

Birnbaum discusses science and funding at talks in UK

By Eddy Ball

NIEHS and NTP Director Linda Birnbaum, Ph.D., was the featured speaker Feb. 12 at the Brunel University Institute for the Environment (IfE) [Public Lecture](http://www.brunel.ac.uk/ife/news/news-archive/ne_353874) (http://www.brunel.ac.uk/ife/news/news-archive/ne_353874) in London.

Birnbaum's talk, "Environmental Exposures Acting Like Uncontrolled Medicine," was hosted by IfE head [Susan Jobling, Ph.D.](http://www.brunel.ac.uk/ife/staff-profiles/academic-staff/professor-susan-jobling)

(<http://www.brunel.ac.uk/ife/staff-profiles/academic-staff/professor-susan-jobling>)

IfE is recognized internationally for its research in environmental science, and it has strong international links with pharmaceutical industries, water companies, and government authorities charged with protecting the environment and health of humans and wildlife.

The following day, Birnbaum joined Jobling and other environmental scientists for a Developmental Origins of Health and Disease (DOHaD) roundtable. Birnbaum's remarks focused on a disturbing trend in funding for scientific research and development in the U.S. and Canada, which declined as much as 5 percent from 2012 to 2013, while funding in China increased by 15 percent.

An eye-opening analogy

Birnbaum opened her talk by acknowledging the remarkable advances in medicine during the past 40 years. "Drugs have been developed that can raise or lower our blood pressure, mimic our endogenous hormones, block receptor binding, upregulate or downregulate biological pathways, and stimulate growth," she told the audience.

"Unfortunately, environmental chemicals can also act like drugs," Birnbaum said, as her focus shifted from the wonders of medicine to the potentially harmful effects of the thousands of untested chemicals in the environment. "The WHO [World Health Organization] estimates that approximately 25 percent of the overall global burden of disease is attributable to environmental factors."

As medicine's success at combating infectious diseases among children and young adults has been widely applauded, Birnbaum said that largely silent epidemics of chronic, and often complex, noncommunicable diseases (NCDs) have increased dramatically worldwide. The environmental link to infectious disease is clear, and the direct effects of polluted water and air are becoming more apparent. But, she added, recent research also suggests that environmental exposures also play a more subtle, but potentially significant role in predisposing people to the major NCDs, such as diabetes, cardiovascular disease, reproductive anomalies, and even cancers.

Linking cause and effect across the decades of life

Pointing to what she called the new science, Birnbaum described the concepts of exposure to mixtures, nonmonotonic dose response, and epigenetic modification. These processes may set the stage *in utero*, in infancy, and during other windows of susceptibility during development, for diseases that may not manifest until decades later or in succeeding generations.

Instead of causing disease by overwhelming the body at high doses, some chemicals can act like hormones and drugs to disrupt development and change gene expression at very low doses. In combination, chemicals and other environmental triggers, such as stress, can have a far greater effect than they do in isolation.

NIEHS and NTP programs offer hope for the future

Birnbaum presented findings from several recent studies that support the hypotheses of the new science, before turning to proactive efforts by NIEHS and NTP scientists to prevent exposures in the first place. She pointed to NIEHS and NTP support for the principles of green chemistry and safe-by-design engineering of new products that do not persist in the environment. She then moved to the final part of her talk, which was devoted to the emerging paradigm of predictive toxicology through efforts



One theme throughout Birnbaum's talk was the power of knowledge to inform prevention. "The choices we make regarding the foods we eat, exercise, and the chemicals we are exposed to will make a difference in our wellness," she said in conclusion. (Photo courtesy of Brunel University)



Established in 1966, Brunel University takes pride in its Institute for the Environment, whose research revealing the link between chemicals in rivers and reproductive health won a 2011 Queen's Anniversary Prize for Higher and Further Education.

such as the Tox21 consortium (see related [story](#)).

With an estimated 80,000 chemicals in the environment, Birnbaum explained, it's impossible to test even a fraction with conventional methods using rodent or other mammalian models. A much more effective and economically feasible approach involves the development of alternative testing, using lower-order organisms, such as zebrafish, worms, and flies, along with rapid throughput biochemical and cell-based *in vitro* assays, and computational analysis of the biochemical pathways that lead to disease.

Enhancing the ability to predict toxicity can help manufacturers, regulators, and individuals make better choices about environmental public health, Birnbaum concluded.

Ubiquitous Human Exposure

Chemicals are *widely dispersed* in our environment

Chemicals are often dispersed at biologically effective levels, exposure to humans is common

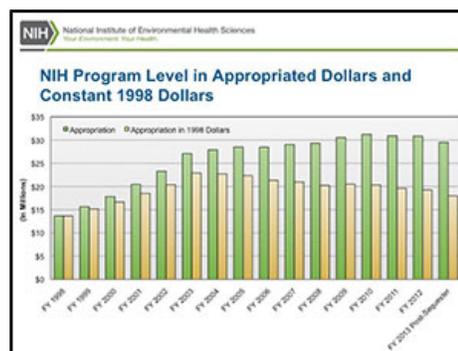
Exposures do not occur singly

One exposure can alter the body's response to other exposures

Combinations must be studied

The "Exposome" is the totality of exposures for a person

This slide from Birnbaum's public lecture outlines several principles of the new science. (Photo courtesy of Linda Birnbaum)



Despite the multiple benefits of NIH research to improving health and promoting economic viability, Birnbaum told DOHaD roundtable participants, appropriations have not kept pace with need. Funding adjusted for inflation, shown in yellow, has increased very little since fiscal year (FY) 1998 and even declined since its peak in FY 2003. (Photo courtesy of Linda Birnbaum)

The Environmental Factor is produced monthly by the [National Institute of Environmental Health Sciences \(NIEHS\)](#) (<http://www.niehs.nih.gov/>)

, Office of Communications and Public Liaison. The content is not copyrighted, and it can be reprinted without permission. If you use parts of Environmental Factor in your publication, we ask that you provide us with a copy for our records. We welcome your [comments and suggestions](#). (bruskec@niehs.nih.gov)

This page URL: NIEHS website: <http://www.niehs.nih.gov/>
Email the Web Manager at webmanager@niehs.nih.gov