

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Research Scientist Paola Costa-Mallen photographs a DNA gel as part of the Parkinson's disease project

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