# Environmental, Microbial, and Mammalian Biomolecular Responses to AhR Ligands

## MSU Superfund Research Program Center


## Norbert Kaminski, Director

## Brad L. Upham, Ph.D., Research Translation Coordinator


https://iit.msu.edu/centers/superfund/





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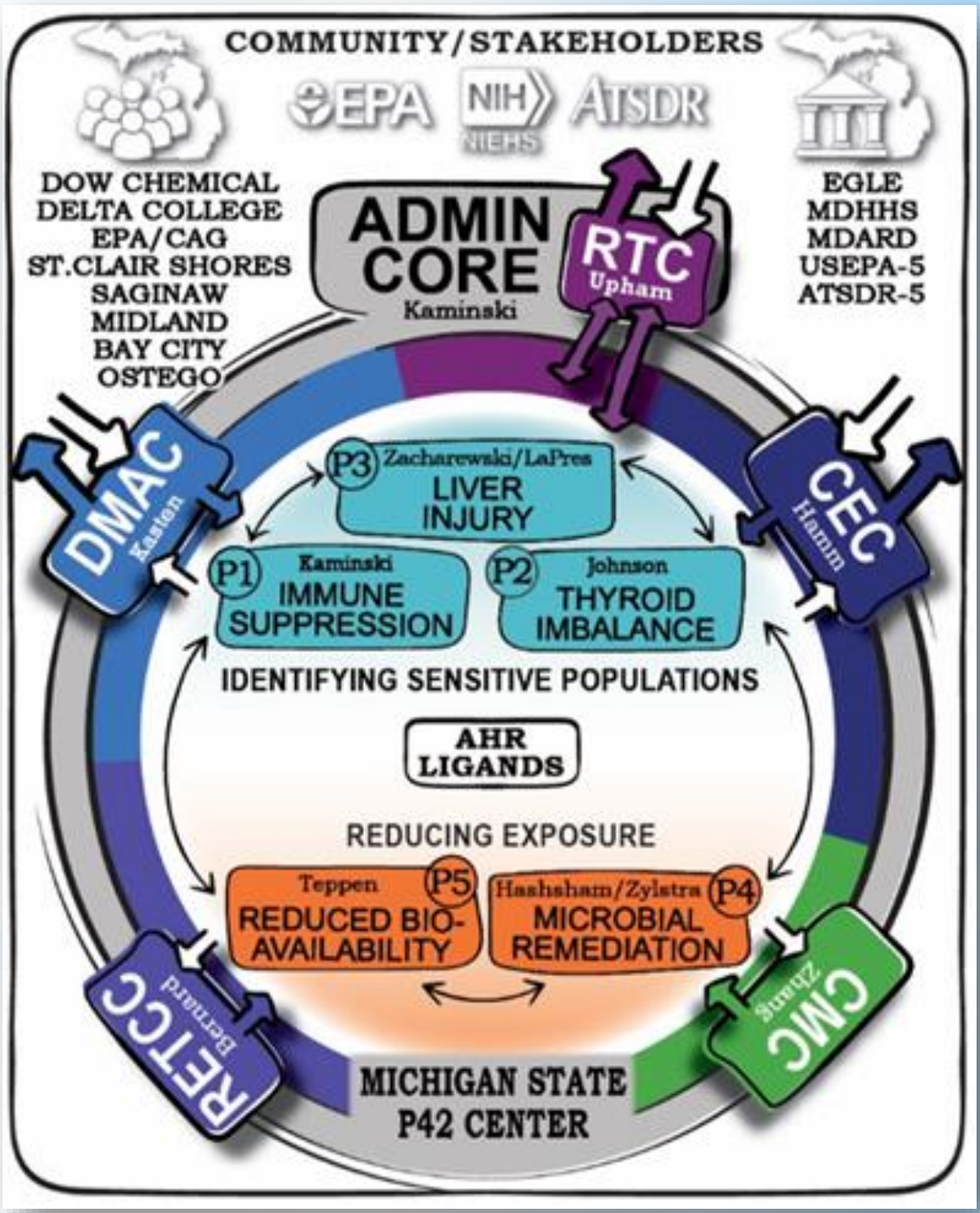
National Institute of Environmental Health Sciences
*Superfund Research Program*

# *MSU Superfund Research Center

"Environmental, Microbial and Mammalian Biomolecular Responses to AhR Ligands"

One of 25 Centers funded through the National Institute of Environmental Health Sciences (NIEHS) of the National Institute of Health (NIH)



# *Biomedical Research Projects

* **PRJ 1 (PI: Norbert Kaminski, Co-I: Lance Blevins)** has as its major objective to elucidate the mechanisms by which TCDD and DLC mediate suppression of the IgM antibody response through induction of inhibitory receptors preferentially expressed on CD5+ (innate-like) B cells.

* **PRJ 2** (**PI: Brian Johnson)** will characterize the mechanism by which AhR agonists disrupt thyroid hormone homeostasis.

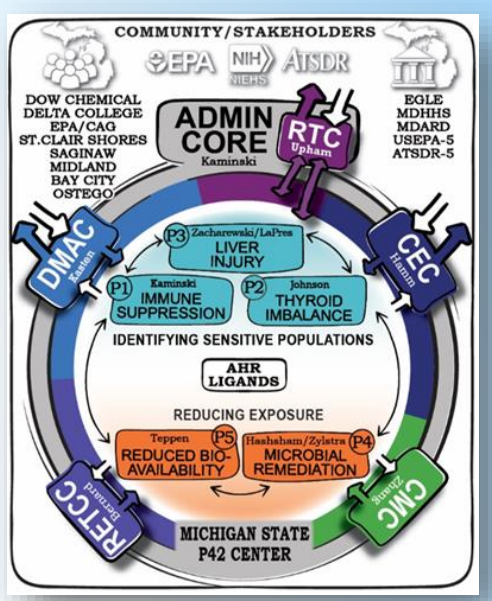
* **PRJ 3 (PIs: Timothy Zacharewski and John LaPres, Co-I: Rance Nault)** will investigate AhR-mediated metabolic reprograming associated with changes in cholesterol biogenesis and its mechanistic link to the progression of hepatic steatosis to steatohepatitis with fibrosis.

# *Environmental Research Projects

* **PRJ 4 (PIs: Syed Hashsham and Gerben Zylstra, CoIs: Alison Cupples and Donna Fennell)** identify new microbes capable of metabolizing PCDD/Fs at Superfund Sites, determine the dechlorination sequence (community pathway), evaluate the respiratory needs of PCDD/Fs-degrading bacteria, establish respiration rate versus biomarker abundance, and develop models to predict TEQ reduction and health risks.

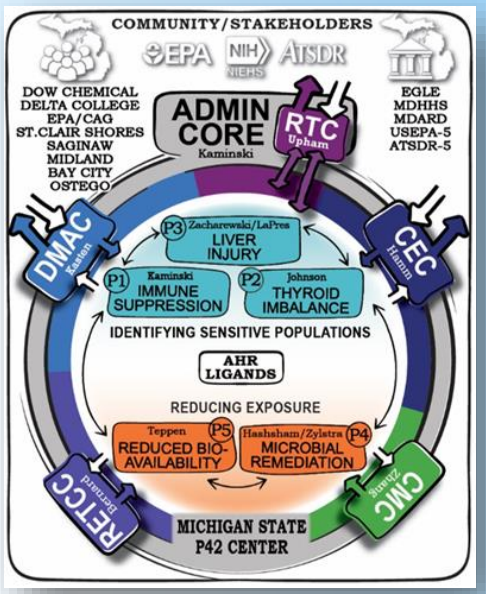
* **PRJ 5 (PI: Brian Teppen, Co-Is: Stephen Boyd, Cliff Johnson and Hui Li )** test the hypothesis that site-specific bioavailability of DLCs are affected by the black carbon geosorbent (BCG)-content of the site, and that remediation practices can be optimized through BCG addition, time, and remediation conditions to reduce the risks to acceptable levels.

# *Support Cores:




***Administartion (PI: Norbert Kaminski, RT: Brad Upham)** provides the **administrative, fiscal and communication resources** required to manage a large multidisciplinary research program. The PD/PI leads this Core and **is responsible for monitoring the progress and direction of research and has decision making responsibility regarding the overall grant effort and direction.** Also included are **Research Translation** (RT) activities led by Dr. Brad Upham who will communicate important research findings and outcomes emanating from the Program to appropriate target audiences and stakeholders in government (local, state and federal) and industry.

# *Support Cores:

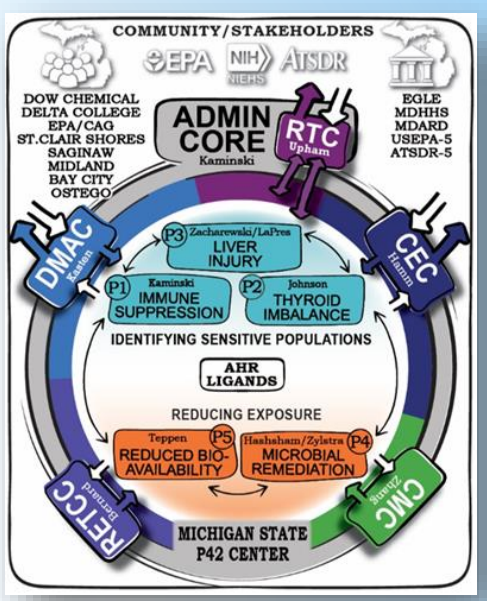



***Community Engagement Core (PI: Joseph Hamm, Co-Is: James Dearing, Kristan Ward, Adam Zwickle)** collaborate with the Michigan Department of Health and Human Services (MDHHS through a novel set of engagement activities that will listen to three Michigan communities affected by dioxins, empower them to make informed prevention decisions through health education interventions, and evaluate the impacts of those engagements. **Focus is to build trusting relationships between MDHHS and Michigan Communities**. And to disseminate what we learn with all USA Superfund Research Programs to better position these centers to build trust with the various individuals and groups impacted by their work.

# Community Engagement Core (public)

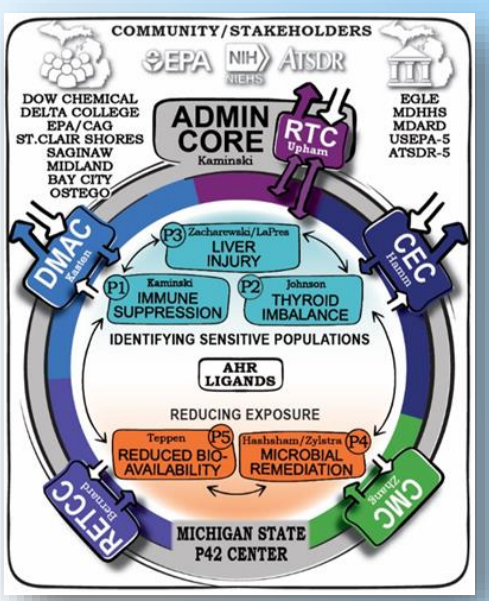
- **Listen**
  - Annual Environmental Health Survey
  - Local Advisory Group
- **Empower**
  - Health Education Interventions (+)
- **Evaluate**
  - HEI Evaluations
  - LAG Interviews
  - LAG Social Network Survey
  - DEH Interviews

# *Support Cores:



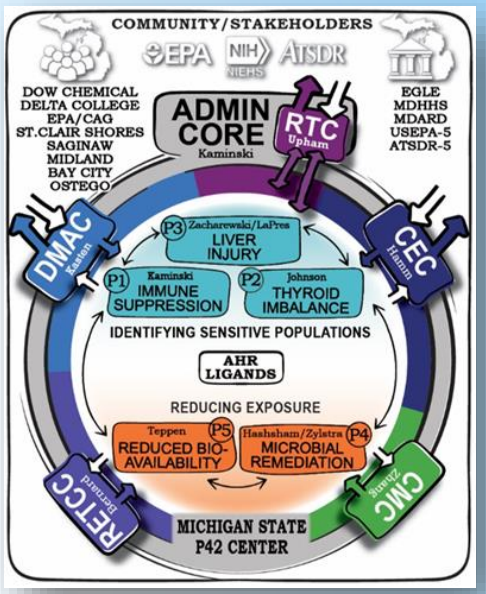

***Research Experience and Training Coordination Core (RETCC, PI: Jamie Bernard; Co-Is: Jay Goodman, Brian Teppen)** will coordinate cross disciplinary training of post docs and students in disciplines not traditionally linked with their respective programs. Using multifaceted approaches, biomedical research students will be trained in environmental science areas and environmental science trainees in biomedical research areas.

# *Support Cores:



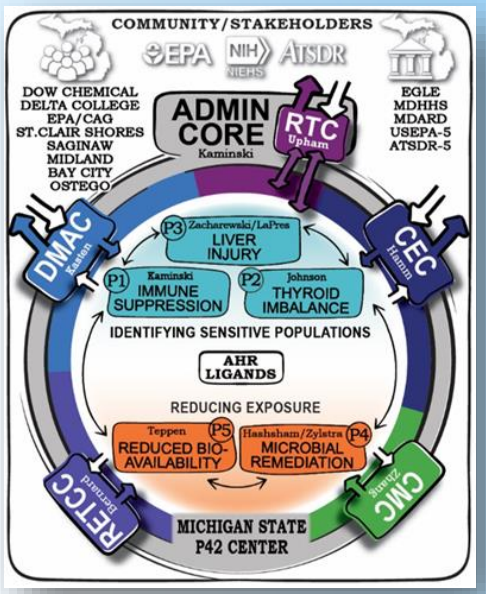

*Research Support - Computational Modeling Core (CMC, PI: Qiang Zhang, Co-Is: Sudin Bhattacharya and Rance Nault ) work collaboratively with MSU Center projects (PRJ 1-5) and the DMAC to assist in data analysis and the development of predictive dosimetry tools, and models of molecular, cellular, tissue, and organism responses to DLCs. Moreover, dynamic systems modeling of toxicity pathways for TCDD and DLC in hepatic, thyroid and immune tissues will be developed to elucidate nonlinear dose-response relationships and examine the extrapolation of low-dose environmentally relevant exposures to human health effects. Application of these tools will support biological research that contributes to next-generation health risk assessment of DLCs.

# *Support Cores:




*Data Management and Analysis Core (DMAC, PI: Eric Kasten, Co-Is: Sudin Bhattacharya, Jonathan Babbage and Rance Nault )** will develop a comprehensive data management and analysis framework, coordinating between projects and cores to foster data sharing, interoperability and analysis by adopting the Findable, Accessible, Interoperable and Reusable (FAIR) Guiding Principles. In addition, mechanisms and best practices will be established to ensure training in FAIR Guiding Principles, data quality assurance and data quality control.

# *Research Translation




*Develop well-established communication systems:

a. *Investigator-initiated research translation (IIRT):* Brad Upham, RT Coordinator, and Anupam Jhingran, Ph.D., Technology Manager from MSU Technologies will meet with each Project and Research Support Core at least biannually to focus on identifying translational opportunities and technology transfer and assist in IIRT
b. *NIEHS:* *R*eporting translational activities to SRP staff at NIEHS, e.g. data base
c. *Other SRP Centers:* Participate monthly RT-CEC monthly meetings, annual meetings, actively pursue research of common interests with other centers.

# *Research Translation (continued)

## *Develop multidirectional partnerships with government and non-government agencies:

a. State Level: Maintain open *dialogue with* Michigan Department of Environment, Great Lakes, and Energy (EGLE), and Michigan Department of Health Human Services (MDHHS), particularly in upgrading the MI Safe Fish App
*b. Federal Level: Maintain open dialogue with* US EPA Region 5, which oversees the cleanup of dioxins and dibenzofurans in the Michigan Tri-Cities area.
*c. Nongovernment professional organizations:* Tap into the expertise of the Society of Toxicology. Several members of our center are members of SOT and have held high level leadership positions offering many avenues to connect with this society in a meaningful way.

# *Research Translation (continued)

d. *Community:* Dr. Upham will attend quarterly meetings of the Saginaw-Tittabawassee Rivers Contamination Community Advisory Group (STRC-CAG) and maintain email communications with this group through their facilitator, Douglas Sarno. The STRC-CAG is composed of a broad cross-section of representatives from Bay, Midland and Saginaw counties. This CAG serves as the focal point for the exchange of information between residents and EPA Region 5, the state regulatory agencies, potentially responsible party and other federal agencies involved in site cleanup.

# *Research Translation (continued)

- **Provide Educational Resources to Key Stakeholders**

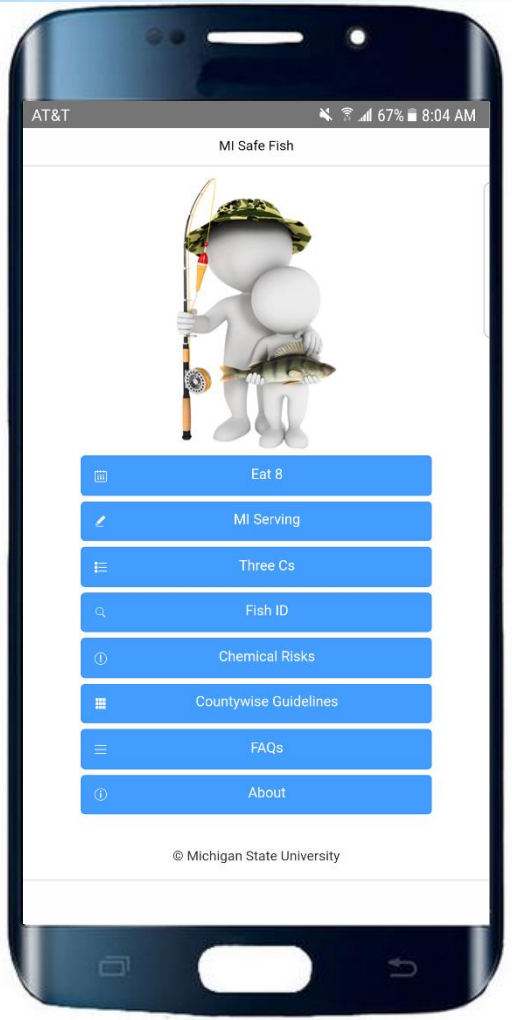
  a. Dr. Upham will work closely with the CEC, in developing educational resources, including those mentioned above.

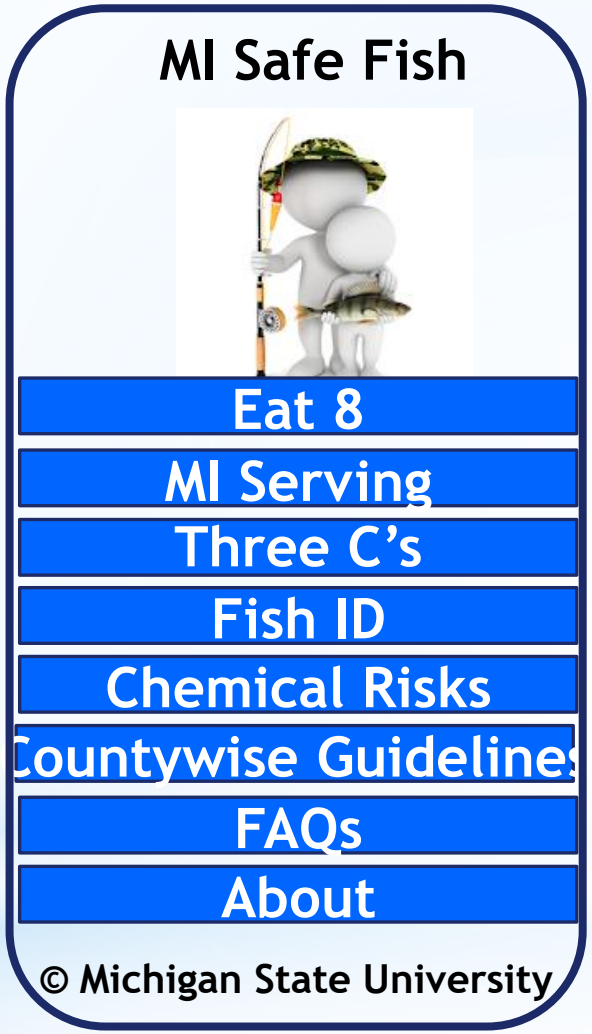
# *Research Translation (continued)

- **Transfer of Technology to External Stakeholders**

a. Drs. Upham and Jhingran will facilitate at their meetings with each research project and cores identify translational projects. Dr. Jhingran primary responsibility for MSU technologies is to assist MSU faculty in technology transfer such as filing patents and copyrights, material transfer agreements, and initiating small businesses, thus his experiences and commitment to assist us will be quite valuable to the RT efforts.
b. Continue to revise and update the *MI Safe Fish App*
c. Develop a new *Clean Communities APP* to help disseminate information broadly, with public health officials and communities as a primary target audience. In particular, the development of this app will rely heavily on the needs expressed by MDHHS and ATSDR colleagues.

# MI Safe Fish App




MSU-SRP Center and MDHHS

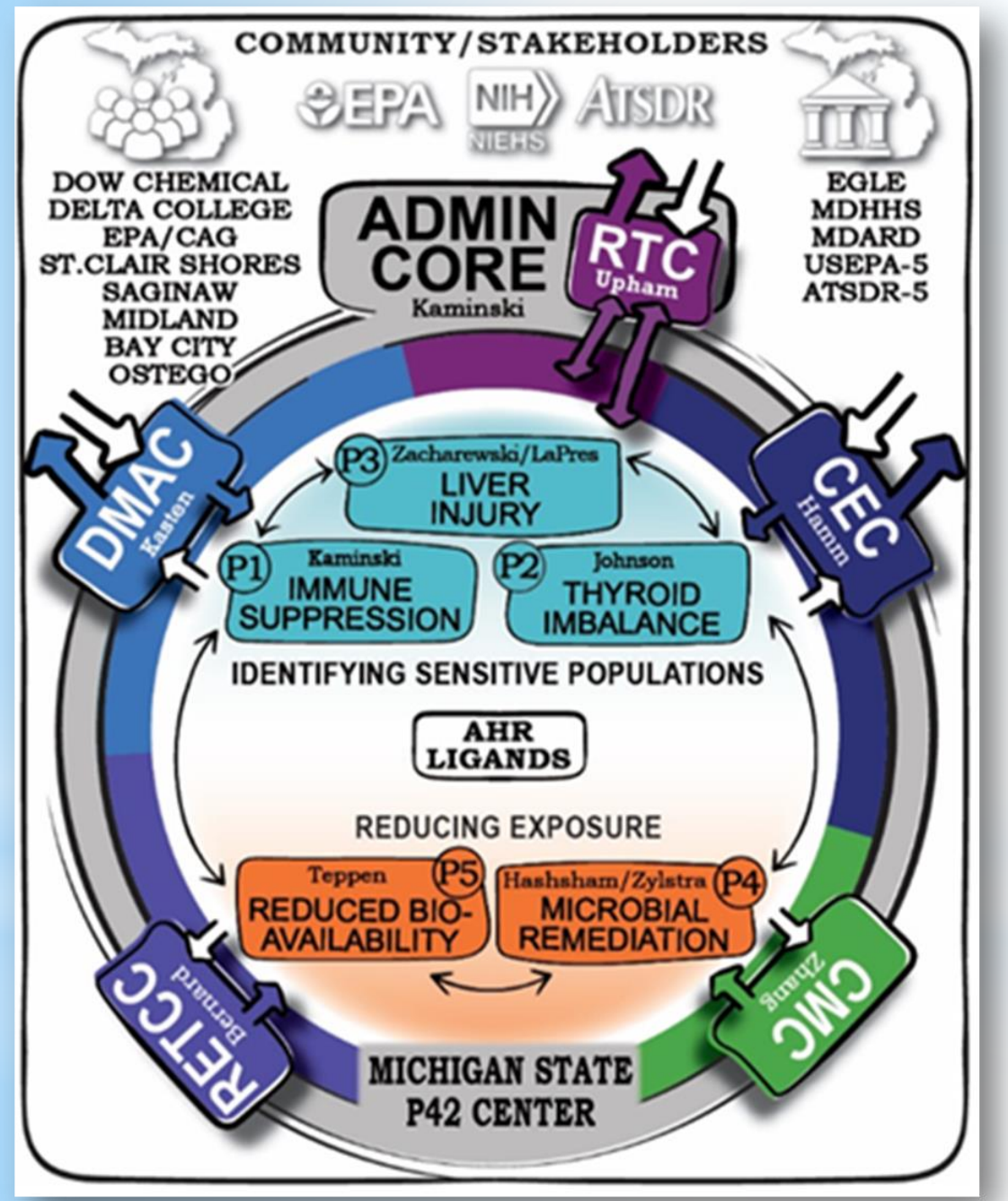
# Gut Microbiome App


MSU-SRP Center-Hashsham

# "Clean Communities App"


## Salient Features:

- Ask an Expert
- Health Effects
- Clean Up Projects
- FAQs
- News
- Google Hangout Stakeholders
- Contamination Sites
- You Tube Channels for Toxicants
- Connections to other SRP centers
- App Feedback Surveys




# Questions?

Son's, John, big catch from Lake Lansing

Dad's, my, big catch from Sessions Lake, Ionia State Recreation Area