

## Woychik talk at Duke explores epigenetics

By Ernie Hood

NIEHS Deputy Director Richard Woychik, Ph.D., spoke Oct. 31 to an audience of students and faculty members at the Nicholas School of the Environment at Duke University, as part of the fall 2014 seminar series presented by the Duke University Integrated Toxicology and Environmental Health Program (ITEHP).

(<http://sites.nicholas.duke.edu/envhealth/>)

Woychik's lecture, "Exploring the Epigenetic Landscape of Environmental Exposures," took his audience of students and faculty members on a journey from the origins of epigenetics to today's cutting-edge innovations.

### New vistas in epigenetics

As one of the architects of the most recent [NIEHS Strategic Plan](#), Woychik related his talk to the areas of the plan addressing the host, and how the genes and variants of genes inherited from one's parents affect his or her response to the environment. "How does the environment change the expression of the gene variants you inherit from your parents in a way that contributes to deleterious health effects, or to positive health effects that keep you healthy?" he asked, as he introduced the basic concepts underlying epigenetics.

Woychik described his early work on a mouse agouti gene mutation called viable yellow, in which genetically identical littermates have different coat colors and other varying characteristics, such as obesity or normal weight. He described how a single transposable element (TE) inserted into the agouti gene allowed the TE to hijack the normal expression of the gene. The varying responses in individual animals were caused by epigenetic regulation of the expression of the promoter within the TE.

He cited work from the laboratory of Randy Jirtle, Ph.D., at Duke demonstrating that expression of the viable yellow mutation is influenced by diet, chemicals, and other environmental exposures. Overall, Jirtle's work with the viable yellow allele of *agouti* revealed how a single repetitive element, under epigenetic control, can influence the expression of an adjacent gene in a way that has a powerful influence on the biology of the organism.

### Potential for change across the genome

As Woychik explained, "The genome is chock-full of these elements, and many contain powerful enhancers and promoters. In fact, it has been estimated that up to 60 percent of the mammalian genome is comprised of repetitive elements such as TEs," he said. The question he posed is whether any of the other TE's located across the genome act like the TE in agouti mice. "Are there any of the other repetitive sequences in the genome that can influence the expression of an adjacent gene in a way that affects the biology of the individual?"

Woychik noted that today, next-gen sequencing technology makes it possible to address that question. He described his lab's research, which has been able to demonstrate that repetitive elements can influence the expression of adjacent genes in response to exposure to cocaine in a murine model. He described how that work can serve as a model to study the mechanisms of other environmental exposures that are more closely related to the mission of NIEHS.

"If genetics isn't complicated enough," Woychik concluded, "now tossing in the cell-type specific epigenetic marks on repetitive elements that clearly influence gene expression at different times in development makes the study of environmental exposures even more complicated."

"But, we have to embrace this complexity because that's how biology works."

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



Woychik clearly enjoyed the opportunity to address an academic audience. (Photo courtesy of Steve McCaw)



The lecture took place in the Field Auditorium in Environment Hall, a room bristling with monitors and other electronics. "I'm a high-tech guy, but this is really over the top!" Woychik quipped. (Photo courtesy of Steve McCaw)



*Students in the audience paid close attention to Woychik's remarks. (Photo courtesy of Steve McCaw)*



*Annette Kirshner, Ph.D., a program administrator in the Genes, Environment, and Health Branch of the Division of Extramural Research and Training, was one of the NIEHS staff people who made the trip to Durham to hear Woychik speak. (Photo courtesy of Steve McCaw)*



*Edward Levin, Ph.D., a professor of psychiatry and behavioral sciences at Duke and organizer of the ITEHP seminar series, asked Woychik whether the epigenetic mechanisms he described were reversible based on intermittent exposures in adulthood. (Photo courtesy of Steve McCaw)*



*Environment Hall on the Duke University campus, the home of the Nicholas School of the Environment, where Woychik spoke as part of the school's ITEHP seminar series. (Photo courtesy of Steve McCaw)*

---

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

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