

Exposome research highlighted at Duke symposium

By Eddy Ball

A symposium April 3 at Duke University explored the impact of environmental exposures on biological pathways involved in cancer. Organized and hosted by Duke's Integrated Toxicology and Environmental Health Program, the event highlighted NIEHS-supported efforts on the exposome, which refers to the theoretical totality of internal and external exposures implicated in health and disease over an organism's lifespan. [Steven Patierno, Ph.D.](#) (<http://www.dukecancerinstitute.org/research/about-dci/news-and-awards/patierno-named-deputy-director>) codirector of the Duke Cancer Institute, moderated the symposium.

The symposium opened with a keynote presentation by exposome pioneer [Stephen Rappaport, Ph.D.](#), (<http://sph.berkeley.edu/stephen-rappaport>)

"The Exposome and EWAS [Exposome-wide Association Studies]: Finding Causes of Cancer." In 2010, Rappaport and his colleague, Martyn Smith, Ph.D., of the University of California at Berkeley, authored what is considered a seminal statement of the exposomic approach to disease research (see [story](#)).

NIEHS program manager David Balshaw, Ph.D., concluded the symposium with an outline of major new funding mechanisms for developing infrastructure to advance exposome research (see [sidebar](#)). "This is really encouraging, to see NIEHS embracing this [exposome] concept to this level," Patierno said during the final discussion of the day.

Taking next steps in exposome research

Attendees also heard reports on new directions in research by two NIEHS Outstanding New Environmental Scientist awardees, environmental chemist [Heather Stapleton, Ph.D.](#), (<https://nicholas.duke.edu/people/faculty/stapleton>) and molecular geneticist [Joel Meyer, Ph.D.](#), (<https://nicholas.duke.edu/people/faculty/meyer>) who are both faculty members in the Nicholas School of the Environment at Duke.

Stapleton, who studies the health effects of exposure to fire retardant chemicals, has teamed up with Duke Cancer Institute surgeon [Julie Sosa, M.D.](#), (<http://surgery.duke.edu/faculty/details/0604985>) to study connections to thyroid cancer. Meyer, who investigates the role of mitochondrial regulation, is working with Duke Medical Center molecular physiologist [Matthew Hirschey, Ph.D.](#), (<http://dmpi.duke.edu/faculty/matthew-hirschey-phd>)

to expand understanding of the role of disrupted mitochondrial function in promoting cancer. A generous donation from Duke alumni Fred and Alice Stanback is promoting these transdisciplinary collaborations.

Also on the program was neurobiologist Gary Miller, Ph.D., director of the NIEHS-funded Health and Exposome Research Center: Understanding Lifetime Exposures ([HERCULES](#)) (http://news.emory.edu/stories/2013/05/hercules_exposome_grant_rollins/) Center at Emory University. The initiative, which is a collaboration between researchers at Emory and the Georgia Institute of Technology, is funded by the first exposome center grant awarded in the U.S.

Because the exposome includes all exposures related to health outcomes, symposium organizers invited Patricia Matthews-Juarez, Ph.D., and Paul Juarez, Ph.D., social scientists at the University of Tennessee (UT) Health Science Center, to present the work of their center on community environmental assessment. Their talk outlined "The Public Health Exposome: A Systems Approach Towards Understanding the Spatial/Temporal Dynamics of Environmental Exposures, Adverse Health Outcomes, and Cancer Health Disparities."

Qualified successes point to tremendous potential

Basic questions about exposome research remain to be answered, such as what biomarkers can offer insight into meaningful exposures and whether the ambitious goal of measuring the totality of those exposures can even be accomplished. But as the presentations made abundantly clear, innovative transdisciplinary collaborations and advances in exposome assessment are helping researchers take novel approaches to addressing questions about host susceptibility and the health effects of multiple, simultaneous exposures.

Attendee Rick Woychik, Ph.D., NIEHS deputy director, noted, "This exposome framework is a way for us to address the issue of mixtures." Better understanding of an individual's matrix of exposures will also help answer the longstanding question of why some people react differently than others to their shared environments.

(Eddy Ball is a contract writer with the NIEHS Office of Communications and Public Liaison.)



"Poverty is a carcinogen," Patierno said in his introduction, underscoring the role of intangibles such as socioeconomic stress in the matrix of exposures that can influence health. (Photo courtesy of Steve McCaw)

National Institutes of Health support for meeting the challenges ahead

The new Children's Health Exposure Analysis Resource, administered by NIEHS, resulted from termination of the National Children's Study and redirection of its funds into support for exposome research to advance understanding of environmental impacts on children's health. The three-part initiative will build infrastructure by providing researchers access to laboratory and statistical analyses to increase the study of environmental exposures.

NIEHS-administered grants will fund a National Exposure Assessment Laboratory Network; a Data Repository, Analysis, and Science Center; and a Coordinating Center. NIEHS is also one of six institutes participating in an additional initiative to develop sensor systems for characterizing the external environment for children's health studies. The Pediatric Research Using Integrated Sensor Monitoring Systems (PRISMS) program is led by the National Institute of Biomedical Imaging and Bioengineering.

"If we're successful, many of the people coming into the program will not be [traditional] environmental health scientists," Balshaw said of the transdisciplinary exposome infrastructure he envisions.



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Balshaw, center was part of the audience as well as a speaker at the well-attended event. (Photo courtesy of Steve McCaw)



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Juarez, above, and Mathews-Juarez integrate enormous amounts of data from different sources to map patterns of health disparities across the U.S. (Photo courtesy of Steve McCaw)



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"I want to get as many people thinking about this as possible," Miller said, as he described the textbook he authored for his course at Emory, "[The Exposome: A Primer.](https://www.elsevier.com/books/the-exposome/miller/978-0-12-417217-3)" (<https://www.elsevier.com/books/the-exposome/miller/978-0-12-417217-3>) (Photo courtesy of Steve McCaw)



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"Mitochondrial metabolism is altered in cancer cells," Meyer said, discussing his research into whether that alteration is a causal factor or an effect of cancer metabolism. (Photo courtesy of Steve McCaw)



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Balshaw invoked goal three of the NIEHS strategic plan as he opened his discussion of new funding to help transform exposure science. "You need to measure as much as you can," he said of the push for better assessment tools. (Photo courtesy of Steve McCaw)

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