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**Environmental Health Sciences**

**Sponsor:** National Institute of Environmental Health Sciences

**Dates:** March 1, 2014 to November 30, 2017

**Anticipated Amount:** \$1,324,528

**Persistent Organic Pollutants and Cognitive Decline in the Elderly**

**Aims:** A longitudinal study is proposed to examine exposure to persistent organic pollutants (POPs) and change over time in neuropsychological function in older men and women. The focus will be on learning, memory, and affect, but other cognitive domains and motor function will also be investigated. The role of thyroid function as an intervening variable also will be evaluated.

**Significance:** The proposed study is significant because it will fundamentally advance our knowledge of how exposure to POPs typical of the general population may contribute to the age-related declines in cognitive and motor function. This is an important public health concern, given the aging of the American population and the ubiquitous of these exposures, and the proposed project will significantly move the field forward, ascertain potentially modifiable risk factors, and identify high risk populations.

**Innovation:** The proposed project is innovative because it is one of only a few studies that have examined whether neurotoxicants may exacerbate age-related nervous system deficits, and is the first to evaluate this issue longitudinally in regard to POPs. It is also the first to examine the role of thyroid hormones and thyroid binding proteins as intervening variables.

**Preliminary Studies:** The proposed project builds upon a cross-sectional study of polychlorinated biphenyls (PCBs), polybrominated biphenyl ethers (PBDEs), and perfluorinated compounds (PFCs) among older residents of upper Hudson River communities in NY from 2000 to 2002. The results to date provide strong support for the approach outlined in this proposal, especially in regard to learning, memory and depression.

**Approach:** Of the 253 persons in the parent project, 213 were alive and had a local address as of December 31, 2012. They will be contacted and invited to participate in a follow-up interview, neuropsychological testing, and serum analysis for PCBs, PBDEs, PFCs, and thyroid hormones analogous to that performed 12 to 14 years earlier. Subtle deficits in memory and learning, executive function, visuospatial function, reaction time, fine motor control, and affective state will be measured and

change in these domains over time will be evaluated in relation to PCB, PBDE, and PFC concentrations, using statistical methods for longitudinal data and adjusting for both time-static and time-varying covariates. A mediation analysis will also be conducted to evaluate the role of thyroid biomarkers as intervening variables linking POPs to neuropsychological function. Propensity analysis, inverse probability weighting, and multiple imputation methods will be used to adjust for the possibility that persons who performed poorly initially may be less likely to participate in the second assessment. The cross-sectional results strongly support the study hypotheses and the likelihood of success is enhanced by the experience and expertise of the research team.

Over Eurasia and North America may influence atmospheric circulation and lead to dry and wet periods over the U.S., Australia, Africa, the Mediterranean region, South and East Asia, and other areas. Finally, we will explore the possibility to use the unforced decadal variations to improve model-simulated land precipitation and drought changes in the next few decades to address the third question.

**Intellectual Merit:** The results from this project will significantly improve our understanding of natural variability in land precipitation and drought, especially the decadal variations associated with ocean and land surface conditions and their associated atmospheric processes. This improved knowledge will greatly facilitate proper comparisons of observed and model-simulated response of precipitation and drought to human-induced global warming and reduce the chances to confuse natural variations with externally forced changes in comparisons of observed and model-simulated changes. The results will also help interpret recent extreme climate events, such as the recent droughts and heat waves in the Southwest U.S., by providing a better context of natural variations. The results also have the potential to improve our projections of near-future precipitation and drought over many land areas, as natural variations will continue to be important compared with GHG-induced changes in the coming decades.

*Broader Impacts:* Results from this project will have direct implications for farmers, water resources managers, and other policymakers and stakeholders in the U.S. and many other countries. The project will support two graduate students for their PhD research, with at least one of them to be a minority student. The project will also allow the PI to continue to educate the media (reporters), policymakers, and the general public (farmers, K-12 teachers and students, and ordinary citizens) on how drought may change under global warming. It will also help the PI develop an undergraduate course on "Water and Climate Change" and other climate courses at SUNY, Albany.