

US EPA ARCHIVE DOCUMENT

Emerging Analytical Tools to Assess Exposure and the Personal Environment

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Program Director

Center for Risk and Integrated Sciences

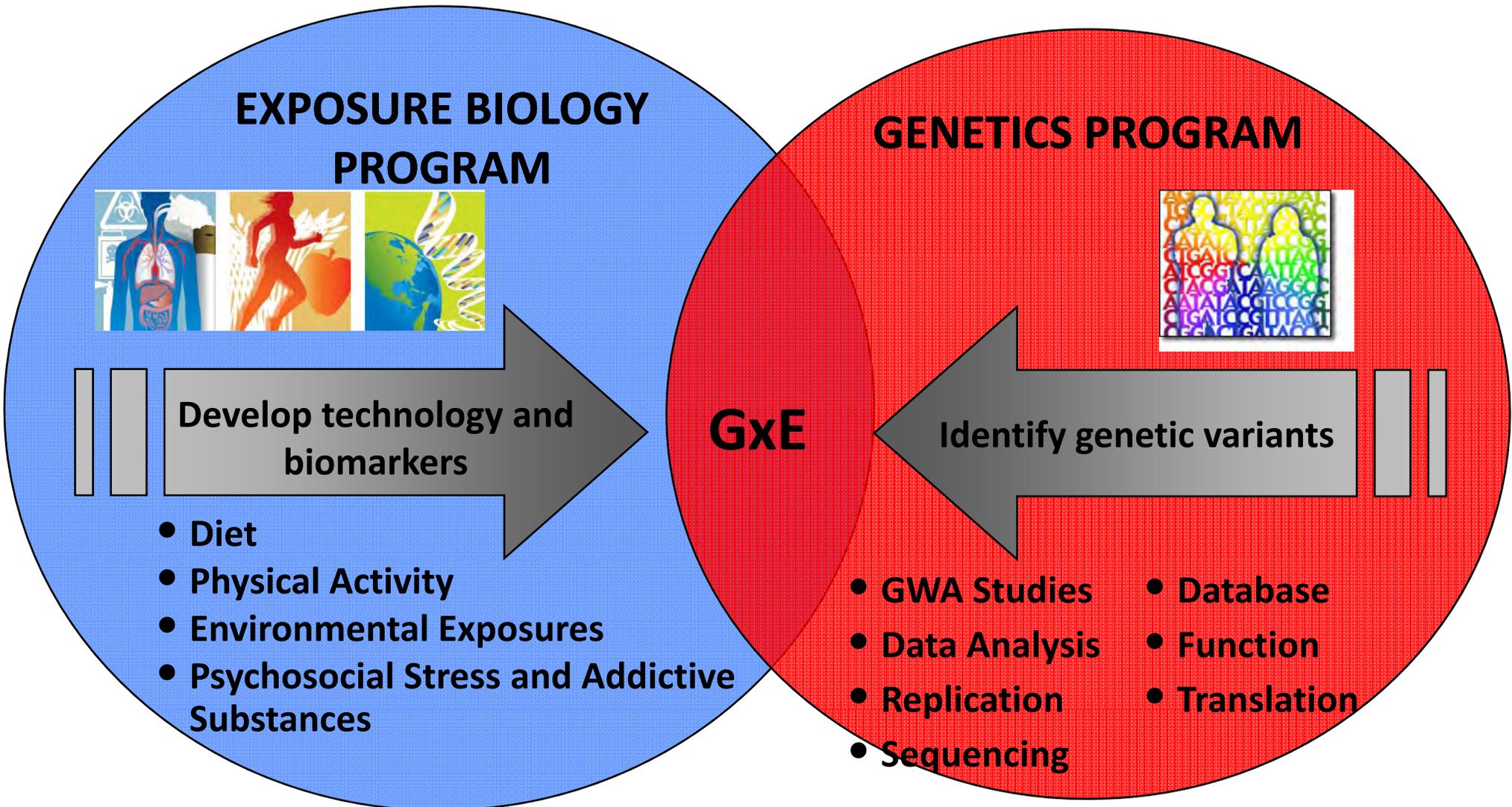
National Institute of Environmental Health Sciences





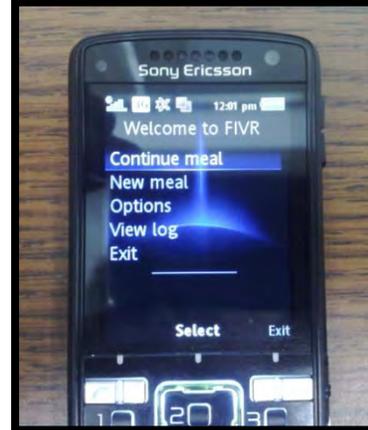
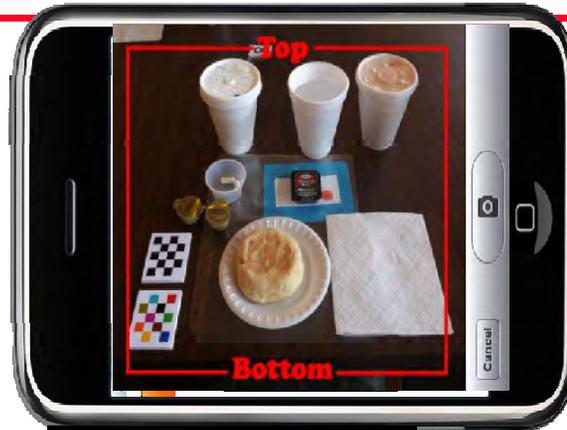
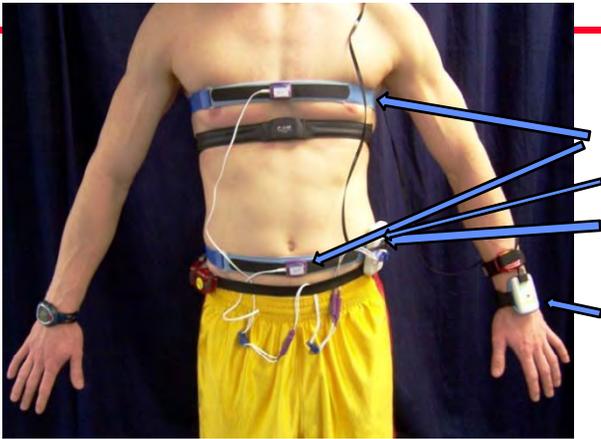
NIH Genes, Environment and Health Initiative Exposure Biology Program

Genes, Environment and Health Initiative: The Vision





Improved Measures of Diet & Physical Activity



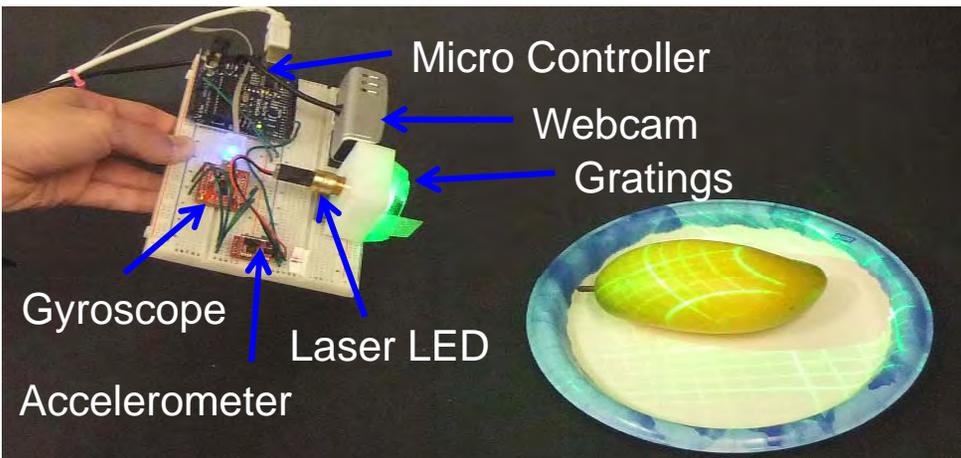
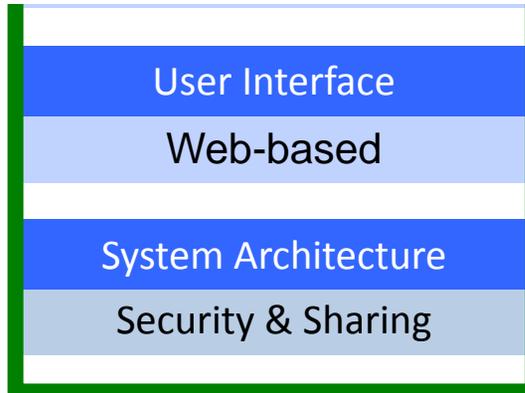
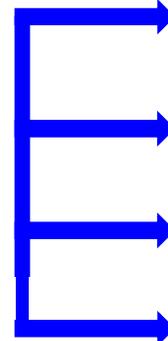
PALMS SYSTEM

← GIS

← STATISTICS

← VISUALIZE

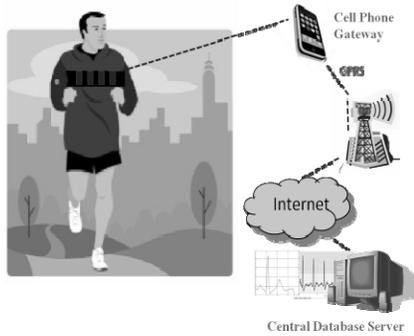
ANALYSIS





Network on Psychosocial Stress and Addictive Substances

Autosense



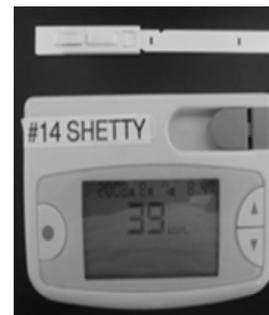
Electronic Diary with GPS Function



Electronic Diary with Real-time and Structured Interview Technologies



Daysimeter

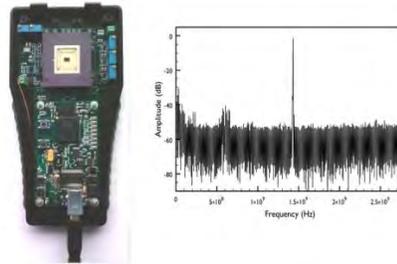


Colorometric Strip

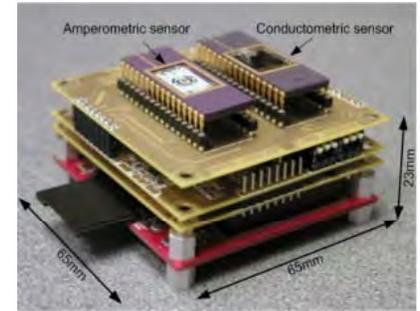
Sensors for Analysis of Chemical Exposures



Personal Monitor for Black Carbon
Columbia University
Steven Chillrud



RAPID Allergenic Particle Identification
Columbia University
Ken Shepard



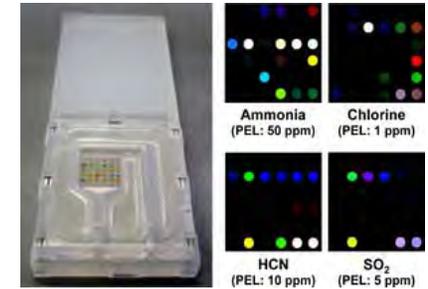
Nanosensor for Diesel and Gasoline Exhaust
UC Riverside
Ashok Mulchandani



Personal Ultrafine Particle Sensor
University of Cincinnati
Sang Young Son



Wearable Sensor for Pesticide Exposures
FLIR, formerly ICx Technologies
Markus Erbedinger, PI



A Colorimetric Array VOC Dosimeter
University of Illinois at Urbana-Champaign
Kenneth S. Suslick



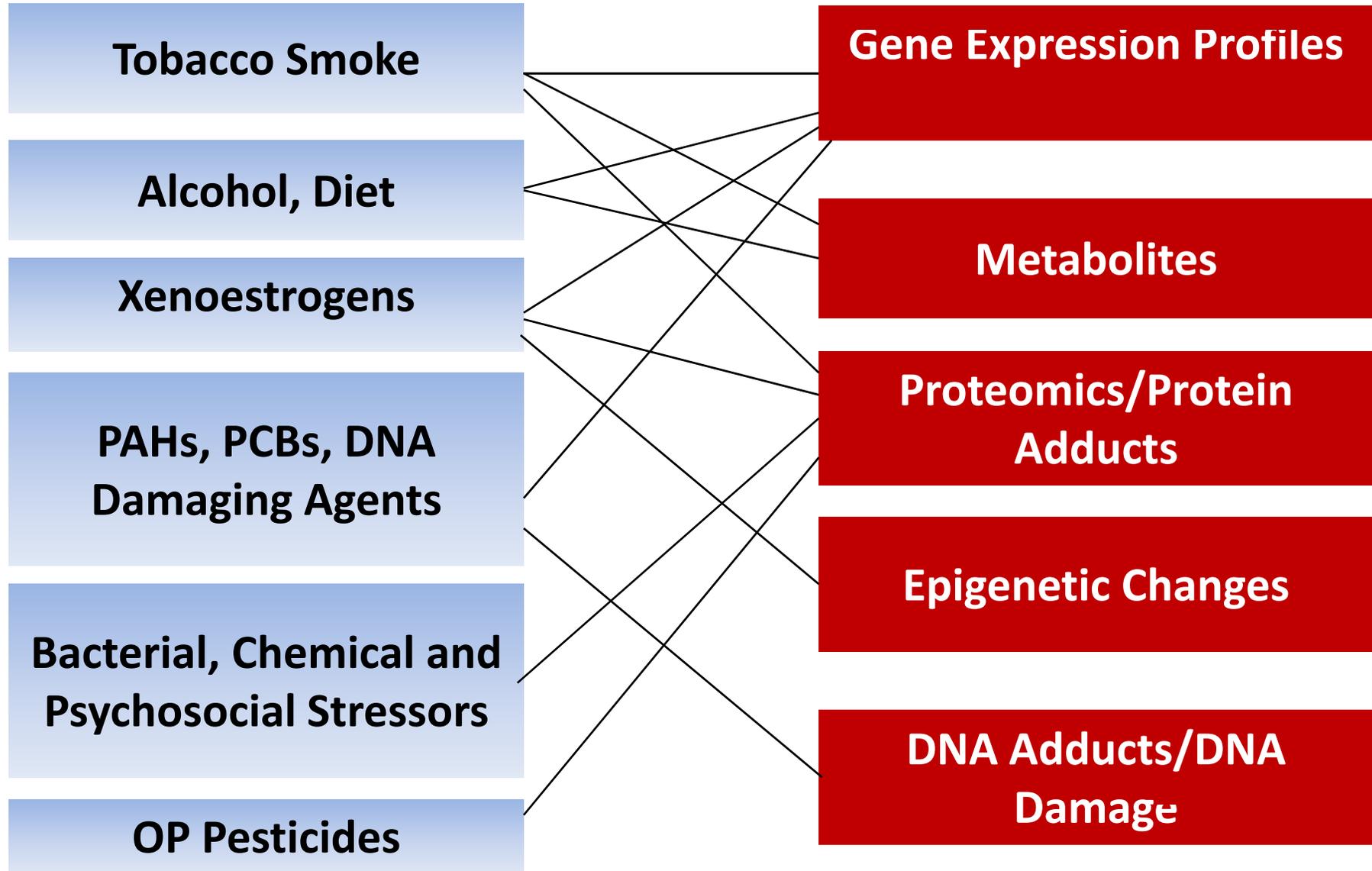
A Personal Aerosol Sensor for Children's Asthma
RTI International
Charles E. Rodes, PI



A Real-time Sensor System for Volatile Compounds
Arizona State University
N.J. Tao

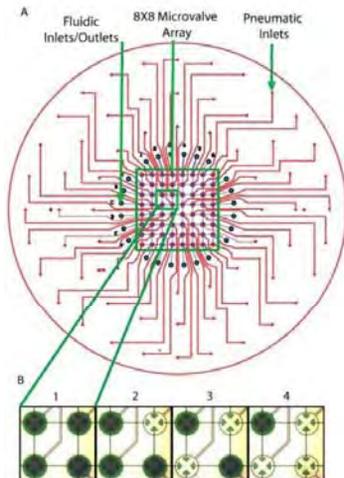


Biological Response Indicators.- Candidate Discovery

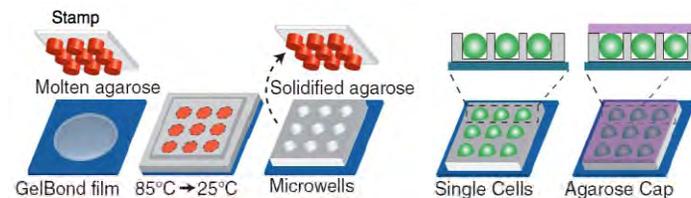




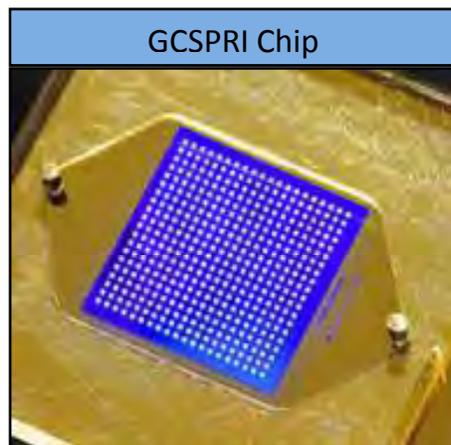
Biological Response Indicators



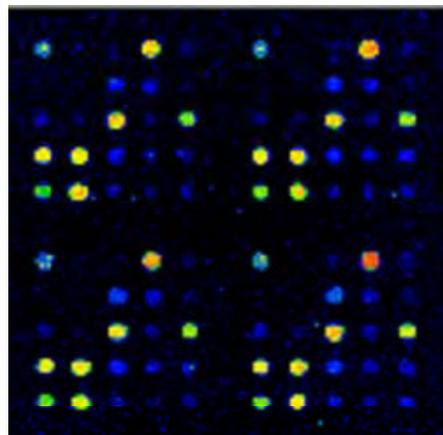
Microfluidic Immunomagnetic Assay



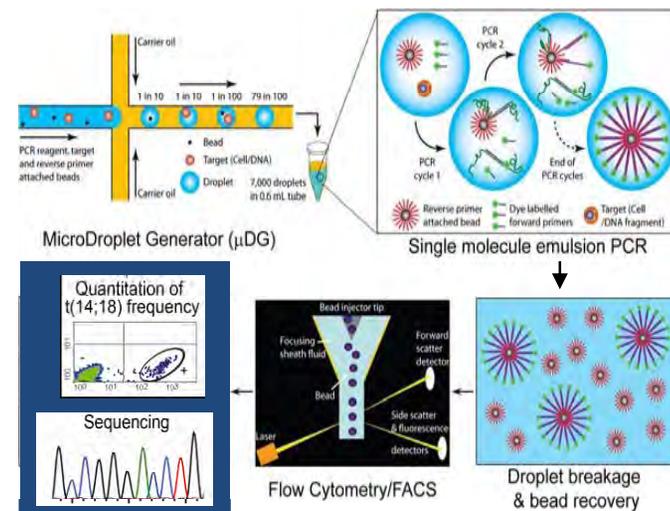
Comet Chip



SPRI and Fluorescence Plasmonics



ELISA Microarrays



Single Cell Genetic Analysis

Vignettes of Pesticide Exposure Assessment Technology Focused Efforts at NIEHS



Enzyme Based Wearable Environmental Sensor Badge for Personal Exposure Assessment

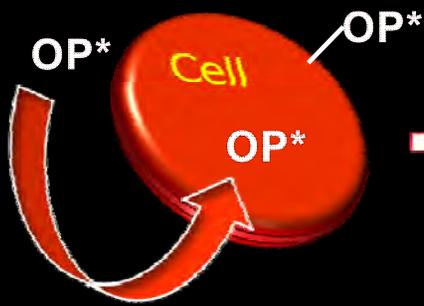
Jessica Milke, Jessica Sinclair and Markus Erbedinger

Contact: markus.erbedinger@icxt.com (412) 423 2103

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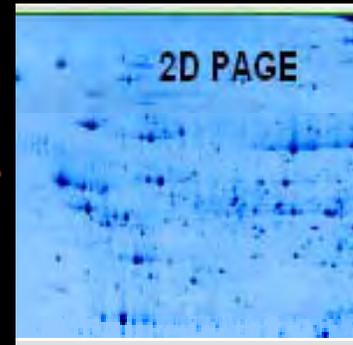
Research Plan



* = reporter

OP-adducted & unmodified proteins

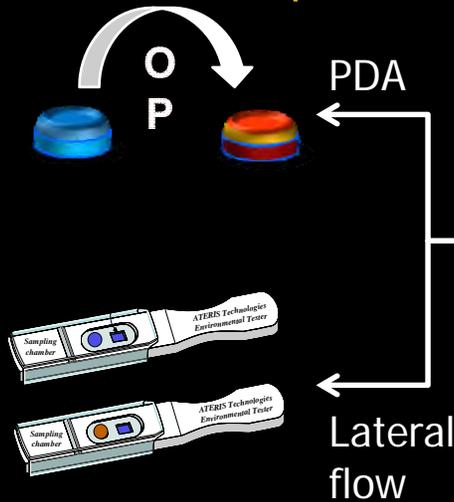
DMOP- and DEOP-modified proteins have MS signature. Unmodified may show altered regulation.



Identify OP-modified proteins or change in protein regulation (cell, biofluid)

1. Digest spots
2. MS analysis and ID proteins
3. ID OP-adducted residue

Translational component



Detect OP-protein biomarker in biological fluid.

Validate OP-biomarker antibodies in ELISA and Western using standards

Generate antibodies to OP-adducted peptides or proteins

Key Point: which OP reporter groups can help elucidate/identify protein targets?



Other NIEHS-funded Projects on Pesticide Detection

- **“HerbiScreen” biosensor based on electrochemical detection of inhibition of photosynthesis of model algae**
 - BioDetection Instruments LLC , Xiaoli Su
- **Disposable sensors based on SERS detection of OPs and OCs in air (vapor)**
 - EIC LABORATORIES, INC., Kevin Spencer
- **Sensor based on carbon nanotubes for electrical impedance detection of pesticides in surface water**
 - Dahl Natural, Anne Schwartz
- **Lateral flow-based assay for OPs (dialkylphosphates) in urine using high affinity chemosensory proteins from insects.**
 - Inscent, Inc. Ken Konrad
- **GC-ECD method for detecting pesticides (OP’s, OC’s, and pyrethroids) in breast milk, infant formula, and baby food**
 - Emory University, Barry Ryan

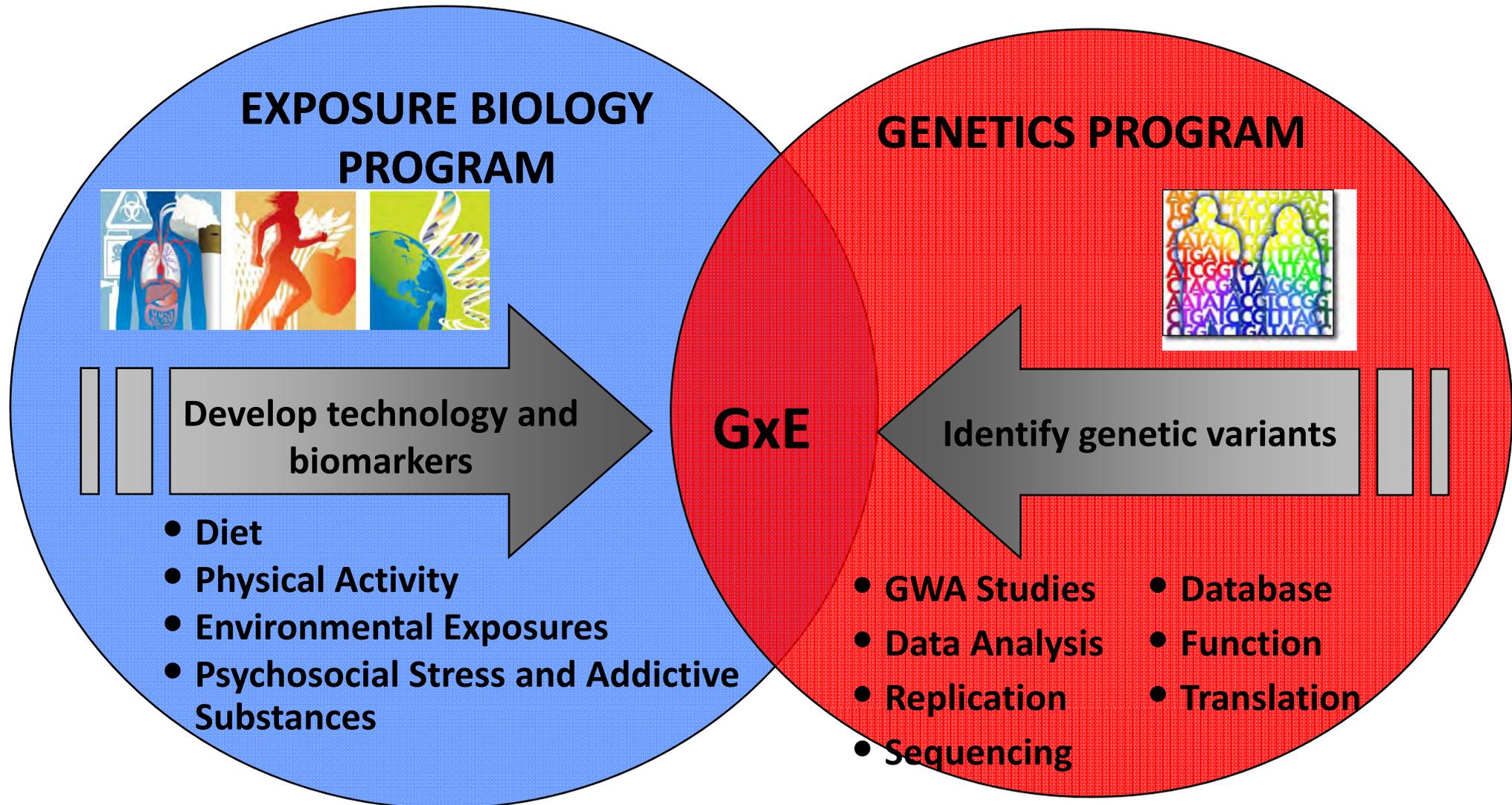
Planned NIEHS/NIH Efforts

Concepts Approved by the NIEHS
Advisory Council May 2011



NIH Genes, Environment and Health Initiative Exposure Biology Program

Genes, Environment and Health Initiative: The Vision



Remaining Barriers to conducting GxE studies

- Characterization of the personal environment still lags
 - We have successfully developed promising tools for measuring individual factors in the external environment but they are not yet validated or integrated
 - We have not yet bridged the gap between external exposure and biological response
- Need Proof-of-Principle for Global analysis of Gene-Environment Interplay
- Need understanding of the mechanistic underpinnings of Gene-Environment interactions

Continued Development of Tools for Exposure Biology:

Build on successes of the Exposure Biology Program to improve our ability to characterize the personal environment

➤ Proposed Activities

- Validation and field testing of prototype tools and candidate markers
- Integration of tools for multi-component analysis of exposure
- Development of technologies for biomonitoring

Proof of Principle for Gene-Environment Interplay:

Build on successes of GEI Genetics and Exposure Biology Program to Demonstrate Utility of Genetic and Environmental Factor interactions for Disease Risk

➤ Proposed Activities

- Secondary analysis of existing GWAS data
- Adding genomic info to environmental studies
- Adding new environmental measures to genomic studies
- Functional Analysis of Gene-Environment Interactions

Thank You!

