



The State of the Institute

ENVIRONMENTAL AND
OCCUPATIONAL
HEALTH SCIENCES
INSTITUTE

EOHSI is jointly sponsored by the University of Medicine and Dentistry of New Jersey - Robert Wood Johnson Medical School and Rutgers, The State University of New Jersey.



The State of the Institute

positioned for the new millennium

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PREFACE

In 1986, the Environmental and Occupational Health Sciences Institute (EOHSI) was conceived as an interdisciplinary research institute to address environmental issues of significance to New Jersey, the nation and the world. During the past fifteen years, the Institute has experienced remarkable growth. Its mission encompasses scientific research, training of health professionals, and communication of findings to professional and lay groups. Activities of the Institute will be of value this century since environmental problems will be more complex and will require a multidisciplinary approach to address them. The membership, recognizing that fifteen years have passed and that much has been accomplished, elected to prepare a State of the Institute document. It describes the organization of EOHSI, and highlights its research and educational programs. It also emphasizes the considerable impact the Institute has had on environmental health issues and points to future directions in its research programs.

Through its scientific and scholarly efforts EOHSI has learned that it is only through a multidisciplinary approach to research and its applications that environmental problems can be solved or prevented. This approach needs to include the ideas of researchers as well as those of stakeholders so that all aspects of an issue can be considered and adequate steps taken to prevent or eliminate future concerns. The members of the Institute recognize that the successes, strengths and unique contributions of EOHSI to environmental health problems result from the integration of laboratory science with applied research and outreach programs.

As the new millennium begins, EOHSI has decided to look back on its successes and achievements. By whatever metric one selects – quantity of publications external funding, member recognition, member influence on policy at the State and National levels, the Institute has been highly productive and competitive. Some of the major achievements include a National Institute of Environmental Health Sciences (NIEHS) Center of Excellence; a U.S. Department of Energy Consortium for Risk Evaluation with Stakeholder Participation (CRESP); an Environmental Protection Agency Modeling Center; an EPA/NIEHS Center for Childhood Neurotoxicology and Exposure Assessment; an NIEHS Worker Education Center; an NIEHS Training Grant in Toxicology, a NIOSH Occupational/Environmental Medicine Residency Training Grant; and a University based Exposure Measurement and Assessment Research and Training Program.

The Institute has also used this opportunity to look ahead and begin to position itself for the future. EOHSI's multidisciplinary approach continues to be particularly of value in responding to the challenges of the new millennium. Some of these challenges include the growing fields of toxicogenomics and bioinformatics which help to gain a better understanding of the interaction between the environment and the human genome, and the need to address issues on the impact of environmental agents on the health of our children and other members of the population who are at greater risk to disease. A truly collegial multidisciplinary approach must be maintained in order to successfully respond to the inevitable new and highly complex environmental challenges of the future.

The development of EOHSI was directly related to the concerns of the people of New Jersey for the impact of chemicals and radiation on their health. During the late 1970's and early 1980's the explosions at the Rollins Waste Disposal site, the discovery of radon in Montclair of dioxin as an environmental pollutant in the Iron Bound district of Newark, and the fire at the Chemical Control Site in Elizabeth thrust hazardous environmental pollutants into national awareness. Then Representative Jim Florio of New Jersey authored the CERCLA legisla-

EOHSI is organized into six interdisciplinary divisions

The Environmental Health Division conducts a variety of research and teaching activities involving field, ecological and epidemiological studies of the effects of exposures to chemical and physical agents, with a major focus on public health.

The Environmental Policy Division provides expertise in economics, land use, risk communication, risk management, children's health and other disciplines relevant to environmental policy issues.

The Exposure Measurement and Assessment Division examines environmental health issues through laboratory research and field studies on a variety of toxic compounds, and by developing models and modeling frameworks to estimate exposure and dose.

The Occupational Health Division studies the complex interrelation between health and work and provides a comprehensive program to prevent work-related illnesses.

The Public Education and Risk Communication Division provides information to the public, school children, teachers, employees and health professionals to advance environmental and occupational health literacy.

The Toxicology Division conducts research on significant biological problems in modern toxicology with a particular emphasis on defining the mechanisms by which chemical and physical agents produce adverse effects in humans.

tion (known as Superfund) patterned on New Jersey's Spill Fund, making New Jersey the centerpiece for both the problems and the response to environmental pollution. In response to the growing concerns about envi-



EOHSI MEMBERS PUBLISH OVER 500 PAPERS A YEAR IN PEER REVIEWED AND POPULAR JOURNALS.

ronmental and occupational health threats, Rutgers University and the University of Medicine and Dentistry of New Jersey (UMDNJ) came together and fostered the development of joint programs in toxicology, public health and exposure assessment. Governor Tom Kean, during his State of the State address in 1986, proclaimed the establishment of the Environmental and Occupational Health Sciences Institute (EOHSI) as a tool to help meet the needs of the state in dealing with the adverse health impacts of environmental agents.

It was the intent of the EOHSI membership to achieve a level of scientific accomplishment which would earn the award of a National Institute of Environmental Health Sciences (NIEHS) Center of Excellence. An NIEHS Center would establish EOHSI as one of the country's leading academic environmental health research facilities. Dr. David Rall, then Director of NIEHS, indicated that if most of the faculty could be united under one roof the Institute would be eligible to compete for NIEHS Center status under the rules of that era. The need for a building in which to house the Center convinced the two universities to go forward with construction of EOHSI's 75,000 square foot state-of-the-art building.

The program was designed to meet the needs of a broad based effort which emphasized basic research, interdisciplinary projects and community outreach as the foundation of the Center. The NIEHS Environmental Health Sciences Center serves as the scientific engine that drives the research of EOHSI. The Center continues to expand and to modify its

configuration to most successfully address the significant environmental health research questions of our time. The Center is comprised of four research cores and the Community Outreach and Education Program. The Cores include: Core I – Environment-Gene Interactions; Core II – Environmental Effects on Signal Transduction; Core III – Neural and Developmental Toxicology; and Core IV – Exposure Analysis and Health Effects.

The NIEHS Environmental Health Sciences Center was the first NIH Center of Excellence in New Jersey and until recently was one of only two NIH-designated Centers of Excellence in New Jersey, the other being the Cancer Institute of New Jersey. EOHSI is now home to a newly designated NIEHS/EPA Center for Childhood Neurotoxicology and Exposure Assessment. The theme of the new Center is the influence of exposure to

neurotoxicants on a child's neurological health and development, with a specific focus on autism and related learning disabilities.

In addition to the growth of environmental research, a number of graduate education programs evolved during the formative years of EOHSI. In 1981 the Joint Graduate Program in Toxicology, was the first of the five graduate programs developed cooperatively by EOHSI faculty from both Rutgers and UMDNJ. Following the model of the Toxicology Graduate Program, jointly sponsored by the two universities, a joint Graduate Program in Public Health was formed. Two additional graduate programs, the Occupational and Environmental Medicine Residency Program, one of 25 nationwide, and the Joint Doctoral Program in Exposure Assessment, the first such program in the United States, followed. In 1998, the Graduate Program in Public Health became the nucleus of the UMDNJ-School of Public Health.

TO DATE, OVER 78,000 STUDENTS
HAVE BEEN IMPACTED BY EOHSI'S
ENVIRONMENTAL HEALTH
EDUCATION CURRICULUM.



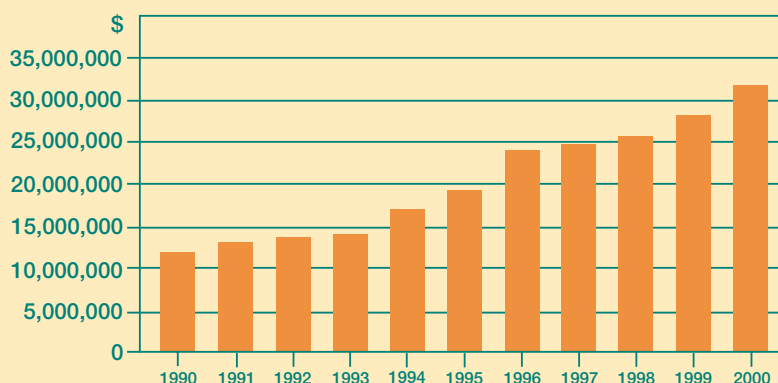
RESEARCH PROGRAMS

Since its establishment in 1986 EOHSI has evolved into one of this nation's leading environmental health institutions. In 1997 EOHSI performed a benchmark exercise of its peers evaluating larger academic programs in human environmental health sciences (Goldstein, Robson and Botnick 1998). These programs are located at schools of public health and at other institutions that also have NIEHS Centers of Excellence. The largest programs were those in which there was both an NIEHS center and a public health graduate education program. This suggests that there is synergy between environmental health sciences research and involvement in public and community health. In a comparison of the 16 institutions with NIEHS environmental health centers, five of which are associated with an accredited school or program of public health, EOHSI's external funding was double the average received by its peers.

With over \$31 million dollars in extramural funding a year, EOHSI is one of the leading environmental health programs in the country. EOHSI continues to be successful in obtaining external funding for its programs. Over the last ten years, EOHSI's extramural funding has tripled. The majority of the Institute's funding comes from federal agencies while monies are also received from state agencies, as well as the industrial and non-profit communities.

The Institute's researchers are at the forefront of the protection of environmental and human health. For example faculty have been studying ozone, dioxin, pesticides, benzene, groundwater, air pollution, Gulf War health issues, the relationship between the workplace and human health, and heavy metal issues for numerous years. They have conducted some of the seminal research in the areas of exposure assessment, risk assessment and chemical sensitivities. The Institute has also been a leader in the development of environmental health education curricula. In addition, EOHSI members are often called upon to assist with some of the more challenging environmental issues on the local, state, national and international levels.

EOHSI Extramural Funding 1990-2000



Divisions of EOHSI

Through its multidisciplinary approach, EOHSI's six divisions work collegially to tackle some of the most difficult issues. The six divisions of EOHSI are Environmental Health, Environmental Policy, Exposure Measurement and Assessment, Occupational Health, Public Education and Risk Communication and Toxicology.

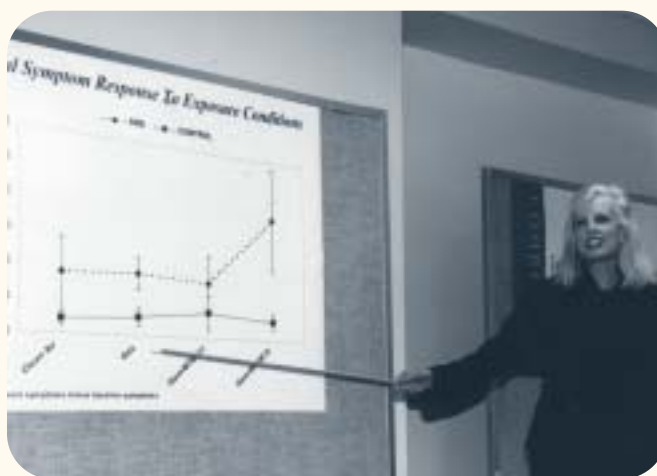
The efforts of the **Environmental Health Division** have focused on the impact of exposure to environmental toxins such as dioxins and lead, as well as exposure of humans through consumption of fish and wildlife. Division researchers are also involved in evaluation of possible health effects of electromagnetic fields and analysis of disease clusters. This latter work has involved the development, review and application of novel methodologies in epidemiology and risk assessment, with special emphasis on geographic patterns. One focus has been on the use of geographic information systems (GIS) to address problems that otherwise are intractable. Two funded applications of this approach being investigated are: (1) designing an epidemiology study for a rare disease with a rare exposure, using childhood leukemia and residential magnetic fields as a model; and, (2) analysis of national data at different scales and in different regions of the country, using childhood lead screening policy as a model. In the 1990's ecological risk assessment emerged as an important new discipline. The Environmental Health Division has played a key role in developing new methodologies and approaches, incorporating some of the techniques used in human health

assessments. The development and evaluation of bioindicators has been important, both to reflect impacts on ecosystems and on humans who consume portions of those ecosystems (fish and game). This has focused on a suite of heavy metals that are widespread in the environment, some of which show biomagnification in aquatic food chains. Research has evaluated the risks to people engaged in recreational and subsistence fishing, particularly with regard to mercury, PCBs and dioxin, and a variety of risk assessment approaches have been used to assess the combined impact of mercury, cesium and strontium.

Other work of the Environmental Health Division has examined some of the assumptions underlying quantitative risk assessment and their implications, critiques of the methods for the study of reported disease clusters, and a historical cohort study of nuclear workers. Substantively, work has focused mainly on cancer, with exposures including passive smoking, solvents, and magnetic fields. Future research will continue to investigate methodologic issues with a focus on geographical issues. As the use of GIS becomes more commonplace, the need to appreciate its strengths and limitations grows. Issues in disease mapping will be investigated and statistical methods will be adapted to use in other contexts, such as prospective surveillance and multivariate analysis, for application to geographic problems. Interest is also increasing in the use of scientific information in the development of public health policy.

Research within the **Environmental Policy Division** is focused in the areas of land use related to public health, the management of hazards, and public health goals for minority populations. Division faculty have diverse interests and backgrounds and they often combine their expertise

to evaluate public policy regarding environmental and occupational health issues. This division provides an essential social science aspect to EOHSI and is a major contributor to the unique breadth of the Institute. Faculty within this division have taken the national lead in research identifying associations between public concerns about the environment and neighborhood quality. Other areas of focus include environmental justice, pollution prevention and children's and women's health.



EOHSI FACULTY MEMBERS HAVE CONDUCTED SOME OF THE SEMINAL CONTROLLED HUMAN EXPOSURE STUDIES

Research on public health challenges to poor urban populations has been important and has linked the work of the Environmental Policy Division with other EOHSI divisions. The division has been a major contributor to the issue of Brownfields redevelopment and how future land use decisions impact

current risk management decisions. In addition to troubled urban areas, the division has examined issues of re-development of former nuclear weapons sites in the Department of Energy Complex, examining how the sites have influenced the economy of regions and how remediation and decommissioning of sites may affect both the health and economic well-being of neighboring regions.

Investigators within the **Exposure Measurement and Assessment Division** have pioneered research in basic and applied science aspects of human contact with exposure to environmental toxins. Laboratory research and field studies have been conducted on a variety of environmental toxins in the air, land and water. The division and its members have taken leadership roles in national and state programs, particularly those which have combined basic evaluation of human exposure to environmental pollutants with atmospheric and pharmacokinetic modeling. Examples of collaborative research with other divisions include: the evaluation of methyl-tert butyl ether (MTBE), indoor air health effects and diesel health effects with members of the Occupational

Health Division; the development of a training video on dust reduction methods with members of the Public Education and Risk Communication Division; and evaluation of the relationship between air pollutants and lung function with members of the Toxicology Division. Inter-institutional collaborations have included the National Human Exposure Assessment Survey (NHEXAS) with US EPA, Research Triangle Institute, and the University of Minnesota; the Indoor, Outdoor and Personal Air study on residential exposure to volatile organic compounds and particulates with the University of Texas and UCLA; and the Rio Bravo Children's Pesticide Exposure Study with Texas A&M University. It is expected that future work of the Exposure Measurement and Assessment Division will continue to build on its strengths of basic exposure assessment using environmental sampling, biomonitoring, and observational methods and advanced modeling methodologies. This work will continue the trend of community-based research, applying exposure measurement, assessment, and modeling to issues with major policy implications. These include studies of children's exposure to a wide range of environmental contaminants, identifying environmental and behavioral contributions to exposure and disease, and developing validated models that describe and predict exposure on many levels.

The focus of the multidisciplinary **Occupational Health Division** is understanding the relationship between human health and the workplace environment. The division studies the complex interrelation between health and work and provides a comprehensive program to prevent work-related illnesses. The approach is multidisciplinary with a core of physicians, nurses and psychologists who interact closely with health educators, industrial hygienists, exposure analysts, and toxicologists. Research is broadly oriented around exploring human health endpoints related to both occupational, and lower environmental levels of exposure. The traditional interests of the founding faculty of this division have been in chronic health effects of heavy metals and dioxins, as well as occupational lung disease. However, almost unique among occupational health programs nationally, is the more recent activity of this division which has broadly focused on medically unexplained symptoms as health outcomes (e.g., sick building syndrome, multiple chemical sensitivities, Gulf War Illness). These are explored as consequences of exposures

including indoor air pollution, ambient environmental exposures, MTBE, and diesel emissions. Research paradigms for exploring these unusual topics include both survey research, clinical observational studies, and blinded controlled exposures.

Other research areas include ergonomics, unique risks to health care workers and farmers, utility of medical monitoring examinations in different settings, and investigating hitherto unknown causes of environmental and occupational diseases. There has been a major emphasis on neurodevelopmental effects of methylmercury and lead, as well as on the applications of new risk assessment methodologies.



FACULTY REGULARLY MEET WITH SENIOR GOVERNMENT OFFICIALS. PICTURED HERE - DR. KENNETH OLDEN, DIRECTOR OF NIEHS (LEFT)

Part of what has made EOHSI so successful is its ability to translate the science for use by the public. In addition, EOHSI feels that it is important, when appropriate, to include the community before, during and after the research is conducted.

The primary goal of the **Public Education and Risk Communication Division** is to enhance environmental and occupational health literacy worldwide through educational initiatives. It realizes this goal by providing accurate, unbiased information about environmental and occupational health risks; developing educational tools that help people make health promoting decisions about the environment, individually, and at the workplace, school or community level; and providing training to upgrade job skills related to occupational health and safety. EOHSI's education outreach initiatives, designed to educate school children, are considered one of

the leaders in the country and a model for programs that have been developed at other institutions. The division has developed model evaluation mechanisms to analyze participants diverse demographic backgrounds and training success.

Members of the Public Education and Risk Communication Division have developed one of the nation's largest worker training programs, the Centers for Education and Training, that has been responsible for the training of more than 200,000 workers. They have also developed innovative approaches to K-12 education resulting in new curricula and in the training of thousands of teachers from around the country and overseas. These science-based educational curriculum materials are multidisciplinary and embrace environmental health as a comprehensive framework for learning in all academic areas and foster the development of critical thinking, problem-solving and decision making skills. Since inception, over 3,900 educators nationwide and overseas, impacting on approximately 78,000 students, have participated in the division's environmental health education programming. These educators include professionals in 27 states and Ghana, West Africa.

During the past two decades the **Toxicology Division** of EOHSI has made major contributions to the understanding of basic mechanisms underlying toxic responses to environmental chemicals. The success of the division is due in part to the collaborative interaction among the division's members, and with researchers throughout EOHSI. The Toxicology Division is the largest within the institute and its research focus diverse. This includes, but is not limited to, cell and molecular toxicology, cell signaling, immunotoxicology, neurotoxicology, carcinogenesis, chemoprevention and drug metabolism, developmental biology, and genetic polymorphisms. Major advances in our understanding of the adverse health effects of toxicants such as benzene have been made by researchers in the Toxicology Division. Another important emphasis has been on the mechanisms of dioxin toxicity. This work is a follow up to the important discoveries made by the division on the relative lack of bioavailability of dioxin found in soils surrounding a waste site in Newark, NJ. This was a seminal study in establishing the importance

of understanding bioavailability to risk assessment. Investigators within the Toxicology Division were also the first to demonstrate that cellular components of the immune system can contribute to tissue injury. This research has changed the way toxicologists view chemically induced tissue injury.

The National Cancer Institute has awarded a program project to members of the Toxicology Division entitled "Inhibition of Carcinogenesis by Tea and Tea Constituents." During this 5 year project researchers will conduct systematic studies on the molecular mechanisms by which tea constituents inhibit skin and lung carcinogenesis. The molecular mechanisms will be investigated both in cell lines and animal models. The bioavailability and bio-transformation of the tea constituents will also be studied in animal models and humans. A key approach is to integrate these studies to obtain mechanistic information that will be useful for the prevention of human cancers.



TOXICOLOGY DIVISION MEMBERS PROVIDE MUCH OF THE INSTITUTE'S BASIC SCIENCE RESEARCH.

Working together, several members of the Toxicology Division also demonstrated that nitric oxide is a critical mediator of chemically-induced toxicity. The importance of this work was recognized by the National Institute of Environmental Health Sciences (NIEHS) through the awarding of a five year Program Project grant. Identification and characterization of patterns of gene expression reflecting host responses to environmental exposure is also a major focus of much of the future research of Toxicology Division. Thus, new and developing technologies in genomics and proteomics are essential for the continuing success of toxicology researchers.

Highlights of EOHSI Research By Division

Environmental Health Division

- Lead Exposure
- Exposure of Humans to Contaminants Through Consumption of Fish and Wildlife
- Analysis and Interpretation of Disease Clusters
- Health Effects of Low Level Electromagnetic Fields
- Exposure to Dioxins and Its Health Consequences

Environmental Policy Division

- Environmental Risk and Neighborhood Quality
- Environmental Justice
- Brownfields Redevelopment
- Children's and Women's Health
- Economic and Land Use Impacts of the Closing of the U.S. Department of Energy's Former Nuclear Weapons Sites and the U.S. Department of Defense's Chemical Weapons Sites

Exposure Measurement and Assessment Division

- Indoor and Outdoor Air Pollution Exposure Studies
- Ozone Exposure and Health
- Development of a Theoretical Framework for Exposure Analysis
- Studies on Chromium in New Jersey
- Studies on Children's Exposure to Lead
- Studies on Children's Exposure to Pesticides
- Methyl Tert Butyl Ether (MTBE) Field and Controlled Exposure Studies
- Studies on Water Quality and Groundwater Contamination
- Studies on Asbestos Exposure from Quarries in New Jersey

Occupational Health

- Investigation of the Relationship Between Medically Unexplained Symptoms and the Environment
- Investigation of the Neurobehavioral effects of Neurotoxicants
- Neurodevelopmental Effects of Heavy Metals
- Studies of Agent Orange
- Human Hematologic Health Effects of Benzene
- Reactive Airways Disease
- Medical Surveillance for Hazardous Waste Workers and Communities
- Clinical Evaluation of Hudson County Chromium-exposed Populations
- Asbestos (Pneumoconiosis) Screening Program

Public Education and Risk Communication Division

- Worker Training
- K-12 Environmental Health Education
- Community Outreach and Education
- Measuring Hispanic Urban Neighborhood Perceptions of Risk

Toxicology Division

- Advances in Understanding the Adverse Health Effects of Benzene
- Studies on Dioxin
- Studies on Diet and Cancer
- Studies on Psoralens
- Neurotoxicology
- Studies on Cytochrome P-450
- Studies of Inflammatory Mediators and Cell Toxicology
- Development of Animal Model Systems
- Studies on Signal Transduction

Specialized Centers and Facilities

The driving force underlying much of EOHSI's scientific research is its **National Institute of Environmental Health Sciences (NIEHS) Center for Environmental Health Sciences**. The Center is one of the twenty-one NIEHS Centers of Environmental Health Sciences across the nation. The Center strives to understand, detect, prevent and solve environmental health problems through collaborative research.

Three major initiatives have recently been supported by the Center: microarray/bioinformatics; diet and cancer prevention; and susceptibility to disease through gene-environment interaction. Researchers are also investigating the roles signal transduction and structural biology play in the understanding of toxic responses involving gene-environment interactions. In addition to the microarray initiative, a major effort has been made to establish a project in diet and cancer prevention. The Center has provided funding to establish a susceptibility markers program that encompasses researchers from various disciplines. The thrust of this program is to understand the role gene-environment interaction plays in susceptibility and disease manifestation.

Working with the local community has been a major focus of the NIEHS Center through its Community Outreach Education Program (COEP) and the Institute. As a result of EOHSI'S involvement with New Jersey communities researchers have been asked to collaborate with colleagues in other parts of the country. Members have

engaged in environmental justice efforts in cooperation with colleagues in Alabama and the Texas-Mexico border, studies of benzene exposure in Valdez, Alaska and studies of hazardous waste problems in Puerto Rico.

Our newest center, the **Center for Childhood Neurotoxicology and Exposure Assessment** is funded by NIEHS and the US EPA. The objective of this \$5 million/five year center is to detect, understand, and prevent environmental health problems as they relate to children. The Center will conduct three projects. One will be to study each aspect of brain development from early neurogenesis through the examination of the complexities of animal behavior. A clinical project will involve studies of children with learning disabilities and their families with the aim of seeking a possible environmentally determined alteration in gene function leading to autism. An exposure assessment component will determine the extent to which learning-disabled children are exposed to neurotoxicants in their environment.

As the result of a national competition in 1995, the Department of Energy (DOE) awarded a five-year, \$30 million cooperative agreement to the **Consortium for Risk Evaluation with Stakeholder Participation (CRESP)**. In 2000, CRESP was renewed for \$35 million over another five years. CRESP is headquartered at EOHSI and its major academic partner is the University of Washington School of Public Health and Community Medicine in Seattle.

CRESP was created specifically to develop a credible strategy for providing the information needed to improve risk-based compliance requirements for the clean-up of

EOHSI's Specialized Centers and Facilities

- NIEHS Center for Environmental Health Sciences
- NIEHS/ EPA Center for Childhood Neurotoxicology and Exposure Assessment
- Analytical Center
- Centers for Education and Training
- Clinical Center for Environmental and Occupational Health
- Controlled Environment Facility
- Computational Chemodynamics Laboratory
- U.S. Dept. of Energy Consortium for Evaluation with Stakeholder Participation
- EPA Center for Exposure and Risk Modeling
- NIOSH Resource Center
- Ozone Research Center
- International Environmental Health Center

complex contaminated environments, especially those for which the U.S. Department of Energy (DOE) is responsible. CRESP work is recognized to enrich the scope and substance of information needed for risk evaluation and to validate the database for systematically assessing present and future risks, especially those associated with management and restoration options at DOE sites. CRESP has three fundamental commitments: 1) to draw upon stakeholders throughout its work for definition and redefinition of priorities and evaluation of technical data; 2) to combine human health and ecosystem impacts with a consideration of social, cultural and economic values in a risk-based decision process at each site; and 3) to work actively and collegially with all other organizations whose skills and capabilities can contribute to the better definition, understanding, and reduction of these risks.

The **Center for Exposure and Risk Modeling** draws upon research that was started at EOHSI in 1992, with initial peer reviewed funding from the Agency for Toxic Substances and Disease Registry (ATSDR). This Center funded by the EPA is one of only two nationwide. It involves faculty from UMDNJ-Robert Wood Johnson Medical School, Rutgers University, Princeton University and Harvard University. The Center's goal is to develop a Modeling Environment for Total Risk Studies, called MENTOR. It involves the design of mathematical models, which can predict how communities and individuals experience exposures that can lead to adverse health effects from environmental chemicals and other toxic agents. The mathematical models being developed will help scientists determine the scope and seriousness of exposure to an environmental contaminant by representing: total human exposure for individuals, populations and specific high-risk populations; source-to-dose relationships for determining the impact on risk of a contaminant or toxic agent; and spatial scales from geographic regions to residential, occupational and personal microenvironments.

Through the **Computational Chemodynamics Laboratory**, state-of-the-art computational models have been developed to estimate exposures and doses. Currently this laboratory supports the activities of three research centers at EOHSI: The **Ozone Research Center**, funded by USEPA and NJDEP, provides a unique capability to perform source-to-dose modeling and population exposure assessments for gaseous photochemical air



RESEARCHERS IN EOHSI'S ANALYTICAL CENTER CONDUCT INDEPTH ANALYSIS OF HEAVY METALS AND OTHER SUBSTANCES.

pollutants, and fine particulate matter; The **Center for Exposure and Risk Modeling**, funded by USEPA, develops and applies new computational tools for probabilistic multimedia, multiroute, multipathway exposure and dose assessments; and the CRESP Center of Expertise in Exposure Assessment, funded by USDOE, focuses on characterizing potential and actual exposures associated with the operations of USDOE nuclear facilities across the nation. Future efforts will focus on refining, testing, and applying the computational tools to a variety of problems; expanding expertise and capabilities in computational biology, currently available at the organism and organ/tissue level, to the molecular level; and expanding and applying expertise in the genomics/proteomics to areas of bioinformatics, with special focus on gene and protein expression data analysis.

The globalization of our economy has brought environmental health issues on the international level to the forefront. EOHSI has increasingly become more involved in international environmental health issues. There are collaborative studies with colleagues in China and Mexico, nascent research and training programs in Thailand and West Africa, and have hosted visiting scientists from Asia, Europe and the Middle East. This involvement includes serving on international committees, conducting research around the globe, and hosting international meetings on environmental health. To serve as a focal for all of these activities EOHSI has formed an **International Environmental Health Center**.

EDUCATION AND TRAINING AT EOHSI

As part of its mission to study and improve environmental and occupational health through scientific research, training and communication of research findings, EOHSI is home to three graduate programs and one campus location for a school.

The **UMDNJ-School of Public Health's** curriculum is designed for health practitioners or others with relevant training or experience. It is sponsored in cooperation with Rutgers University and the New Jersey Institute of Technology and in collaboration with the Public Health Research Institute. The School confers the degrees of Master of Public Health (M.P.H.), Doctor of Philosophy (Ph.D.), and Doctor of Public Health (Dr.P.H.).

The **Joint Doctoral Program in Exposure Assessment** is a collaborative effort between Rutgers University, the Rutgers Graduate Program in Environmental Science, and UMDNJ-Robert Wood Johnson Medical School. It provides a unique opportunity for students to obtain training in human exposure assessment. A Doctor of Philosophy (Ph.D.) degree is conferred by the Program.

The **Joint Graduate Program in Toxicology** provides a broad and flexible base of education in biology and chemistry which can be applied to the study of the adverse effects of chemicals on biological systems. Masters of Science (M.S.) and Doctor of Philosophy in Toxicology (Ph.D.) degrees are conferred jointly by Rutgers University and the UMDNJ-Robert Wood Johnson Medical School.

Residents in the **Occupational and Environmental Medicine Residency Program** receive a heavy emphasis on the recognition of toxic exposures in the home, community, and workplace environments of their patients. They see patients in EOHSI's Clinical Center where they encounter a wide variety of patients from those with high level occupational exposures to those with more subtle chemical exposure.

In addition to graduate education, EOHSI has taken a leading role in public education about environmental health. Our Public



STUDENTS WORK CLOSELY WITH FACULTY IN THEIR LABORATORIES.

Education and Risk Communication Division has developed one of the nation's largest worker training programs, the Centers for Education and Training, which is responsible for the training of more than 200,000 workers. It has also developed innovative approaches to K-12 education resulting in new curricula and in the training of thousands of teachers from around the country and the world.

Working with EOHSI scientists and classroom teachers nationwide, our Public Education and Risk Communication Division's history includes the development, implementation and evaluation of environmental health sciences curricular materials and teacher professional development initiatives. The award-winning science-based materials encompass inquiry-based, cooperative hands-on activities, fact sheets, videos, children's books, games and computer software.

THE IMPACT OF EOHSI

The scientists of EOHSI have been extraordinarily productive as is evident from publications and grants awarded. EOHSI members publish over 500 publications a year which appear in a variety of popular and peer reviewed journals and chapters written in a variety of popular and peer reviewed books. In addition, several EOHSI members have published books in their discipline. It is clear that while the members of EOHSI have made major contributions to the scientific literature, the real strength of EOHSI research has been the ability to link results from basic science studies to the prediction of a potential population at risk.

EOHSI combines emphasis on toxicology and exposure assessment with policy and outreach to stakeholders. There is a major emphasis on understanding the toxicity of chemicals and the pathways of exposure in the home, community, and workplace environments through air, water, soil, and food. In addition to providing expertise to assess risks and implement hazard reduction.

The NIEHS Center and CRESPI are examples of programs that evolved as a result of scientists from diverse disciplines, working together to establish methods to address environmental problems. In addition, the EPA Center for Exposure and Risk Modeling and the Ozone Research Center address the science of exposure to inform public policy.



MENTORING OF STUDENTS IS AN INTEGRAL PART OF EOHSI.

Collaborations to address current environmental problems extend beyond EOHSI to include scientists from other Institutions. EOHSI's unique structure enables the Institute to call upon faculty members with a variety of expertise to work together to address problems in the areas of environmental and occupational health.

The table on the following pages provides a sample of the environmental problems addressed by EOHSI inter-divisional research projects initiated, the agencies that funded these projects, and the implications of the research completed.



Problem	Research	Agencies/Sponsors	Impact
Existing ozone standard inadequate to protect public health	<ul style="list-style-type: none"> ■ Summer camp study of respiratory function and ozone levels. ■ Animal inhalation studies of ozone toxicity. ■ Modeling of regional and national patterns of ozone dispersion. ■ Epidemiologic study of emergency room visits related to ozone levels. 	<ul style="list-style-type: none"> ■ EPA 	<ul style="list-style-type: none"> ■ EOHSI was first to recommend an 8 hr ozone standard (1987). ■ Led directly to promulgation of revised National ambient ozone standard with 8 hour averaging time. ■ Documented high ozone lowers respiratory function in healthy children and increases emergency room visits for adults. ■ Led to new State health advisories for sensitive individuals during summertime ozone episodes.
Community and commuter complaints of gasoline odors associated with methyl-tert-butyl-ether (MTBE)	<ul style="list-style-type: none"> ■ Exposure assessment for commuters. ■ Case-control study of garage workers. ■ Exposure in vehicles during refueling. ■ Blood and breath biomarkers. ■ Controlled exposure symptom prevalence. ■ Assessment of dermal and inhalation exposure from MTBE 	<ul style="list-style-type: none"> ■ NJDEP ■ EPA ■ Lyondell (ARCO) 	<ul style="list-style-type: none"> ■ Reduced reliance on MTBE for Carbon Monoxide reduction in air pollution compliance. ■ Demonstrated that gasoline is a consumer product with large potential for non-occupational exposure, hence future testing cannot be based solely on occupational risks.
Contamination of water supplies poses hazard beyond drinking water ingestion	<ul style="list-style-type: none"> ■ Multi-route exposure assessment and risk from drinking water. ■ Inhalation and dermal exposure and dose calculation for chloroform from bathing and showering. 	<ul style="list-style-type: none"> ■ EPA ■ NJDEP ■ NJDHSS 	<ul style="list-style-type: none"> ■ Influenced changes in exposure and risk assessment guidance for drinking water standards in US and Canada. ■ Advisories regarding drinking water extended to include showering and bathing.
Lead poisoning continues to be identified in NJ cities and strategies for reduced exposure needed	<ul style="list-style-type: none"> ■ Treatment of lead exposed children study. ■ Childhood lead exposure assessment research study. ■ New Jersey assessment of cleaning techniques study. ■ Developmental neurotoxicology studies in birds. ■ Examination of mechanism of toxicity focusing on cell adhesion molecules. 	<ul style="list-style-type: none"> ■ EPA ■ NICHHD ■ NIEHS ■ RWJ Foundation 	<ul style="list-style-type: none"> ■ Identified routes of exposure and simplified home cleanup procedures after demonstrating efficacy. ■ Demonstrated negligible utility of chelating children with blood lead levels in 25-40 ug/dL range. ■ Developed education strategies for families in lead contaminated dwellings. ■ Supported funding initiatives for study of metal effects on cell adhesion molecules.
Public concern over dredging and pollution of the New York-New Jersey Harbor	<ul style="list-style-type: none"> ■ Participated in EPA's Harbor Estuary program. ■ Develop reproductive indicators for avian populations as an integrator of overall estuary quality. ■ Conduct hazard and risk assessment for dredged material. 	<ul style="list-style-type: none"> ■ EPA ■ U.S. Army Corps 	<ul style="list-style-type: none"> ■ Document improved estuary quality from 1970's to 1990's. ■ Contributed to closure plans for "mud dump". ■ Required consideration of more options for dredge material disposal.

Problem	Research	Agencies/Sponsors	Impact
Report that dyes used to label food wrappers contains lead is announced	<ul style="list-style-type: none"> ■ Analysis of bread bag dyes. ■ Extraction experiment to measure bioavailability of lead in pigments. ■ Home use survey of bread-bag re-use. 	<ul style="list-style-type: none"> ■ FDA ■ EPA ■ DHHS ■ Food Industry 	<ul style="list-style-type: none"> ■ Voluntary ban on use of lead pigments for labeling bread bags.
Report of four cases of cancer among NY Giants football team attributed to Meadowlands stadium	<ul style="list-style-type: none"> ■ Review of cases. ■ Review of contaminants on site. ■ Exposure assessment for players and employees. ■ Assessed possible dermatitis related to artificial turf. 	<ul style="list-style-type: none"> ■ Meadowlands Authority ■ EPA 	<ul style="list-style-type: none"> ■ Provided reassurance that the cases did not constitute a “cluster”. ■ Documented that there was no significant exposure to carcinogens, allowing continued use of the facilities.
Concern over pesticide exposure increases with children's intimate contact with stuffed toys.	<ul style="list-style-type: none"> ■ Analysis of pesticide residues on surfaces after various applications of chlorpyrifos. ■ Analysis of videotaped behavior. ■ Availability of pesticide residues. 	<ul style="list-style-type: none"> ■ EPA 	<ul style="list-style-type: none"> ■ Led to current ban on use of chlorpyrifos for home applications.
Community near Toms River voices concern over childhood cancer	<ul style="list-style-type: none"> ■ Advise NJDHSS on design of case-control study and on statistical analysis of cluster. ■ Work with NJDEP on identification of contaminants and exposure via water. ■ Conduct exposure assessment for airborne route. ■ Peer review epidemiologic and environmental studies. 	<ul style="list-style-type: none"> ■ NJDHSS ■ NJDEP 	<ul style="list-style-type: none"> ■ Developed investigation protocol acceptable to stockholders, industry, and government. ■ Provided exposure assessment for NJDHSS case-control study.
Children identified as the major subgroup at risk from environmental exposures by the National Academy of Sciences and the Environmental Protection Agency	<ul style="list-style-type: none"> ■ Form research Center for Child and Environmental Health. ■ Study effects of PCBs and dioxins on development. ■ Study effects of neurotoxins on development. ■ Ozone impact on children in summer camps (see also childhood lead and pesticide exposure in children). ■ Passaic Asthma Reduction Effort 	<ul style="list-style-type: none"> ■ EPA ■ NIEHS ■ RWJ Foundation 	<ul style="list-style-type: none"> ■ Developed training fellowship for pediatricians and obstetricians in environmental health. ■ Methods development for studying environmental effects on children. ■ Contributed to innovation of an 8 hour ozone standard. ■ Reduced school absenteeism from asthma.
Many NJ cities grapple with the re-development of contaminated abandoned industrial and waste sites	<ul style="list-style-type: none"> ■ Develop Brownfields initiatives. ■ Risk assessment to adjust soil cleanup guidelines for lead, mercury and arsenic for residential vs commercial land uses. 	<ul style="list-style-type: none"> ■ NJDEP ■ EPA 	<ul style="list-style-type: none"> ■ Assisted EPA in developing a progressive Brownfields program. ■ Advanced land redevelopment policy.
Widespread environmental damage and possible human exposure through fish consumption after the 1990 Arthur Kill oil spill	<ul style="list-style-type: none"> ■ Plan and evaluate emergency intervention to protect habitat. ■ Habitat and wildlife damage assessment. ■ Study impact on behavior of invertebrates and vertebrates. ■ Study recovery of breeding bird colonies. ■ Conduct ecological and human health risk assessments. 	<ul style="list-style-type: none"> ■ NJDEP ■ EPA 	<ul style="list-style-type: none"> ■ Documented wildlife damage assessment. ■ Because EOHSI had obtained baseline data prior to spill, the data was used by NJ to negotiate settlement with Exxon.

Problem	Research	Agencies/Sponsors	Impact
Recognition of the toxicologic importance of aging	<ul style="list-style-type: none"> ■ Developed mouse model of aging. ■ Examined reproductive parameters in aged mice. ■ Conducted life cycle study of constitutive and inducible enzymes in male and female mice. 	<ul style="list-style-type: none"> ■ NJDEP 	<ul style="list-style-type: none"> ■ Informed attempts to use enzyme induction as a biomarker for pollution, due to life cycle variability. ■ Developed wild mouse model for study of contamination.
Recognition that poor, elderly, and minorities are disproportionately likely to be exposed to hazardous waste sites and other sources of exposure, often in communities already blighted	<ul style="list-style-type: none"> ■ Environmental justice initiative. ■ Environmental risk assessment in poor rural African American community in Alabama. ■ Assessment of worker health issues on Texas/Mexico border. 	<ul style="list-style-type: none"> ■ NIEHS ■ RWJ Foundation 	<ul style="list-style-type: none"> ■ Developed a collaboration with Rutgers College of Pharmacy and West Alabama Health Clinic. ■ Evaluated field conditions and published results in a peer-review journal. ■ Hosted bi-national environmental health meeting with NIH support and IOM support, gained recognition of problems facing agricultural workers on the border.
Need to incorporate environmental health into K-12 teaching	<ul style="list-style-type: none"> ■ TOXRAP™ implementation and evaluation. 	<ul style="list-style-type: none"> ■ NJDEP ■ EPA ■ NIEHS 	<ul style="list-style-type: none"> ■ Teachers educated and trained in environmental health issues which are incorporated into the curricula in 27 states.
Remediation of hazardous waste sites becomes a growth industry in NJ. Efficacy of medical surveillance and biological monitoring for protecting cleanup workers	<ul style="list-style-type: none"> ■ Conducted physical risk evaluation prior to workers training. ■ Efficacy of workers training in influencing behavior. 	<ul style="list-style-type: none"> ■ NIOSH 	<ul style="list-style-type: none"> ■ Train over 200,000 remediation workers. ■ Eliminated routine biomonitoring from medical surveillance programs. ■ Use of medical surveillance as a quality control on preventive strategies for hazardous wasteworkers. ■ Published books on protecting hazardous waste workers.
Complaints of odors, contamination, and illnesses on residents adjacent to solid waste landfills	<ul style="list-style-type: none"> ■ Hazard assessment of chemicals in air and leachate. ■ Exposure assessment for neighboring homes and site workers. ■ Risk assessment for exposure to gases and leachate. ■ Risk communication and reduction effort. 	<ul style="list-style-type: none"> ■ Affected communities and workers 	<ul style="list-style-type: none"> ■ Provided objective assessment of hazards, exposure, and risks. ■ Provided reassurance to neighbors and site workers. ■ Encouraged renovation of methane recovery facility. ■ Accelerated or validated landfill closures and achieve responsible cleanups. ■ Denial of permit for Edgeboro incinerator.
Citizen complaints of health effects and excess birth defects attributed to microwave communication towers in Vernon, NJ	<ul style="list-style-type: none"> ■ Cluster evaluation for birth defects. ■ Exposure evaluation for microwaves. 	<ul style="list-style-type: none"> ■ NJDEP ■ EPA 	<ul style="list-style-type: none"> ■ Birth defects rate not elevated and no relation to microwave exposure. ■ Some measure of reassurance provided to some residents. ■ Decision not to remove transmission towers.
Global transport of mercury recognized as significant input to marine and freshwater ecosystems and bioaccumulation by fish. High risk group identified as pregnant women	<ul style="list-style-type: none"> ■ Develop methods for speciation of mercury. ■ Develop fish and wildlife bioindicators of mercury accumulation. ■ Epidemiologic survey of diet, blood and hair mercury among pregnant women in NJ. ■ Risk assessments for fish consumption using appropriate dietary data. 	<ul style="list-style-type: none"> ■ EPA ■ NAS ■ USDOE 	<ul style="list-style-type: none"> ■ Identified distribution of mercury levels in pregnant population of NJ. ■ Identified patterns of mercury contamination around Pacific Rim. ■ Developed fish advisories for fisherfolk in Puerto Rico, South Carolina, New York and New Jersey. ■ Recognition by agencies that a small but significant portion of the population consumes much greater amounts of fish than allowed for in traditional risk assessment assumptions.

Problem	Research	Agencies/Sponsors	Impact
Many people exposed to mercury from transportation spill in mountains of Peru	<ul style="list-style-type: none"> ■ Exposure assessment from outdoor and indoor elemental mercury. ■ Biomonitoring elemental mercury: urine levels vs air levels. ■ Field comparison of Jerome and Lumex mercury monitors. 	<ul style="list-style-type: none"> ■ Communities ■ Mining company ■ Peruvian ministry of health 	<ul style="list-style-type: none"> ■ Developed outdoor/indoor assessment and remediation criteria and plan. ■ Documented effectiveness of cleanup. ■ Provided reassurance to unexposed and validated treatment protocol for exposed persons.
Challenge to EPA's clean air standard on particulates	<ul style="list-style-type: none"> ■ Investigate mechanisms underlying association between PM2.5 particulates and morbidity. ■ Investigate oxidant-macrophage-inflammation-injury axis. 	<ul style="list-style-type: none"> ■ Health Effects Institute ■ EPA 	<ul style="list-style-type: none"> ■ Provided data relevant to court challenge of Clean Air Act provisions.
Recognition of decline of migratory birds and other wildlife in New Jersey	<ul style="list-style-type: none"> ■ Population based research to quantify trends in migratory shorebirds. ■ Radiotracking studies of birds and reptiles. ■ Reproductive rate monitoring and identification of risk factors for impairment. 	<ul style="list-style-type: none"> ■ NJDEP ■ EPA ■ USFWS 	<ul style="list-style-type: none"> ■ Intervention in growing harvest of Horseshoe Crabs to protect the food base for migratory shorebirds. ■ Prevented development of critical wildlife habitats. ■ Several species added to State Endangered species list.
Current and historic pesticide use recognized as potentially significant health hazards	<ul style="list-style-type: none"> ■ Exposure assessment for tree fruit farmers using organophosphate pesticides. ■ Neurobehavior assessment of farmers exposed to pesticides. ■ Risk assessment for residents living on former agricultural land. 	<ul style="list-style-type: none"> ■ NJDEP 	<ul style="list-style-type: none"> ■ Developed education programs for safe use of pesticides. ■ Developed criteria for residential use of farmland.
Increasing number of patients reporting illness attributed to very low levels of chemicals	<ul style="list-style-type: none"> ■ Develop unexplained symptoms research initiative. ■ Evaluate causes, consequences and risk factors for Multiple Chemical Sensitivity and Gulf War Syndrome. ■ Exposure chamber studies. ■ Biomarkers. 	<ul style="list-style-type: none"> ■ NJ Hazardous Materials Research Center ■ NIEHS ■ VA 	<ul style="list-style-type: none"> ■ Contributed to definition and understanding of vexing illness patterns known as multiple chemical sensitivities. ■ Advised VA, IOM and IPCS on chemical sensitivity and Gulf War issues.
Growing emphasis on prevention of cancer in the context of failures in massive trials of beta carotene	<ul style="list-style-type: none"> ■ Research on cancer clusters and diet in China. ■ Biomarkers of chemopreventive substances. ■ Effects of diet on carcinogenesis and anticarcinogenesis. ■ Chemoprevention trials 	<ul style="list-style-type: none"> ■ Public 	<ul style="list-style-type: none"> ■ Provided rationale for increased research on mechanisms of chemoprevention. ■ Future impacts on healthy diet and reduced risks of cancer.
OSHA reassesses PEL for benzene	<ul style="list-style-type: none"> ■ Study metabolic pathways of benzene in vivo. ■ Study myelotoxic properties of various metabolites. ■ Validate retrospective exposure estimates for pliofilm cohort. ■ Hosted international meeting on toxicology and risk from benzene. ■ Modification of benzene toxicity by co-exposure to other contaminants. 	<ul style="list-style-type: none"> ■ OSHA ■ API 	<ul style="list-style-type: none"> ■ Supported reassessment of permissible exposure limit. ■ Advanced research agenda for understanding mixtures.

Problem	Research	Agencies/Sponsors	Impact
NJ colleges request funds to remove all asbestos	<ul style="list-style-type: none"> ■ Review of asbestos hazards. ■ Comparison of remediation options. 	<ul style="list-style-type: none"> ■ NJ Dept. of Higher Ed ■ State colleges and universities 	<ul style="list-style-type: none"> ■ Budget requests granted to remove friable but not intact asbestos.
National Academy of Sciences recommends that U.S. Dept. of Energy seek independent assessment of its risk assessment/risk management strategies for legacy wastes from nuclear weapons production	<ul style="list-style-type: none"> ■ EOHHSI leads the multi-university Consortium for Risk Evaluation with Stakeholder Participation (CRESP). ■ Review of chemical and radionuclide contamination. ■ Modeling and measurement of exposure pathways. ■ Assessment of risks from recreational and subsistence use of land and waters (wildlife and fish). ■ Epidemiologic mortality study at a DOE site. ■ Worker training and risks from subcontractor remediation work. ■ Methods development for metal and radio - nuclide analysis. ■ Apply risk assessment to the stewardship process for long-term management of nuclear and chemical waste. 	<ul style="list-style-type: none"> ■ US DOE 	<ul style="list-style-type: none"> ■ Convinced states and EPA to develop target-specific messages re: risks and fish consumption, and encouraged EPA to focus on exposure reduction where fundamental cleanup was not possible. ■ Set priorities for remediation. ■ Incorporated stakeholder views into remediation plans and priorities and future land uses. ■ Modified DOE stewardship plans. ■ Established viability of recreational and wilderness land uses for uncontaminated and moderately contaminated sites. ■ Aided selection of remediation technologies. ■ Created site specific and culturally appropriate risk communication and fish advisories.
Endocrine disruptors becomes public health controversy	<ul style="list-style-type: none"> ■ Endocrine active agents in NJ rivers. ■ Endocrine active agents and avian reproduction. ■ Metals and alligator reproductive development. ■ Review for NRC Endocrine Disruptor committee. 	<ul style="list-style-type: none"> ■ EPA 	<ul style="list-style-type: none"> ■ Increased emphasis on endocrine disruption in wildlife in NRC report.
Discovery of numerous chromium waste sites in Hudson county with residential exposure	<ul style="list-style-type: none"> ■ Multi-route exposure assessment in homes, schools, and workplaces. ■ Medical screening for residential and occupational exposures and establishment of biomarkers. ■ Bioavailability studies. ■ Develop speciation techniques for chromium III and VI. ■ Plan and evaluate remediation. ■ Survey of behavioral, nutritional, occupational and demographic characteristics influencing exposure. ■ Development of household measurement techniques for surface contamination of chromium. ■ Health effects study. 	<ul style="list-style-type: none"> ■ NJDEP ■ NJDHSS ■ Hudson County Regional Health Commission 	<ul style="list-style-type: none"> ■ Identified populations at risk. ■ Documented routes of significant exposure. ■ Informed remediation priorities. ■ Quantified success in exposure and risk reduction. ■ Defined species of concern and their bioavailability.
Community exposed to mercury identified adjacent to a Superfund site in Puerto Rico	<ul style="list-style-type: none"> ■ Developed Quality Assurance protocols. ■ Collected and analyzed environmental media, particularly fish, birds, cows milk. ■ Interview survey of fisherfolk behavior and consumption patterns. 	<ul style="list-style-type: none"> ■ EPA 	<ul style="list-style-type: none"> ■ Extent of contamination much less than previously feared. ■ Cleanup restricted to small part of waterway. ■ Pristine character of large wetlands preserved (protected from unnecessary construction/destruction).

Problem	Research	Agencies/Sponsors	Impact
Growing community concern over broadcast spraying to control mosquitos implicated in transmission of West Nile Virus	<ul style="list-style-type: none"> ■ Review epidemiologic and epizootic history of West Nile Virus in Europe and Africa. ■ Provide balanced data on risks from pesticide use. 	<ul style="list-style-type: none"> ■ NJDHSS ■ NYDEP 	<ul style="list-style-type: none"> ■ Validated NJ mosquito control program based on integrated pest management and larvicides. ■ Reduced reliance on broadcast spraying of adulticides. ■ Encouraged use of strategies to reduce mosquito breeding in proximity to human habitation.
Dioxin Contamination in Newark	<ul style="list-style-type: none"> ■ Bioavailability of TCDD in different soils. ■ Estrogen receptor studies. 	<ul style="list-style-type: none"> ■ EPA ■ NJDEP ■ NJDHSS 	<ul style="list-style-type: none"> ■ Set soil cleanup levels and informed remediation policy.
Many residential areas on former coal gas manufacturing sites require assessment and remediation	<ul style="list-style-type: none"> ■ Exposure assessment protocol development, implementation and evaluation. ■ Risk assessments for children playing on contaminated soil. ■ Exposure assessment for remediation workers. ■ Risk communication to residents on sites. 	<ul style="list-style-type: none"> ■ NJDEP ■ PSEG 	<ul style="list-style-type: none"> ■ Provided interim evaluation and evacuation plan. ■ Facilitated remediation of contaminated sites. ■ Verified safe conditions for subsequent occupancy.

- API - American Petroleum Institute
- EPA - Environmental Protection Agency
- IOM - Institute of Medicine
- FDA - Food and Drug Administration
- NAS - National Academy of Sciences
- NICHD - National Institute for Children's Health and Development
- NIEHS - National Institute of Environmental Health Sciences
- NIOSH - National Institute of Occupational Safety and Health
- NJDEP - NJ Department of Environmental Protection
- NJDHSS - NJ Department of Health and Senior Services
- NYDEP - NY Department of Environmental Protection
- OSHA - Occupational Safety and Health Administration
- PSEG - Public Service Electric and Gas
- RWJ Foundation - Robert Wood Johnson Foundation
- US DOE - US Department of Energy
- USFWS - US Fish and Wildlife Society
- VA-US - Department of Veteran's Affairs

KEY

EOHSI SERVICE

Service to the State, the Nation and World

EOHSI plays a major role in protecting New Jersey's environmental and occupational health. From providing expertise to numerous committees of state agencies to conducting research throughout the state, EOHSI has maintained a major focus on problems of New Jersey's urban environments. In addition, faculty have worked closely with representatives of the New Jersey Departments of Health and Senior Service and Environmental Protection as well as other state agencies, to confront common problems in urban environments, bringing together issues of environmental hazards, child health, deteriorating infrastructure, and access to services.

EOHSI includes an emphasis on ecosystem evaluation and quality which contributes to understanding and protecting sensitive natural areas. This includes studies of fishery quality, subsistence fishing, and biodiversity. EOHSI faculty participate with the State's Non-Game and Endangered Species program. They work with the New Jersey Department of Environmental Protection (NJDEP) and the New Jersey Department of Health and Senior Services (NJDHSS) to evaluate the quality of consumable natural resources, to focus appropriate public health advisories on fish consumption, and to develop educational materials.

EOHSI projects enhance the level of expertise in the target communities developing the necessary human resources for public health and environmental quality. For example, EOHSI has a major interest in Brownfields recovery and redevelopment. Through its investigations of toxicology, hazard assessment and risk analysis, it contributes to land use decisions which in turn govern cleanup standards. While working with local community groups is not familiar territory to most academic organizations, EOHSI faculty have gained extensive and usually positive experience in this challenging domain. Moreover, this involvement in New Jersey has naturally led to collaborations nationally and internationally. This has ranged from Environmental Justice grants in coop-



EOHSI LEADERS AND FACULTY MEMBERS ARE REGULARLY CALLED UPON BY STATE OFFICIALS TO ASSIST WITH ENVIRONMENTAL HEALTH ISSUES. PICTURED HERE – NEW JERSEY SENATOR JON CORZINE MEETS WITH EOHSI AND UNIVERSITY LEADERSHIP.

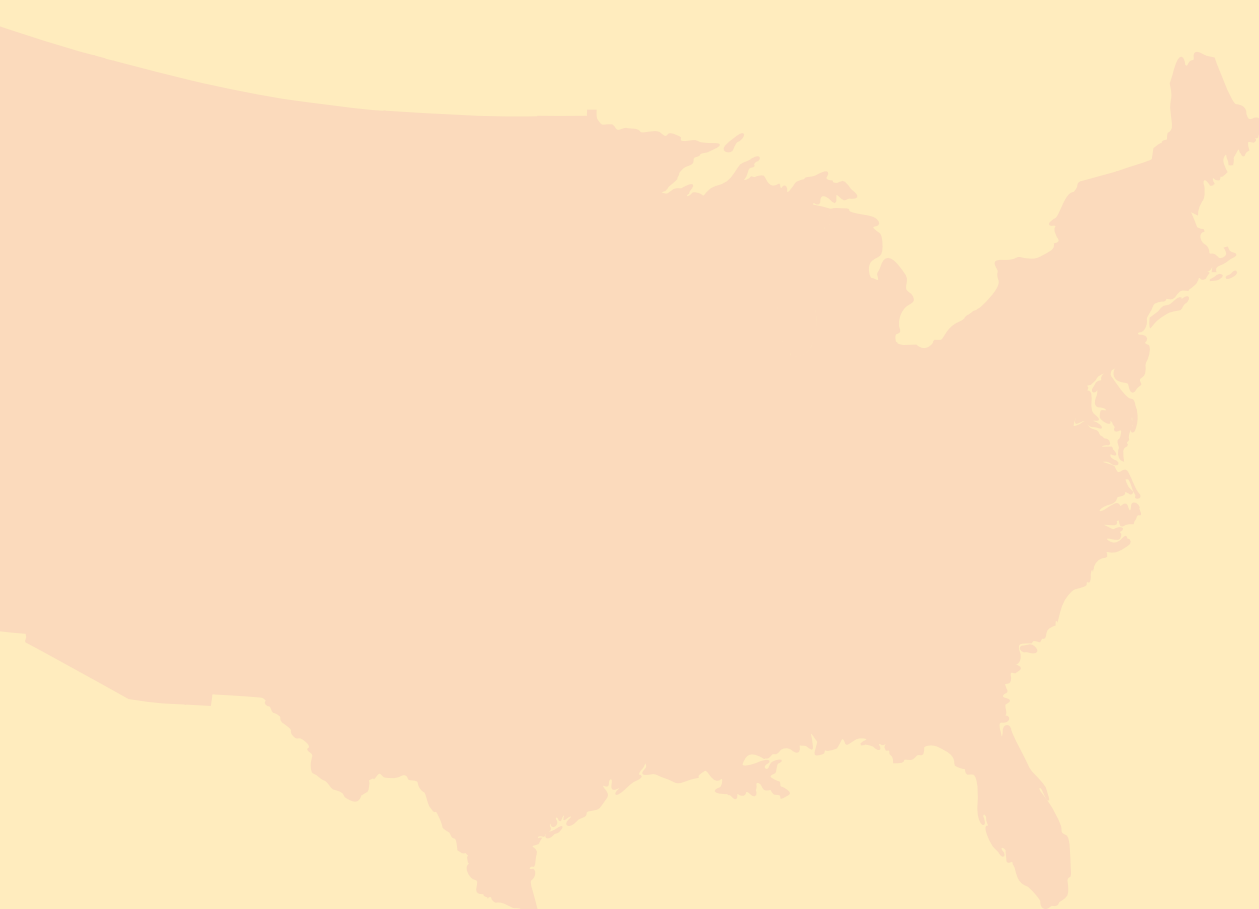
eration with colleagues in Alabama and the Texas-Mexico border, to studies of benzene exposure in Valdez, Alaska, a mercury spill in Peru, and hazardous waste problems in Puerto Rico. Such community-based activities built upon high quality science is a major reason EOHSI was asked to be leaders in the Consortium for Risk Evaluation with Stakeholder Participation (CRESP).

Sample of Issues EOHSI Members Have Been Called on to Assist the State of New Jersey

- Dioxin contamination on former industrial sites in Newark.
- Chromium contamination in Hudson County, one of the most heavily chromium contaminated areas in the world.
- Lead in homes in Jersey City, Newark and New Brunswick.
- Substance abuse and environmental quality in Perth Amboy.
- Lead and arsenic in soils in southern New Jersey.
- Hazardous waste contamination of soil and water.
- Evaluation of potential for air contamination by new incinerators.
- Dredging of contaminated sediments in Newark Bay.
- Ozone air pollution health advisories.
- Providing environmental health science education for classroom teachers in Toms River as well as other communities.
- Conducting safety and health training for workers in New Jersey.
- Environmental problems in Phillipsburg, Toms River and Sparta, New Jersey.

EOHSI faculty also serve on a wide variety of national and international committees including the peer review panels of the National Institute of Health. They are frequently called upon to serve on National Academy of Sciences councils, boards and committees, including the Council on the Life Sciences and the Board of Environmental Science and Toxicology as well as the Environmental Protection Agency including the Science Advisory Board. Faculty have also served on a variety of advisory and peer review panels and on state boards and task forces.

International activities have become an increasingly prominent aspect of EOHSI. We have collaborative studies with colleagues in China and Mexico, research and training programs in Thailand and West Africa, and have hosted visiting scientists from Asia, Europe and the Middle East. In 1998 we hosted the tenth triennial meeting of the Scientific Committee of Problems of the Environment (SCOPE). This 39-member nation organization, headquartered in Paris, had its two previous meetings in Seville and Tokyo.



FUTURE DIRECTIONS FOR RESEARCH

In laying a course for future research at EOHSI it is important to recall the mission statement of the Institute: The mission of EOHSI is to study and affect environmental and occupational health through scientific research, training of health professionals, and communication of research findings to professionals and lay groups. With respect to the adverse impact of environmental agents on health, our major objectives are to determine approaches to their detection, recommend mechanisms for preventing their development, and, when they occur, to seek effective solutions to the health risks they represent, through the combined efforts of multi-disciplinary teams of EOHSI scientists.

New Analytical Instrumentation is Essential for Collaborations to be Successful in the Future

From its inception EOHSI has attempted to maintain a state-of-the-art analytical facility for the support of research by the members. As newer types of instruments become available the Institute has made appropriate investments, e.g., flow cytometry and image analysis. New resources need to be identified to expand the building, and to purchase the tools necessary to keep our research current. Once the new equipment is in place, it is important to provide an opportunity for researchers to learn how the instrumentation can be applied to their research. This can be accomplished with individual tutorials, mini-courses and seminars and newsletters. Shared resources and equipment are valuable only if investigators know how to take advantage of them. Mechanisms to evaluate polymorphisms as well as gene/protein expression are also required in order to understand susceptibility of humans to environmental toxins. The key to success is to push these tools to work at the low exposure levels such as those that occur in the general environment and are found in samples obtained from humans. Certainly, in the future much of EOHSI research will depend not only on expansion of our facilities, upgrading of existing

equipment and acquisition of new state-of-the-art technologies, but also on the recruitment of new young faculty with unique and complementary research expertise who can drive modern research.

Research Initiatives Underway and on the Horizon at EOHSI: Expansion of Children's Environmental Health Research; Exploration of Issues Associated with Chemical and Biological Terrorism; and Incorporation of the Human Genome in Environmental Health Research.

While children's environmental health research has been a part of EOHSI's research agenda for quite some time, it has recently become more of a focal point for the Institute. The new NIEHS/EPA Center for Childhood Neurotoxicology and Exposure Assessment will address the influence of exposure to neurotoxicants on a child's neurological health and development, with a specific focus on autism and related learning disabilities. Studies on the effects of lead, pesticides, dioxin-like chemicals, mercury, and ozone on children's health will continue and will be expanded to include state-of-the-art information and technology.

In recent times, the issue of chemical and biological terrorism has become increasingly important. EOHSI faculty members have been assisting in the coordination of efforts to improve our ability to detect, prevent and respond to chemical and biological terrorism. New initiatives in these areas will build upon research already underway and will serve as a catalyst for exploring new methods of detection, prevention, and communication of information to the public and the appropriate stakeholders.

One of the most significant developments in the recent history of the biological sciences was the announcement of the "first draft" assembly of the human genome, along with parallel findings of the genomes of other species. The transcription process is subject to influences by any of a variety of proteins which normally modulate DNA function, or by environmental chemicals. We must now recognize that environmental diseases are ultimately caused by the impact of chemicals on the genome itself,

and/or on specific proteins or groups of proteins. EOHSI faculty members are planning to incorporate genomics into many of their new research initiatives. The challenge in this area, as in other research strategies, is to learn how to use these techniques and the resulting data in the integrated approach to research that is the norm for EOHSI.

The Success of EOHSI will Continue to be Based on Effective Interdisciplinary Problem Solving Enhanced by Excellence in Fundamental Research.

The essence of EOHSI resides in its ability to conduct discussions and research along several different continua: from pure mechanistic science to applied research, from the study of short-term, acute problems to those that are long-term, from ecological to human health, from the scientific literature to health and risk communication, and from science to public policy. The Institute is not just broad in personnel and disciplines represented, but also in the flexibility with which people work together to solve the scientific, applied, and public policy issues of today. What we have built at EOHSI, through the efforts of many investigators, is a series of mechanisms tackling complex environmental problems, e.g., the NIEHS Center, CRESPI, the NIEHS/EPA Center for Childhood Neurotoxicology and Exposure Assessment, the EPA Modeling Center, and the NIEHS Worker Education Center. EOHSI is one of the few places where one can freely share ideas, information and develop programs with researchers of diverse backgrounds. The institute's past and future strengths lie in maintaining the wide diversity of expertise and approaches, and in the ability to meld them to solve key environmental problems.

Scientists at EOHSI are always involved in research, some of which may be interdisciplinary, but much of which represents the ongoing research interests of individuals. Much of the Institute's research in the future will be aimed at continuing to study mechanisms of toxicity, new approaches to exposure assessment, epidemiology, and other disciplines. Thus, while it is difficult to predict specifically what the research effort of the future will be in EOHSI, we can be certain that there will be stress on developing more interdisciplinary research projects while continuing to foster a solid foundation of basic and mechanistic research.

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