



EMERGING SCIENCE FOR ENVIRONMENTAL HEALTH DECISIONS

AGENDA

The Promise of Genome Editing Tools to Advance Environmental Health Research

JANUARY 10–11, 2018

THE NATIONAL ACADEMIES OF SCIENCES, ENGINEERING, AND MEDICINE

500 FIFTH STREET NW, ROOM 100, WASHINGTON, DC 20001

THIS WORKSHOP WILL BE WEBCAST

RECENT SCIENTIFIC ADVANCES have made genome editing technologies—a suite of biological tools for making precise additions, deletions, and alterations to the DNA and RNA of living cells—more rapid, efficient, and flexible than ever before. These advances have spurred an explosion of interest in using genome editing as a research tool in the environmental health sciences.

This workshop will bring together experts in molecular biology, toxicology, and public health to explore opportunities for using genome (and epigenome) editing technologies

in environmental health research. Participants will discuss genome editing tools such as CRISPR/Cas9 and their applications to help unravel the mechanisms through which environmental stressors affect human health, including developing models of health and disease, testing chemicals for toxicity, and determining mechanisms of toxicity. Speakers will also explore how research that leverages genome editing tools might inform different types of decisions, including for risk assessment and environmental policy.

WEDNESDAY, JANUARY 10, 8:45 AM–5:10 PM

- 8:00 Registration
- 8:45 Welcome and Context
 - Keegan Sawyer, National Academies of Sciences, Engineering, and Medicine
 - Melissa Perry[§], The George Washington University
 - Kimberley Thigpen-Tart, National Institute of Environmental Health Services
- 8:55 Workshop Overview—Lesia Aylward^{§†}, Summit Toxicology

[§] Member of the Workshop Planning Committee for The Promise of Genome Editing Tools to Advance Environmental Health Research Workshop.

[†] Member of the Standing Committee on Use of Emerging Science for Environmental Health Decisions.

SESSION 1 GENOME AND EPIGENOME EDITING: TRENDS, TECHNIQUES, AND CAPABILITIES

Moderator: Shruthi Mahalingaiah[§], Boston University School of Medicine

- 9:00 Introductory Remarks by the Moderator
- 9:05 The Genome Editing Era—Fyodor Urnov, Altius Institute for Biomedical Sciences and University of California, Berkeley
- 9:25 Defining and Improving Cas9 Specificity—Vikram Pattanayak, Massachusetts General Hospital
- 9:45 Break

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**WEDNESDAY, JANUARY 10, 8:30 AM–5:10 PM
(CONTINUED)**

- 10:05 **Genome Editing Perspective from NIEHS: Questions, Challenges, Promise?**—Richard Woychick, National Institute of Environmental Health Sciences
- 10:25 **Applying CRISPR in Environmental Health Research: From Cells to Human Populations**—Luoping Zhang[†], University of California, Berkeley
- 10:45 Panel Discussion with Morning Speakers
- 11:45 *Lunch*

**SESSION 2 EXPLORING TOXICOLOGY-RELEVANT USES OF
GENOME EDITING TOOLS**

Moderator: David Taylor, University of Texas at Austin

- 1:00 **Introductory Remarks by the Moderator**
- 1:10 **Applications of Piwi-interacting RNA (piRNA) for Epigenome Modification in Environmental Health Research**—Dana Dolinoy, University of Michigan
- 1:30 **Tracking an AHR Regulatory Circuit in Cancer with AHR Inhibitors, CRISPR/Cas9 Knockdown, and Other Tricks**—David Sherr, Boston University
- 1:50 **Using CRISPR Genomic Screening to Examine Gene-Environment Interactions**—Christopher Vulpe[†], University of Florida
- 2:10 **CRISPR Screening to Identify Suppressors of Cellular Stress Response to Proteo-Toxicants**—Quan Lu, Harvard University
- 2:30 **Panel Discussion on Leverage Genome Editing Tools in Molecular and Cellular Studies**
- 3:10 *Break*
- 3:30 **Genome Editing Research for Translational Toxicology Solutions**—Rebecca Fry, University of North Carolina at Chapel Hill

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- 3:50 **Applications of Genome Editing to Understand Molecular Mechanisms of Chemical Sensitivity and Resistance**—Mark Hahn, Woods Hole Oceanographic Institution
- 4:10 **Genome Editing in Rat Models of the Metabolic Syndrome**—Anne Kwitek, University of Iowa
- 4:30 **Panel Discussion on Leverage Genome Editing Tools in Whole Organism and Human Population Studies**
- 5:00 **Day 1 Closing Remarks**—David Gerhold[†], National Center for Advancing Translational Sciences
- 5:10 **Adjourn Day 1**

THURSDAY, JANUARY 11, 8:45 AM–12:30 PM

- 8:45 **Welcome and Recap**—Gary Miller^{§†}, Emory University
- 9:00 **Recording Biological Surroundings from Within**—Harris Wang, Columbia University

**SESSION 3 INCORPORATING GENOME EDITING TOOLS INTO
ENVIRONMENTAL HEALTH RESEARCH:
PATHWAYS FORWARD**

Moderator: Norbert Kaminski^{§†}, Michigan State University

- 9:20 **Introductory Remarks by the Moderator**
- 9:25 **Designing Research to Inform Environmental Risk Assessment**—Keith Houck, U.S. Environmental Protection Agency
- 9:45 **Designing Research to Inform Medical Practice**—Lynae Brayboy, Brown University
- 10:05 **Panel Discussion—Research Ideas to Generate Evidence for Action**
—Dana Dolinoy, University of Michigan
—Rebecca Fry, University of North Carolina at Chapel Hill
—Mark Hahn, Woods Hole Oceanographic Institution
- 11:00 *Break*

(continued)

11:15 **Panel Discussion—Perspectives on Use of Genome Editing Research for Environmental Health Decisions**

Moderator—Trey Thomas[†], U.S. Consumer Product Safety Commission

— **Stanley Barone**, U.S. Environmental Protection Agency

— **Gary Ginsberg[†]**, Connecticut Department of Public Health

— **Linda Wennerberg**, National Aeronautics and Space Administration

— **Carolyn Wilson**, U.S. Food and Drug Administration

12:10 **Closing Remarks—Reza Rasoulpour^{§†}**, Dow AgroSciences

12:30 **Adjourn Workshop^{*}**

Workshop Planning Committee

This workshop was organized by the following experts: **Lesa Aylward[†]**, Summit Toxicology; **David Gerhold**, National Center for Advancing Translational Sciences; **Norbert Kaminski[†]**, Michigan State University; **Shruthi Mahalingaiah**, Boston University School of Medicine; **Gary Miller[†]**, Emory University; **Reza Rasoulpour[†]**, Dow AgroSciences; **Trey Thomas**, U.S. Consumer Products Safety Commission; **Christopher Vulpe**, University of Florida; **Luoping Zhang**, University of California, Berkeley

^{*} Emerging Science for Environmental Health Decisions Committee Business Meeting 1:00pm–4pm. This meeting is open to Committee, Government Liaisons, and workshop participants.

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<http://dels.nas.edu/envirohealth>

Emerging Science workshops are free and open to the public.

About Emerging Science for Environmental Health Decisions

The National Academies' Standing Committee on Use of Emerging Science for Environmental Health Decisions (ESEHD) examines and discusses issues on the use of new science, tools, and research methodologies for environmental health decisions. The ESEHD committee is organized under the auspices of Board on Life Sciences and the Board on Environmental Studies and Toxicology of the National Academies of Sciences, Engineering, and Medicine, and sponsored by the National Institute of Environmental Health Sciences.

