

Birnbaum keynotes at National Environmental Monitoring Conference

By Eddy Ball

NIEHS and NTP Director Linda Birnbaum, Ph.D., found herself on familiar turf Aug. 6, as she presented one of three keynote addresses at a meeting in San Antonio.

Birnbaum spoke to attendees of the [2013 National Environmental Monitoring Conference \(2013 NEMC\)](#)

(<http://nemc.us/index.php>)

Aug 5-9 about "Linking Low Dose Exposure of Environmental Contaminants to Health Effects," kicking off the second of five days of talks, poster presentations, and training.

Reassessing conventional wisdom about dose response

In her presentation, Birnbaum explored the notion that less can be sufficient, or even more than enough, when it comes to the adverse health effects of exposure to environmental chemicals. As Birnbaum told the attendees, the conventional notion of dose response doesn't account for the effects of hormone-mimicking substances on the endocrine system or the implications of exposure to a range of other chemicals, even at low doses, during critical periods of development.

Birnbaum began with an examination of the endocrine system in humans and nonlinear dose response patterns for endocrine disrupting compounds (EDCs). Very small doses, measured in the parts-per-million and parts-per-billion range, she explained, can have profound effects on health and development.

"A one unit change in hormone concentration, in a low concentration range, may have a large - 50 percent - effect on receptor occupancy," she said, "while the same change in hormone concentration, in a higher concentration range, may have a small - 5 percent - effect on receptor occupancy. [As a consequence,] low-dose exposures to endocrine disruptors may be able to have profound impacts on receptor binding and activation, and, therefore, the downstream events that are controlled by those receptors."

According to Birnbaum, proponents of the low-dose hypothesis contend that a large number of recent studies now provide clear support for their hypothesis.

Timing also shapes dose response

When exposure occurs can influence the effects of exposure, Birnbaum continued, so that low-dose exposures need to be integrated into risk analysis. "Timing of exposure is critical. Exposure during development is not comparable to adults."

Birnbaum offered examples of the effects of what would be considered a low-dose arsenic exposure for a pregnant woman, on the health of her child, as he or she develops and grows into adulthood. She also referred to a new NTP monograph on the effects of low levels of lead on the growth and neurological, digestive, and sensory health of exposed children. Both arsenic and lead continue to be present in the environment, from natural and manmade sources, at doses that can impact health when exposure occurs at critical periods during development.

Returning to EDCs, Birnbaum outlined adverse effects on health, by exposure to a range of chemicals that are virtually everywhere in the environment. These include the plasticizing compounds phthalates and bisphenol A, fire retardant chemicals, and pesticides, such as chlorpyrifos and residues of DDT and related chemicals.

Advancing toxicology study design

Translating measurements into risk assessment

2013 NEMC featured more than 133 oral and 29 poster presentations organized into concurrent technical sessions. Presentation topics ranged from optimizing U.S. Environmental Protection Agency (EPA) detection method instrumentation, to seasonal variation in the composition of air pollution.

Not surprisingly, EPA dominated the meeting, which is billed as the largest conference focused on environmental measurements in North America. Since 2006, NEMC has been co-sponsored by [The NELAC Institute](#) (<http://www.nelac-institute.org/>) under a cooperative agreement with EPA.

The conference brings together scientists and managers from federal and state agencies, the regulated community, academia, and laboratory and engineering support communities. NEMC meeting agendas feature a balance of technical and policy topics related to data gathering, measurement, and risk assessment.

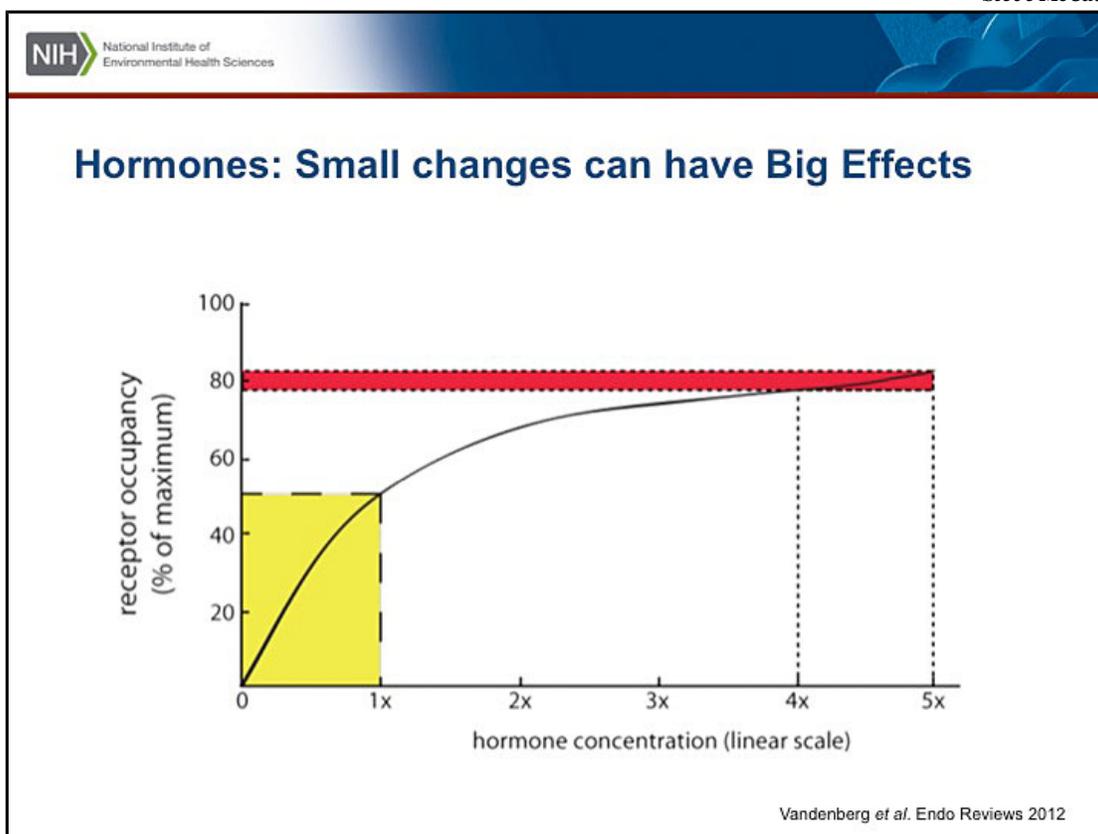


"Traditional high-dose toxicity studies may not be adequate to assess adverse effects from these hormonally active agents, in that they do not detect effects that are occurring at low doses," Birnbaum concluded.

Traditional toxicity studies have often not made developmental stage a consideration or adequately considered the significant differences between the response of individuals and populations. Birnbaum explained that future studies will need to integrate these typically overlooked considerations into more broadly applicable risk assessments of chemical exposures at physiological doses, comparable to those that might be expected from environmental exposure or to what is seen in diverse human populations.



According to Birnbaum, newer studies, several funded by NIEHS, are leading to a reconsideration of the low dose hypothesis in light of their findings. (Photo courtesy of Steve McCaw)



In this slide from her presentation, Birnbaum shows how a low dose of a hormone or hormone-mimicking chemical has a disproportionately large effect on receptor occupancy (shown in yellow), while greater doses have a relatively smaller effect, as receptors become saturated. (Photo courtesy of Linda Birnbaum)

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