WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2002MS2B

Title: Screening of Environmental Contaminants Detected in Mississippi Sediments as Inducers and/or Inhibitors of CYP1B1 Expression in Channel Catfish - Continuation

Project Type: Research

Focus Categories: Toxic Substances, Sediments, Agriculture

Keywords: pesticides, toxic substances, bioindicator

Start Date: 03/01/2002

End Date: 02/28/2003

Federal Funds: $17,403

Non-Federal Matching Funds: $34,806

Congressional District: First

Principal Investigator:
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Abstract

Sediments associated with Mississippi rivers and lakes contain significant concentrations of environmental contaminants including pesticides and industrial by-products. Chemical characterization of these complex mixtures is often expensive and incomplete. Certain cytochrome P450 enzymes such as CYP1A have been developed as biomarkers of exposure in fish and wildlife. These physiological endpoints integrate exposure to several types of contaminant, are cheaper than analytical analyses, and are indicative of bioavailable contaminants. Biomarker methodologies are critical in order to detect toxic insult at sublethal exposures so that individuals, population and community structure are not affected by contamination of Mississippi waterways. This project is specifically aimed at characterizing the utility of a recently discovered cytochrome, CYP1B1, as a marker of exposure to contaminants that have been reported by the USGS NAWQA and BEST programs in Mississippi sediments and fish samples. Because channel catfish are such an abundant and economically significant species in Mississippi, they will be used as the test organism in these studies.

Using primary cultured channel catfish liver hepatocytes and gill cells to screen a series of diverse contaminants including polychlorinated biphenyls, polycholorinated dibenzo-p-dioxins, polycyclic aromatic hydrocarbons and organochlorine pesticides, we will continue to characterize the inducibility and/or inhibition of CYP1B1 RNA. A highly sensitive new technology, quantitative real time reverse transcription PCR, will be used to detect differences across contaminant dose responses and cell systems. For compounds that indicate in vitro inducibility, we will conduct in vivo exposures to characterize the in vivo time course and dose response relationships in channel catfish. Ultimately, we will characterize the in situ utility of CYP1B1 as a biomarker of exposure to contaminated sediment in channel catfish collected from three Mississippi delta lakes. This project has the potential to develop an entirely new physiological endpoint of contamination in fish. Because of its role in carcinogenesis, insight into the mechanisms of CYP1B1 induction across taxa will be a significant advance toward applications of CYP1B1 status as a marker for environmental contaminants and potentially cancer.