Superfund Basic Research Program

Balancing Scientific Excellence with Research Relevance

October 2008

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
National Institutes of Health

NIEHS
National Institute of Environmental Health Sciences

http://www.niehs.nih.gov/sbrp

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Multiproject Grants

Boston University

Superfund Basic Research Program at Boston University

Program Director: David Ozonoff (*dozonoff@bu.edu*)
Funded by SBRP: 1995-2010

This program focuses on the effects of exposures to environmentally hazardous substances on reproduction and development in humans and wildlife. Special emphasis is placed on halogenated and nonhalogenated organic substances commonly encountered as a result of improperly managed waste disposal. The research focuses on the underlying mechanics of xenobiotic/endocrine interactions and their effects to allow a better understanding of the implications of perturbations of reproductive and developmental processes by hazardous substances in the environment.

2005-2010 Projects and Cores

Analyzing Patterns in Epidemiologic and Toxicologic Data
Project Leader: Thomas Webster

Biomimetic Remediation of Hazardous Substances
Project Leader: Pericles Stavropoulos

CYP Genes and Developmental Toxicity
Project Leader: John Stegeman (Woods Hole Oceanographic Institution)

Endocrine Disrupting Effects in a Sentinel Species
Project Leader: Ian Callard

Estrogen Receptor- AhR Interactions in the CNS
Project Leader: Gloria Callard

Mechanism and Impacts of Dioxin Resistance in Fish
Project Leader: Mark Hahn (Woods Hole Oceanographic Institution)

Neurotoxic Effects of PCE Exposure During Gestation and Childhood
Project Leader: Ann Aschengrau

Nuclear Receptors and Gonadal Toxicity of Xenochemicals
Project Leader: David Waxman

PPAR^3 and Environmental Phthalate Toxicity in the Immune System
Project Leader: Jennifer Schlezinger

Administrative Core
Project Leader: David Ozonoff

Bioinformatics Core
Project Leader: Sandor Vajda

Communicating the Health Impacts of Environmental Contamination
Project Leader: David Ozonoff

Research Translation Core
Project Leader: David Ozonoff

Training Core
Project Leader: Ian Callard

Brown University

Reuse in Rhode Island - A State-Based Approach to Complex Exposures

Program Director: Kim Boekelheide (*Kim_Boekelheide@Brown.edu*)
Funded by SBRP: 2005-2009

This program addresses three inter-related thematic components: land reuse in Rhode Island, a state-based approach, and complex exposures. The research effort addresses theoretical and practical aspects of disease mechanisms and potential biomarkers associated with co-exposures and the identification, characterization, separation, and remediation of complex mixtures. This program is a cooperative academic-government-community effort to address basic and translational research issues, management decisions, and communication barriers associated with the complex mixtures and co-exposures inherent to hazardous waste sites.

2005-2009 Projects and Cores

Biological Dosimetry of Hexavalent Chromium
Project Leader: Anatoly Zhitkovich

Genetic Stress and Toxicant-Induced Pregnancy Disruption
Project Leader: Surendra Sharma (Women & Infants Hospital of Rhode Island)

Genotoxic Potential of Mixed Dust Exposures
Project Leader: Agnes Kane

Mechanisms of Hg Adsorption and Metals Exposure from Mixed Pollutant Streams
Project Leader: Robert Hurt

Metals Removal via Spouted Bed Electrolytic Reactors (SBER)
Project Leader: Joseph Calo

Testicular Sensitization and Co-Exposure Synergy
Project Leader: Kim Boekelheide

Vapor Pressures and Thermodynamic Properties of Complex Organic Containing Mixtures
Project Leader: Eric Suuberg

Administrative Core
Project Leader: Kim Boekelheide

Analytic Core
Project Leader: David Murray

Molecular Pathology Core
Project Leader: Mary Hixon

Research Translation Core
Project Leader: Eric Suuberg

Training Core
Project Leader: Agnes Kane

University-Community Partnerships to Address Local Toxic Contamination
Project Leader: Phil Brown

Columbia University

Health Effects and Geochemistry of Arsenic and Manganese

Program Director: Joseph Graziano (*jg24@columbia.edu*)
Funded by SBRP: 2000-2011

This program seeks to obtain new knowledge, and train multidisciplinary students concerning the health effects, geochemistry, and remediation of arsenic and manganese, with a particular focus on groundwater. The program involves substantial work at the single most seriously arsenic-affected Superfund site (Vineland, NJ), as well as epidemiologic studies of arsenic and manganese exposed adults and children residing in Bangladesh and New Hampshire.

2006-2011 Projects and Cores

Consequences of Arsenic and Manganese Exposure on Childhood Intelligence
Project Leader: Joseph Graziano

Genotoxic and Cell Signaling Pathways of Arsenic in Mammalian Cells
Project Leader: Tom Hei

Health Effects of Arsenic Cohort Study
Project Leader: Habibul Ahsan (University of Chicago)

Mitigation of As Mobilization in Groundwater
Project Leader: Alexander Van Geen

Mobilization of Anthropogenic As in Groundwater
Project Leader: Steven Chillrud (Lamont Doherty Earth Observatory of Columbia University)

Mobilization of Natural As & Mn in Groundwater
Project Leader: Yan Zheng (Queens College of CUNY), Martin Stute (Barnard College)

One-carbon Metabolism, Oxidative Stress and As Toxicity
Project Leader: Mary Gamble

Administrative Core
Project Leader: Joseph Graziano

Biogeochemistry Core
Project Leader: Alexander Van Geen

Data Management Core
Project Leader: Diane Levy

Hydrogeology Core
Project Leader: Martin Stute (Barnard College)

Research Translation Core
Project Leader: H. James Simpson

Trace Metals Core Laboratory
Project Leader: Joseph Graziano

Training Core
Project Leader: Paul Brandt-Rauf

Dartmouth College

Toxic Metals in the Northeast - From Biological to Environmental Implications

Program Director: Bruce Stanton (*bruce.a.stanton@dartmouth.edu*)
Funded by SBRP: 1995-2013

The overall objective of this program is to understand how arsenic and other toxic metals contribute to adverse effects on human health and the environment. This program has a particular emphasis on arsenic, which is the focus of research in all six of its research projects and which serves as a major integrator of its program across disciplinary boundaries; the program also has an emphasis on mercury, cadmium and lead. Other major integrating themes of the program are the extensive application of toxicogenomics and biomarkers, and the analysis of multiple stressors as a major mechanism underlying the environmental health impact of toxic metals.

2008-2013 Projects and Cores

Arsenic Uptake, Transport and Accumulation in Plants
Project Leader: Mary Guerinot

Arsenic and the Ubiquitin-Lysosome Pathway
Project Leader: Bruce Stanton

Arsenic as an Endocrine Disrupter
Project Leader: Joshua Hamilton

Bioaccumulation and Trophic Transfer of Hg in Aquatic Food Webs
Project Leader: Celia Chen

Epidemiology, Biomarkers and Exposure Assessment of Metals
Project Leader: Margaret Karagas

Administrative Core
Project Leader: Bruce Stanton (Dartmouth Medical School)

Integrative Biology Core
Project Leader: Jason Moore (Dartmouth Medical School)

Research Translation Core
Project Leader: Nancy Serrell

Trace Elements Analysis Core
Project Leader: Brian Jackson

Training Core
Project Leader: Bruce Stanton (Dartmouth Medical School)

Duke University

Superfund Chemicals Impact on Reproduction and Development

Program Director: Richard Di Giulio (*richd@duke.edu*)
Funded by SBRP: 2000-2009

The major theme of this program is the elucidation of mechanisms of exposure and toxicity in humans and ecosystems to particular Superfund chemicals selected based upon their potential significance with respect to developmental effects. This program focuses on microarray approaches for assessing gene expression development; developing markers for developmental toxicities; microbial and photolytic transformations of selected Superfund chemicals that augment their environmental fate; effects upon development; and the transfer of information relevant to human and/or ecological health to critical members of the scientific, governmental, business and lay communities.

2005-2009 Projects and Cores

Developmental Effects of Superfund Hydrocarbon Mixtures in Fundulus Heteroclitus
Project Leader: Richard Di Giulio

Developmental Neurotoxicity of Superfund Pesticides: Biomarkers and Mechanisms
Project Leader: Theodore Slotkin

Mechanism of Environmental Stress-Induced Developmental Abnormalities
Project Leader: Dennis Thiele

Microbial and Photolytic Transformations of Superfund Chemicals
Project Leader: Andrew Schuler

Neurobehavioral Mechanisms of Cognitive and Affective Impairment from Fetal Exposure to Superfund Chemicals
Project Leader: Edward Levin

Zebrafish as a Detector and Discriminator of Organophosphate Exposure
Project Leader: Elwood Linney

Administrative Core
Project Leader: Richard Di Giulio

Developmental Toxicants Outreach Core
Project Leader: Marie Lynn Miranda

Functional Genomics Research Core
Project Leader: Seth Kullman

Research Translation Core
Project Leader: Marie Lynn Miranda

Training Core
Project Leader: Edward Levin

Michigan State University

Environmental, Microbial, and Mammalian Biomolecular Responses to AhR Ligands

Program Director: Norbert Kaminski (*kamins11@msu.edu*)
Funded by SBRP: 1989-2011

This program investigates a subclass of chemicals belonging to the halogenated aromatic hydrocarbon family that bind and activate the aryl hydrocarbon receptor (AhR). The central theme of this program is to define specific aspects of environmental, microbial and mammalian biomolecular responses to environmental contaminants that act as ligands for the AhR. Two major goals of the program are to characterize molecular mechanisms of AhR ligand interactions with specific abiotic and biotic processes and to develop new tools that can be used to more accurately estimate the fate, microbial biotransformation and human risk associated with AhR ligands contaminating the environment.

2006-2011 Projects and Cores

A Proteomic Analysis of the AHR signaling Network
Project Leader: John LaPres

Characterization of the Pathways Linking Ah Receptor Activation with Altered B Cell Differentiation Using an Integrated Experimental and Computational Modeling Approach
Project Leader: Norbert Kaminski

Dissecting the Signaling Network for Ah Receptor-mediated B-cell Toxicity
Project Leader: Russell Thomas

Geochemical Controls on the Adsorption, Bioavailability, and Long-term Environmental Fate of Dioxins, PCBs, and PAHs
Project Leader: Stephen Boyd

Influence of Ah Receptor Ligands on Inflammatory Responses: Consequences for Tissue Injury and Gene Expression
Project Leader: Patricia Ganey

Molecular Insight into Polyaromatic Toxicant Degradation by Microbial Communities
Project Leader: James Tiedje

Non-Additive Ah Receptor Ligand Interactions
Project Leader: Timothy Zacharewski

Administrative Core
Project Leader: Norbert Kaminski

Biomedical Informatics Core
Project Leader: Russell Thomas

Computational Modeling of Mammalian Biomolecular Responses Core
Project Leader: Rory Conolly

Environmental Molecular Analysis Core
Project Leader: Gerben Zylstra (Rutgers University)

Research Translation Core
Project Leader: James Trosko

University of Arizona

Hazardous Waste Risk and Remediation in the Southwest

Program Director: A. Jay Gandolfi (*gandolfi@pharmacy.arizona.edu*)
Funded by SBRP: 1990-2010

The theme of this program is to support development of a risk assessment process for metal and organic contaminants through toxicologic and hydrogeologic studies and through development of innovative remediation technologies. The program emphasizes, but is not limited to, hazardous waste issues in the Southwestern U.S. due to the unique arid nature of this environment. This program examines the mechanism of arsenic toxicity in target tissues; factors that affect the susceptibility of populations to arsenic-induced toxicity; the effects of arsenic and TCE on organ development; how hazardous wastes can be optimally characterized for remediation; and innovative techniques for containing or degrading these contaminants in the arid Southwest environment.

2005-2010 Projects and Cores

Arsenic in Water: Removal Technologies and Residuals Disposal
Project Leader: Wendell Ela

Gene Enhanced Remediation of Co-Contaminated Soils
Project Leader: Ian Pepper

Mass-Transfer Dynamics of Chlorinated-Solvent Immiscible Liquids in Porous Media
Project Leader: Mark Brusseau

Molecular Effects of Low Level Arsenic on the Human Bladder
Project Leader: A. Jay Gandolfi

New Technologies for the Destructive Remediation of Halogenated Organics
Project Leader: Eric Betterton

Phytostablization of Mine Tailings in the Southwestern United States: Plant-Soil-Microbe Interactions and Metal Speciation Dynamics
Project Leader: Raina Maier

Pulmonary Response to Arsenic in Susceptible Populations: Alterations Following In Utero and Early Postnatal Exposure
Project Leader: R. Clark Lantz

Role of Annexin II in Peripheral Vascular Disease
Project Leader: Richard Vaillancourt

Susceptibility to Trichloroethylene (TCE) and Chlorinated Acids in Heart Development
Project Leader: Ornella Selmin

The Human Genetics of Arsenic Biotransformation
Project Leader: H. Vasken Aposhian

Administrative Core
Project Leader: A. Jay Gandolfi

Hazard Identification Research Support Core
Project Leader: A. Jay Gandolfi

Outreach to the Southwestern Hispanic Communities and Neighboring Mexico
Project Leader: James A. Field

Research Translation Core
Project Leader: Mónica Ramirez

Training Core
Project Leader: Raina Maier

University of California-Berkeley

Toxic Substances in the Environment

Program Director: Martyn Smith (*martynts@berkeley.edu*)
Funded by SBRP: 1987-2011

The overall theme of the program is the application of functional genomics, proteomics, transcriptomics, and nanotechnology to better detect arsenic, mercury, benzene, polycyclic aromatic hydrocarbons, trichloroethylene and other Superfund priority chemicals in the environment; evaluate their effects on human health, especially the health of susceptible populations such as children; and remediate their presence and reduce their toxicity. Research includes using proteomics and transcriptomics to study the role of chemical exposure in causing childhood leukemia; taking a functional genomic approach to finding susceptibility genes; applying novel biomarkers to study the health effects of arsenic; improving bioremediation of toxic chemicals through the application of -omic technologies and nanotechnology; and developing nano-scale sensors of chemical species in the environment.

2006-2011 Projects and Cores

Application of Comparative Genomics, Transcriptomics, and Proteomics to Optimize Microbial Reductive Dehalogenation
Project Leader: Lisa Alvarez-Cohen

Arsenic Biomarker Epidemiology
Project Leader: Allan Smith

Biomarkers of Chemical Exposure and Leukemia Risk
Project Leader: Martyn Smith

Contaminant Oxidation Using Nanoparticulate and Granular Zero-valent Iron
Project Leader: David Sedlak

Functional Profiling of Susceptibility Genes
Project Leader: Christopher Vulpe

Nanotechnology-based Environmental Sensing
Project Leader: Catherine Koshland

Computational Biology
Project Leader: Mark van der Laan

Program Coordination / Administration
Project Leader: Martyn Smith

Research Translation Core
Project Leader: Amy Kyle

Toxicogenomics Laboratory
Project Leader: Christine Skibola

Training Core
Project Leader: Catherine Koshland

University of California-Davis

Biomarkers of Exposure to Hazardous Substances

Program Director: Bruce Hammock (*bdhammock@ucdavis.edu*)
Funded by SBRP: 1987-2010

This program aims to address some of the current limitations in our ability to 1) trace the movement of hazardous materials from Superfund sites through various media, 2) prioritize and mitigate the hazards involved, and 3) predict exposure or effect of hazardous materials on humans and their environment. This program is expanding its use of transcriptomics, metabolomics and integrated bioinformatics technologies to discover new mechanisms of action of hazardous materials and biomarkers for their action.

2005-2010 Projects and Cores

Assessing the Adverse Effects of Environmental Hazards on Reproductive Health
Project Leader: Bill Lasley

Biomarkers of Exposure to Pulmonary Toxicants
Project Leader: Alan Buckpitt

Development and Applications of Integrated In Vitro and Cell-Based Bioassays
Project Leader: Michael Denison

Development and Implementation of Immunoassays for Human and Environmental Monitoring
Project Leader: Shirley Gee

Development of Rapid, Miniaturized Sensors for Use in the Detection of Environmental Toxins
Project Leader: Ian Kennedy

Epidemiology Studies
Project Leader: Ellen Gold

Transport, Transformation, and Remediation of Perchlorate and VOCs in the Vadose Zone and Groundwater
Project Leader: Kate Scow

Administrative Core
Project Leader: Bruce Hammock

Analytical Chemistry/AMS Core
Project Leader: Bruce Hammock

Integrated Response to Toxic Perturbation
Project Leader: Robert Rice

Research Translation Core
Project Leader: Daniel Chang

Statistical Analysis of Toxics Measurement Data
Project Leader: David Rocke

Training Core
Project Leader: Robert Rice

University of California-San Diego

Molecular Mechanisms and Models for Exposure

Program Director: Robert Tukey (*rtukey@ucsd.edu*)
Funded by SBRP: 2000-2010

The goals of this program are to implement modern scientific approaches to identify and characterize mechanisms responsible for genomic stress elicited by water born pollutants found at Superfund sites. This program is testing the hypothesis that alterations in cellular signaling and gene expression by Superfund site chemicals can be exploited to develop biological models for the detection and bioremediation of chemical toxicants. Experimental strategies rely heavily upon recombinant DNA and the development of new technologies to yield new perspectives on monitoring, remediation and mechanisms of toxicity mediated through altered gene expression and aberrant cellular signaling.

2005-2010 Projects and Cores

A Mouse Strain That Exhibits Elevated Sensitivity to Chemical Carcinogens and Hepatotoxins and the Mechanism Underlying That Increase
Project Leader: Michael Karin

Cholinesterase Inhibition as a Target of Pesticide Residues and the Effect of Cholinergic Intervention on Gene Expression
Project Leader: Palmer Taylor

Molecular Mechanisms of Bacterial Metal Redox Transformations
Project Leader: Bradley Tebo

Molecular Mechanisms of Heavy Metal Detoxification and Accumulation in Plants
Project Leader: Julian Schroeder

The Expression in Mice of Human Xenobiotic Drug Metabolizing Genes Responsive to Ah Receptor Toxicants
Project Leader: Robert Tukey

Toxicogenomic Analysis of Nuclear Xenobiotic Receptors, PXR and CAR, in Chemical Metabolism and Human Health
Project Leader: Ronald Evans

Yeast Genetics and Stress Response Genes
Project Leader: Paul Russell

Administrative Core
Project Leader: Robert Tukey

Integrating Superfund-Related Science and Native Cultural Traditions
Project Leader: Keith Pezzoli

Molecular Imaging
Project Leader: Mark Ellisman

Mouse Genetics Core
Project Leader: Pamela Mellon

Protein Characterization
Project Leader: Elizabeth Komives

Research Translation Core: Applying Toxicogenomics and Biomolecular Technologies to Environmental Monitoring, Risk Assessment and Bioremediation
Project Leader: Keith Pezzoli

Training Core
Project Leader: Palmer Taylor

University of Iowa

Semi-volatile PCBs - Sources, Exposures, Toxicities

Program Director: Larry Robertson (*larry-robertson@uiowa.edu*)
Funded by SBRP: 2006-2010

This program's overall theme is the investigation of consequences of atmospheric sources and exposures to semi-volatile polychlorinated biphenyls (PCBs). The research addresses volatilization; transport and exposure of lower-halogenated PCBs, especially those PCBs that are associated with contaminated waters and former industrial sites; consequences of exposure; and novel methods of phytoremediation.

2006-2010 Projects and Cores

Atmospheric Sources of PCB Congeners
Project Leader: Keri Hornbuckle

Characterization of Exposures of Urban and Rural Cohorts to Airborne PCBs
Project Leader: Peter Thorne

Oxidative Stress and PCB Exposure in Mammalian Cells
Project Leader: Douglas Spitz

PCBs and Hydroxysteroid (Alcohol) Sulfotransferases
Project Leader: Michael Duffel

PCBs: Metabolism, Genotoxicity and Gene Expression in vivo
Project Leader: Larry Robertson

Phytoremediation to Degrade Airborne PCB Congeners from Soil and Groundwater Sources
Project Leader: Jerald Schnoor

Administrative Core
Project Leader: Larry Robertson

Analytical: Extraction, Detection, and Interpretation of PCB Congeners in Complex Matrices
Project Leader: Keri Hornbuckle

Community Outreach Core
Project Leader: Victoria Persky (University of Illinois at Chicago)

Cross-Disciplinary Training
Project Leader: Gabriele Ludewig

Inhalation Toxicology
Project Leader: Peter Thorne

Research Translation Core
Project Leader: Peter Thorne

Synthesis
Project Leader: Hans-Joachim Lehmler

University of Kentucky

Nutrition and Superfund Chemical Toxicity

Program Director: Bernhard Hennig (*bhennig@uky.edu*)
Funded by SBRP: 1997-2013

This program focuses on the toxicology of Superfund chemicals and how health effects of exposure can be modulated by both intrinsic (genetic) and extrinsic (nutrition) factors. A major objective of the program is to explore the paradigm that nutrition can modify Superfund chemical toxicity. The biomedical projects focus on chronic diseases such as cardiovascular disease, cancer, obesity, hypertension, and diabetes, and the non-biomedical projects explore novel techniques for remediation and detection of PCBs and other chlorinated organics.

2008-2013 Projects and Cores

Chloro-Organic Degradation by Nanosized Metallic Systems and by Chelate-Modified Hydroxyl Radical Reaction
Project Leader: Dibakar Bhattacharyya

Sensing Superfund Chemicals with Recombinant Systems
Project Leader: Sylvia Daunert

Superfund Chemicals, Nutrition, and Endothelial Cell Dysfunction
Project Leader: Bernhard Hennig

The Impact of Obesity on PCB Toxicity
Project Leader: Lisa Cassis

Vascular Mechanisms of PCB-Induced Brain Metastases
Project Leader: Michal Toborek

Administrative Core
Project Leader: Bernhard Hennig

Research Support Core
Project Leader: Michal Toborek

Research Translation Core
Project Leader: Lindell Ormsbee

Superfund Community Action Through Nutrition (SCAN)
Project Leader: Lisa Gaetke

Superfund Inter-Disciplinary Training Core
Project Leader: Leonidas Bachas

University of North Carolina-Chapel Hill

Environmental Exposure and Effect of Hazardous Chemicals

Program Director: James Swenberg (*james_swenberg@unc.edu*)
Funded by SBRP: 1992-2010

In an effort to address scientific issues that underpin the assessment of human risk and the development of improved methods for remediation of hazardous waste sites, the UNC program is: 1) applying new molecular and analytical tools in a systems biology framework to understand critical pathways for environmental disease and bioremediation; 2) developing biomarkers of exposure and effect for humans and experimental models of environmental disease; 3) using this knowledge to elucidate the modes of action for major chlorinated hydrocarbons and polycyclic aromatic hydrocarbons; 4) examining the effects of dose-response; 5) investigating genetic susceptibility to hazardous chemicals; 6) determining factors controlling dermal absorption of polycyclic aromatic hydrocarbons and the relationship of internal dose to both skin and systemic exposure; and 7) develop and evaluate remediation methods in complex, field-relevant systems for their potential to reduce overall human exposures and risks.

2006-2010 Projects and Cores

Bioavailability and Biodegradation of Polycyclic Aromatic Hydrocarbons
Project Leader: Michael Aitken

Comparative Toxicogenomics and Individual Differences in the Human Response to Dermal Exposure to Polycyclic Aromatic Hydrocarbons
Project Leader: Leena Nylander-French

Development and Application of Biomarkers of Exposure
Project Leader: Stephen Rappaport

Enhanced Remediation of Heterogeneous Subsurface
Project Leader: Cass Miller

Genomic and Genetic Analysis of Liver and Kidney Toxicity of Trichloroethylene
Project Leader: Ivan Rusyn

The Role of Oxidative Stress in Toxicology and Carcinogenesis
Project Leader: James Swenberg

Administrative Core
Project Leader: James Swenberg

Chemistry and Analytical Core
Project Leader: Louise Ball

Mathematical and Statistical Analysis and Modeling Core
Project Leader: Cass Miller

Research Translation Core
Project Leader: Frederic Pfaender

Training Core
Project Leader: Frederic Pfaender

University of Washington

Effects-Related Biomarkers of Toxic Exposures

Program Director: Harvey Checkoway (*checko@u.washington.edu*)
Funded by SBRP: 1987-2009

This program focuses on biomarker applications for investigations of adverse effects to human health and the environment from neurotoxic chemicals, primarily metals and pesticides. Researchers are developing and validating biomarkers for elucidating underlying neurotoxicity mechanisms; characterizing risks to humans, animals, and the environment; identifying host susceptibility traits that modify exposure/risk relations; and for implementing phytoremediation techniques.

2006-2009 Projects and Cores

Environmental and Genetic Risk Factors for Parkinson's Disease
Project Leader: Harvey Checkoway

Gene-Environment Interactions in Salmon Neurotoxicity
Project Leader: Evan Gallagher

Heme Pathway Polymorphisms in Mercury Neurotoxicity in Adults and Children
Project Leader: James Woods

Paraoxonases: Biomarkers of Susceptibility to Environmentally-Induced Diseases
Project Leader: Lucio Costa

Phytoremediation of Organic Pollutants Using Transgenic Plants
Project Leader: Stuart Strand

Administrative Core
Project Leader: Harvey Checkoway

Functional Genomics and Bioinformatics Core
Project Leader: Federico Farin

Research Translation Core
Project Leader: Clement Furlong

Small Business Innovation Research (SBIR) Grants

Advanced Microlabs, LLC, Fort Collins, Colorado

Microchip-based Perchlorate Analyzer for Water Remediation Monitoring and Field A

Program Director: Dale Willard (*dwillard@advancedmicrolabs.com*)
Phase I
Funded by SBRP: 2008-2009

Advanced Microlabs, LLC's online monitoring device will significantly reduce costs for remediation, and allow smaller communities to address cleanup issues. Phase I of this project will: 1. develop pumps, valves, instrumentation, etc. to assemble a field deployable device; 2. optimize microchip functions by incorporating a sample membrane barrier and assessing non-hazardous alternative internal standards; and 3. method validation and field testing.

Edenspace Systems Corporation, Manhattan, Kansas

Engineering Enhanced Plants for Arsenic Remediation

Program Director: David A. Lee (*lee@edenspace.com*)
Phase I
Funded by SBRP: 2008-2009

Edenspace and its research partner, the University of Massachusetts (UMass), propose to develop enhanced plants for arsenic phytoremediation. In Phase I, Edenspace will confirm that the transgenic *Brassica napus* shows the same arsenic tolerance and uptake phenotype observed in transgenic Arabidopsis, which will lead, in Phase II, to a small scale field demonstration.

Eon Corporation

Ceriodaphnia DNA Microarrays

Program Director: Owen Hughes (*owen@eonresearch.com*)
Phase II
Funded by SBRP: 2002-2011

In Phase II, Eon Corporation will expand on Phase I; this project aims to develop DNA microarrays for the identification and understanding of environmental toxicity in one of the key organisms used for testing environmental toxicity the water flea *Ceriodaphnia dubia*. Eon Corporation will facilitate use of these arrays through contracted performance of microarray-based tests, and distribution of an expression analysis database that incorporates identification, function, and expression information for each element/gene.

Microvi Biotech, LLC., Overland Park, Kansas

A Novel Permeable Barrier for Groundwater Bioremediation

Program Director: Fatemeh Shirazi (*fshirazi@microvibiotech.com*)
Phase II
Funded by SBRP: 2007 - 2009

The overall and long-term objectives of Microvi Biotech's SBIR research are to develop new approaches that can cost-effectively destroy major contaminants in water resources while protecting human life and the ecosystem. Phase I results allow for the further development and validation of new technology under field conditions at Edwards Air Force Base (AFB). A comprehensive evaluation of this new technology and the critical design and operational criteria will help complete the analysis of scale-up issues, as well as the long-term performance of the completed new technology. Upon the successful completion of the pilot-scale demonstration in Phase II, a full-scale treatment unit will be supported by Microvi Biotech's Phase III partner, Edwards AFB.

Tesla Laboratories, Inc., Boulder, Colorado

Advanced Toxic Metal Contaminant Remediation System

Program Director: Patrick I. James (*pijames@tesla.net*)
Phase II
Funded by SBRP: 2004-2010

This project's long-term application enhances public health by lessening exposure to toxic metals by reducing their release into the environment. Phase I successfully demonstrated concept technical viability and experimentally verified the new technology. Tesla Laboratories' objectives for Phase II include extending the Phase I work and seeking to create a complete pilot-scale 10 gallon per minute (GPM) water treatment system incorporating the new technology, in addition to demonstrating its operation under service conditions, and positioning the technology for commercialization.

Individual Research Projects

Arizona State University

Novel Approaches to Studying the *in situ* Bioremediation of Complex Mixtures

Program Director: Ulrich Rolf Halden (*halden@asu.edu*)
Funded by SBRP: 2006 – 2009

Dr. Halden and his research team's long-term goal is to improve the success rate of bioremediation at sites containing complex chemical mixtures by using *in situ* microcosm array (ISMA) technology. The ISMA is a field-deployable, miniaturized laboratory consisting of a large number of small microcosms arranged in parallel. Upon deployment, incubation, and retrieval from a ground water well, the ISMA can be analyzed to reveal the impact of mixture components on the rates of pollutant degradation and on the structure and function of microbial communities. Dr. Halden's objectives for this work are to evaluate the ISMA with respect to reproducibility and discriminatory power; ability to assess additive, synergistic, and antagonistic effects of mixture components on microbial communities; and utility in simulated field conditions. Dr. Halden also plans to deploy the ISMA device at a Maryland Superfund site.

Louisiana State University

Development of a Demonstrable Model of Dioxin Formation

Program Director: Barry Dellinger (*barryd@lsu.edu*)
Funded by SBRP: 2006 – 2009

This research is focused to develop demonstrable and practical models for the formation of PXDD/F (polychlorinated dibenzo-p-dioxins and dibenzofurans, polybrominated dibenzo-p-dioxins and dibenzofurans, and mixed bromo and chloro congeners) in combustion and thermal processes. Specifically, the researchers are working to: determine the role of combustion-generated nanoparticles in the formation of PXDD/F and other bromo/chlorohydrocarbons; formulate a mechanism of PXDD/F formation; measure and calculate the rates of key elementary reactions; consolidate this information into detailed elementary reaction kinetic models; and identify particles, pollutant mixtures, and combustion conditions that are most likely to have human health impacts.

Medical University of South Carolina

Integrating Microbial Biostimulation and Electrolytic Aeration to Degrade POPs

Program Director: Harold May (*mayh@musc.edu*)
Funded by SBRP: 2008-2011

Because naturally occurring anaerobic dechlorination of chlorinated organics is generally incomplete, Dr. May is working to complete the anaerobic process to unflanked di- through tetrachlorinated by *in situ* bioaugmention with dechlorinating microorganisms followed by application of low current hydrolysis to provide a constant level of oxygen for the complete degradation of the chlorinated compounds. This integrated approach will optimize both anaerobic and aerobic processes to achieve complete *in situ* detoxification of chlorinated compounds through mineralization to small molecular weight metabolites and carbon dioxide. Implementation of a tractable *in situ* detoxification process to organohalide impacted sites will mitigate exposure to the food chain and subsequent exposure risks to the general public.

New York University School of Medicine

Mechanisms of Resistance of Aquatic Vertebrate Populations to Mixtures

Program Director: Isaac Wirgin (*wirgin@env.med.nyu.edu*)
Funded by SBRP: 2006 – 2009

The overall objectives of this project are to describe the extent of resistance to environmentally relevant doses of coplanar PCBs and TCDD in the Hudson River tomcod population and to characterize its mechanistic basis. Although, at one time, tomcod from the Hudson River exhibited remarkably elevated prevalences of hepatic tumors, the role of PCBs in this process was never empirically addressed. In controlled laboratory studies, the researchers are determining if tomcod offspring from the Hudson River, compared to those from sensitive populations, are resistant to hepatic neoplasia and related preneoplastic endpoints such as preneoplastic lesions, K-ras activation, ROS modified bases, bulky DMA adducts after exposure to PCBs and PAHs. The researchers are also investigating the effects of co-exposure to Cr VI on B[a] P- induced mutations, DNA adducts, and nucleotide excision repair at the K-ras oncogene which is frequently mutated in environmentally-exposed and chemically-treated fishes.

Northeastern University

A Reactive Mat to Remediate Contaminated Sediments and Reduce Health Risks

Program Director: Thomas Clair Sheahan (*tsheahan@coe.neu.edu*)
Funded by SBRP: 2008 – 2011

Contaminated sediments present a global public health challenge that requires new, innovative approaches. Dr. Thomas Sheahan is developing a new type of permeable, reactive geocomposite for remediation and management of contaminated sediments. The barrier, which consists of one or more filtering layers surrounding a reactive layer, can be placed on the sediment surface. By immobilizing and/or neutralizing contaminants, the composite has the potential to minimize further contaminant migration and, in subaqueous environments, contaminant resuspension and diffusion into the overlying water column. This will limit the bioavailability of contaminants and bioaccumulation in aquatic food webs, which can be a pathway for human exposure via ingestion.

Stanford University

Activated Carbon as a Multifunctional Amendment to Treat PCBs and Mercury

Program Director: Richard Luthy (*luthy@stanford.edu*)
Funded by SBRP: 2007-2010

The goal of this research is to develop activated carbon (AC) amendment as a multifunctional, *in situ* sediment remediation technique that will reduce the bioavailability of mercury (Hg) and polychlorinated biphenyls (PCBs) at contaminated sediment sites. These goals will be accomplished through a combination of spectroscopic, physicochemical, and biological tests. This research advances AC amendment as a remediation strategy that will lower human health risks by reducing the level of Hg and PCBs entering the food chain, and decreasing the availability of Hg and PCBs in the
local environment.

Stony Brook University-SUNY

Sources, Fate, and Identification of Endocrine Disrupting Compounds in the Hudson

Program Director: Bruce Brownawell (*bbrownawell@notes.cc.sunysb.edu*)
Funded by SBRP: 2006 – 2009

The goal of this study, which includes extensive field studies in the Hudson Basin, is to increase knowledge of the sources, environmental fate and health risks of chemical contaminants and their transformation products that have the potential to disrupt endocrine function in wildlife or humans - alkylphenol ethoxylate metabolites (APEMs), polybrominated diphenyl ethers (PBDEs) and other brominated flame retardants. This work focuses on sediments, which are likely to be larger reservoirs of bioaccumulative and persistent EDCs than wastewater effluents and ambient water.

University of California-Merced

Sequestration and Immobilization of Metal and Metalloid Contaminants in Sediments

Program Director: Peggy O'Day (*poday@ucmerced.edu*)
Funded by SBRP: 2007-2010

This project is investigating the use of reactive amendments as an alternative remediation technology for hazardous metal and metalloid contaminants, namely, As, Hg, Se, Pb, Cu, of high priority in sediments at Superfund and other contaminated sites. Using laboratory experiments with sediments from contaminated sites, the team is investigating contaminant sequestration reactions and aging of the amendment products, with the aim of optimizing novel treatments to maintain or increase their stability as sedimentary environments change from oxidized to reduced. This project will also evaluate the feasibility of adapting existing engineering technologies for the delivery of reactive amendments to field systems.

University of Cincinnati

Bacterial Diversity as a Biomarker of Soil Health

Program Director: Daniel Oerther (*daniel.oerther@uc.edu*)
Funded by SBRP: 2006 – 2009

In this project, researchers are using molecular biology-based measures of bacterial diversity as a diagnostic tool to predict the threat to human health at Superfund sites, that is, using bacteria as sentinels for pollution. The researchers expect that the positive findings of this study can be used to evaluate the potential for success of bioremediation strategies as well as to establish an effective endpoint of bioremediation – when appropriate bacterial diversity has been re-established and the threat to human health significantly reduced.

University of Cincinnati

PAH Bioremediation and Monitoring in Biowalls

Program Director: Paul Bishop (*paul.bishop@uc.edu*)
Funded by SBRP: 2006 – 2009

Researchers are studying a novel groundwater treatment system known as a "biowall" or permeable bio-barrier system. Research applying microelectrodes developed in SBRP-funded studies and will yield information on the mass transport mechanisms, structural forms, and biodegradation processes in soil biofilms. The result of this research will be a better understanding of how complex mixtures of toxic materials can be bioremediated at Superfund sites so as to reduce the potential impact of these PAHs and heavy metals on human health.

University of Delaware

Toxicity and Mobilization of Metals and Metal Mixtures in Sediments

Program Director: Dominic DiToro (*dditoro@ce.udel.edu*)
Funded by SBRP: 2006 – 2009

The goal of this research is to develop models for predicting the toxicity and mobilization of individual metals and metal mixtures in sediments. These predictions are critical in evaluating the risk associated with contaminated sediments at Superfund sites. The researchers are developing a model that predicts the toxicity of metals in sediments with little or no acid volatile sulfides. The researchers will also work to develop the next generation of models for the prediction of mobilization of metals from sediments that explicitly include the mechanisms of mobilization.

University of Florida

Molecular Mechanisms of Endocrine Disruption in Largemouth Bass

Program Director: Nancy Denslow (*denslow@biotech.ufl.edu*)
Funded by SBRP: 2006 – 2009

Fish are useful as sentinels of environmental quality and are excellent models to monitor adverse effects in reproduction caused by contaminants in Superfund sites. This research tests the hypothesis that exposure of largemouth bass to concentrations of organochlorine pesticides (OCPs) found in the Lake Apopka, Florida region disrupts endocrine system function by sex hormone receptor mediated and sex hormone receptor independent mechanisms. The researchers are conducting a set of interrelated experiments from the organismal level where pleiotropic effects of OCPs can be measured to the cellular level where specific molecular mechanisms of action can be assessed.

University of Maryland-Baltimore County

Pilot-scale Research of Novel Amendment Delivery for *in situ* Sediment Remediation

Program Director: Upal Ghosh (*ughosh@umbc.edu*)
Funded by SBRP: 2007 – 2010

Human health risks associated with the presence of chemicals in sediments arise from either direct contact with the sediments or by eating fish and shellfish that accumulated chemicals from the sediments. The researchers are developing an *in situ* remediation technology through a pilot-scale investigation aimed at addressing the critical barriers in the advancement of the technology. This research will evaluate the effectiveness of a novel approach to alter the binding capacity of sediments to reduce human exposure to such contaminants.

University of Missouri-Rolla

In situ Sediment Remediation Using Benthic Waterjet Amendment Placement

Program Director: Joel Gerard Burken (*burken@umr.edu*)
Funded by SBRP: 2008-2011

Dr. Joel Burken's research is focused to optimize design and operational parameters for *in situ* sediment remediation amendments. His work to develop methods, designs and procedures to minimize resuspension will allow for efficient use of newly developed amendments, which are expensive, and likely foster the research into other amendments currently viewed as too expensive or undeliverable. This research will provide direct input for scale-up and transition to field-scale testing and implementation.

University of Texas-Austin

Funnel and Gate Innovations - Stabilization and Treatment of Contaminated Sediments

Program Director: Danny Reible (*reible@mail.utexas.edu*)
Funded by SBRP: 2007 – 2010

The primary goal of this project is control of exposure and risk to human health and the environment at the sediment-water interface. The resulting reduction in exposure and risk to benthic and aquatic organisms will eliminate human food chain exposure to contaminants in sediments. This project tests the broad hypotheses that a funneling cap can effectively contain contaminants and introduced reagents beneath the cap, and effectively channel interstitial fluids (water or NAPL) to a collection or treatment gate.

http://www.niehs.nih.gov/sbrp