Symposium Proposal for the 2014 Annual Meeting of the International Society of Exposure Science (ISES)

Meeting URL: http://www.ises2014.org/

Meeting Theme: *Exposure Science Integration to Protect Ecological Systems, Human Well-Being, and Occupational Health.*

Symposium Title: "Thinking Through Computational Exposure as an Evolving Paradigm Shift for Exposure Science: Development and Application of Predictive Models from Big Data"

Symposium Organizers:

Timothy J. Buckley, PhD
Director of the Human Exposure & Atmospheric Sciences Division
National Exposure Research Laboratory
109 TW Alexander Drive
Research Triangle Park, NC 27711

Email: buckley.timothy@epa.gov
URL: http://www.epa.gov/heasd/staff/buckley.html
Phone: (919) 541-2454 (O); FAX: -0239
(919) 308-3480 (C)

Rosemary T. Zaleski, PhD
Exposure Sciences Section Head
ExxonMobil Biomedical Sciences, Inc.
1545 Route 22 East
Annandale, New Jersey 08801- 3059
rosemary.t.zaleski@exxonmobil.com
(Office) 908-730-1009
(Fax) 908-730-1192

Symposium Abstract: Exposure science has evolved from a time when the primary focus was on measurements of environmental and biological media and the development of enabling field and laboratory methods. The Total Exposure Assessment Method (TEAM) studies of the 1980s were classic examples of such measurement intensive studies. The measurements from these early years prompted and enabled the development of predictive exposure models. These predictive exposure models have similarly evolved from those that are relatively simple and deterministic considering a single pollutant and a single medium (e.g. SHAPE -- simulation of human activity and pollutant exposure) to those that are stochastic, consider multiple pollutants across multiple media and are computationally sophisticated (e.g. SHEDS-Multimedia). Although measurements will always be at its core, exposure science is entering a new era of research that is much more computationally based than before. We now have: 1) the models that predict the fate and transport of chemicals within and across media; 2) the computational

means to process massive data streams using complex algorithms; and 3) unprecedented access to informative data streams that inform and enable model prediction. In this symposium, we will discuss the opportunities and challenges of the emerging and quickly evolving research landscape of exposure science.

Symposium Speakers:

1. **Title:** "A Vision for Big Data and Computational Predictive Exposure Science"
   Presenter: Timothy J. Buckley, US EPA & Rosemary T. Zaleski, ExxonMobil Biomedical Sciences, Inc.

Abstract: A new and compelling line of exposure science is emerging out of a combination of technological advances in measurement capability, modeling, computation, and internet enabled access to data descriptive of time, activity, behavior, and social condition. Advances in measurement technology have made it possible to collect simultaneous information for multiple agents with greater temporal resolution and reduced cost. Growth of computational technologies has eased data collection and storage issues, and expanded the capability to analyze large data sets. Systematic compilation of large data sets under a common set of terms (ontology) that facilitates compiling information from multiple studies in common formats have also been proposed. To date, these activities are largely occurring discretely. Information from each is useful but the full value of combined data from integrating information from these technologies has not yet been realized. We will discuss opportunities and provide examples for how this information may be used in an integrated manner to better understand exposures and their sources, and to be more predictive. Particularly, ways to incorporate available data sources and emerging technologies within current biomonitoring programs will be explored. Key considerations for integration include approaches for identifying a manageable subset of these technologies, defining consistent integration methods, and developing consistent terminology for data collection and reporting as well as useful metrics for evaluating utility of the integrated information. To be successful, the path forward will require the cooperative involvement of stakeholders, including research partnerships with industry and other information owners. The promise of these efforts for public health are enormous in combination with computational toxicology, providing an unprecedented opportunity to inform risk sciences via expanding data and enhancing predictive reliability.

2. **Title:** "The importance of commercial data and research and the value it brings to public health and safety communication"
   Presenter: Michael Link, Ph.D., Nielsen, 3784 Ardsley Ct, Marietta, GA 30062; (o) 678-401-3753; (e) Michael.Link@Nielsen.com

Abstract: The science of measuring and understanding what types of products consumers purchase, and hence the potential associated chemical and biological exposures, as well as why they choose one product over another has grown more sophisticated with the rapid advances in data science. It is no longer enough to know what was bought, but rather to understand the entire "lifecycle" of the purchase decision, from interaction with advertising campaigns, to resonance of the campaign message, to the actual purchase behavior. The tools and data employed in this "big data" era are also complex, from analysis of millions of lines of purchase data to

identification of advertising exposure across multiple media types including TV, radio, mobile devices, and websites visited, to the use of GPS on the ground and satellite information in the sky to monitor physical location and potential purchase locations. These approaches and insights have direct understanding of persons' exposures to commercially available forms of chemical and biological exposures -- in particular systemic and on-going exposures, but potential short-term outbreaks as well. It also has bearing on understanding how public safety message can shape behavior in these areas. Moreover, these efforts are taking place on a global scale, in both developed and emerging markets. This discussion focuses on some of the important commercial innovations and methodologies in commercial consumer research and demonstrates their utility for furthering insights in exposure science.

3. **Title:** "Developing a Passive Time-Activity Triage System In support of Consumer Ingredient Exposure Prioritization"
   Presenter: Rocky Goldsmith, US EPA

   Abstract: Chemical Hazard/toxicity assessment of chemicals relies on droves of chemical-biological data at the organism, tissue, cell, and biomolecular level of resolution. Big data in the context of exposure science relies on a comprehensive knowledge of societies' and community activity levels at both length and time-scales that can span seasons, years, and global geographical distances, and a diverse array of product and chemical ingredient exposures as a function of these activities. OpenHealth platforms (symptoms), aggregated search term volume (Google trends), Social Media (Twitter) and consumer exposure ground-truthing activities with aggregated national consumer marketing/purchasing data holds the key in prioritizing and defining the nature of personal chemical exposures, and their geospatial variability to put a realtime fly-on-the-wall for chemical exposure prioritization. We provide an overview of our workflow, demonstrate how these web technologies can be integrated into a tractable triage system to better inform chemical exposure related study design (product, timing and population selection) and elucidate meaningful near-field exposures from consumer products.

4. **Title:** "Social Media to Augment Exposure Science: Current Applications and Future Possibilities"
   Presenter: Joe Murphy and Seung-Hyun Cho, RTI International

Abstract: With the explosion of popularity of social media over the last decade, researchers are presented with a new and largely untapped data source that can augment exposure science in several ways. This opportunity comes at a time when traditional survey research methods are challenged with trends in communications and society making their processes less efficient and more difficult to obtain accurate, reliable results; these include the decline in landline telephone coverage and decreased public willingness to participate in research.

We will present several of the opportunities for incorporating social media in exposure science, from the first stages of study design through the dissemination of research results. We include both original examples and those from other researchers. For example, at the time of an environmental disaster, social media can be used to identify a potentially exposed group through geolocation information. Topics of conversation can indicate immediate effects from the disaster

or actions taken to mitigate those effects. At the same time, officials can broadcast important safety information using social media to benefit those exposed. Social media can be used to reach out directly to identified exposed individuals for study recruitment; capture co-occurring terms or conditions that might impact the degree of exposure for investigation in a follow-up study; and solicit and collect diary information over the course of a study to track reported exposure and behavior. In studies with a survey or mobile data capture component, the social media postings of willing participants can be appended to the data to provide additional characteristics, insights, and a longitudinal view. Finally, social media can be used as a means to stay in touch or locate participants between waves of a study and quickly disseminate the results of research to inform the public.

5. **Title**: TBD
   Presenter: Davida Herzl, ACLIMA, Inc. & TBD, Google, Inc.