

## Webinars highlight European advances in exposome research

By Annah Wyss and Kelly Lenox

This summer, the NIEHS Exposome Webinar Series highlighted two groundbreaking European research efforts into the combined health effects of increasingly complex environmental exposures.

Denis Sarigiannis, Ph.D., of Aristotle University of Thessaloniki, Greece, presented on the Health and Environment-wide Associations Based on Large Population Surveys (HEALS) project July 14, and Martine Vrijheid, Ph.D., with the Centre for Research in Environmental Epidemiology in Barcelona, Spain, discussed the Human Early-Life Exposome (HELIX) project July 23. The projects explore the challenges and innovative solutions associated with leading-edge exposome research.

"The series will help in defining the concept of the exposome and determining the challenges we face in studying it," said David Balshaw, Ph.D., lead of the NIEHS [Exposure Biology and the Exposome](#) program and host of the series.



### HEALS: beyond the state of the art

The multifaceted [HEALS](#)

(<http://www.heals-eu.eu/>)

project integrates genome-wide association studies with exposome-wide association studies, combining existing cohort data with a new longitudinal and nested case-control study, including twins and singletons, and their mothers and fathers. Detailed exposure data, gathered from exposure sensors, biomonitoring, and ambient monitoring, will be key to refining exposure models.

Another component of HEALS involves studying a full array of molecular pathways, with a focus on DNA methylation. By analyzing biomonitoring information and other biomolecular data obtained from samples provided by participants, the researchers aim to model lifetime exposures, from preconception through later life.

"The power of the project lies in large cohort data, brought together with a full array of analytical modeling and bioinformatics," Sarigiannis said.

One goal of the project, according to Sarigiannis, is to move the state of the art forward. "It is important to be practical and focus on what can be of use to public health protection," he said.

### HELIX: early life exposures and childhood health

Like the HEALS project, [HELIX](#)

(<http://www.projecthelix.eu/>)

aims to assess the associations between environmental hazards and health outcomes, with the added distinction of a focus on early life exposures and childhood health. "Pregnancy and childhood are vulnerable periods of rapid development," Vrijheid said.

Using a network of cohorts from across Europe, the HELIX consortium pooled exposure and outcome data for nearly 32,000 mother-child pairs. And among a subcohort of 1,200 pairs, researchers collected and harmonized data on exposures, biomarkers, and phenotypes.

Finally, for a panel of 150 children and another panel of 150 pregnant women, HELIX collects long-term measurements, through use of repeated assays, exposure sensors, and diaries. "Participants carried exposure sensors in backpacks and smartphones on their waists," said Vrijheid, describing some of the novel, individual-level exposure assessments scientists used.

The efficiencies of this tiered approach enable HELIX researchers to collect detailed information on numerous exposures, such as pesticides, phthalates, metals, water disinfection byproducts, and indoor air. Using data from geographic information systems, researchers integrate measures of air pollution, UV radiation, temperature, and the built environment into their research.

Vrijheid and colleagues hope that HELIX data will be used in future exposome research, while helping to build a more comprehensive approach to children's environmental health.

(Annah Wyss, Ph.D., is an Intramural Research Training Award fellow with the NIEHS Genetics, Environment, and Respiratory Disease Group.)

**Exposure Biology Research** is challenged with detecting and measuring combined environmental exposures and figuring out how the human body responds.

**Environmental Exposures** include what we breathe, eat and drink, or absorb through our skin. Each person experiences these combinations of exposures every day and can have different reactions. For example, environmental exposures can lead to changes in DNA, adversely affect health, or cause diseases.



 A key part of Exposure Biology Research is developing technology — such as cell and smart phones, monitors, sensors, cameras, computers, and software — to measure exposures and biological responses.

**My Air My Health**

The My Air, My Health Challenge was one example where researchers created a personal, portable, and wearable air pollution sensor.

To learn more about Exposure Biology Research and NIEHS-funded programs, go to <http://www.niehs.nih.gov/exposurebiology>

## The challenges of exposure biology research

By Joe Balintfy

The infographic below illustrates the complex challenges researchers face when studying how combined environmental influences affect health. It depicts environmental factors, such as pesticides, pollution, and tobacco, which play a role in adverse health outcomes such as allergies, obesity, and heart disease, which are on the rise worldwide. The silhouette of a woman running conveys that exercise can change some health outcomes. The runner is wearing a personal sensor - one of the many technologies being developed to measure a person's exposure to environmental pollutants.

"Measuring all those exposures and health outcomes is an enormous task," said Balshaw. "A big part of this field is developing technology that can capture and measure the influencers and results." In an effort to encourage development of personal air pollution and health sensors, the My Air, My Health Challenge was announced in 2012. The challenge led to the development of innovative products, including a wearable personal air pollution sensor (see related [story](#)).

The infographic, which supports the NIEHS [2012-2017 Strategic Plan](#) goal of advancing understanding of the exposome, has been shared via social media, reaching more than 700 people on Facebook, and roughly 2,500 on Twitter. Produced in partnership with the NIEHS Office of Communications and Public Liaison, the graphic has been posted on the NIEHS website and is currently part of a National Institutes of Health (NIH) exhibit in Building 1 on the NIH campus in Bethesda, Maryland.

(Joe Balintfy is a public affairs specialist in the NIEHS Office of Communications and Public Liaison.)

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([bruskec@niehs.nih.gov](mailto:bruskec@niehs.nih.gov))

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