



# UNIVERSITY OF KENTUCKY

## SUPERFUND BASIC RESEARCH PROGRAM



The overall goal of the SBRP centers on the toxicology of Superfund chemicals, with chlorinated organics as model toxins, and how health effects of exposure can be modulated by both intrinsic and extrinsic factors, namely genetics and nutrition. A major objective of our program is to explore the paradigm that nutrition can modify Superfund chemical toxicity and thus modulate health and disease outcomes associated with Superfund chemical insult. Studies are underway to investigate mechanisms of adverse health effects of chlorinated organic compounds and to explore novel techniques for the detection and removal of these pollutants from the environment.



### Student Success



At the 2004 PCB Workshop **Gudrun Reiterer** won the Best Toxicological Poster Award  
**Karthik Venkatachalam** won the Best Analytical Chemistry Poster.



**Morgan Campbell** won the first place award from his oral presentation section and overall third place award for his paper at 2005 AIChE.

**Xabier Arzuaga** won the Merck Postdoctoral Travel Award to the 2008 Society of Toxicology Meeting.

### AIChE

**Jian, Xu** received the Environmental Division Student Paper Award at the AIChE Conference in 2005.



**David Meyer**, received 2nd place award for his poster presentation at the ECI Water Treatment and Water Reuse Conference.

**Beth Oesterling** received an American Heart Association Pre-doctoral Fellowship for 2006-2008.



**Lei Wang** won the 2006-2007 University of Kentucky Presidential Fellowship Award.  
**Zuzana Majkova** received a student travel award to the 2008 SOT Meeting.

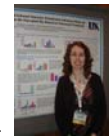
**Jian Xu** won a poster award at the 2007 North American Chemical Society Annual Meeting.

**Students and postdocs** at the 2007 KRCEE Scientific and Technical Symposium  
**Amol Date** was chosen to give the Sci-Mix Presentation at the Fall 2006 American Chemical Society Meeting.

**Andrew Lynch**, an undergraduate researcher, was awarded the prestigious Gates Cambridge Scholarship to receive his Ph.D. in Chemical Engineering.



**Beth Oesterling** received a poster award at the 2007 SBRP Annual Meeting.



### Proposed Research Projects

#### Project #1: Superfund Chemicals, Nutrition, and Endothelial Cell Dysfunction

The goals of this project are to investigate if lipid rafts (caveolae) are involved as a critical regulatory platform for the protective mechanisms of bioactive food components (e.g. flavonoids) against



Bernhard Hennig

PCB-induced endothelial cell dysfunction and determine if dietary polyunsaturated fatty acids can differentially modulate PCB-induced endothelial cell dysfunction as well as change the cellular lipid milieu to alter the protective actions of flavonoids.

#### Project #3: Vascular Mechanisms of PCB-Induced Brain Metastases

The goals of this project are to determine molecular mechanisms of metastatic events induced by exposure to PCBs and how nutrition can modulate and protect against dissemination of



Michal Toborek

tumor cells. It is hypothesized that PCBs alter caveolar-associated pathways, such as the Ras and Rho signaling cascades, leading to brain microvascular endothelial cell injury, disruption of the blood brain barrier, and the development of brain metastases.

#### Project #4: The Impact of Obesity on PCB Toxicity

The goal of this project is to investigate the mechanisms of coplanar PCB-induced regulation of lipid deposition and proinflammatory gene



Lisa Cassis

expression in adipocytes and the role of AhR in these processes. Dietary manipulation of the fat content will be studied for modulating the adverse effects of PCBs on Angiotensin II-induced abdominal aortic aneurysms.

#### Project #6: Sensing Superfund Chemicals with Recombinant Systems

The goals of this project are to design and develop genetically engineered whole-cell biosensors using bacterial resistance operons and protein-based molecular switches for toxic compounds



Sylvia Daunert

as well as incorporate these switches into miniaturized microfluidic platforms and investigate the use of spores as rugged storage elements. The aim is to develop highly sensitive detection systems for environmental pollutants including PCBs and related organics.

#### Project #7: Chloro-Organic Degradation by Nanosized Metallic Systems and by Chelate-Modified Hydroxyl Radical Reaction

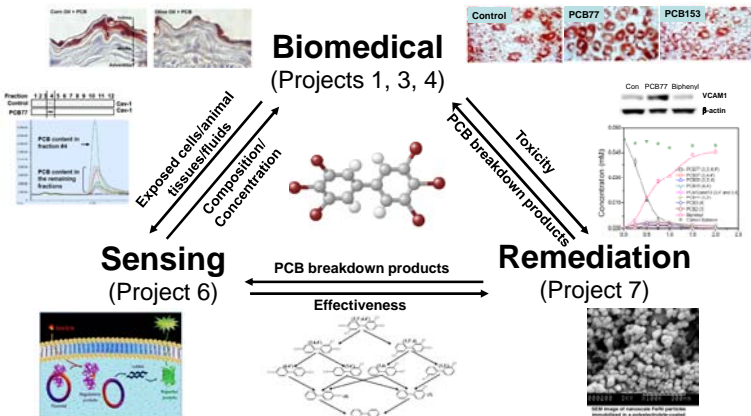
The overall goal of this project is to advance the development of bimetallic/catalytic, nanostructured metal systems for reductive



Dibakar Bhattacharyya

platform, and the influence of both hydroxyl and superoxide anion radical on the oxidative platform. Integration of these two steps will lead to the dechlorination of halogenated organics to remediated products with lower toxicity.

### Integration of Projects

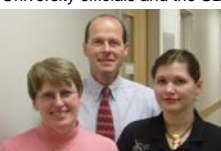


### Core A: Administration

*Building a Well Organized Program*

Core Leader: Bernhard Hennig

- Responsible for:
- coordination
  - planning
  - financial oversight
  - information dissemination and transfer
  - liaison between Government and University officials and the SBRP



Betty Newsom Jennifer Moore

### Core B: Research Support

*Building the Integration of Research Bioinformatics*

Core Leader: Michal Toborek



Haining Zhu Arnold Stromberg Penri Black

The Research Support Core provides a central facility that will enhance and develop the research capabilities of the University of Kentucky SBRP in the areas of "omics", bioinformatics, statistics, and PCB analysis.

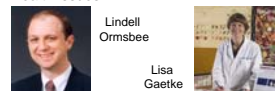
### Core C: Research Translation

*Building Bridges Between the Disciplines*

Core Leader: Lindell Ormsbee

The Research Translation Core will translate research findings to: Government, Industry, Broad Audiences, Health Professionals, and Academia by:

- communicating important research outcomes to appropriate audiences;
- developing a mechanism for receiving feedback from target audiences to confirm the utility and appropriateness of the communication tools selected;
- ensuring that research results are being applied to immediate environmental and health issues.



Lindell Ormsbee Lisa Gaetke

### Core D: Superfund Community Action through Nutrition

*Building Partnerships with Communities*

Core Leader: Lisa Gaetke

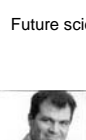


SCAN will provide nutrition and environmental health education programs to improve knowledge, attitudes, and behavior related to reducing health risks associated with exposure to Superfund environmental contaminants.

### Core E: Superfund Cross-Disciplinary Training

*Building on Successful Collaborations*

Core Leader: Leonidas Bachas



Future scientists/ engineers need:

- thorough training in their field
- basic knowledge about socio-economic, law, engineering, and science aspects outside their field
- an ability to communicate and cooperate with specialists in other disciplines.