

March 2013

NIEHS Spotlight



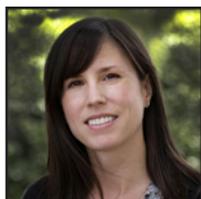
[Council approves concepts, shares budget concerns](#)

The 138th meeting of the National Advisory Environmental Health Sciences Council Feb. 20-21 included a candid assessment of budget challenges ahead.



[Public-private group explores sustainable alternatives assessment](#)

NIEHS provided much more than meeting space and hospitality during a Health and Environmental Sciences Institute workshop Feb. 7-8.



[Putting climate change and human health science into practice](#)

A meeting Jan. 30-31 in Washington, D.C., brought together agency partners and grantees to address one of today's most critical public health issues.



[NIEHS hosts workshop for secondary school science educators](#)

Thanks to a long-standing partnership with the N. C. Association for Biomedical Research, 27 educators were able to attend a free workshop Feb. 6 at NIEHS.



[Birnbaum visits Northeastern SRP partner in Puerto Rico](#)

NIEHS/NTP Director Linda Birnbaum, Ph.D., visited the University of Puerto Rico Medical Campus Feb. 4 to discuss the importance of transdisciplinary research.

Science Notebook



[BPA grantees share findings](#)

Nearly 100 researchers studying the health effects of the chemical bisphenol A gathered at NIEHS Jan. 28-29 to provide an update on their findings.



[Council enjoys epigenetics and bioinformatics talks](#)

The two scientific presentations scheduled into most Council meetings provided members with some relief from making the tough decisions about grants.



[Translating women's environmental reproductive health research into practice](#)

NIEHS was host to leading scientists and physicians for the 2nd annual meeting Jan. 30 of the Women's Environmental Reproductive Health Consortium.



[Expert meeting ponders chemical testing in the 21st century](#)

Experts gathered to address lingering questions about predictive toxicology at a meeting Jan 24-25 in Washington, DC., organized by the Environmental Defense Fund.



[Birnbaum discusses low dose at Tox Forum](#)

NIEHS/NTP Director Linda Birnbaum, Ph.D., presented a talk on non-monotonic dose response Jan. 30 at the 38th Annual Winter Meeting of The Toxicology Forum.

NIEHS Spotlight



[Summer intern earns national recognition](#) ▶ Video

William Ge was chosen as one of three hundred semi-finalists in the 2013 Intel Science Talent Search, the nation's oldest and most prestigious pre-college science competition.



[Miller hands over the reins at the NIEHS Clinical Research Program](#)

CRU Medical Director Stavros Garantziotis, M.D., who will now serve as acting clinical director, said Miller's efforts to help integrate the program were invaluable.



[NTP postdoc wins top award at SOT](#)

Yuanyuan (Laura) Xu, Ph.D., of the NTP Laboratory, will be honored with the Best Postdoctoral Publication Award at the group's annual meeting this month.



[NIEHS fellow transitions into private-sector translational research](#)

NIEHS trainee Jennifer Sims, Ph.D., left her lab last month for a translational research and development research associate position at Expression Analysis.



[SOT goes to San Antonio](#)

NIEHS and NTP staff will be donning their cowboy boots, hats, data, and science posters for the Society of Toxicology's 52nd Annual Meeting, March 10-14.



[NTP fellow lands toxicologist position at EPA](#) ▶ Video

NTP fellow Minerva Mercado-Feliciano, Ph.D., began her new position Jan. 27 as a toxicologist in the Health Effects Division of the Office of Pesticides Programs.

Science Notebook



[Diaz edits special issue of the journal Autoimmunity](#)

NIEHS researcher Marilyn Diaz, Ph.D., wrote the introduction and contributed a review article on the role of activation-induced deaminase in lupus nephritis.



[Speaker calls for crowdsourcing to advance predictive toxicology](#)

Guest lecturer Maurice Whelan, Ph.D., discussed the impact of a European ban on animal testing of cosmetics on chemical risk assessment, in a Jan. 29 talk at NIEHS.



[Wetterhahn awardee discusses community project on arsenic in vegetables](#)

Monica Ramirez-Andreotta, Ph.D., created a community-based program to evaluate the risk of arsenic in homegrown vegetables near Superfund sites.



[Study links prenatal exposure to PM with low birth weight](#) ▶ Audio

A global team of researchers has reinforced concerns that exposure to increased levels of particulate matter during pregnancy may lead to low birth weight.



[Validating hair as a biomarker of manganese exposure](#)

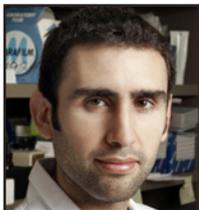
A new NIEHS-funded study describes a process for reliable and non-invasively determining levels of manganese exposure in children and adults.

NIEHS Spotlight



[Midwest legislators convene at Environmental Health Summit](#)

The purpose of the Midwest Environmental Health Summit was to inform state legislators about environmental health issues in the region.



[FDA program marks next step for NIEHS research fellow](#)

Trainee Javier Revollo, Ph.D., said he hadn't even started his job search when opportunity came knocking in the form of an email announcement.



[Tribal college program engages Native American students in STEM](#)

Salish Kootenai College professor Douglas Stevens, Ph.D., described efforts to engage Native American students in science, technology, engineering, and mathematics careers.



[LMC fellow enters the field of regulatory affairs](#)

Bhargavi Rao, Ph.D., an intramural research training award fellow in the Laboratory of Molecular Carcinogenesis, left NIEHS in February for a career in regulatory affairs.



[Outreach program begins second year at local school](#)

The NIEHS Citizen Schools project kicked off its second year of service Feb. 4 with an orientation for students at Lowes Grove Middle School in Durham, N.C.

Science Notebook



[Grantees discuss Superfund pollutants and reproductive health](#)

The Collaborative on Health and the Environment-sponsored Reproductive Health Working Group call Feb. 7 featured presentations by NIEHS-funded scientists.



[This month in EHP](#)

This month's feature stories in Environmental Health Perspectives examine radiation from power plant accidents and newly generated polychlorinated biphenyls.



[Parsonnet to give Falk distinguished lecture](#)

Infectious disease specialist Julie Parsonnet, M.D., will present the 2013 Falk lecture on "Spirits in the Microbial World (or Who is Steering this Ship)?"



National Institutes of Health

[Stem cell biology symposium to be hosted by NIEHS in April](#)

A two-day symposium April 11-12 will bring to NIEHS prominent experts in stem cell research, an area identified as one of NIEHS strategic interests.

Extramural Research

[Extramural papers of the month](#)

- [Cost of mercury pollution](#)
- [Reducing air pollution continues to increase life expectancy](#)
- [Tributyltin linked to transgenerational obesity](#)
- [Early pregnancy inflammation could increase autism risk](#)

Inside the Institute



[Institute achievements honored at annual awards ceremony](#)

NIEHS staff from across the institute gathered in Rodbell Auditorium on Feb. 13 for the annual ceremony, hosted by NIEHS/NTP Director Linda Birnbaum, Ph.D.

Intramural Research

[Intramural papers of the month](#)

- [New mouse model advances study of mitochondrial diseases](#)
- [A new method to analyze case-sibling studies](#)
- [Novel loci for lung function identified by using genome-wide joint meta-analysis](#)
- [The effects of sulfite-induced lesions in DNA](#)

Calendar of Upcoming Events

- **March 5**, in the NIEHS Executive Dining Room, 12:00-1:00 p.m. — Receptor Mechanisms Discussion Group Seminar Series with Christopher Wingard, Ph.D., exploring “Metabolic Syndrome: Rho-Kinase Signaling and Erectile Dysfunction”
- **March 8 (offsite event)**, in the Levine Science Research Center, Room A247, at Duke University, 12:00-1:30 p.m. — Integrated Toxicology and Environmental Health Program Seminar Series with Ilona Jaspers, Ph.D., addressing “Inhaled Pollutants and Host Defense: Studies From Right Under Your Nose”
- **March 10-14 (offsite event)**, at the Henry B. Gonzalez Convention Center in San Antonio — Society of Toxicology Annual Meeting and ToxExpo
- **March 15**, in Rodbell A, 9:00-10:00 a.m. — Keystone Science Lecture Series, featuring Rusty Thomas, Ph.D., discussing “Incorporating New Technologies into Toxicity Testing and Chemical Risk Assessment: Moving From 21st Century Vision to a Data-Driven Framework.”
- **March 19**, in Rodbell Auditorium, 11:00 a.m.-12:00 p.m. — 2013 Hans L. Falk Memorial Lecture with Julie Parsonnet, M.D., giving a presentation titled “Spirits in the Microbial World (or Who is Steering This Ship)?”
- **March 20**, in Keystone 1003AB, 10:00-11:00 a.m. — NTP Toxicology Branch presentation on “Excess Lifetime Cancer Risk Attributable to Complex Mixtures of Polycyclic Aromatic Hydrocarbons. Can We Assume Response Additivity?” by Paul White, Ph.D.
- **March 21-22**, in Keystone 1003AB: March 21 1:00-5:00 p.m.; March 22 8:30 a.m.-adjournment — NTP Peer Review of Draft Report on Carcinogens Monographs for 1-Bromopropane and Cumene
- **March 22**, in Rodbell Auditorium, 1:30-2:30 p.m. — Spirit Lecture, featuring Lydia Villa-Komaroff, Ph.D., discussing “A Life in Science: From Cloning to Cell Therapies”
- **March 27-28**, in Rodbell Auditorium, 8:30 a.m.-5:00 p.m. — Training Directors’ Meeting
- **March 29**, in Keystone 1003AB, 9:00 a.m.-4:00 p.m. — NTP Tox21 Review conference
- **March 29 (offsite event)**, in the Levine Science Research Center, Room A247, at Duke University, 12:00-1:30 p.m. — Integrated Toxicology and Environmental Health Program Seminar Series with John Groopman, Ph.D., speaking on “Biomarkers for Etiology and Prevention of Liver Cancer: Third Leading Cause of Global Cancer Mortality”
- View More Events: [NIEHS Public Calendar](#)

NIEHS Spotlight

Council approves concepts, shares budget concerns

By Ernie Hood

The 138th meeting of the National Advisory Environmental Health Sciences Council Feb. 20-21 followed a brisk schedule, including the usual briefings from NIEHS/NTP Director Linda Birnbaum, Ph.D., and Division of Extramural Research and Training (DERT) Director Gwen Collman, Ph.D., designed to bring Council up to date on recent Institute activities and achievements.

Council approved two concepts, enjoyed two exciting scientific presentations ([see related story](#)), and heard presentations on an NIH Common Fund initiative related to metabolomics technology; the recently released [report](#) of the Interagency Breast Cancer and Environmental Research Coordinating Committee; and ongoing NTP work on a new approach to systematic review. The second day of the proceedings was devoted to a closed session for consideration of grant applications.

Birnbaum: budget issue changing almost daily

Given the looming potential difficulties, Birnbaum's calm recitation of the current budget situation was laudable. She noted that the government is currently operating under a Continuing Resolution (CR) that expires March 27, when a shutdown would be triggered if Congress does not pass either a budget or another CR.

"If they were to pass another six-month CR, we can live with that, because at least we would know how much money we would have at the end of the fiscal year," she told Council. "But if they start doing what they did in FY 2012, when they went to weekly and even sometimes daily CRs, there's complete chaos and a huge amount of effort and funds spent in order to deal with it." She said that the general feeling seems to be that Congress will ultimately not allow a government shutdown to take place.

Reports to council

As always, Birnbaum also briefed Council on NIEHS legislative activities, news and highlights, scientific advances, and awards and recognitions earned by staff and grantees since its September 2012 meeting. She updated the group on the status of the new NIEHS strategic plan, noting that NIEHS leadership recently received implementation plans from working groups devoted to the eight



Birnbaum always seems to enjoy reporting to Council on the most recent scientific advances achieved by NIEHS grantees and intramural scientists. (Photo courtesy of Steve McCaw)



Collman reported that in FY 2012, research project grants (RPGs) represented 76.6 percent of the \$248 million DERT portfolio, with R01s comprising 70.6 percent of the RPGs. (Photo courtesy of Steve McCaw)

transdivisional priorities identified in the plan – epigenetics, inflammation, stem cells, the exposome, predictive toxicology and disease, global environmental health, knowledge science and data management, and the website and social media. She also shared background information about the recent changes in the NIH and NIEHS logos.

Collman reported on DERT staff changes, and highlighted the Worker Education and Training Program (WETP) response to Superstorm Sandy, which has included training more than 400 workers on-site and distributing more than 35,000 informational booklets to aid worker health and safety. She provided Council with a summary of FY 2012 NIEHS research grant activities, including an overall success rate of 14.6 percent for the year's grant applications, and described planned requests for applications (RFAs) and program announcements for FY 2013.

Andrew Rooney, Ph.D., from the NTP Office of Health Assessment and Translation (OHAT) provided a status report on the draft OHAT Approach for Systematic Review and Evidence Integration for Literature-based Health Assessments. The draft approach was presented to the NTP Board of Scientific Counselors last December, and was released for public comment on Feb. 26. Eventually, two case studies will be included, and an updated guidance document will be released.

Council voted to approve concepts involving proposed new topics for the Small Business Innovation Research grants program, and new RFAs planned for the NIEHS neurodegeneration research portfolio.

The next Council meeting is scheduled for May 14-15.

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

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Public-private group explores sustainable alternatives assessment

By Eddy Ball

NIEHS provided much more than meeting space and hospitality during a Health and Environmental Sciences Institute (HESI) [workshop](#) Feb. 7-8, evaluating assessment strategies for selecting safer, sustainable alternatives to chemicals of concern.



Council members Thomas McKone, Ph.D., of the University of California, Berkeley, left, and Thomas Gasiewicz, Ph.D., of the University of Rochester, listened intently to a presentation during the long, but productive, session. (Photo courtesy of Steve McCaw)



Council members Lisa Conti, D.V.M., from One Health Initiative, left, and Viola Waghiyi from Alaska Community Action on Toxics, each contributed several important comments during the course of the meeting. (Photo courtesy of Steve McCaw)

NIEHS/NTP Director Linda Birnbaum, Ph.D., gave opening remarks to the interdisciplinary group of technical experts from academia, business, and government. NIEHS grantee [Joel Tickner, Sc.D.](#), a recognized authority in alternatives assessment and sustainable product development, presented the keynote address. Several NIEHS and NTP scientists, including HESI workshop organizing committee member Darlene Dixon, D.V.M., Ph.D., participated in the three working group sessions.

In a presentation that was much more than the formulaic welcome from the director, Birnbaum said, “We need to identify toxic chemicals before they reach the market place.” With her discussion of the effects of early-life exposures on development and adult-onset diseases, Birnbaum offered the multistakeholder group a public health perspective on lifecycle analysis of products, by emphasizing that unsafe products and chemicals may have negative effects on health long after exposure occurs.

As Dow Chemical Company toxicologist Pam Spencer, Ph.D., workshop co-chair, explained in her opening remarks, properly assessing alternatives to replace unsafe products and ones with unintended negative health effects is important in terms of profitability, as well as public health.

“It can take ten years and \$250 million to research, develop, and register a new crop protection product,” she said, noting that only a very small percentage of chemicals proposed for agricultural applications ever make it successfully from the lab to the field.

Inspiration and perspiration

In her charge to participants, Spencer made it clear that she expected them to produce during the two-day meeting, which was equally divided between presentations and discussions, and the give-and-take of workgroups examining attributes and tools; decision-making and weighing; and data gaps. One important goal, she said, was the creation of short overviews for specific groups, and technical articles with more original data for publication in one or more peer-reviewed journals.

The morning of the first day included short talks by industrial consultant William Greggs of Soleil Consulting; University of California, Los Angeles law and environmental sustainability specialist [Peter Sinsheimer, Ph.D.](#); and BASF senior sustainability specialist [Bruce Uhlman](#). These speakers introduced several themes that gained added force with a keynote address by Tickner, a University of Massachusetts Lowell professor and a leading advocate of the precautionary principle in product safety and functional analysis.



In her opening remarks, co-chair Spencer described the economic drivers behind the growing interest in alternatives assessment among manufacturers. As her statistics made clear, how successful a company is at developing safer products from the outset will have a major impact on its bottom line. (Photo courtesy of Steve McCaw)



Following her welcome and charge to attendees, Birnbaum, left, joined Dixon in the audience, where they had a chance to discuss the agenda. Several participants remarked afterwards that they were pleased to see Birnbaum show such a level of interest in, and understanding of, their goals for the meeting. (Photo courtesy of Steve McCaw)

“California is the million pound gorilla in the room,” Tickner said, as he described the social, regulatory, and economic pressures driving alternatives assessment today. Product developers are facing new, basic questions, including whether some products, such as fire retardants and dry cleaning solvents, are needed at all. Instead of looking solely at convenience and profitability, engineers are being called upon to determine whether a function, such as degreasing, can be performed as well by a safer chemical.

Safety can also mean accepting ambiguities, Tickner explained. “There’s rarely going to be an easy drop-in,” he said, “[and] we shouldn’t let perfection of the data be the goal. ... Take action — that’s the bottom line.”

Lessons learned and a sober look forward

When the workshop reconvened following the breakout sessions, two things were clear from the group reports. On the one hand, participants felt they’d gained valuable insights from stakeholders with different perspectives on product safety and made significant progress toward their goals. On the other hand, there was a consensus that much more work remains to be done.

“We’ve picked the low-hanging fruit,” observed Procter and Gamble environmental toxicologist [Don Versteeg, Ph.D.](#) “The other work is more difficult.”

In her closing remarks, Spencer agreed, saying, “We’ve just scratched the surface.” But that realization failed to dampen the enthusiasm participants felt about their two days together. “This was an extremely successful workshop,” Spencer said, as the workshop came to a close. “I’m really excited that we’ll be able to take this to the next level.”



Among the stakeholders working to establish common ground for the public and private sectors were London School of Economics and Political Science professor of public policy on sustainability [Kira Matus, Ph.D.](#), left, and Robert Dwyer, Ph.D., associate director of the Environment Health, Environment, and Sustainable Development Program at the International Copper Association. (Photo courtesy of Steve McCaw)



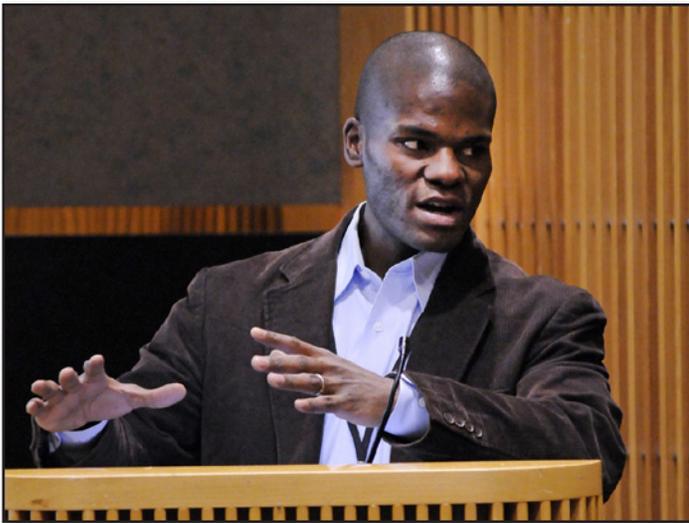
Greggs described sustainable product design as a whack-a-mole problem. “Every decision has trade-offs,” he said. But hard work pays off, he added, quoting from the second part of Edison’s famous perspiration and inspiration comment. “A ‘genius’ is often merely a talented person who has done all of his or her homework.” (Photo courtesy of Steve McCaw)



With his presentation of tools, flowcharts, and checklists, documenting the design process at chemical maker BASF, Uhlman demonstrated his in-depth understanding of broader implications, including detailed life cycle assessment, social implications, and total environmental and public health impact, in efforts to balance what he called the triple bottom line — people, planet, profit. (Photo courtesy of Steve McCaw)



Like Birnbaum, Tickner had a marked influence on the working group and general discussions at the workshop. “Avoid paralysis by analysis,” he told the audience, but also warned them about the danger of introducing alternatives that could be as unsafe as the products they replace. “There is [also] a responsibility to make sure we’re not jumping from the frying pan into the fire.” (Photo courtesy of Steve McCaw)



Reporting back for the Decision-making and Weighing work group, George Washington University engineering management professor [Royce Francis, Ph.D.](#), emphasized the importance of providing guidance for making decisions with limited data. He said that smaller companies, especially, may not have ready access to sustainability professionals or the expertise needed to negotiate complicated tools for weighing considerations. (Photo courtesy of Steve McCaw)



During the final few minutes of the workshop, sustainability consultant [James Fava, Ph.D.](#), expressed what seemed to be the sentiments of most of the participants. “We just hit the tip of the iceberg,” he said. “It was a lot of education for all of us.” (Photo courtesy of Steve McCaw)

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Putting climate change and human health science into practice

By *Carol Kelly*

As extreme weather events, such as droughts and superstorms, call attention to the effects of climate change, questions about actions that can be taken to protect and prevent harm to the health of people are becoming a focus of climate discussions.

To help find the answers, for the first time, NIEHS and the Centers for Disease Control and Prevention (CDC) formally brought together their grantees working on climate change and human health, to share their research findings and discuss practical strategies for implementing this knowledge. The meeting, “Extreme Weather, Climate, and Health: Putting Science Into Practice,” was held Jan. 30-31 in Washington, D.C.

“The goal of this meeting was for grantees to share latest advances, as well as for participants to network with each other to build new relationships and plant the seeds for future collaborations toward solving one of the most critical public health issues facing our world,” said [Caroline Dilworth, Ph.D.](#), NIEHS health scientist administrator.



Dilworth led the symposium planning committee and described current grant projects funded by NIH. (Photo courtesy of Steve McCaw)

Supporting the climate change and health research community

NIEHS and the [Fogarty International Center](#) have led the coordination and expansion of NIH support for research on the human health effects from climate change.

“Our goal is to build and support the climate change and human health research community,” said NIEHS/NTP Director Linda Birnbaum, Ph.D. “At NIEHS, our research focus is on prevention rather than diagnosis. Our understanding of the complex relationships among extreme weather events, health outcomes, and biological, social, and geographical risk factors continues to develop.”

Vulnerable populations were given special emphasis in some presentations. NIEHS grantee [Joel Schwartz, Ph.D.](#), from Harvard University, explained his finding that when temperature changes erratically within a few days, even without reaching extremes, the variability is a health risk for the elderly, especially those with existing health conditions, because their bodies may have difficulty adapting to rapid changes. [Shao Lin, M.D., Ph.D.](#), an NIEHS grantee at the University of Albany, presented her finding that exposure to excessive heat during pregnancy was associated with congenital cataracts, a cloudiness in the eye lens, in newborns.

Other panelists spoke about climate and health issues, such as increasing rates of infectious diseases carried by such insects as mosquitoes and ticks; escalating energy demand during temperature extremes may create blackouts that affect the environment and potentially health; encroaching tropical marine toxins in subtropical zones that impair seafood security; and managing adaptation to high-heat exposures in localities, ranging from the rural South to the North, to lessen vulnerabilities among people.

Integrating climate data and public health at the local level

George Luber, Ph.D., associate director for Global Climate Change at the CDC National Center for Environmental Health, presented the Building Resilience Against Climate Effects ([BRACE](#)) framework. This five-step method enables state or local health departments to integrate the best available climate data and projections with the incidence and prevalence of health conditions, to better anticipate, prepare for, and respond to a range of climate-related health effects. CDC’s [Climate-Ready States and Cities Initiative](#) supports BRACE programs in 16 states and two cities.

“NIEHS would like to see more meetings like this one, to translate research to scientists in other fields, to decision-makers, and to the public,” said John Balbus, M.D., NIEHS senior advisor for public health. “Collaboration between the research and the public health communities is essential for addressing the climate change and human health challenge. We need to ensure that significant research findings are integrated into public health planning, as well as ensure that researchers are addressing the topics of greatest concern.”



The symposium marked a truly historic moment, because attendees — experts on climate change and human health — helped create the present regard for climate change as a mainstream issue, according to Balbus, HHS principal to the [U.S. Global Change Research Program](#). (Photo courtesy of Steve McCaw)



“Weather and climate have always had a key influence on human health. This influence on our lives will increase with climate change,” said Chris Portier, Ph.D., director of the CDC National Center for Environmental Health and Agency for Toxic Substances and Disease Registry. Previously, as a senior science advisor at NIEHS, Portier led the ad hoc Interagency Working Group on Climate Change and Health that developed the report, [“A Human Health Perspective on Climate Change,”](#) which outlines research needs. (Photo courtesy of Steve McCaw)

Howard Koh, M.D., assistant secretary for health at the U.S. Department of Health and Human Services (HHS), spoke to the group early in the meeting about the importance of their work to public health.

“I want to remind all of us that we are interconnected, we are all doing work that is interrelated, and we all have promises to keep,” said Koh.

Promoting collaboration

Both the research and public health practice communities face data needs and challenges. Offering one solution, Juli Trtanj, Oceans and Human Health Initiative program manager at the National Oceanic and Atmospheric Administration (NOAA), gave a special preview demonstration of the Metadata Access Tool for Climate and Health, a searchable clearinghouse of publicly available federal monitoring and surveillance data sets, early warning systems, and tools for characterizing the health impacts of global climate change. The system is being developed by the U.S. Global Change Research Program Interagency Crosscutting Group on Climate Change and Human Health, co-chaired by NIEHS, CDC, and NOAA.

Successful models for researchers and practitioners to work together, as well as examples of community involvement in research and public health adaptation efforts, were highlighted at the meeting. Best practices for translating and communicating research to decision-makers, including the use of key messages, case studies, and communication tools, were also presented.

“There is a real need to apply behavioral and social science strategies to communicating about the risks of climate change,” said Kimberly Thigpen Tart, J.D., an NIEHS program analyst who moderated the research translation panel. “We need to understand what will be most effective in motivating people to act on the science we present.”

“People want to know what’s happening where they live,” said Kim Knowlton, Dr.PH., senior scientist in the health and environment program at the Natural Resources Defense Council, in her keynote address. “Local data gets conversations started. People hear about national data and wonder what does this mean in my backyard. Climate change is a global issue with local effects.”

The spirit of collaboration at the meeting was also reflected in the impressive range of sponsors. In addition to HHS, NIEHS, and CDC, the American Public Health Association, Association of State and Territorial Health Officials, and National Association of County and City Health Officials contributed to making the meeting a success.

(Carol Kelly, a health communication specialist, works for MDB Inc., a contractor for the NIEHS Division of Extramural Research and Training.)

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NIEHS hosts workshop for secondary school science educators

By Eddy Ball

Thanks to a long-standing partnership with the [North Carolina Association for Biomedical Research \(NCABR\)](#), 27 educators were able to attend a free continuing education credit workshop Feb. 6 at NIEHS that was packed full of new information they could take back to schools throughout the state.

The full-day event was part of the NCABR “RX for Science Literacy” series. It was organized and hosted by the [NIEHS Office of Science Education and Diversity \(OSED\)](#), represented by OSED Director Ericka Reid, Ph.D., and biologist Huei-Chen Lao, who is serving a detail appointment as K-12 Science Education and Outreach Coordinator. Six NIEHS scientists volunteered their time to make presentations related to the workshop theme, “Cancer and Cell Biology.”

In her opening remarks, NCABR Director of Programs Regina Williams welcomed attendees and described resources available through her organization’s website. She also acknowledged the importance of NIEHS science education outreach efforts.

“We are very grateful to the NIEHS for hosting us and partnering with us to bring this workshop to you,” she said. “It is free to you, but it’s not a free workshop. It’s funded by the generous support of NIEHS and it’s supported by the time and efforts given by the [NIEHS] volunteers.”

Learning to use the NIH curriculum guide

Following an introduction to resources available through several NIEHS programs, by Industrial Hygienist [Sharon Beard](#), participants spent their morning in hands-on training on the use of the newly revised [NIH Curriculum Supplement](#) and online resources, presented by Program Administrator [Mike Humble, Ph.D.](#) The supplement contains five modules — The Faces of Cancer, Cancer and the Cell Cycle, Cancer as a Multistep Process, Evaluating Claims About Cancer, and Acting on Information About Cancer.

Humble, a former high school teacher, led the educators through student activities, and showed some of the videos and animations available as part of the NIH Curriculum Supplement. His quick wit kept his audience engaged, as he went over the sobering messages about cancer, such as “Cancer is a single disease [process] and a hundred diseases [of different tissues and with different treatments and prognoses].”

Cancer and cell biology research at NIEHS

The afternoon sessions of the workshop featured presentations about ongoing research at NIEHS by Veterinary Medicine Section Chief Terry Blankenship-Paris, D.V.M.; [Molecular and Genetic Epidemiology Group](#) postdoctoral fellows Ashley Godfrey, Ph.D., and Sara Harlid, Ph.D.; and Cell Adhesion Group staff scientist [John Roberts, Ph.D.](#)

Blankenship-Paris started off the afternoon with her presentation on “Human Use of Animals in Environmental Research.” After a short introduction, she led workshop participants on a tour of the Comparative Medicine Branch facilities.



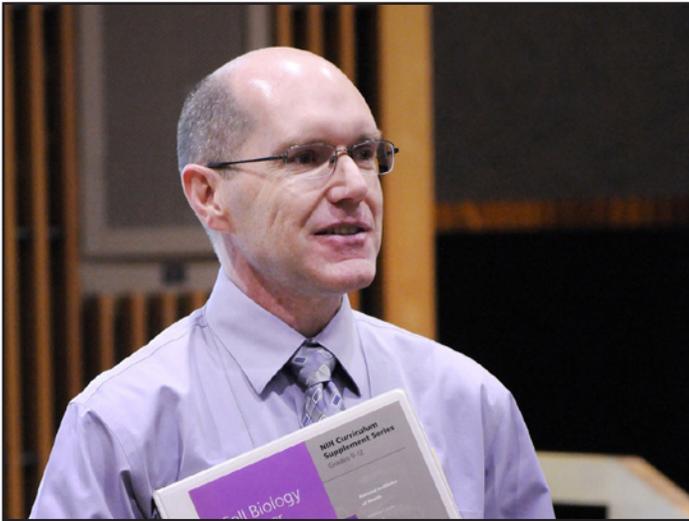
Williams was clearly gratified by the interest and enthusiasm of the latest group of educators taking advantage of continuing education programs offered by NCABR. (Photo courtesy of Steve McCaw)



As she began her overview of NIEHS and its mission, Reid welcomed workshop participants to the latest installment of the “RX for Science Literacy” series. “This is one of our special partnerships that we have with NCABR, and we always look forward to these teacher workshops,” she said. “We understand that they are very important, and we are very happy to have you with us.” (Photo courtesy of Steve McCaw)

Godfrey and Harlid examined two research questions currently being examined by their group — “Can microRNAs Predict Breast Cancer?” and “Can Early Exposure to DES Reprogram Women’s DNA?” For his part, Roberts explored strategies for preventing the spread of cancers throughout the body with his presentation on “How Cancer Cells Metastasize (and what can we do about it)?” As they explained, the answers to these questions can help further the NIEHS mission of preventing disease in the first place, by reducing exposures and controlling disease progression so that treatments are more likely to save or extend lives.

By completing the workshop, the teachers receive credit toward their continuing education requirements and certification.



Humble made sure workshop participants enjoyed the session on the NIH Curriculum Supplement Series, as he laced the presentation with his dry wit. He is an acknowledged master at delivering jokes with a straight face, but now and then even he can't avoid giving away, with his mischievous smile, that a joke is coming up. (Photo courtesy of Steve McCaw)



Lynge, center, said she learned a great deal at the workshop (see text box), and also enjoyed plenty of laughs during Humble's presentation. (Photo courtesy of Steve McCaw)

Take-home impressions of a day at NIEHS

Although the focus of NCABR is the teacher currently working in the secondary school science classroom, the workshops also attract former teachers getting ready to re-enter active teaching, teacher trainers, environmental and sustainability advocates, and representatives of community groups.

One such attendee at the “Cancer and Cell Biology” workshop was 69-year-old Evelyn Lynge, a retired geologist and substitute teacher who serves as vice president of the Onslow County (N.C.) Council for Women. Lynge’s group is concerned with the quality of education in Onslow County, as well as the quality of life there.

Lynge said the workshop addressed her concerns as an educator and a citizen interested in environmental health. Onslow County, like much of Eastern N.C., has poorer educational outcomes than more affluent parts of the state. It also faces the lingering effects of contaminated drinking water at its U.S. Marine Corps base, which contained known and suspected carcinogens for more than three decades, and of mold from flooding triggered by storms in April 2012.

“I loved the presentations,” said Lynge, who plans to present what she learned to others in Onslow County trying to improve science, technology, engineering, and math education there, including the county commissioner who sits on her board. “I’d also like to get more information about mold [part of Beard’s presentation], because of my own exposure at home.”

As workshop evaluations indicate, Lynge spoke for many participants when she concluded, “I thank the NCABR and NIEHS for sponsoring this [wonderful] workshop and giving me the chance to attend.”



University of North Carolina at Greensboro education professor Valerie Vickers, Ph.D., said she attended the workshop for new ideas about how to better prepare young environmental science educators for today's classroom. (Photo courtesy of Steve McCaw)



Davey County, N.C., teacher Deb Gustafson was representative of the majority of the participants — middle and high school teachers who took their training directly back to the classroom. (Photo courtesy of Steve McCaw)



Godfrey led off the basic science segment of the program, which was designed to give attendees a taste of the leading-edge biomedical research underway at NIEHS. As Williams had told the teachers earlier, the information from the afternoon sessions might not be as practical as the NIH curriculum, but it would prove valuable. "We [also] want to enlighten your scientific side as an educated consumer and citizen," Williams said. (Photo courtesy of Steve McCaw)



As the final presenter of the day, Roberts kept his audience on the edge of their seats with a suspenseful story about the search for a molecular pathway responsible for metastasis, the process that makes cancer a deadly disease. (Photo courtesy of Steve McCaw)

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Birnbaum visits Northeastern SRP partner in Puerto Rico

NIEHS/NTP Director Linda Birnbaum, Ph.D., visited the University of Puerto Rico (UPR) Medical Sciences Campus Feb. 4 to discuss the importance of transdisciplinary research in the environmental health sciences. [Braulio Jimenez, Ph.D.](#), a lead researcher in the Northeastern University Superfund Research Program (SRP) human subjects and sampling core, located at UPR, coordinated the talk.

During Birnbaum’s visit, she gave a lecture on “Future Research at the National Institute of Environmental Health Sciences,” where she discussed the Northeastern SRP Puerto Rico Testsite for Exploring Contamination Threats (PROTECT) program. The PROTECT program, supported with NIEHS SRP funding, studies exposure to environmental contamination in Puerto Rico and its contribution to preterm birth.

Birnbaum highlighted the PROTECT program as an excellent example of transdisciplinary research that not only identifies treatments, but also works to understand and communicate preventative measures. Birnbaum also focused on the need to better understand the interaction between chemical and physical environmental factors, and the potential synergistic effects individuals are subjected to with a number of exposures.

Birnbaum previously highlighted PROTECT program research in a February 2011 [Statement for the U.S. Senate Committee on Environment and Public Works’ Hearing on Drinking Water Contaminants](#).

For more information about the Northeastern SRP and Birnbaum’s talk, visit the [PROTECT website](#). Read the Spanish language [story](#) in the digital periodical El Vocero.

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Birnbaum discussed transdisciplinary research such as work supported by PROTECT as a key driver in public health that not only identifies treatments but also preventative measures. (Photo courtesy of El Vocero and Dennis Jones)



UPRMC lecture host Jimenez (Photo courtesy of Baulio Jimenez)

Summer intern earns national recognition

By Melissa Kerr

Even though he is still a high school senior, NIH summer intern William Ge is already taking big strides toward an impressive scientific career. He was chosen as one of three hundred semifinalists in the 2013 [Intel Science Talent Search \(STS\)](#), the nation’s oldest and most prestigious precollege science competition. Ge was one of just six NIH summer interns who made the grade.

“It felt good seeing that the work I’ve done has been validated by people who are big in the field,” said Ge, a senior at the [North Carolina School of Science and Mathematics \(NCSSM\)](#) in Durham, N.C., one of 17 constituent institutions of the University of North Carolina system.



Linked video:
[Watch a video commemorating the 25th anniversary of NCSSM \(09:43\)](#)

(Launches in new window)

Download Media Player:  Flash 

This science competition, previously known as the Westinghouse Science Talent Search, was started in 1942 by the Society for Science and the Public. Since 1998, Intel has sponsored this national competition, which this year recognized 1,700 of America's most promising high school seniors and their achievements in science, technology, engineering, and math.

Seven previous Intel STS finalists have gone on to win the Noble Prize. According to Intel's website, the company is honored to be a part of this competition's 70-year history of inspiring scientific advancement. The 40 STS finalists competed for \$630,000 in prizes, and the first place finalist received a cash prize of \$100,000 from the Intel Foundation.

NIEHS fosters curiosity and initiative

Ge spent this past summer interning in the NIEHS laboratory of [Michael Fessler, M.D.](#), who leads the Clinical Investigation of Host Defense Group and the Environmental Innate Immunity Group in the Clinical Research Program. Fessler was impressed by the young scientist.

"[Ge] was certainly interested in immersing himself into what we were doing," Fessler explained. "He had the confidence and maturity to develop his own ideas and to ask questions of the team."

During his summer in Fessler's lab, Ge was involved in attempting to further understand, within human blood, the relationship between the protein Apolipoprotein E and cytokine populations from inflammatory responses (see text box).

Ge said he enjoyed his first experience of working with some independence on a project, and he was surprised by the latitude he was given in fulfilling the requirements of the experiment in Fessler's lab. "It was a very insightful experience," Ge said.

Growing up with science

Ge has lived a varied life, thus far. He was born in Indianapolis, has had extended stays with his grandparents in China, and lived with his parents in several American locations, including Michigan, Oregon, and various places within the Triangle region of North Carolina. He feels his parents allowed him the freedom to pursue whatever interests he had as he was growing up. He believes that his aptitude for science has fed his interest in the field.



Ge is a soft-spoken young man whose talents include playing the violin. Like his fellow semifinalists, Ge earned \$1,000 prizes for himself and for NCSSM. (Photo by Eddy Ball)

A summer of discovery at NIEHS

Apolipoprotein E is a lipid-trafficking and immunomodulatory protein that is polymorphic in humans, with three well-described wild type (APOE3) and disease-associated (APOE2, APOE4) alleles. While APOE4 has been associated with increased risk for Alzheimer's disease and cardiovascular disease, and has been proposed to be proinflammatory, its effect on immune responses of primary human cells has never been defined.

During his summer internship, Ge organized blood collection from APOE3/APOE3 and APOE3/APOE4 healthy human donors in the NIEHS Clinical Research Unit, and was able to confirm in an *ex vivo* whole blood assay that APOE3/APOE4 whole blood, compared with APOE3/APOE3 whole blood, displays twofold to threefold higher induction of a broad panel of cytokines in response to Toll-like receptor (TLR) 2, TLR4, and TLR5 agonists. This suggests that APOE4 may be a central genetic determinant of multiple innate immune signaling cascades in humans.

Many of Ge's extracurricular activities involve environmental science in some way. He is involved with the Envirothon and the National Ocean Sciences Bowl. He also participates in a program called Science Days, where he visits local elementary schools to have fun with hands-on experiments, in order to foster the interest of young students in science.

Although he has already been accepted to a few colleges, he has yet to make a final decision as to where he is going. He also is trying to determine exactly what he will focus on in his college years — engineering and problem application or health. "I've been more interested in researching environmental health and environmental engineering," he explained. He said he is leaning more towards the health aspect, because of how much of an issue it is for his generation of scientists.

(Melissa Kerr studies chemistry at North Carolina Central University and is an intern in the NIEHS Office of Communications and Public Liaison.)

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Miller hands over the reins at the NIEHS Clinical Research Program

By Robin Arnette

When [Frederick Miller, M.D., Ph.D.](#), became acting clinical director in October 2011, his goal was to maintain and improve the NIEHS Clinical Research Program (CRP) until a permanent director took over. During the year and a half he spent in the position, Miller met his objectives by furthering the mission of the CRP and laying the groundwork for its continued growth.

One of the things he accomplished was strengthening ties between the clinical researchers and support staff here in Research Triangle Park (RTP) and those in Bethesda, Md. When the NIEHS [Clinical Research Unit \(CRU\)](#) opened its doors in July 2009, the North Carolina clinicians were focused on getting their research projects going and generating data. They knew their fellow scientists to the north but, because of the geographical distance, the two groups didn't interact on a regular basis.

CRP retreat builds solidarity

Miller changed all that by instituting the first annual CRP retreat. Held April 2012 at the Radisson Governors Inn in RTP, the researchers and support staff personally exchanged ideas and suggestions for improvements, all the while getting to know each other better.

"The spirit of teamwork had always been with CRP staff, but this gathering really reinforced that bond," Miller said, as he fondly remembered the retreat. "It made us realize we're all moving toward the same goal, which is to improve our understanding of how the environment impacts human health."



An Ohio native, Miller received his M.D. and Ph.D. after completing the Medical Scientist Training Program at Case Western Reserve University School of Medicine in Cleveland. (Photo courtesy of Steve McCaw)

Miller hopes the annual CRP retreats will alternate between both locations, with the next one being held in Bethesda. The 2013 Maryland meeting will allow CRU staff to see the inner workings of NIEHS at the [NIH Clinical Center](#).

Miller also developed a quarterly CRP meeting, which keeps everyone abreast of what's going on in each group, as well as providing a fertile environment for new ideas and collaborative projects. To better focus the program's efforts, Miller created three working groups — research, administration, and protocol workflow — to more effectively manage the CRP's intellectual and financial resources.

A smooth transition to new leadership

CRU Medical Director [Stavros Garantziotis, M.D.](#), will now serve as acting clinical director. Garantziotis said Miller's efforts in helping integrate the CRP were invaluable, and believes because of his leadership, the group is poised to make greater progress in the future.

“During Dr. Miller's tenure, the NIEHS CRP published several papers that chip away at the hidden causes of environment-related conditions, such as autoimmunity, asthma, and cancer,” Garantziotis said.

“Dr. Miller supported our operations masterfully, and I hope to continue this trajectory during my tenure.”

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NTP postdoc wins top award at SOT

By Robin Mackar and Martha Lindauer

Yuanyuan (Laura) Xu, Ph.D., of the National Toxicology Program (NTP) Laboratory, will be honored with the Best Postdoctoral Publication Award as part of the Society of Toxicology (SOT) Annual Meeting March 10-14 in San Antonio. [Xu](#), a third-year postdoctoral fellow in the NTP Inorganic Toxicology Group, led by Michael Waalkes, Ph.D., is being recognized for her work related to arsenic, stem cells, and cancer.

The award is for the paper “[Arsenic-transformed malignant prostate epithelia can convert noncontiguous normal stem cells into an oncogenic phenotype](#),” which appeared in *Environmental Health Perspectives* last summer ([see story](#)) and was selected as an NTP paper of the year ([see summary](#)). Publications competing for this award are judged on the basis of scientific innovation, impact of the research on toxicological sciences, and the scientific impact of the publishing journal, among other factors.



Garantziotis earned his M.D. at the University of Freiburg in Germany. (Photo courtesy of Steve McCaw)

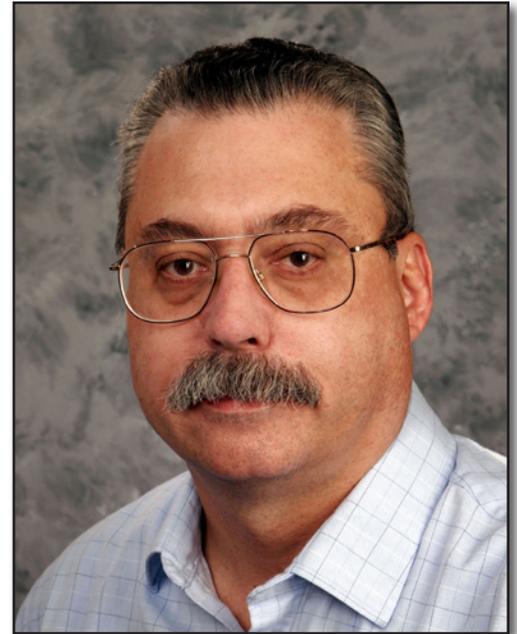


Award-winning postdoctoral researcher Xu. (Photo courtesy of Steve McCaw)

Xu's paper was considered to contain seminal scientific findings on how arsenic-transformed malignant human prostate epithelial cells impact neighboring human prostate normal stem cells (NSCs), via a transwell co-culture system (see text box).

This transwell system prevented physical contact between the malignant epithelial cells and NSCs, but did allow them to share secreted factors. The results indicate that arsenic-transformed malignant epithelial cells could drive the nearby, but noncontiguous, NSCs into a cancer phenotype, in effect creating cancer stem cells (CSCs) without any actual physical contact.

“This work is a highly significant step forward in our quest for mechanisms in arsenic carcinogenesis,” said Waalkes, who serves as Xu's mentor. “Throughout the work, Dr. Xu employed clever design, elegant experimentation, and outstanding interpretation of data to produce this article. Her work represents a major advance in defining the role of stem cells during arsenic carcinogenesis.”



Mentor Waalkes (Photo courtesy of Steve McCaw)

Xu won a first place Stem Cells Specialty Section Excellence in Research Award in the postdoctoral category at SOT last year. She also won first place for her research at the North Carolina SOT fall meeting in 2010 ([see story](#)) and was just elected the group's 2013 postdoctoral representative.

A summer of discovery at NIEHS

Xu found that with arsenic-transformed malignant epithelial cells, CSC recruitment appears to occur by malignant cells sending out tumor microenvironmental factors, potentially including interleukin-6, which alone converted NSCs into CSC-like cells and duplicated most responses induced by malignant epithelial cell co-culture.

This recruitment of NSCs into CSCs by arsenic-transformed malignant epithelial cells potentially constitutes a new phenomenon in tumor growth, invasion, dissemination, or field cancerization.

CSCs are thought to be the source of new malignant cells that allow tumors to grow and spread, and they may well be integral to tumor initiation, progression, and metastasis. Inorganic arsenic is a known human carcinogen, but the precise mechanisms are unknown.

The recruitment of NSCs into CSCs by arsenic-transformed malignant epithelial cells may be a key mechanism in arsenic-induced CSC overabundance previously seen in multiple *in vivo* and *in vitro* model systems.

(Robin Mackar is the news director in the NIEHS Office of Communications and Public Liaison, and a frequent contributor to the Environmental Factor. SOT Communications/Media Manager Martha Lindauer wrote the SOT press release on Xu's award.)

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NIEHS fellow transitions into private-sector translational research

By Aleksandra Adomas

NIEHS trainee Jennifer Sims, Ph.D., left her lab last month for a translational research and development research associate position at Expression Analysis, a Quintiles company specializing in genomic services for pharmaceutical, biotechnology, academic, government, and nonprofit markets.

Power of networking

An Intramural Research and Training Award fellow in the [NIEHS Eukaryotic Transcriptional Regulation Group](#), Sims credits the power of networking with making her job search successful. “I never knew how many connections I had,” she declared, explaining that a childhood friend submitted a general referral for her to Quintiles. Another friend, familiar with Sims’ line of work, suggested Expression Analysis as a company that could be a good fit. Finally, it was a next-door neighbor who submitted her resume to Expression Analysis and assured her, “It’s a person and not a computer who will look at your application.”

While preparing for a career transition and planning her next steps, Sims attended many of the career exploration workshops offered at NIEHS and mentioned, in particular, a seminar by Sharon Milgram, Ph.D., director of the NIH Office of Intramural Training and Education (OITE). “Sharon’s words about a success rate of 1 in 4,000 among people applying for jobs online, as compared to 1 in 12 among those using networking, stuck with me,” Sims recalled. Consequently, she reached out to her personal connections and talked to co-workers, collaborators, friends, and acquaintances.

A successful mix of experience and communication skills

If networking was the most significant factor that landed Sims a job interview, it was the right mix of skills, experiences, and ability to communicate that contributed to securing a job offer. During her four years at NIEHS, she worked with lead researcher Paul Wade, Ph.D., on understanding the role of chromatin remodeling complex, Mi-2/NuRD, in chromatin assembly and structure maintenance during replication.

This cell cycle research, coupled with her graduate work on epigenetic transcription regulation at the University of Southern California, provided her with experience in a diverse skill set of molecular biology techniques, including next-generation sequencing. On top of that, Sims believes that her ability to communicate science in lay terms was crucial while interviewing with bioinformatics, quality control, and regulatory affairs specialists. “All of them liked that I could explain my research to them,” she said.

Career Vision Change

Securing an industry-based research position wasn’t always Sims’ career goal. Throughout her undergraduate and graduate education, she was single-minded about pursuing the academic path.

Writing the NIH Pathway to Independence Award grant in the last year of her postdoctoral training was what changed her mind, as Sims became fully aware of the time and effort she would need to invest into obtaining funding as an independent investigator. It also gave her a taste of the stress of providing a livelihood for members of her future laboratory. Finally, a desire to have a better control of the work-life balance pushed her to consider non-bench career paths.



Sims said she hopes the transition to industry will not be a very difficult one in terms of laboratory duties, and considers learning more about clinical studies and regulatory affairs a welcome challenge. (Photo courtesy of Steve McCaw)

Sims will be able to apply those skills to designing clinical trials at Expression Analysis, working out test assays, and communicating with customers to better understand their needs.

Sims gratefully acknowledges the advice she received when considering different career options from her mentors in the Laboratory of Molecular Carcinogenesis (LMC), Wade and lead researcher Karen Adelman, Ph.D., of the [Transcriptional Responses to the Environment Group](#). Sims also took advantage of various opportunities to gain leadership and outreach experience, which included participating in the NIEHS Summer Internship Program, becoming a North Carolina DNA Day ambassador, and organizing the LMC Journal Club.

Sims said she is also grateful to the other fellows in the Wade laboratory for their advice and encouragement. “I think that having a great support system within the laboratory is necessary for success inside the lab, as well as preparing for a career outside NIEHS,” Sims concluded.

(Aleksandra Adomas, Ph.D., is a research fellow in the NIEHS Eukaryotic Transcription Regulation Group.)



“Jenn’s work made a major contribution to our understanding of how cells copy epigenetic information during the process of cell division,” Wade said. “Her unique skill set and perseverance allowed us to address this difficult issue at a very fundamental level.” (Photo courtesy of Steve McCaw)



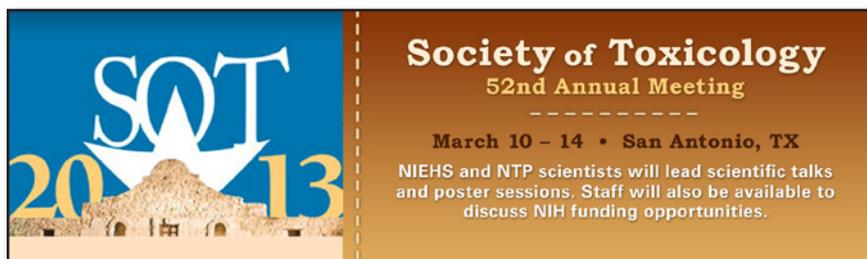
Milgram and colleagues in OITE have helped provide NIEHS trainees with career development training and counseling opportunities, complementing those provided by the NIEHS Office of the Scientific Director and NIEHS Trainees’ Assembly. (Photo courtesy of Sharon Milgram)

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SOT goes to San Antonio

By Robin Mackar

Later this month, NIEHS and NTP staff will be donning their cowboy boots, hats, data, and science posters, as they head to San Antonio March 10-14 to participate in the 52nd annual meeting of the Society of Toxicology.



More than 7,300 scientists from academia, government, and industry, representing countries around the globe, are expected to attend this year's conference. As a former president of SOT, NIEHS/NTP Director Linda Birnbaum, Ph.D., is looking forward to meeting with many acquaintances, both old and new, and sharing information about NIEHS/NTP research efforts.

Some highlighted events

Birnbaum will join other agency leaders during the typically well-attended "Meet the Directors" session on Monday, March 11, from 1:00-3:30 p.m. Directors from the U.S. Environmental Protection Agency, National Institute of General Medical Sciences, and the National Institute for Occupational Safety and Health are among the agency leaders expected to join Birnbaum to update attendees on what is happening at their agencies, with a special focus on funding opportunities.

Birnbaum will be participating in the "SOT Undergraduate Education Program" session on Sunday, March 10, where she will talk about her own career path and answer questions from participants.

She is also expected to join colleagues on Tuesday night, March 12, for the highly anticipated return of the "Tox ShowDown." This academic-style quiz show will find teams competing to answer questions related to toxicology, both in its scientific context and as it relates to society, culture, and the arts.

NIEHS and NIH program staff will be available in the Research Funding Information Room on Tuesday and Wednesday, to have individual conversations about scientific review or specific grant opportunities. New investigators are encouraged to stop by. A brown bag luncheon, focusing on strategies for submitting successful grants, will be held Tuesday at noon.

NIEHS/NTP plans to hold an exhibitor session on Tuesday, from 2:45-3:45, to share information about the NTP's draft approach for incorporating systematic review methodology into its literature-based assessments. The session "Implementing Systematic Review at the NTP" will be led by Andrew Rooney, Ph.D., and Abee Boyles, Ph.D., from the NTP's Office of Health Assessment and Translation.

Many other NIEHS/NTP scientists will be at SOT chairing sessions, presenting posters, providing demonstrations of databases and other resources, and honoring colleagues as they receive SOT awards.

For more detailed information about dates, times, and locations for many of the events that NIEHS/NTP will be participating in, visit www.niehs.nih.gov/sot.

(Robin Mackar is the news director in the NIEHS Office of Communications and Public Liaison, and a frequent contributor to the Environmental Factor.)

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NTP fellow lands toxicologist position at EPA

By SheetalThakur

NTP fellow Minerva Mercado-Feliciano, Ph.D., began a new position Jan. 28 as a toxicologist in the Health Effects Division of the Office of Pesticide Programs at the U.S. Environmental Protection Agency (EPA).

In her new role at EPA, Mercado-Feliciano will be part of a team responsible for evaluating safety of pesticide products that are to be sold or distributed in United States. She will be directly contributing to the regulatory decision-making process, by ensuring that new and existing pesticide products can be used with a reasonable certainty of no harm to human health, and that the pesticide producers have met the federal toxicity evaluation standards.

Mercado-Feliciano completed her Ph.D. in pharmacology and toxicology at Indiana University. She came to NIEHS in February 2008 as a postdoctoral Intramural Research Training Award (IRTA) fellow in the Laboratory of Reproductive and Developmental Toxicology. Driven by her passion for applied toxicology and risk assessment, she moved to the Toxicology Branch in the Division of the National Toxicology Program (NTP) in August 2009, and in 2012 successfully completed requirements for becoming a Diplomate of the American Board of Toxicology (DABT).

Under the mentorship of [Barry McIntyre, Ph.D.](#), who heads the Developmental and Reproductive Toxicology Group and also holds a DABT, Mercado-Feliciano completed her fellowship with NTP. “While at the NTP, Minerva developed a strong foundation in study design and interpreting large *in vivo* data sets,” McIntyre said of his colleague. “In her new position, she will have the opportunity to further expand upon this experience. We are confident that she will do well.”



Linked video:
[Watch a short video interview with Barry McIntyre \(01:50\)](#)

(Launches in new window)

Download Media Player:  Quicktime 

Key to success — one-of-a-kind career training in NTP

According to Mercado-Feliciano, her training in the NTP Toxicology Branch was pivotal in making her a desirable candidate for the EPA toxicologist position. While there, she worked in collaborative multidisciplinary teams to design and interpret large-scale toxicology studies in laboratory animals for chemicals and herbals that characterize potential threat to human health. She also gained advanced appreciation and training in how to develop scientifically strong and logically sound toxicity testing strategies for potentially hazardous chemicals — a skill that will prove invaluable in her role reviewing toxicology studies at EPA.

Mercado-Feliciano said she is appreciative of the on-the-job training, support, and encouragement she received from McIntyre and other senior toxicologists in the branch during her training and job search.



Mercado-Feliciano was honored by SOT for her [service](#) to HOT in 2011, and recognized as first author of an NTP [paper of the year](#) in 2012. (Photo courtesy of Steve McCaw)



Developmental and Reproductive Toxicology Group head and mentor McIntyre (Photo courtesy of Steve McCaw)

To add to the top-notch skills she gained in NTP, Mercado-Feliciano had a unique set of experiences in the environmental sciences arena. For nearly a decade, she worked as an environmental manager at the Indiana Department of Environmental Management. There she was mainly involved in scientific efforts to ensure safe, efficient, and environmentally sound solid waste recycling and disposal. This experience helped her appreciate the significance of safe handling of pesticides.

Leadership and involvement in SOT

Mercado-Feliciano always recognized the importance of networking, effective communication, and involvement in professional development activities. She has been an active member of the Society of Toxicology (SOT) since 2005, contributing to a special interest group, the Hispanic Organization of Toxicologists (HOT). She was involved from the organization's inception and rose through the ranks to become vice president-elect of HOT.

“If you are interested in honing your interpersonal skills, be involved in activities at the annual scientific meetings from the start,” Mercado-Feliciano said. Her participation in HOT led to valuable opportunities for sharpening communication and project management skills, which she claims will be of tremendous value in her current position.

(Sheetal Thakur, Ph.D., is an IRTA fellow in the NTP Toxicology Branch.)

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Midwest legislators convene at Environmental Health Summit

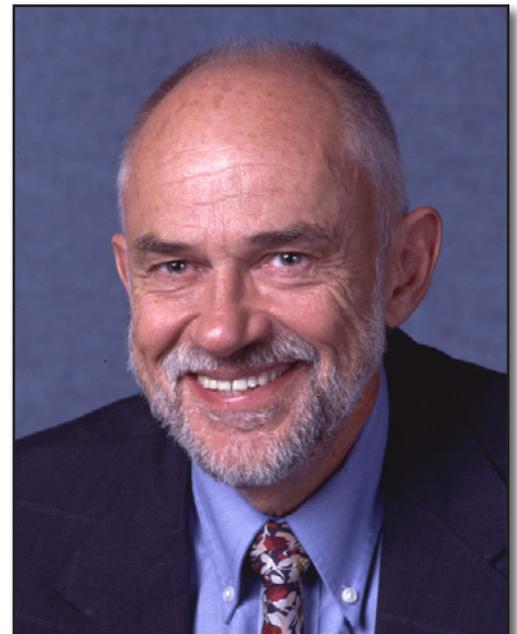
By Sara Mishamandani

Environmental health topics were the focus of a workshop Jan. 24-25, co-hosted by the University of Iowa (UI) Superfund Research Program (SRP), featuring an interagency panel of presenters. The purpose of the Midwest Environmental Health Summit was to inform state legislators about environmental health issues in the region. More than 20 legislators and a number of legislative staff attended the summit in Des Moines, Iowa.

The SRP worked with the [UI Environmental Health Sciences Research Center](#), as well as the [National Conference of State Legislatures \(NCSL\)](#) and the [American Lung Association](#), to organize and conduct the successful two-day workshop. Sessions included information on radon, biofuels, agriculture, hydrofracturing, and airborne polychlorinated biphenyls (PCBs), which are the SRP's main research focus.

Engaging the legislative audience

[David Osterberg](#), SRP Research Translation Core leader and former Iowa state legislator, helped organize the summit and spoke during a working lunch session about translating research into information that policymakers can use.



Osterberg is a clinical associate professor of occupational and environmental health at UI and coordinates research translation efforts at the SRP. (Photo courtesy of David Osterberg)

“Legislators have often said they are happy to have science information coming from institutions they trust, rather than coming from those who lobby in their states,” said Osterberg. “They enjoy engaging in conversation with scientists and regulators, and can have very specific questions for the scientific community.”

Because PCBs are a significant health hazard, [Craig Just, Ph.D.](#), SRP Community Engagement Core leader, described how the SRP engages 7th and 8th grade students in Iowa and Indiana communities, by teaching them about PCBs — what they are, why they are a danger, and how people can be exposed. PCBs were a widely used chemical in electrical products and building materials, before a federal ban took effect in the late 1970s. PCBs were gradually removed from most electrical equipment, but many buildings throughout the U.S., built before 1979, still have PCBs in building materials and fluorescent lighting fixtures.



Just is an assistant professor in the Department of Civil and Environmental Engineering at UI and director of the SRP Community Engagement Core. (Photo courtesy of Craig Just)

A push to test for pollutants in schools

The organizers tied PCBs and radon, a hazardous gas known to cause lung cancer, together as potential pollutants in schools, in an effort to include PCBs as a topic of concern during the workshop.

According to workshop presenters, the potential dangers of PCBs in schools, as a result of old and leaky light ballasts and building materials, are real. PCBs were recently measured in the air in many public school buildings in New York City, raising significant public health concerns and highlighting the need to measure airborne PCBs in older schools.

Part of the legislative workshop was presented before the Iowa Senate State Government Committee (SGC). A bill has been introduced by the chair of the SGC to test for radon in schools, so organizers used the workshop as a way to help committee members better understand the issue. The organizers targeted this legislative push and invited scientific experts R. William Field, Ph.D., an international expert on radon health effects from the UI Environmental Health Sciences Research Center, and Robert Dye, U.S. Environmental Protection Agency (EPA) Region 7 Radiation Program manager, to explain the problem and stress the need for testing in schools.



To engage legislators during his presentation, Just gave legislative representatives, right to left, Mike Fortner, R-Ill.; Ann Williams, D-Ill.; and Susan Concannon, R-Kansas, a hands-on opportunity to build models of PCB molecules. (Photo courtesy of David Osterberg)

(Sara Mishamandani is a research and communication specialist for MDB Inc., a contractor for the NIEHS Superfund Research Program and Division of Extramural Research and Training.)

State legislative workshops

The legislative workshop in the Midwest was the fourth of its kind convened by the SRP Research Translation Core since 2007. The workshops have attracted state legislators and legislative staff from throughout the Midwest, including legislators from 10 states, and have provided effective translation of research for state officials to consider in the development of public policies and practices.

“State senators and representatives in the Midwest region are generally part time and understaffed,” said Osterberg. “Our legislative workshops are designed to bring elected officials unbiased, current environmental health information, to inform decisions.”



Presenters at the Midwest Environmental Health Summit, held in the beautiful Iowa State Capitol hearing room, included, left to right, Kathleen Fenton, EPA Region 7; Osterberg; Just; Ken Sharp, Iowa Department of Public Health; and Doug Farquhar, National Conference of State Legislatures. (Photo courtesy of David Osterberg)

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FDA program marks next step for NIEHS research fellow

By Mallikarjuna Metukuri

Laboratory of Signal Transduction (LST) trainee Javier Revollo, Ph.D., said he hadn't even started his job search when opportunity came knocking in the form of an email announcement from NIEHS Deputy Scientific Director Bill Schrader, Ph.D.

The message contained information about a two-year commissioners' fellowship [program](#) with the U.S. Food and Drug Administration (FDA). The program offers early-career scientists and engineers a rigorous course of regulatory science training, and the chance to conduct cutting-edge research on targeted scientific and regulatory issues, under the mentorship of a senior scientist.

Revollo, who had completed a five-year visiting fellowship with NIEHS and just begun his tenure as a research fellow, decided to give it a try. “A few days later, I applied for the position, thinking that I would never hear back,” he said.

But, of course, he did, and he is now pursuing a new direction in his career in 2013, by applying his scientific training in a somewhat different way.

Comparing his experience at NIEHS with his new job at FDA, Revollo said, “The work is similar, but with much more independence and many more responsibilities attached. I am expected to perform and deliver on my own.” Rather than reinventing the wheel, Revollo said, the main goal of his team is to apply new technologies to FDA problems — in his case, genetic toxicology.

Career development at NIEHS

Revollo credits his time at NIEHS with helping him grow as a scientist and transition into his current position, in particular his scientific experience with a deep sequencing project. “I had the specific skills and experience the position required,” he said, “and I gained that experience by pursuing a side project.”

Along with the support of lead researchers, workshops and other career development activities proved helpful for Revollo. “Being at NIEHS exposed me to other career options,” he said. “I came to realize that academic positions are few and far between, so I really started to look for what else could be out there.”

Accomplishments at the bench

As a visiting fellow in LST, Revollo examined the regulation of glucocorticoid signaling in the Molecular Endocrinology Group headed by [John Cidlowski, Ph.D.](#), receiving an NIH Fellows Award for Research Excellence award for his work on Hes1 regulation of glucocorticoid signaling in 2011 ([see story](#)).

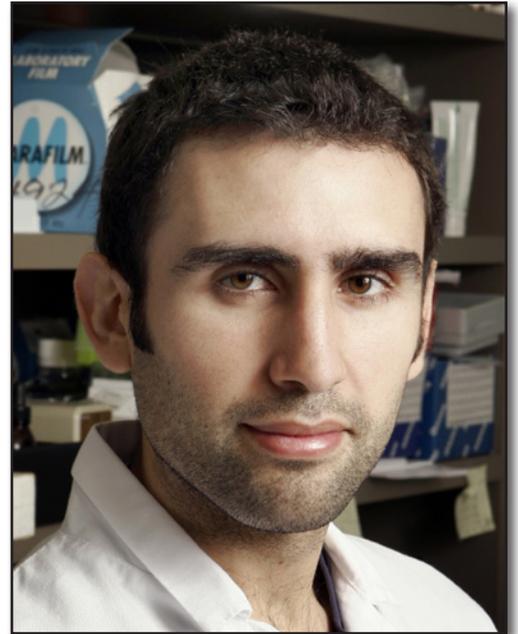
Revollo also received the Presidential Poster Award for his Hes1 work at the 2011 annual meeting of the Endocrine Society ([see story](#)). In 2012, he joined the Metabolism, Genes, and Environment Group led by [Xiaoling Li, Ph.D.](#), where he studied the regulation of Sirtuin-1.

According to Revollo, his time in Cidlowski’s group helped him learn how to be a successful scientific leader, and his work with Li gave him experience in how to successfully start a lab and become established in a crowded scientific field.

Last year, Revollo co-authored a study in PNAS with Cidlowski and staff scientist Robert Oakley, Ph.D., that was recognized as a paper of the month ([see story](#)) and 2012 [paper of the year](#). The team discovered a mechanism by which glucocorticoids, stress hormones produced by the body to maintain homeostasis, act upon certain key cellular receptors through alterations in arrestin gene expression.

Although there are no guarantees, Revollo has reason to expect that, upon completion of his fellowship, FDA will make him an offer of permanent employment. In the inaugural class of fellows, 78 percent stayed with the agency and the remaining were hired by industry or academia.

(Mallikarjuna Metukuri, Ph.D., is a research fellow in the NIEHS Metabolism, Genes, and Environment Group.)



Revollo is excited about career opportunities at FDA, but he is also open to new directions in the future. “My advice [to other fellows] is to think outside the box when job hunting. There are lots of opportunities out there, not just in academia, so take advantage of whatever opportunities come your way,” he said. (Photo courtesy of Steve McCaw)

Tribal college program engages Native American students in STEM

By Sheila Yong

“How many of you have been to a tribal college?” asked toxicologist [Douglas Stevens, Ph.D.](#), as he began his talk Feb. 8 at NIEHS. “It is challenging to work with Native American students, if we don’t understand where they are coming from,” Stevens said, of efforts to engage Native American students in science, technology, engineering, and mathematics (STEM) careers.

Stevens is director of the Department of Life Sciences at [Salish Kootenai College \(SKC\)](#) in Pablo, Mont., which he founded in 2006. His talk offered the audience a fresh perspective on college-level science education for underrepresented populations.

Among the audience at the talk were several NIEHS employees with interests in outreach and diversity, including Office of Science Education and Outreach Director Ericka Reid, Ph.D., who represents NIEHS at annual meetings of the Society for Advancement of Chicanos and Native Americans in Science (SACNAS).



Stevens’ talk was informal, with plenty of opportunity for the audience to ask questions during the presentation. (Photo courtesy of Steve McCaw)



Linked video:
[Watch a SACNAS video on the power of community for young scientists from underrepresented groups \(10:54\)](#)

(Launches in new window)

Download Media Player:  Flash [↗](#)

The unique features of SKC

SKC prides itself on its ability to provide individual attention to students, due to its low teacher-to-student ratio. “The largest class in my organic chemistry course, I have ever had, consisted of nine students,” Stevens said, to the surprise of the audience.

Since SKC accepts all who apply, it administers placement exams to determine if remedial classes are needed to prepare the students for college-level courses, and overcome the knowledge gap they may have experienced due to insufficient preparation during high school.

Stevens also pointed out that SKC students are often nonconventional — they are generally older, have lower incomes, and may already have families. To accommodate the students’ need for family and childcare support, SKC provides on-campus family housing and childcare facilities. “Exposing Native American students to STEM is not just about the hard science,” remarked Stevens. He said it’s equally important to understand the students’ ties to their community and the needs of their tribes, in order to promote self-efficacy and a sense of belonging to the institution among the students.

On the right track to success

SKC offers a four-year molecular-based Bachelor of Science degree program, the first among tribal colleges nationwide. Since its inception, the life sciences department has received financial support from various agencies and organizations, including the National Science Foundation, U.S. Department of Defense, and NIH Research Initiative for Scientific Enhancement program. To date, the program has acquired approximately \$7 million worth of state-of-the-art laboratory equipment, which, due to the small class and lab sizes, allows students to gain proficiency with these advanced tools.

The students begin their research early in the program. “They start in their sophomore year, and will present their research as their senior projects,” Stevens explained. Besides working at the bench, the students are also encouraged to present at in-house meetings and journal clubs, as well as attend meetings and conferences off campus. Stevens also seeks opportunities for his students to go to other institutions for internships or short-term research stints, so they can experience life outside of the reservation. So far, some of Stevens’ students have worked at universities in Montana, Washington, and Utah, as well as the National Cancer Institute. He is looking into sending some to NIEHS this summer.

Advice for future educators

Stevens offered advice for future educators who may be interested in teaching at tribal colleges. “Find out as much as possible about the tribal colleges you are interested in. The American Indian Higher Education Consortium website is a good resource,” Stevens commented. Although these colleges have adopted a Native American preference hiring system, the number of qualified Native American scientists is also limited, so opportunities do exist. “Tribal colleges cannot afford competitive salaries, so you have to realize you are not in it for the money,” Stevens advised.

It requires substantial effort to understand the tribal cultures and to develop innovative teaching styles that suit the local community. Still, if educators can overcome these challenges, the relationships they can form with the students will make all the sacrifices worthwhile.

(Sheila Yong, Ph.D., is a visiting fellow in the NIEHS Laboratory of Signal Transduction.)

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Tribal college program enjoys national recognition

For his efforts in promoting interest in STEM programs among Native American students, Stevens was named the Distinguished Community/Tribal College Mentor of the Year by SACNAS in 2011. The Department of Life Sciences also achieved a major milestone that year, when four out of five of its students who attended the annual SACNAS meeting received awards for their posters. “The fifth one, Amy Stiffarm, didn’t get an award, simply because she had received one the previous year,” Stevens smiled. Nonetheless, Stiffarm’s poster was chosen by NIH to be featured at the 40th Anniversary celebration of the National Institute of General Medical Sciences Minority Opportunities in Research program in October 2012.

Stevens is aware that these achievements are just the beginning. “We are still a long way from producing RO1 [research project] grant-writing investigators, but we are hopeful that the training our students receive will give them the confidence to venture out of their comfort zone and work confidently alongside other scientists in the real world,” Stevens concluded.

LMC fellow enters the field of regulatory affairs

By Sonika Patial

Bhargavi Rao, Ph.D., an intramural research training award fellow in the Laboratory of Molecular Carcinogenesis (LMC), left NIEHS in February to begin a career in regulatory affairs at Pharmaceutical Product Development (PPD). Rao's work will involve ensuring clinical trials conducted by pharmaceutical companies follow proper regulations, so that safe products enter the market in a timely manner.

At NIEHS, Rao worked in the [Chromatin and Gene Expression Group](#) headed by Trevor Archer, Ph.D., lead researcher and chief of the LMC. Her project involved understanding the role of chromatin remodeling in maintenance of pluripotency of embryonic and induced pluripotent stem cells.

Looking back at her investment of time and energy in career development, Rao said, "Identifying your interests early on, and starting to build up your skills and CV to make yourself more marketable, can really pay off in the long run when you actually start looking for a job."

Building a CV and taking advantage of opportunities at NIEHS

Rao was an active member of the NIEHS Trainees' Assembly (NTA) and served on several committees, including the Biomedical Career Fair and Brown Bag Lunch Committee. When asked about what steps she took as a postdoctoral fellow at NIEHS to be a good fit for this particular career, she mentioned she had invited the director of regulatory affairs at the [Duke Translational Medicine Institute](#) as a guest for one of the Brown Bag Lunch programs she hosted.

"She introduced me to the regulatory affairs internship opportunity at Duke," Rao said. "One thing led to another and, in a few months, I was doing an internship there. I really enjoyed the experience I gained through this internship and would recommend this to other fellows who might be interested in regulatory affairs," she added. In addition, she joined the [North Carolina Regulatory Affairs Forum](#) and attended the group's networking events. "These were really helpful, as I was able to learn more about regulatory affairs in general, as well as build my network."

Rao also wrote stories for the Environmental Factor newsletter. "Since my new job involves quite a bit of data interpretation and writing, the experience gained while writing for the eFactor was extremely helpful in honing my writing skills," she said.

According to Rao, Archer was also a very supportive mentor who gave her independence in terms of trying to decide the direction of her projects. "He was very understanding of my decision to pursue my career goals."



Rao took an active part in NTA and other career development and networking opportunities during her stay at NIEHS, which helped her decide on her eventual career path. (Photo courtesy of Steve McCaw)



"Bhargavi was a pleasure to have in the lab," Archer said of Rao. "She brought her prior experience in yeast, working on epigenetics and histone modifications, to a totally new set of studies on embryonic stem cells. Bhargavi was very hard working and stepped up to the challenge of establishing protocols and, in collaboration with the Clinical Research Unit, for the creation of the first set of human-induced pluripotent stem cell lines at NIEHS." (Photo courtesy of Steve McCaw)

“Networking, as well as good organizational and good presentation skills I developed during my stay at NIEHS, came in handy when I started looking and applying for jobs,” Rao said.

Networking, networking, and more networking

Rao stressed the importance of networking, by saying that it is absolutely essential. “This is the only way to get your dream job. The idea of approaching people that we don’t know can be intimidating in the beginning. However, networking is a skill in itself and, with time, you get better at it,” she added with a laugh.

PPD is a global contract research organization providing services in the areas of drug discovery, development, and life cycle management.

(Sonika Patial, D.V.M., Ph.D., is a fellow in the NIEHS Laboratory of Signal Transduction.)

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Outreach program begins second year at local school

By Eddy Ball

The NIEHS [Citizen Schools](#) project kicked off its second year of service Feb. 4 with an orientation for students at Lowes Grove Middle School in Durham, N.C.

Staffed by 15 volunteers from NIEHS, this year’s program marshals the talents of postdocs and staffers for a 10-week series of hands-on science activities related to respiratory health, which will culminate May 2 with what the program calls the “WOW! Event.” On that final night of the program, parents, friends, and community members join students for an evening of celebration, as program participants share what they have learned and volunteers see the fruits of their labor.

Sponsored by the NIEHS [Office of Science Education and Diversity \(OSED\)](#), headed by Ericka Reid, Ph.D., the program is part of a nationwide program that has proven its worth, by boosting participants’ success rates. According to Citizen Schools follow-up since 2002, young people who were part of the program attend classes more often, outperform their peers in six measures of student success, are 20 percent more likely to graduate from high school, attend classes more often, outperform their peers in six measures of student success, and are 80 percent more likely to attend college.

“I think we have another winning combination this year,” said Reid. “Everyone involved is passionate about science and about inspiring kids. We learned last year just how much impact the program had, especially for children from groups that are underrepresented in scientific careers. I look forward to another great experience this year for students, as well as for the volunteers.”

The program was so successful in its initial year that 2012 volunteers were honored during the NIEHS Annual Awards Ceremony Feb. 13 ([see story](#)). Citizen Schools organizers encouraged NIEHS to make an encore presentation of its lung health series this year, and NIEHS turned to Huei-Chen Lao, who is on detail to OSED as the K-12 Science Education and Outreach Coordinator, for organization and leadership of the project.



Contributing to this year's effort are a lucky 13 trainees from research groups across the Institute:

Margaret Adgent, Ph.D.

Sara Andres, Ph.D.

Miranda Bernhardt, Ph.D.

Lindsay Buckley, Ph.D.

Christopher Campos, Ph.D.

Felicity Davis, Ph.D.

Jacqueline de Marchena, Ph.D.

Yanshun Liu, Ph.D.

Caroline Pantazis

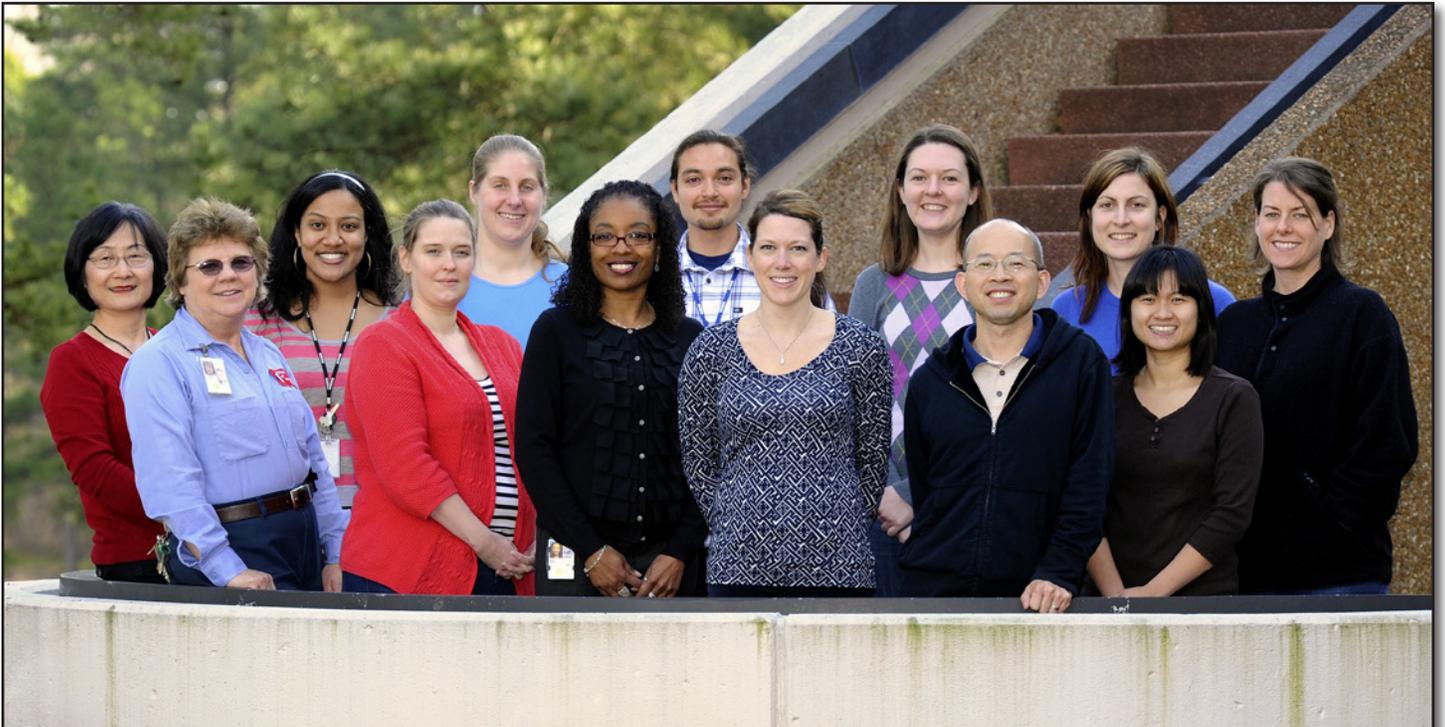
Wipawee (Joy) Winuthayanon, Ph.D.

Shannon Whirledge, Ph.D.

Kimberly Wiggins, Ph.D.

Taylor Wolfgang

They are joined by Laboratory of Signal Transduction biologist Agnes Janoshazi, Ph.D., and Office of Research Facilities electrician Sarah O'Donnell, who is lending her expertise to the creation of instructional props.



This year's Citizen Schools group includes, left to right, Lao, O'Donnell, Wiggins, Buckley, Andres, Reid, Campos, Whirledge, Bernhardt, Liu, Davis, Winuthayanon, and Adgent. Not shown: Wolfgang, Pantazis, de Marchena, and Janoshazi. (Photo courtesy of Steve McCaw)

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Science Notebook

BPA grantees share findings

By Robin Mackar

Nearly 100 researchers studying the health effects of the chemical bisphenol A (BPA) gathered at NIEHS Jan. 28-29 to provide an update on their findings. Many were presenting the final data from funding they received through the American Recovery and Reinvestment Act.

“We’ve invested well over \$30 million on BPA in the past few years, and we are here today partially to bask in our research accomplishments, but also to talk about the issues we really need to work on as we move forward,” NIEHS/NTP Director Linda Birnbaum, Ph.D., said, as she kicked off the meeting organized by Jerry Heindel, Ph.D., and Thaddeus Schug, Ph.D., of the NIEHS Division of Extramural Research and Training (DERT).

The one-NIEHS approach to BPA

After the official welcome and meeting kickoff, Birnbaum presented an overview of the big picture, one-NIEHS strategic approach that the Institute has been taking to assess the health effects of bisphenol A.

“At NIEHS, we have developed an unprecedented, comprehensive research program that combines extramural grant funding with targeted intramural research efforts and outside collaborations, to help fill research gaps and provide results that will help inform regulatory decision-making,” Birnbaum said proudly, detailing many of the points made by her and her colleagues in an [Environmental Health Perspectives](#) commentary.

BPA biomonitoring and pharmacokinetics

During the morning’s biomonitoring topic session, Tracey Woodruff, Ph.D., and Roy Gerona, Ph.D., from the University of California, San Francisco teamed with Laura Vandenberg, Ph.D., of Tufts University, to give an update on the status of the round-robin experiments that NIEHS has been supporting to help determine the most accurate way to measure BPA levels in human serum.



Birnbaum cleared her busy schedule to spend two full days with the grantees and invited speakers. She listened to the discussions and presented some data from her own studies. (Photo courtesy of Steve McCaw)



There were some lively discussions among the attendees, following the update on the BPA round-robin testing of human blood levels by Vandenberg, left, and Woodruff. (Photo courtesy of Steve McCaw)

The round-robin experiment includes having members of the BPA Grantee Consortium, from five laboratories, measure, analyze, and interpret BPA levels in a variety of NTP blood samples, to determine if the labs can get similar results. Woodruff reported that the labs are completing the third round of blind testing and results should be available soon.

“We are hoping to identify a preferred protocol that can reliably measure BPA in serum, and can eliminate potential contamination and other sources of error among various labs,” Vandenberg said.

Also during the biomonitoring session, Birnbaum and others, including grantee Fred vom Saal, Ph.D., of the University of Missouri, presented updates on ongoing studies looking at exposure to BPA through routes other than diet, including through the skin. For example, BPA and BPA alternatives are often used in some cash register receipts and may contribute to BPA exposure levels.

The session concluded with a presentation from one of France’s leading experts on BPA pharmacokinetics, Pierre-Louis Toutain, D.V.M., Ph.D., who illustrated the similarities of ingested BPA across species.

Disease endpoints

Much of the rest of the meeting was spent hearing from grantees who have been working on various diseases endpoints that may be related to BPA.

Overall, the grantees’ recent work continues and expands many of their earlier findings that showed that early life exposures to BPA, in animal studies, can lead to a variety of diseases or health problems into adulthood. Adult diseases with a fetal basis under consideration include prostate cancer, breast cancer, obesity, diabetes, cardiovascular problems, and some neurobehavioral conditions, such as anxiety, as well as reproductive disorders. The animal literature seems to support outcomes now being found in some human studies.

“The findings are suggesting that individual susceptibility to BPA may be at play,” Birnbaum said, after hearing all the presentations. “BPA may have different effects in different people, [and] those more susceptible to it may experience adverse health effects later in life. Our primary concern related to BPA continues to be during prenatal development.”

(Robin Mackar is the news director in the NIEHS Office of Communications and Public Liaison, and a frequent contributor to the Environmental Factor.)



Gail McCarver, M.D., of the Medical College of Wisconsin, listened to research being presented by others working on BPA. McCarver also collaborates and advises both NIEHS and NTP on many other environmental health issues. (Photo courtesy of Steve McCaw)



Joseph Braun, Ph.D., of Brown University, left, consulted with Antonia Calafat, Ph.D., a biomonitoring expert at the Centers for Disease Control and Prevention. (Photo courtesy of Steve McCaw)



Heindel, left, who oversees much of the NIEHS BPA grants portfolio and served as the lead organizer for the third annual meeting of the BPA consortium, made the rounds at the meeting, talking to everyone, including, left to right, FDA scientist Jason Aungst, Ph.D.; European Food Safety Authority representative Trine Husøy, Ph.D.; and NIEHS grantee Justin Teeguarden, Ph.D., of the Pacific Northwest National Laboratory. (Photo courtesy of Steve McCaw)



Poster presentations at the meeting offered additional opportunities for people to talk science. University of Michigan (UM) Ph.D. candidate Caren Weinhouse, right, described some of her early exposure research findings to UM colleague Almudena Veiga-Lopez, D.V.M., Ph.D., who specializes in endocrine disruption. (Photo courtesy of Steve McCaw)

Bringing CLARITY to BPA

Luisa Camacho, Ph.D., of the U.S. Food and Drug Administration (FDA) National Center for Toxicological Research (NCTR), presented an update on the Consortium Linking Academic and Regulatory Insights on BPA Toxicity (CLARITY-BPA) research program.

CLARITY-BPA is an unprecedented collaboration that brings together academic researchers with federal regulators to answer critical research questions that will help inform regulatory decision-making.

The **collaboration** calls upon the expertise of NTP, DERT, and FDA to conduct a BPA toxicity study in rats at NCTR, in accordance with established good laboratory practices (GLP). The strain on the animal, the animal's diet and housing conditions, the number of animals, the dosing regimen, and the route of exposure of BPA are all tightly controlled.

Twelve NIEHS-supported grantees are also participating in the study. The grantees were selected through a competitive review process for their expertise on various disease endpoints and have been heavily involved in designing the protocols for the GLP study. The grantees will also have access to tissue samples and laboratory animals from the GLP-compliant study, drawing upon their areas of expertise to study a range of health endpoints, including male and female reproduction; uterine, mammary, and prostate cancer; metabolic effects; neurological and neurobehavioral effects; and immune function.

The study uses a broad range of BPA doses to look at effects across two generations.

“This is quite an endeavor that we’ve undertaken,” Heindel said in amazement, as he looked at a slide depicting the labor-intensive dosing schedule that NCTR is managing. “It’s really a new way of doing science that should help answer a lot of questions.”



Heindel, right, talked to grantee Thomas Zoeller, Ph.D., of University of Massachusetts Amherst about his work on BPA and thyroid signaling during one of the meeting breaks. (Photo courtesy of Steve McCaw)



Julius Thigpen, Ph.D., formerly with the Comparative Medicine Branch at NIEHS, listened to most of the discussions at the meeting and spent some quality time talking to the students and grantees working on BPA, including Tristan Nicholson of the University of Wisconsin. (Photo courtesy of Steve McCaw)

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Council enjoys epigenetics and bioinformatics talks

By Ernie Hood

Like the icing on the cake, the two scientific presentations scheduled into most Council meetings provide members with some relief from making the tough decisions on grants and weighing in on budgetary matters. The winter National Advisory Environmental Health Sciences Council meeting was no exception, as members and other attendees were treated to a talk Feb. 20 on epigenetics, by a long-time NIEHS grantee, as well as a presentation on bioinformatics innovations being developed by an intramural researcher.

Challenging conventional wisdom about epigenetics

First up was Johns Hopkins University researcher and NIH Pioneer Award winner [Andrew Feinberg, M.D.](#), who described his work on “Investigating Epigenetic Plasticity in Development and in Response to the Environment.” By developing an integration of new conceptual, technological, epidemiological, and statistical approaches, Feinberg’s group is working to advance understanding of the role of epigenetics in areas ranging from cancer to common disease.

Feinberg began by saying epigenetics is where genes meet the environment. “The epigenome can integrate information that comes from your environment, from your genotypes, and the genotypes themselves can have an effect on the epigenome, so you have this



Feinberg colorfully described the epiphany that led to his formulation of a theory about the importance of stochastic events in normal development. He is a polymath who peppered his entertaining talk with references to other scientific disciplines and even modern American drama. (Photo courtesy of Steve McCaw)

complex interplay,” he explained. By adapting some of the statistical methods employed by astronomers, his group at the [Johns Hopkins Center for Epigenetics](#) has developed new tools to help understand the epigenetic contribution to diseases, such as cancer and neuropsychiatric disorders.

One of these new tools, comprehensive high-throughput arrays for relative methylation (CHARM), allows an unbiased look at the whole spectrum of epigenetic marks within the entire genome. Using CHARM to measure up to four million DNA methylation sites throughout the genome, the team discovered that, contrary to prior assumptions, most variable DNA methylation is not in islands, but in nearby sequences they termed shores. They discovered that aberrant methylation in cancer involves roughly equal gains and losses of DNA methylation at these shores, and involves much the same sequence involved in normal differentiation of widely disparate tissues.

Feinberg also shared his ideas regarding a non-Lamarckian model for the role of epigenetics in evolution, involving stochastic epigenetic variation as a driving force of development and evolutionary adaptation. He said the inherited stochastic variation model would provide a mechanism to explain an epigenetic role in selectable phenotypic variation, as well as the largely unexplained heritable genetic variation underlying common, complex diseases.

Bringing bioinformatics to the rescue

[Leping Li, Ph.D.](#), is the most recent NIEHS researcher to be awarded [tenure](#), and is making great strides in bioinformatics, the essential tool for effectively processing and analyzing the huge amounts of data generated in contemporary biomedical research. In a presentation titled “Bioinformatics in Environmental Health Research,” Li described his work developing new bioinformatic tools and methods designed specifically to address questions related to environmental factors. For example, he and his group have developed novel tools for detection and analysis of transcription factor binding sites in DNA sequences. These motif analysis tools apply to large-scale, high-throughput DNA sequencing technologies, such as ChIP-seq. One, known as GADEM, performs motif discovery and identification, while another, known as coMotif, identifies primary motifs and potential coregulatory motifs in ChIP-seq data. Such computational analysis methods facilitate new, unbiased discovery and hypothesis generation.



Li told Council members that bioinformatics is an integral part of environmental health science research, and that bioinformatics methods have a broad application to toxicogenomics data. (Photo courtesy of Steve McCaw)



NIEHS Acting Director of the Clinical Research Program Stavros Garantziotis, M.D., listened closely to the scientific presentations. (Photo courtesy of Steve McCaw)

Li described how the tools have been used to yield important new insights regarding the functions of estrogen receptor alpha in the uterus, which are critical for establishment and maintenance of pregnancy and are subject to environmentally influenced perturbations.

The [motif analysis tools](#) have been made available free to the public.

Li and his colleagues are also developing statistical and computational methods to identify differentially expressed isoforms from mRNA-seq data. As he explained, tools for detecting differential splicing could have a major impact in toxicogenomics, as examples exist where changes or imbalances in isoforms have been implicated in tumor development.

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

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Translating women's environmental reproductive health research into practice

By Ashley Godfrey

NIEHS was host to leading scientists and physicians for the 2nd annual meeting Jan. 30 of the [Women's Environmental Reproductive Health Consortium](#). The all-day event showcased the consortium's goal of advancing research and facilitating collaboration, to move the field of women's environmental health forward.

[Jerry Heindel, Ph.D.](#), program administrator in the NIEHS Division of Extramural Research and Training (DERT), and Karin Russ, national coordinator of the [Collaborative on Health and the Environment \(CHE\)](#) Fertility and Reproductive Health working group, co-hosted the meeting, with Russ serving as the main organizer and meeting facilitator.

Heindel opened the day by describing the meeting goals, which ranged from updates on the science to insights into how to translate research into real world applications. He explained that the consortium is a



Council member Thomas Gasiewicz, Ph.D., asked Li to elaborate on the biological significance of his work on estrogen receptor alpha mutants. (Photo courtesy of Steve McCaw)



With its focus on women and reproductive health, it's not surprising that the consortium includes several NIEHS women scientists as members, such as NTP pathologist Darlene Dixon, D.V.M., Ph.D., right. (Photo courtesy of Steve McCaw)

joint effort between DERT and CHE, and the meeting was a good opportunity for everyone involved to see who is doing what and share both ideas and resources. “This is only the second time we are meeting and already we are expanding,” Heindel said ([see story](#)).

Along with a number of NIEHS grantees and in-house scientists in attendance, Russ was pleased to introduce several leaders from clinical reproductive health professional organizations and groups working on translation of science into practice ([see text box](#)). “The goal was for researchers to meet the end users of their data and open up discussions on moving research findings from bench to bedside,” she explained.

To that end, Jeanne Conry, M.D., Ph.D., president-elect of the American Congress of Obstetricians and Gynecologists, spoke about integrating environmental health concepts into preconception and prenatal care. Laura Anderko, Ph.D., discussed a project in biomonitoring of methylmercury and risk reduction counseling. Mark Miller, M.D., of the University of California, San Francisco (UCSF), was on hand to talk about [Pediatric Environmental Health Specialty Units \(PEHSU\)](#), an environmental health science resource for clinicians.

Paradigm-changing research

The agenda was tightly scheduled, with 20 presenters on the program. The focus of many of the talks was cutting-edge research, as well as viewing pregnancy as a sensitive window of exposure for the mother, as well as the fetus. Many of the researchers shared exciting results using new techniques, along with novel approaches to answering the difficult question of translating research into clinical practice.

The morning began with a keynote address by NIEHS grantee [Russ Hauser, M.D., Sc.D.](#), of Harvard University, who described his team’s exciting research using artificial reproductive technology (ART) to study the impact of environmental chemicals on very early human development. Hauser explained that traditional epidemiologic studies are limited by what they can study and are missing some of the most sensitive time windows for exposure. “Preconception is important,” stated Hauser, who went on to show some early results relating BPA concentrations in the mother to embryo implantation failure among closely monitored patients receiving ART.

The afternoon’s keynote address featured Tulane University researcher [John McLachlan, Ph.D.](#), who summarized some of the emerging trends covered during the day. He stressed that DES remains a model



Michael Diamond, M.D., representing the American Society for Reproductive Medicine, took notes during the presentations. Diamond was one of the many clinical representatives in attendance. (Photo courtesy of Steve McCaw)



Barbara Cohn, Ph.D., director of the Child Health and Development Studies, commented on Hauser’s keynote address. Cohn later presented her group’s work on pregnancy as a maternal sensitive window for environmental exposure, using a large study of women encompassing three generations. Cohn called the data set a gold mine and offered it as a resource to the group. (Photo courtesy of Steve McCaw)

estrogen exposure, and that lessons learned can be applied to other exposures and other systems. McLachlan emphasized that researchers need to look outside of their field and study all of the possible effects, in order to make research more integrated and translatable.

Looking to the future

Russ led a discussion in the afternoon focused on translation and outreach. “How can NIEHS scientists communicate with clinicians?” she asked, stimulating a discussion of what each profession values in terms of women’s reproductive environmental health. Russ also pointed out a number of professional conferences that would be great opportunities for the consortium members to communicate their research to a broader audience.

Russ encouraged participants to think about symposium and speaker suggestions for future meetings. Following the meeting, she said, “I’ve gotten really positive feedback from both researchers and clinical people.” Russ hopes to organize next year’s meeting at a professional conference where top researchers are already gathered.



University of Cincinnati researcher Shuk-Mei Ho, Ph.D., described her group’s work on how a high-fat diet and BPA exposure during pregnancy affects the mother’s reproductive health in a mouse model. The preliminary results are interesting and show an increase in the number of nonpregnant females that persist even after diet and exposure are changed. (Photo courtesy of Steve McCaw)



Russ, with Heindel seated in front, led the afternoon discussion focused on translating research into clinical use and increasing education. Russ also thought the open communication between clinicians and researchers was very productive. “The consortium has grown from about 40 people to 70, just in one year,” explained Russ, who encourages anyone interested to email her. (Photo courtesy of Steve McCaw)



Cheryl Walker, Ph.D., explained how an exposure ultimately leads to changes in the proteins that read, write, and erase the epigenetic code. When asked how this translated to other chemicals not classified as classic endocrine disruptors, Walker responded by stating, “If we were still in the 25 percentile world [a higher level of government funding for biomedical research], we would all be able to ask these questions.” (Photo courtesy of Steve McCaw)



NIEHS lead researcher Ken Korach, Ph.D., chief of the Laboratory of Reproductive and Developmental Toxicology, was on hand to listen to the short research presentations. (Photo courtesy of Steve McCaw)

Clinical professional attendees

- Laura Anderko, Ph.D. — Robert and Kathleen Scanlon Endowed Chair in Values Based Health Care at the Georgetown University School of Nursing and Health Studies
- Martha Berger — Acting director of Program Implementation and Coordination in the Office of Children’s Health Protection at the U.S. Environmental Protection Agency
- Susan Buchanan, M.D. — Director of the Great Lakes Center for Children’s Environmental Health, and Consortium for Reproductive Environmental Health in Minority Communities
- Jeanne Conry, M.D., Ph.D. — President-elect of the American Congress of Obstetricians and Gynecologists, and assistant physician-in-chief at the Kaiser Permanente Roseville Medical Center
- Michael Diamond, M.D. — Wayne State University assistant dean for Clinical and Translational Research, representing the American Society for Reproductive Medicine
- Michael Hatcher, Dr.P.H. — Chief of the Environmental Medicine and Education Services Branch at the Agency for Toxic Substances and Disease Registry
- Gay Johnson — Chief executive officer of the National Association of Nurse Practitioners in Women’s Health
- Mark Miller, M.D. — Director of the UCSF Pediatric Environmental Health Specialty Unit
- Anjana Solaiman, R.N.C. — Clinical instructor at The Universities at Shady Grove School of Nursing, representing the Association of Women’s Health, Obstetric, and Neonatal Nurses
- Marya Zlatnik, M.D. — Associate program director of the Maternal-Fetal Medicine Fellowship Program at UCSF, representing the Society for Maternal-Fetal Medicine



NTP lead researcher Suzanne Fenton, Ph.D., presented later in the afternoon, describing a study by her group that is about to begin. Fenton will be using rats to try to identify a metabolic fingerprint for in utero DES exposure that can then be used to identify exposure in women. (Photo courtesy of Steve McCaw)



Members of the consortium listened and took notes during the presentations. (Photo courtesy of Steve McCaw)



McLachlan, right, and retired NIEHS researcher Retha Newbold discussed some of the key issues during one of the breaks. They have known each other since McLachlan’s tenure as scientific director at NIEHS more than two decades ago. (Photo courtesy of Steve McCaw)

(Ashley Godfrey, Ph.D., is a postdoctoral fellow in the Molecular and Genetic Epidemiology Group in the NIEHS Laboratory of Molecular Carcinogenesis.)

Expert meeting ponders chemical testing in the 21st century

By *Thaddeus Schug*

Rapid advances in science are fueling an evolution in toxicity testing, from predominantly animal-based studies, to greater incorporation and reliance on 21st century predictive toxicology methods, such as rapid, high-throughput *in vitro* testing. These types of new tests are cheaper and faster, lessen use of laboratory animals, and hold the potential to help address practical limitations we face in assessing chemical exposures in the real world.

But will these new testing strategies, in fact, improve our ability to understand and predict chemical hazard and risk and, ultimately, better protect the public's health? What advances have been made and what potential benefits and challenges do they present?

To help begin addressing these questions, the Environmental Defense Fund (EDF) convened a meeting, "Chemical Testing in the 21st Century: Opportunities and Challenges," Jan 24-25 in Washington, D.C., with experts from government, industry, academia, and non-governmental organizations.

Faster and cheaper testing strategies

"Toxicology has come a long way in the past few decades, and we are now at the stage where we can discuss replacing traditional long-term animal testing protocols with cost-effective high-throughput assays," said NIEHS/NTP Director Linda Birnbaum, Ph.D., in an impromptu welcome to participants. "We are developing reliable assays that can quickly and efficiently flag problematic chemicals," she added.

Opening presentations reviewed some of the key regulatory and scientific factors motivating the development of new chemical testing approaches.

Scientists from EPA and NIEHS spent some time explaining how ToxCast and the multiagency Tox21 program aim to move forward in this direction, through utilization of state-of-the-art high-throughput acellular and cellular assays that probe interactions between chemicals and a wide range of biological processes.

"The Tox21 program is in the process of testing a battery of 10,000 chemicals to produce activity profiles," explained NTP Biomolecular Screening Branch Chief **Ray Tice, Ph.D.** "Currently, the activity profiles from these compounds require complex analysis of many different assays but, very soon, the technology will exist to perform multiple, genomic-based assessments of cellular responses to chemicals that will provide a complete, integrated picture of biological response to chemicals."



Birnbaum sees predictive toxicology as a potentially important driver in disease prevention. (Photo courtesy of Steve McCaw)



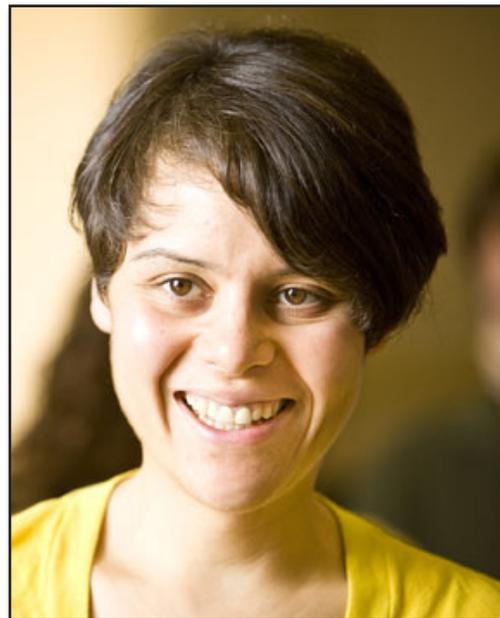
Tice is the NIEHS lead in Tox21, a consortium that includes the U.S. Environmental Protection Agency, NIH Chemical Genomics Center, and its newest member, the U.S. Food and Drug Administration. (Photo courtesy of Steve McCaw)

Considerations of validation, use, and communication

Sessions on day two of the meeting covered an array of important topics, including test validation and the ability of high-throughput tests to reflect real-world exposures; new tools for high-throughput exposure modeling; potential near-term and future applications of newer methods; and means for greater stakeholder and public engagement and communication in this area.

Over the course of the two days, many ideas and perspectives were shared. It is clear that there are many critical and complex issues that need to be addressed, as efforts to advance new chemical testing approaches are made. Meetings, like this one, with multiple stakeholders, are valuable forums for working through the major issues.

“The goal of this multistakeholder meeting was really twofold — to foster a better understanding of the development and direction of emerging approaches for evaluating chemical hazard and risk, and to begin sharing various perspectives on the critical issues shaping the future of chemical testing and assessment,” said [Jennifer McPartland, Ph.D.](#), meeting lead organizer and EDF health scientist.



McPartland's work serves to protect public health and the environment from adverse chemical effects, through policies that drive safer chemical innovation. (Photo courtesy of Jennifer McPartland and EDF)

(Thaddeus Schug, Ph.D., is a health scientist in the NIEHS Division of Extramural Research and Training and a regular contributor to the Environmental Factor.)

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Birnbaum discusses low dose at Tox Forum

By Thaddeus Schug

NIEHS/NTP Director Linda Birnbaum, Ph.D., presented a talk titled “Low Dose Exposure and NMDR [Non-Monotonic Dose Response]: Context and Implications” Jan. 30 at the [38th Annual Winter Meeting of The Toxicology Forum](#). During a session on non-monotonic dose, Birnbaum teamed with Kristina Thayer, Ph.D., director of the NTP Office of Health Assessment and Translation (OHAT), to explain how low dose environmental exposures can lead to adverse health outcomes.

Birnbaum gave an overview of low dose exposures, explaining that some classes of chemicals, such as endocrine disruptors, can have very different biological effects at different doses. Birnbaum made her case using examples of studies in human and animal models that illustrate adverse biological outcomes at exposure levels similar to those found in many human populations.

“We see low dose chemical effects in many normal biological processes, for example, in circulating levels of hormones, nutritional exposure to essential vitamins, and in pharmaceuticals,” she explained. “There is no reason to believe that hormone mimicking chemicals would behave any differently.”

Thayer used the opportunity to describe how OHAT plans to bring systematic review methodology and new information management tools into the group's literature-based evaluations. According to Thayer, the systematic

review process is going to be a powerful tool in helping NTP develop evidence-based conclusions in difficult topic areas, such as low dose exposures.

Meeting organizer, Tim Pastoor, Ph.D., principal scientist at Syngenta, observed that the area of non-monotonic dose-response is not new, but perspectives recently presented in an [editorial](#) published by Birnbaum in *Environmental Health Perspectives* challenge the fundamentals of toxicology and the regulatory testing paradigm.

The Toxicology Forum meetings primarily consist of senior regulatory scientists from government, such as the U.S. Environmental Protection Agency (EPA) and the U.S. Food and Drug Administration (FDA), and the private sector. Members of academia and non-government organizations, such as the Humane Society, often attend the event as well, and academics frequently participate.

The motto of The Toxicology Forum is “Understanding Through Dialogue.” The Forum sponsors two meetings a year with topics that range from FDA and EPA regulatory issues, to scientific presentations that can include such topics as cardiac biomarkers or acrylamide exposure studies. According to Pastoor, the Forum truly seeks to foster robust scientific discourse that is open, honest, and instructive.

(Thaddeus Schug, Ph.D., is a health scientist in the NIEHS Division of Extramural Research and Training and a regular contributor to the *Environmental Factor*.)

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Diaz edits special issue of the journal *Autoimmunity*

By Robin Arnette

Ever wonder why you don't get as sick the second time you get a particular infection? The short answer is your body's immune system has learned to recognize the pathogen and is able to mount a vigorous response the second time around. However, according to research performed by NIEHS researcher [Marilyn Diaz, Ph.D.](#), this process also increases the chance your immune cells will attack your own healthy cells, causing autoimmune disorders.

Diaz studies a set of immune cells, called B lymphocytes or B cells, and the small molecule they make called activation-induced deaminase (AID). Because of her expertise in the area, the editor-in-chief at the journal *Autoimmunity* asked her to edit a special issue on the topic. In addition to her editing duties for the 2013 [March issue](#), she wrote the introduction and contributed a review article on the role of AID in lupus nephritis, an autoimmune disease of the kidney.

“Non-Monotonic Dose Response: Exploration of Concept and Implications” presentations included:

- Introductory remarks by session chair William Slikker Jr., Ph.D., of the FDA National Center for Toxicological Research
- Birnbaum — “Context and Potential Implications”
- Thayer — “Recent Conceptual Developments”
- EPA scientist Earl Gray, Ph.D. — “Low Dose Effects, Dose Response and Implications for Endocrine Screening and Testing”
- Alan Boobis, Ph.D., of Imperial College, “Perspectives”
- Panel Discussion — All speakers plus EPA Senior Science Advisor Rita Schoeny, Ph.D.

AID in autoimmunity

According to Diaz, B cells produce millions of antibodies the body uses to fight infection. Surprisingly, the origins of certain systemic autoimmune disorders may be traced to two pathways that take place during B cell development. In one, the body may normally produce B cells that recognize self-antigens in the bone marrow. Diaz said these cells are usually purged from the body, but sometimes this removal doesn't occur.

“There's a process in the bone marrow that prevents them from getting out and participating in an immune response,” Diaz said. “When that process breaks down, these autoreactive cells get out and mistakenly destroy the body's cells.”

Diaz said the second route involves previously nonautoreactive cells becoming autoreactive. As B cells mature, they accumulate mutations in the genes that eventually encode the antibodies. These mutations are positively selected for their ability to recognize that pathogen, but these mutations may also accidentally enhance the B cell's ability to recognize self-antigens. She explained that the molecule responsible for causing the mutations was AID.

“You cannot get the mutations that increase affinity to either self or foreign antigens without AID,” Diaz said, “and since AID is only expressed in B cells and has no other function than mutation and the generation of the different classes of antibodies like IgG, it has the potential to be a target for therapeutics.”

As a matter of fact, several pharmaceutical companies are exploring that possibility by developing AID inhibitors. It's no wonder Diaz and other researchers in the field, not to mention the millions of people with autoimmune diseases, are excited by the prospects.

Wearing her editing hat

When Kyoto University's Tasuku Honjo, Ph.D., discovered AID in 2000, Diaz said, immunologists around the world hailed it as a monumental find, because it identified the molecule responsible for improving B cell immune memory. Researchers didn't zero in on AID's connection to autoimmunity, though, until Diaz and a few other scientists started looking at it from that angle in 2006.

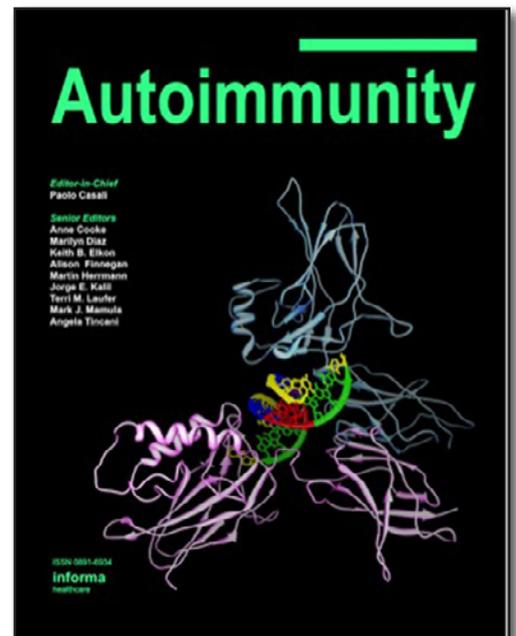
Her knowledge of the mechanisms of autoimmunity made Diaz an excellent choice as editor, but, she said, this journal issue will be important for other reasons.

“It introduces AID to the world as a potential focus for treating autoimmunity, and it would not have been possible if it weren't for the high caliber of scientists who contributed articles,” Diaz added. “The issue will have an impact because of them.”

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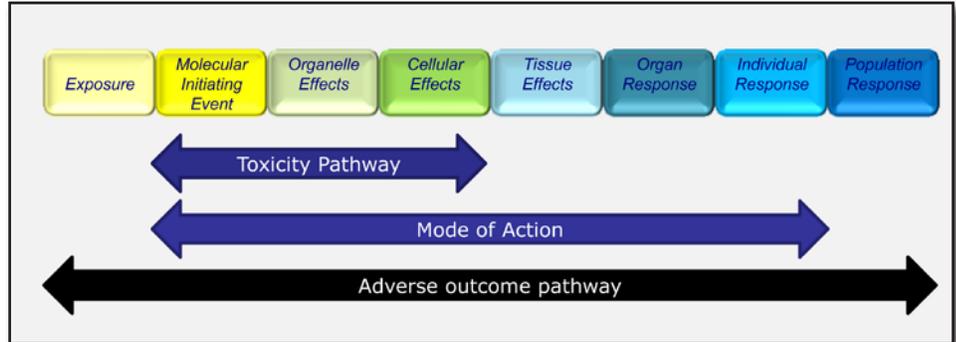
Diaz is head of the Somatic Hypermutation Group in the NIEHS Laboratory of Molecular Genetics. (Photo courtesy of Steve McCaw)



Speaker calls for crowdsourcing to advance predictive toxicology

By Laura Hall

Guest lecturer Maurice Whelan, Ph.D., discussed the implications of a European ban on animal testing of cosmetics for chemical risk assessment during a Jan. 29 talk at NIEHS. Whelan is head of both the Systems Toxicology Unit and European Union (EU) Reference Laboratory for Alternatives to Animal Testing at the EU Joint Research Centre.



Example of modular units of an AOP template (Graphic courtesy of Maurice Whelan)

“On March 11, 2013, the marketing ban will be enforced in Europe for cosmetics tested on animals,” Whelan explained. “No chemical explicitly for use as a cosmetic ingredient should be tested on an animal after that date, anywhere in the world.” Cosmetics companies are, therefore, faced with a considerable challenge – how to ensure product safety when validated alternative methods that cover the spectrum of relevant adverse health effects are simply not available.

Whelan’s group has been given a broad mandate — “Bridge the gap between what is coming out of research and what we need to deliver to decision-makers,” he said. What’s needed is a determined shift toward a safety assessment paradigm that relies on understanding toxicity, rather than simply observing its effects.

Typically, toxicological evidence comes in the form of observational data on endpoints derived from animal tests, which often lack sufficient indication of underlying causes. This shortcoming presents a major obstacle in the development of alternatives, since searching for blind correlations between *in vitro* and *in vivo* assays is insufficient.

As Whelan explained, only by shifting to a knowledge-based paradigm for chemical safety assessment, will scientists be able to save resources, avoid the use of animals, and ultimately provide better risk predictions relevant to humans. As one useful means to achieve these goals, Whelan presented what is known as the adverse outcome pathway (AOP) framework.



“The way I see it, is most of the knowledge we need exists. It exists in your heads,” said Whelan, to his mostly NTP audience, as he discussed the knowledge requirements of AOPs. (Photo courtesy of Steve McCaw)

Adverse Outcome Pathway

“An AOP is what engineers would call a mode of failure — the sequence of events that leads to system failure or dysfunction,” said Whelan. It is an analytical tool captured in a template that is defined by two anchors — an initiating event at the biological-chemical interface and, at the other end, an adverse outcome. In between is a chain of events that are manifest at the molecular, cellular, tissue, organ, and organism levels — a causal flow linking an initial insult to an adverse health effect. The AOP paradigm allows profiling a chemical by its potential to trigger an initiating event, as opposed to its association with an endpoint, Whelan added.

Developing an AOP requires knowledge of the underlying biological mechanisms, and how sufficiently perturbing normal function results in dysregulation and, ultimately, toxicity. The fact that there can be areas within the chain of events that are unknown helps focus attention on what research needs to be done for a fuller understanding. Whelan said he is convinced we have most of the knowledge needed, but conceded, “We have done a terrible job of distilling it down, of being explicit in what we know and how we can use it.”

Crowdsourcing

As co-chair of the Advisory Group on Molecular Screening and Toxicogenomics of the [Organisation for Economic Co-operation and Development \(OECD\)](#), Whelan is heavily involved in the OECD’s AOP development program, which was officially launched in January. He argued that its success will depend on implementing a crowdsourcing model to ensure that the widest community of experts can contribute to AOP development and evaluation.

“It starts today,” he said. The process will continue through communications like this talk and through various web-based media. “We want to put all of this knowledge in one place, so that people can contribute online, can evaluate online, and really exploit the community model,” explained Whelan.

Whelan’s proposals sparked questions and discussion among the audience at the seminar, which was hosted by Raymond Tice, Ph.D., head of the NTP Biomolecular Screening Branch.

(Laura Hall is a biologist in the Program Operations Branch of the Division of the National Toxicology Program.)



During the discussion, Michael DeVito, Ph.D., left, head of the NTP Experimental Toxicology Group, said, “The advantage of this approach is that it is actually forcing you to quantitatively and qualitatively describe what you think is happening.” (Photo courtesy of Steve McCaw)

Implementing alternative methods in Europe

The [EU Reference Laboratory for Alternatives to Animal Testing \(EURL ECVAM\)](#), is part of the Institute for Health and Consumer Protection at the Joint Research Centre, the in-house scientific service of the European Commission.

Originally the European Centre for the Validation of Alternative Methods (ECVAM), EURL ECVAM inherited the role of validating alternative approaches to reduce, refine, and eventually replace the use of animals in laboratory testing.



Tice expressed his interest in the AOP concept. “This approach should allow us to accelerate the identification of alternative assays that will be useful for predicting the ability of environmental compounds to pose a hazard to humans.” (Photo courtesy of Steve McCaw)

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Wetterhahn awardee discusses community project on arsenic in vegetables

By Sara Mishamandani

By teaming up with the Dewey-Humboldt community in Arizona, former University of Arizona (UA) Superfund Research Program (SRP) training fellow Monica Ramirez-Andreotta, Ph.D., created a community-based program to better understand and communicate the risk of arsenic in homegrown vegetables near Superfund sites. Ramirez-Andreotta, who was the 14th annual [Karen Wetterhahn Memorial Award winner](#), presented the outcomes of her [Gardenroots](#) project Feb. 5 at NIEHS.

Motivated by a report that came out in 2008 by the National Research Council on “Public Participation in Environmental Assessment and Decision Making,” Ramirez-Andreotta used public participation in scientific research to shape her project.

“Public participation in environmental science research improves the quality, legitimacy, and capacity of investigations,” said Ramirez-Andreotta. “These efforts can lead to positive individual, programmatic, and community outcomes.”

Getting the Gardenroots project off the ground

At a 2008 community meeting in Dewey-Humboldt, where a nearby Superfund site had been listed on the U.S. Environmental Protection Agency (EPA) National Priorities List, residents asked Ramirez-Andreotta, who was the UA SRP Research Translation Core leader at the time, if it was safe to eat homegrown vegetables. Ramirez-Andreotta knew she needed to find an answer, with what would become her doctoral project.

With an interest in soil quality and environmental education, Ramirez-Andreotta began her Ph.D. at UA with the Gardenroots project. She conducted a controlled greenhouse study in parallel with a cocreated citizen science project, to characterize the uptake of arsenic by homegrown vegetables.



Ramirez-Andreotta stressed the importance of community engagement and research translation during her talk at NIEHS. (Photo courtesy of Steve McCaw)

Joining environmental health research and social science

Ramirez-Andreotta will continue her work in environmental health in her new postdoctoral position at Northeastern University under the advisement of Phil Brown, Ph.D. She’s excited to learn new perspectives and methodologies, and to be part of Northeastern’s stellar Social Science Environmental Health Research Institute. She stressed the importance of, and remains committed to, cocreated public participation in scientific research projects that will advance the field of environmental health while democratizing science.

Ramirez-Andreotta recruited various home gardeners in Dewey-Humboldt to submit soil, water, and vegetable samples. She measured the arsenic concentration in their samples, and estimated arsenic exposure and potential risk to the vegetable gardeners. Ramirez-Andreotta maintained ongoing communication and provided informal science education experiences throughout the project, to manage community expectations and involvement.

Study results

Testing indicated that the arsenic concentrations in most of the homegrown vegetables from the *Asteraceae* (lettuce), *Fabaceae* (bean), *Liliaceae* (onion, garlic), *Brassicaceae* (radish, broccoli, kale, and cabbage), and *Amaranthaceae* (beets, spinach, Swiss chard) families were greater than the arsenic concentrations reported in the 2010 US FDA Market Basket Study. The *Asteraceae* and *Brassicaceae* families were the top accumulators, when combining the results from the greenhouse and home garden study.

However, Ramirez-Andreotta concluded that the estimated average arsenic daily intake was much greater from drinking water — assuming their primary source of water for irrigation was also used for drinking — and slightly greater from incidental soil ingestion. Out of the 25 irrigation water samples collected, Ramirez-Andreotta observed arsenic water levels above the EPA limit of 10 micrograms per liter in 16 of the samples, which included water from both private wells and the public water system.

Communicating the results

Ramirez-Andreotta hosted workshops to explain the potential risks to community members and provided personalized result booklets for all participants. She reported back the raw data, such as milligrams of arsenic per kilogram of vegetable, and broke down the risk by creating easy to understand scales that put participants' soil, water, and vegetable samples in low, medium, or high excess risk categories. She included a chart that allowed the participants to decide for themselves how many cups per week they could consume from their garden, based on different excess target risks. She also provided participants with a series of supplemental materials describing recommended gardening practices to reduce an individual's arsenic exposure.

Spurred by the unexpected finding that the town's water system arsenic levels were above the EPA limit, the study participants worked together to identify and notify households about the public water supply. Community members also brought the issue to the state and federal government, and the town water system received several notices of violation — one for being in excess of the arsenic maximum contaminant level. Through this project, Ramirez-Andreotta not only advanced the scientific understanding of participants, she also built capacity within the community to effect change.



Using her minor in art, Ramirez-Andreotta created the Gardenroots logo and communication materials, to recruit participants and inform them of the science. (Graphic courtesy of Ramirez-Andreotta)



After the presentation, Ramirez-Andreotta discussed her work with NIEHS Division of Extramural Research and Training (DERT) Director Gwen Collman, Ph.D., right. (Photo courtesy of Steve McCaw)



NIEHS SRP Program Administrator Danielle Carlin, Ph.D., introduced Ramirez-Andreotta (Photo courtesy of Steve McCaw)



Attendees included NIEHS SRP Program Administrator Heather Henry, Ph.D., right, and DERT Program Analysis Branch Chief Christie Drew, Ph.D. (Photo courtesy of Steve McCaw)

(Sara Mishamandani is a research and communication specialist for MDB Inc., a contractor for the NIEHS Superfund Research Program and Division of Extramural Research and Training.)

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Study links prenatal exposure to PM with low birth weight

By Monica Frazier

A global team of researchers has reinforced concerns that exposure to increased levels of particulate matter (PM) throughout pregnancy can lead to an increased risk for low birth weight. Published online by Environmental Health Perspectives (EHP), this new [research](#) highlights the need for continued study of environmental exposures and their effects on the fetus.

The study, a meta-analysis headed by NIEHS grantee [Tracey Woodruff, Ph.D.](#), director of the Program on Reproductive Health and the Environment in the Department of Obstetrics, Gynecology, and Reproductive Sciences at the University of California, San Francisco (UCSF), and Jennifer Parker, Ph.D., from the Office of Analysis and Epidemiology at the National Center for Health Statistics, evaluated pregnancy outcomes based on levels of PM throughout pregnancy, as well as during each trimester.

“Low birth weight is a very important risk factor that is of general concern among clinical and public health audiences,” Woodruff explained, in an interview with EHP. “Babies who are born too small, for their gestational age, are at increased risk of a variety of morbidity outcomes, either during infancy or during childhood ...



Woodruff and her team are dedicated to educating policymakers and clinicians about the effects of environmental exposures during windows of susceptibility in gestation and early childhood on the lifelong health of children. (Photo courtesy of UCSF)

Now we know, from very interesting research, that even the effects that occur early in gestation ... can also be a marker for increased risk of adult disease.”

	Listen to Woodruff's interview with Researcher's Perspective host Ashley Ahearn (10:39)
	Read Transcript

With PM, size matters

PM is categorized by the [U.S. Environmental Protection Agency](#) as PM10 and PM2.5, based on size and associated potential toxicity. Sources of PM include cars, trucks, power plants, agriculture, and road dust.

The study is, to Woodruff's knowledge, the largest meta-analysis of its kind, with more than 3 million births in 9 countries, accounted for by the efforts of 14 International Collaboration on Air Pollution and Pregnancy Outcomes centers. What Woodruff and colleagues have found is that pregnancies with elevated exposures to PM10 or PM2.5 are correlated with low birth weight and inversely correlated with normal birth weight.

In addition, the cohort identified factors from previous studies, including differences in how exposure is gauged, that may have contributed to previous discrepancy regarding PM's role in birth weight.

Comparing births across the globe

Complicating factors in a study like Woodruff's include how to normalize for factors such as socioeconomic status among nonhomogeneous populations. For example, populations living in areas with higher levels of particulates may also be more or less wealthy or more or less educated than populations in areas with lower levels of particulates. The researchers looked at the correlation between PM and low birth weight, with and without normalization for these factors, and saw higher particulate exposure associated with low birth weight in either case.

Interestingly, smaller sized particulates seem to play a larger role in birth weight than larger sized. These smaller particulates, which have the potential to be more invasive to the human body, are likely more toxic. Even with elevated levels of PM, the resultant risk of low birth weight is relatively modest, but, according to the researchers, it constitutes a significant public health concern because of the range of adverse health effects associated with low birth weight.

The mechanism of how exposure to particulates results in low birth weight is not clear, and will likely be an active area of study in the future. One focus Woodruff mentioned during her recent podcast interview involves the tendency of particulates to raise blood pressure, a side effect that combined with pregnancy could have adverse effects.

Citation: [Dadvand P, Parker J, Bell ML, Bonzini M, Brauer M, Darrow L, Gehring U, Glinianaia SV, Gouveia N, Ha EH, Leem JH, van den Hooven EH, Jalaludin B, Jesdale BM, Lepeule J, Morello-Frosch R, Morgan GG, Pesatori AC, Pierik FH, Pless-Mulloli T, Rich DQ, Sathyanarayana S, Seo J, Slama R, Strickland M, Tamburic L, Wartenberg D, Nieuwenhuijsen MJ, Woodruff TJ. 2013. Maternal exposure to particulate air pollution and term birth weight: a multi-country evaluation of effect and heterogeneity. Environ Health Perspect; doi:10.1289/ehp.1205575 \[Online 6 February 2013\].](#)

(Monica Frazier, Ph.D., is an Intramural Research Training Award fellow in the NIEHS Mechanisms of Mutation Group.)

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Validating hair as a biomarker of manganese exposure

By Bailey Schug

Epidemiologists have long struggled to establish reliable noninvasive methods to predict human exposure to chemicals. A new study by NIEHS grantee [Donald Smith, Ph.D.](#), from the University of California, Santa Cruz, describes a process to accurately and noninvasively determine levels of manganese (Mn) exposure in children and adults, as a tool for better evaluating health risks from exposure.

According to Smith, there is clear evidence that elevated Mn exposure in children and adults can lead to neurological deficits, including problems with cognitive, behavioral, and neuromotor function. However, the Achilles heel of environmental epidemiology is exposure assessment. Researchers have long struggled with the challenge of developing standardized methods to measure internalized dose from exposure over longer time frames.

This study contributes to the ongoing effort, by describing and testing a protocol for cleaning hair of exogenous contamination, and then measuring levels of Mn incorporated into hair during metabolism with high-resolution inductively coupled plasma mass spectrometry (ICP-MS).

Hair levels reflect exposure over time

Studies have suggested that levels of Mn in blood or urine may not reliably reflect environmental exposure. However, since hair grows relatively slowly, and since Mn is incorporated from blood into hair during hair growth, hair may reflect and integrate changes in body Mn levels from exposure over a period of several months.

As Smith explained, “In the simplest terms, hair Mn levels may reflect environmental Mn exposure over the period of hair growth better than other commonly used exposure biomarkers, such as urine or blood.”

High tech methods to measure Mn in hair

Smith’s group developed a hair analysis method using ICP-MS, scanning electron microscopy, and laser ablation. Exogenous metal contamination on hair that was untreated or intentionally contaminated with dust or Mn-contaminated water was removed using a sequential sonification cleaning method that does not alter the morphology of the hair, employing a laboratory detergent and weak nitric acid before rinsing in ultrapure water. Analyses were performed in a standard trace-metal clean room environment.

The cleaning method was then used on hair samples from 121 children, which were collected as part of an ongoing epidemiologic study of health effects of environmental Mn exposure from a ferroalloy plant operation in northern Italy. Studies have documented elevated air, dust, and soil Mn levels in the homes and schools near historically or currently active ferroalloy plants.

“Using this cleaning method, hair Mn levels were found to be significantly higher in children living in the vicinity of active, but not historic, ferroalloy plant emissions,” the authors concluded, “substantiating the use of hair Mn levels as a biomarker of environmental Mn exposure in children.”



Smith is an environmental toxicologist at the University of California, Santa Cruz. He set out to develop a biomarker for Mn that could be useful as established biomarkers for other metals, such as lead, have proven to be. (Photo courtesy of Donald Smith)

Citation: [Eastman RR, Jursa TP, Benedetti C, Lucchini RG, Smith DR.](#) 2013. Hair as a biomarker of environmental manganese exposure. *Environ Sci Technol* 47(3):1629-1637.

(Bailey Schug studies health promotion at Appalachian State University. She is an intern with the NIEHS Office of Communications and Public Liaison.)

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Grantees discuss Superfund pollutants and reproductive health

By *Sara Mishamandani*

Early-life exposure to several common pollutants in food, drinking water, and household products has been associated with neurotoxic effects and other health outcomes, according to NIEHS-funded Superfund Research Program (SRP) presenters on a [Fertility and Reproductive Health Working Group](#) call Feb. 7, hosted by the Collaborative on Health and the Environment (CHE) and Boston University (BU) SRP.



Madeleine Scammell (Photo courtesy of Madeleine Scammell)

 [Listen to the presentations \(01:02:42\)](#)

SRP researchers from the Harvard School of Public Health (HSPH), University of California, Davis (UC Davis), and BU School of Public Health presented their findings to a diverse audience, including individuals from academia, federal government, and non-profit organizations. The call is the first of many activities to emerge from this collaboration between the BU SRP and CHE. [Madeleine Scammell, D.Sc.](#), BU SRP Research Translation Core leader and co-host of the call, worked to form the partnership, to improve application of findings and consolidate resources.

“CHE does a fabulous job with research translation across the board, reaching scientists, decision-makers, and advocates,” said Scammell. “My goal is to get more NIEHS-funded SRP research out there via the infrastructure and network they have already established.”

Common contaminants and reproductive health

HSPH researcher [Susan Korrick, M.D.](#), discussed prenatal polychlorinated biphenyl (PCB) and mercury exposure and subsequent neurobehavioral development. A [study](#) by Korrick and her team, with funding from SRP and other NIEHS grants, found that an increase in ADHD-associated behaviors was linked with low-level prenatal PCB and mercury exposure. However, in a seemingly contradictory finding, higher prenatal fish consumption, which can be a common source of mercury and PCB exposure, was protective against ADHD-related behaviors (read more about Korrick’s research in a 2012 [SRP Research Brief](#)).

Korrick’s findings demonstrate the risk of PCB and mercury exposure, and the benefits of maternal fish consumption, emphasizing the need for further research to better inform dietary recommendations for pregnant women.

[Ann Aschengrau, Sc.D.](#), of the BU SRP, discussed her [study](#) reporting on an association between early-life exposure to tetrachloroethylene (PCE) from contaminated drinking water, and risky behaviors as a teen or adult. Her team found that individuals highly exposed to PCE-contaminated drinking water during gestation and childhood experienced 50 to 60 percent increases in the risk of using two or more major illicit drugs as a teen or adult.

“PCE remains a commercially ubiquitous solvent and common contaminant of drinking water,” said Aschengrau. “It is important to further determine its impact on the health of vulnerable populations.”

Understanding endocrine-disrupting mechanisms

Chemicals in many common household products amplify the activity of hormones in the body and act as endocrine disruptors, according to [Bill Lasley, Ph.D.](#), professor emeritus at UC Davis, who also presented during the call. Lasley’s group is working to identify the mechanism of action and effect of [parabens](#), such as [triclocarban](#), as endocrine disruptors.

Parabens are common small molecules used by cosmetic and personal care manufacturers as an antimicrobial agent.

Lasley’s group also found major differences in the ability to metabolize triclocarban, which may help to identify more vulnerable populations to health effects of the exposure.

Coordinating communication and improving collaboration

The discussion provided an outlet to share emerging scientific research with university researchers; U.S. Environmental Protection Agency (EPA), Centers for Disease Control and Prevention, and NIH staff; non-governmental organizations; and the general public.

“That call was the first time I heard SRP grantees from three different programs talking specifically about their research on reproductive health,” said Scammell. “I think the working groups established by CHE may provide nice frameworks for learning about, and fostering, cross-SRP center collaboration.”

Mark Maddaloni, Ph.D., an EPA Region 2 toxicologist, also noted that the presentations were timely and relevant.

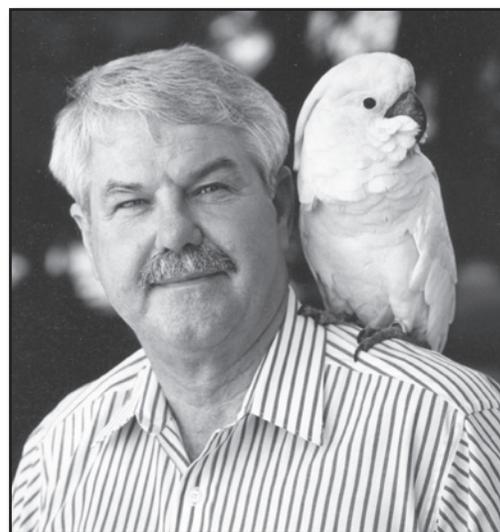
“EPA has been directing increased attention on reproductive/developmental outcomes and vulnerable life stages,” said Maddaloni. “Focusing on some of our big sticker contaminants, such as PCBs, mercury, and PCE, as well as identifying an emerging one, triclocarban, is right on target.”



Susan Korrick (Photo courtesy of Susan Korrick)



Ann Aschengrau (Photo courtesy of Boston University)



Bill Lasley (Photo courtesy of Bill Lasley)

(Sara Mishamandani is a research and communication specialist for MDB Inc., a contractor for the NIEHS Superfund Research Program and Division of Extramural Research and Training.)

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This month in EHP

This month's feature stories in [Environmental Health Perspectives \(EHP\)](#) examine radiation from power plant accidents and newly generated polychlorinated biphenyls (PCBs).

A Tale of Two Forests: Addressing Postnuclear Radiation at Chernobyl and Fukushima

After the 1986 Chernobyl disaster, Soviet officials took immediate steps to limit the health impacts of the contamination, by removing the region's residents and managing the land as a protective buffer absent of human communities. In contrast, Japan's current recovery plan following the Fukushima Daiichi explosions revolves around removing contamination from the landscape to allow residents to move back home. But this management strategy is meeting with opposition from Fukushima residents. Lessons learned from Chernobyl may yet prescribe a different path forward for Japan.

Nonlegacy PCBs: Pigment Manufacturing By-Products Get a Second Look

PCBs were banned in 1979 under the Toxic Substances Control Act, because of concerns about their environmental persistence and adverse human health effects. Despite this ban, some PCBs continue to be generated and released into the environment — not intentionally as commercial products, but as unintentional byproducts of certain manufacturing processes, including pigment manufacturing.

Podcast — Phthalates and Childhood Asthma, with Randi Bertelsen

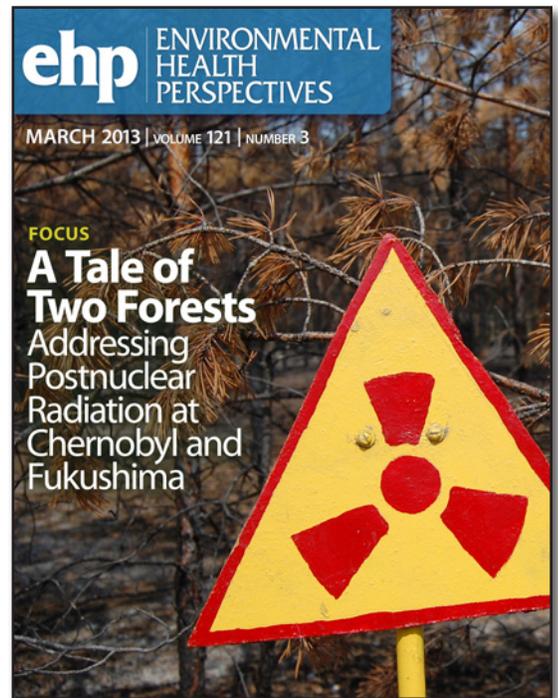
NIEHS visiting fellow [Randi Bertelsen, Ph.D.](#), discusses her EHP research article on phthalates and childhood asthma in a cohort of 10-year-old Norwegian children, in this month's [Researcher's Perspective](#) podcast.

Featured research and related new articles this month include:

- Maternal Exposure to Particulate Air Pollution and Term Birth Weight: A Multi-Country Evaluation of Effect and Heterogeneity — Global Push: Multicontinent Project Assesses Particulate Matter and Birth Outcomes



<http://twitter.com/ehponline>



- Systems Biology and Birth Defects Prevention: Blockade of the Glucocorticoid Receptor Prevents Arsenic-Induced Birth Defects — A Systems-Level Approach to Studying Birth Defects: Novel Method Identifies Potential Key Pathway
- Transgenerational Inheritance of Increased Fat Depot Size, Stem Cell Reprogramming, and Hepatic Steatosis Elicited by Prenatal Obesogen Tributyltin in Mice —An Obesogen over Time: Transgenerational Impact of Tributyltin
- Bisphenol S Disrupts Estradiol-Induced Nongenomic Signaling in a Rat Pituitary Cell Line: Effects on Cell Functions — Assessing the Safety of a Replacement Chemical: Nongenomic Activity of Bisphenol S

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Parsonnet to give Falk distinguished lecture

By Kristen Ryan

Infectious disease specialist Julie Parsonnet, M.D., will present the 2013 Hans L. Falk Memorial Lecture with a discussion of “Spirits in the Microbial World (or Who is Steering This Ship)?” Hosted by NIEHS senior researchers Walter Rogan, M.D., and Stephanie London, M.D., Dr.P.H., of the Epidemiology Branch, Parsonnet will deliver her talk March 19 at 11:00 a.m. in Rodbell Auditorium.

As a noted researcher and professor of medicine at Stanford University, [Parsonnet](#) has a primary research interest in investigating the relationship between chronic exposure to infectious agents and chronic disease. Her work in the infectious disease arena began in 1987 at Massachusetts General Hospital, following completion of her medical degree at Cornell University Medical College. She spent two years working for the Centers for Disease Control and Prevention as an Epidemic Intelligence Service Officer, before starting her career at Stanford University. Parsonnet is currently a member of both the Department of Medicine and Department of Health Research and Policy at Stanford.

Much of Parsonnet’s work focuses on infection by *Helicobacter pylori*, a bacterium estimated to be present in the gastrointestinal tracts of 50 percent of the world’s population, and its association with stomach cancer. Infection-related childhood obesity, atherosclerosis, and diarrheal and foodborne diseases are also a focus in her laboratory. Parsonnet, who has authored more than 100 peer-reviewed [scientific papers](#), books, book chapters, and reviews, advises on economically sound strategies for promoting stomach cancer prevention and vaccine development in the U.S. and developing countries.

Hans Falk, Ph.D., joined NIEHS in 1967 and made important contributions to the emerging field of environmental health science during his career as the Institute’s first scientific director. Initiated by scientists and friends of Falk, the annual memorial lecture series features noted guest speakers who have made significant contributions to environmental health science research, among them several Nobel Prize winners.

(Kristen Ryan, Ph.D., is an Intramural Research Training Award fellow in the NTP Toxicology Branch.)

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Stem cell biology symposium to be hosted by NIEHS in April

By Aleksandra Adomas

A two-day symposium April 11-12, “[Unlocking the promise of the stem cells](#),” will bring to NIEHS prominent experts in stem cell research, an area of strategic interest to NIEHS. The symposium will feature world-renowned experts in the areas of embryonic and adult stem cells, cellular reprogramming and differentiation, and epigenetics ([see text box](#)). Gerald Crabtree, M.D., a Howard Hughes Medical Institute (HHMI) researcher and professor of pathology and developmental biology at Stanford University School of Medicine will deliver the keynote address.

Stem cells, which are unique in their ability to self-renew and differentiate into any specialized cell type, can be used in cell-based medical therapies and as a model to study development, differentiation, and complex diseases, such as diabetes, spinal cord injuries, retinal disease, Parkinson’s disease, heart disease, and cancer.

The organizers, NIEHS lead researchers Raja Jothi, Ph.D., and Guang Hu, Ph.D., believe the symposium will be valuable for many of the NIEHS researchers and trainees who have begun to use stem cells to address clinical and environmental questions.

As Hu explained, “The symposium will cover all the different stem cell types — embryonic, adult, and induced — but also the epigenetic events associated with self-renewal and differentiation processes.” Jothi added, “We would like the symposium to highlight the potential future applications of stem cells, rather than focus on any particular biological question.”

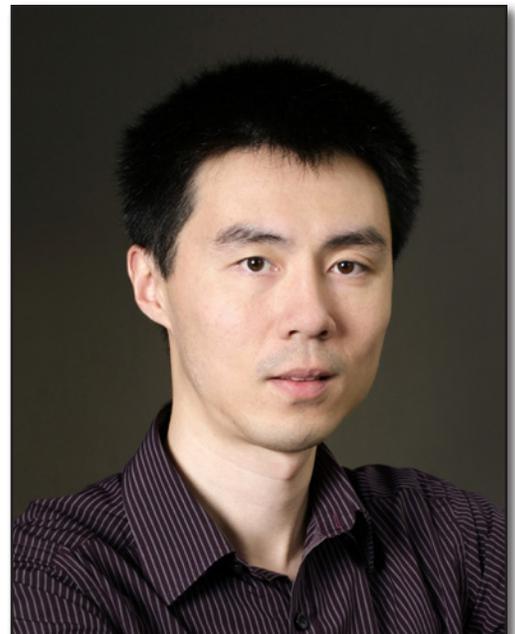
Hu and Jothi hope that the symposium will be an opportunity to enhance interactions among researchers at NIEHS and other research institutions in the area, including Duke University, the University of North Carolina at Chapel Hill, and North Carolina State University.

The [registration](#) for the symposium is free and open to the general public. The organizers are also accepting [abstract submissions](#) for poster presentations.

(Aleksandra Adomas, Ph.D., is a research fellow in the NIEHS Eukaryotic Transcriptional Regulation Group.)



Jothi is head of the Systems Biology Group in the Laboratory of Molecular Carcinogenesis. (Photo courtesy of Steve McCaw)



Hu leads the Stem Cell Biology Group in the Laboratory of Molecular Carcinogenesis. (Photo courtesy of Steve McCaw)

Symposium speakers and talk titles

- [Trevor Archer, Ph.D.](#) (NIEHS, NIH) “Chromatin remodeling and stem cell function”
- [Iannis Aifantis, Ph.D.](#) (Howard Hughes Medical Institute, New York University), “*In vivo* mapping of Notch pathway activity in adult stem cell differentiation”
- [Juan Carlos Izpisua Belmonte, Ph.D.](#) (Salk Institute for Biological Studies), “Stem cells and heart regeneration”
- [Gerald Crabtree, M.D.](#) (Howard Hughes Medical Institute, Stanford University School of Medicine), “Chromatin regulation: new methods and concepts”
- [Konrad Hochedlinger, Ph.D.](#) (Howard Hughes Medical Institute, Harvard Stem Cell Institute), “Understanding cellular reprogramming and pluripotency”
- [Brigid Hogan, Ph.D.](#) (Duke University), “The life of breath: stem cells in the adult lung”
- [Guang Hu, Ph.D.](#) (NIEHS, NIH), “Identification of novel players in ES cell self-renewal”
- [Raja Jothi, Ph.D.](#) (NIEHS, NIH), “ES cell identity and homeostasis”
- [Carla Kim, Ph.D.](#) (Harvard Stem Cell Institute), “Microenvironmental regulation of lung stem cell differentiation”
- [Minoru Ko, M.D., Ph.D.](#) (Keio University, Japan), “How do ES cells maintain their exceptional genome stability?”
- [Ihor Lemischka, Ph.D.](#) (Mount Sinai School of Medicine), “Embryonic stem cell self-renewal and pluripotency”
- [Terry Magnuson, Ph.D.](#) (University of North Carolina at Chapel Hill), “Epigenetics, chromatin remodeling and mammalian development”
- [Mahendra Rao, M.D., Ph.D.](#) (National Institute of Arthritis and Musculoskeletal and Skin Diseases, NIH), “Using iPSC-derived cells for therapy — promises and pitfalls”
- [Lorenz Studer, M.D.](#) (Memorial Sloan-Kettering Cancer Center), “Derivation of neurons from pluripotent stem cells”
- [Yi Zhang, Ph.D.](#) (Howard Hughes Medical Institute, Harvard Medical School), “Mechanism and function of Tet-mediated 5mC oxidation”
- [Thomas Zwaka, M.D.](#) (Baylor College of Medicine), “The strange case of pluripotentiality: embryonic stem cells, germ cells and genomic conflicts”

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Extramural papers of the month

By Nancy Lamontagne

- [Cost of mercury pollution](#)
- [Reducing air pollution continues to increase life expectancy](#)
- [Tributyltin linked to transgenerational obesity](#)
- [Early pregnancy inflammation could increase autism risk](#)



Read the current Superfund Research Program [Research Brief](#). New issues are published on the first Wednesday of each month.

Cost of mercury pollution

According to study partly supported by NIEHS, each year in Europe, more than 1.8 million children are born with unsafe prenatal methylmercury exposures. Preventing prenatal methylmercury exposure could save the European Union 8-9 billion euro per year in lost earning potential.

Exposure to methylmercury typically occurs from eating fish, which bioconcentrate the contaminant. Methylmercury affects brain development leading to a lower IQ and, thus, lower earning potential. To calculate the costs associated with this exposure, the researchers examined mercury concentrations in hair samples from the [DEMOCOPHES](#) study of exposure to environmental chemicals, as well as other studies. They assumed that mercury levels below 0.58 micrograms per gram of hair would have little adverse effect.

The researchers estimated that preventing exposure within the European Union would bring an annual benefit equivalent to 600,000 IQ points per year, corresponding to the estimated annual economic benefit of 8-9 billion euro. Prevention would have the most impact in southern Europe, where hair-mercury concentrations were the highest. The study did not examine less tangible benefits of protecting against methylmercury exposure, and supports the need for interventions to minimize exposure.

Citation: [Bellanger M, Pichery C, Aerts D, Berglund M, Castano A, Cejchanova M, Crettaz P, Davidson F, Esteban M, Exley K, Fischer ME, Gurzau AE, Halzlova K, Katsonouri A, Knudsen LE, Kolossa-Gehring M, Koppen G, Ligocka D, Miklavcic A, Reis MF, Rudnai P, Tratnik JS, Weihe P, Budtz-Jorgensen E, Grandjean P. 2013. Economic benefits of methylmercury exposure control in Europe: Monetary value of neurotoxicity prevention. Environ Health; doi:10.1186/1476-069X-12-3 \[Online 7 January 2013\].](#)

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Reducing air pollution continues to increase life expectancy

NIEHS grantees report that air pollution reductions occurring from 2000 to 2007 were associated with improved life expectancy. These results show that the last decade of air pollution control continues to positively affect public health.

From 2000 to 2007, U.S. levels of particulate matter, less than 2.5 micrometers in diameter (PM_{2.5}), declined, but at a slower rate than between 1980 and 2000. To find out if these levels continued to improve life expectancy, the researchers looked at yearly average PM_{2.5} and life expectancy data for 545 rural and urban

U.S. counties from 2000 to 2007. Controlling for socioeconomic status, smoking prevalence, and demographic characteristics, they found that the average life expectancy increased by 0.35 years for every 10 microgram per meter decrease in PM2.5 concentration (SD = 0.16 years, P = 0.033). The association between life expectancy and air pollution levels was stronger in more urban and densely populated counties.

A commentary on the study says that the findings provide support for continuing efforts to further decrease air pollution in the United States and globally, where some people experience much higher concentrations of particulate matter than in the United States.

Citation: [Correia AW](#), [Pope CA 3rd](#), [Dockery DW](#), [Wang Y](#), [Ezzati M](#), [Dominici F](#). 2013. Effect of air pollution control on life expectancy in the United States: an analysis of 545 U.S. counties for the period from 2000 to 2007. *Epidemiology* 24 (1):23-31. [Commentary]

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Tributyltin linked to transgenerational obesity

An NIEHS-supported study showed that mice prenatally exposed to the endocrine disruptor tributyltin (TBT) were more likely to be obese, and the effects persisted in subsequent generations not directly exposed to TBT. The findings hold important implications for understanding obesity in people.

TBT is used as an antifungal agent in some paints, certain plastics, and consumer products. To analyze the effects of TBT, the researchers exposed pregnant mice to doses comparable to the established human tolerable daily intake. The offspring of the pregnant mice exposed to TBT, and the subsequent two generations of mice, had a greater number of fat cells, larger fat cells, and heavier fat depots. The TBT exposure also reprogrammed mesenchymal stem cells so that they were more likely to become adipocytes instead of bone, and produced changes in the liver that resembled nonalcoholic fatty liver disease. If TBT has similar effects on people, then exposure to it and other endocrine disruptors could reprogram the metabolism of exposed individuals and future generations, predisposing them toward weight gain.

Citation: [Chamorro-Garcia R](#), [Sahu M](#), [Abbey RJ](#), [Laude J](#), [Pham N](#), [Blumberg B](#). 2013. Transgenerational inheritance of increased fat depot size, stem cell reprogramming, and hepatic steatosis elicited by prenatal exposure to the obesogen tributyltin in mice. *Environ Health Perspect*; doi:10.1289/ehp.1205701 [Online 15 January 2013].

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Early pregnancy inflammation could increase autism risk

Inflammation during pregnancy could be associated with an increased risk for autism, according to new research that was partially funded by NIEHS.

The researchers looked at an inflammatory biomarker called gestational C-reactive protein (CRP) in the Finnish Maternity Cohort, which contains an archive of serum samples collected from about 810,000 pregnant women in Finland. They also used national psychiatric registries that contain virtually all treated autism cases in the population.

Analysis of CRP in archived maternal serum corresponding to 677 childhood autism cases and an equal number of matched controls, revealed that the risk of autism among children in the study was increased by 43 percent among mothers with CRP levels in the top 20th percentile, and by 80 percent for maternal CRP in the top 10th percentile. These findings could not be explained by maternal age, paternal age, gender, previous births, socioeconomic status, preterm birth, or birth weight. The researchers caution that the results should be viewed in perspective, since the prevalence of inflammation during pregnancy is substantially higher than the prevalence of autism.

Citation: [Brown AS, Sourander A, Hinkka-Yli-Salomäki S, McKeague IW, Sundvall J, Surcel HM. 2013. Elevated maternal C-reactive protein and autism in a national birth cohort. Mol Psychiatry; doi:10.1038/mp.2012.197 \[Online 22 January 2013\]. \[Story\]\(#\)](#)

(Nancy Lamontagne is a science writer with MDB Inc., a contractor for the NIEHS Division of Extramural Research and Training, Superfund Research Program, and Worker Education and Training Program.)

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Intramural papers of the month

By Monica Frazier, Mallikarjuna Metukuri, Ajeet Singh, and Darshini Trivedi

- [New mouse model advances study of mitochondrial diseases](#)
- [A new method to analyze case-sibling studies](#)
- [Novel loci for lung function identified by using genome-wide joint meta-analysis](#)
- [The effects of sulfite-induced lesions in DNA](#)

New mouse model advances study of mitochondrial diseases

Researchers at NIEHS have determined that POLG2, the accessory subunit of the DNA polymerase gamma complex, is necessary for mammalian embryogenesis and mitochondrial DNA (mtDNA) replication. The finding will help scientists better understand disorders caused by mutations in mtDNA or depletion of mtDNA, such as Alpers' disease, an illness that causes dementia, seizures, and liver failure.

The DNA polymerase gamma complex is made up of a catalytic subunit and an accessory subunit. While approximately 200 pathogenic mutations in the catalytic subunit, which lead to mitochondrial diseases, have been described, the accessory subunit had not been well characterized. The mouse model developed in this study is the first mammalian model of the *Polg2* gene, and allowed the scientists to study the accessory subunit.

The researchers monitored mice that were heterozygous for *Polg2* for two years and found them to be no different than wild-type mice. However, they determined that a homozygous knockout of *Polg2* was embryonic lethal. Further investigation into the knockout revealed a loss of mtDNA, structural defects of the mitochondria, and respiratory-chain failure seen via the lack of cytochrome c oxidase I activity.

These results will be critical to the future development of additional mitochondrial disease mouse models, and in determining the susceptibility of mitochondria to environmental agents. (MF)

Citation: Humble MM, Young MJ, Foley JF, Pandiri AR, Travlos GS, Copeland WC. 2013. Polg2 is essential for mammalian embryogenesis and is required for mtDNA maintenance. Hum Mol Genet 22(5):1017-1025.

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A new method to analyze case-sibling studies

NIEHS investigators have proposed an improved approach to testing genetic susceptibility factors and gene-exposure interactions using siblings. It treats case-sibling data as nuclear family data for which the parents are missing, and uses a statistical missing data method, the expectation-maximization algorithm, to increase statistical power, by exploiting the fact that the case and their control share parents. The method also permits the investigator to enroll cases who lack a sibling control, and controls whose case sibling is unavailable, such as in cases of death.

Nuclear family-based designs are commonly used in genetic epidemiology to study complex diseases that involve both genetic variants and environmental exposures. When parental information is unavailable, as with diseases occurring late in life, siblings can serve as controls. Such case-sibling studies are typically analyzed using conditional logistic regression (CLR), where each case is matched with at least one unaffected sibling as control.

The NIEHS authors compared the traditional CLR with the missing-parents approach and found that the latter improved statistical efficiency, when at least some of the cases had two or more control siblings available, particularly when testing for genetic effects. Furthermore, the missing-parents approach provided additional improvements in power, through inclusion of unmatched cases and controls. **(DT)**

Citation: Shi M, Umbach DM, Weinberg CR. 2012. Case-sibling studies that acknowledge unstudied parents and permit the inclusion of unmatched individuals. Int J Epidemiol; doi:10.1093/ije/dys212.

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Novel loci for lung function identified by using genome-wide joint meta-analysis

NIEHS researchers, along with collaborators, identified novel genetic loci in the most comprehensive meta-analysis to date of gene-by-smoking interaction in relation to pulmonary function.

Meta-analysis generally refers to methods that contrast and combine results from different studies, to identify patterns among study results and provide sufficient sample size to detect moderate effects. The authors conducted genome-wide joint meta-analyses (JMA) of single nucleotide polymorphism (SNP) main effects and SNP-by-smoking interaction associations, using ever-smoking or pack-years, with cross-sectional pulmonary function measures in 50,047 study participants of European ancestry.

Three novel gene regions, DNER, HLA-DQB1/HLA-DQA2, and KCNJ2/SOX9, which were not previously related to pulmonary function, were identified from the JMA. The authors evaluated *DNER*, *KCNJ2*, and *SOX9* and found them to be expressed in human lung tissue. *DNER* and *SOX9* were also differentially expressed in human airway cells in smokers compared to non-smokers. The authors did not check for the two *HLA* genes, given the known expression of this class in a range of airway cell types.

By using JMA, the authors identified loci that would have remained unknown using standard genome-wide association study approaches. This study demonstrated the importance of applying JMA to determine novel genetic risk factors that might further uncover the mechanisms leading to reduced pulmonary function. **(MM)**

Citation: Hancock DB, Artigas MS, Gharib SA, Henry A, Manichaikul A, Ramasamy A, Loth DW, Imboden M, Koch B, McArdle WL, Smith AV, Smolonska J, Sood A, Tang W, Wilk JB, Zhai G, Zhao JH, Aschard H, Burkart KM, Curjuric I, Eijgelsheim M, Elliott P, Gu X, Harris TB, Janson C, Homuth G, Hysi PG, Liu JZ, Loehr LR, Lohman K, Loos RJ, Manning AK, Marcianti KD, Obeidat M, Postma DS, Aldrich MC, Brusselle GG, Chen TH, Eiriksdottir G, Franceschini N, Heinrich J, Rotter JI, Wijmenga C, Williams OD, Bentley AR, Hofman A, Laurie CC, Lumley T, Morrison AC, Joubert BR, Rivadeneira F, Couper DJ, Kritchevsky SB, Liu Y, Wjst M, Wain LV, Vonk JM, Uitterlinden AG, Rochat T, Rich SS, Psaty BM, O'Connor GT, North KE, Mirel DB, Meibohm B, Launer LJ, Khaw KT, Hartikainen AL, Hammond CJ, Gläser S, Marchini J, Kraft P, Wareham NJ, Völzke H, Stricker BH, Spector TD, Probst-Hensch NM, Jarvis D, Jarvelin MR, Heckbert SR, Gudnason V, Boezen HM, Barr RG, Cassano PA, Strachan DP, Fornage M, Hall IP, Dupuis J, Tobin MD, London SJ. 2012. Genome-wide joint meta-analysis of SNP and SNP-by-smoking interaction identifies novel loci for pulmonary function. *PLoS Genet* 8(12):e1003098.

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The effects of sulfite-induced lesions in DNA

In a new study, NIEHS researchers developed a mutagenesis reporter system in yeast that specifically detects mutations arising from damage within single-strand DNA (ssDNA). ssDNA arises transiently during DNA replication and repair, as well as transcription. Since repair opportunities are fewer for ssDNA, it is more at risk than the more prevalent double-strand DNA. This study helps researchers to understand the molecular mechanisms of ssDNA-specific damage, which has been implicated in causing mutation clusters and up to 40 percent of all mutations in some cancers.

To validate their approach, the authors first showed that the human APOBEC3G, an enzyme that acts preferentially on ssDNA, converted cytosines to uracils in ssDNA, resulting in clusters of multiple mutations on the same DNA strand. They then treated cells with sulfites, a common environmental agent found in the atmosphere and food supply. Sulfites similarly caused multiple mutations on the same DNA strand, by damaging cytosines in ssDNA. Neither APOBEC3G nor sulfites caused mutations in double-strand DNA controls. Additionally, the chemically-modified uracils formed by sulfites were resistant to repair initiated by an enzyme that removes uracil from DNA.

This study highlights the first *in vivo* system to identify the genomic risk from environmental agents that can cause ssDNA damage and how they might contribute to disease including cancer. **(AS)**

Citation: Chan K, Sterling JF, Roberts SA, Bhagwat AS, Resnick MA, Gordenin DA. 2012. Base damage within single-strand DNA underlies *in vivo* hypermutability induced by a ubiquitous environmental agent. *PLoS Genet* 8(12):e1003149.

(Monica Frazier, Ph.D., is an Intramural Research Training Award (IRTA) fellow in the NIEHS Laboratory of Molecular Genetics. Mallikarjuna Metukuri, Ph.D., is a research fellow in the NIEHS Laboratory of Signal Transduction. Ajeet Singh, Ph.D., is a visiting fellow in the NIEHS Laboratory of Molecular Carcinogenesis. Darshini Trivedi, Ph.D., is an IRTA fellow in the NIEHS Laboratory of Toxicology and Pharmacology.)

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Inside the Institute

Institute achievements honored at annual awards ceremony

By Ian Thomas

NIEHS staff from across the institute gathered in Rodbell Auditorium Feb. 13 for the annual awards ceremony. Hosted by NIEHS/NTP Director Linda Birnbaum, Ph.D., the awards honor outstanding achievement, throughout the year, on the part of Institute staff.

“Every year, our staff and scientists make incredible strides toward the advancement of environmental health research, and 2012 was no different,” said Birnbaum, who presented certificates to each of the awardees. “We have a lot to be proud of.”

NIEHS Associate Director for Management and event co-emcee Joellen Austin agreed.

“These nominations and awards serve as yet another reminder of the outstanding science and support that our Institute carries out every day,” said Austin, who praised the work of her OM colleagues for their commitment to the event’s success.

Noteworthy NIEHS Highlights from 2012

- The release of the NIEHS five-year strategic plan
- The Institute’s first-ever virtual forum on obesity
- The naming of “Discovery Lake”
- The success of the Citizen Schools Project
- Feds Feed Families’ exceeding its annual giving goal

NIEHS Award Winners

2012 NIH Director’s Award

Group Award: Partnerships for Environmental Public Health Program — Lynn Albert, Beth Anderson, Maureen Avakian, John Balbus, Sharon Beard, Justin Crane, Helena Davis, Caroline Dilworth, Christina Drew, Sally Eckert-Tilotta, Symma Finn, Kimberly Gray, Heather Henry, Chip Hughes, Michael Humble, Cindy Lawler, Liam O’Fallon, Kristianna Pettibone, Jerry Phelps, Molly Puente, Claudia Thompson

Individual Award: Molecular Mechanism of Learning and Memory — Serena Dudek

Unsung Hero Awards — Angela Sanders, Hwei-Chen Lao, Laura Miller-DeGraff, John Petranka, Rachel Frawley

Peer Awards — Allison Eason, Jennifer Evans, Dee Lunney, Tameka Thomas



Alicia Moore, center, smiles proudly as she receives her Individual Merit Award from Birnbaum, right. NTP Associate Director John Bucher, Ph.D., left, joined Moore and Birnbaum on stage. (Photo courtesy of Steve McCaw)

Individual Merit Awards – Kimberly Gray, Jerrold Heindel, Bill Suk, Grace Kissling, Jef French, Dori Germolec, Alicia Moore

Division Group Merit Awards

Office of Management — William Fitzgerald, William Hawkins, John McLamb, Christopher Parker, Terrance Saulter, Meagan Tozer, Mitch Williams

Division of Extramural Research and Training — Sharon Beard, Liam O’Fallon, Molly Puente, Elizabeth Ruben, Leroy Worth

Division of Intramural Research – James Clark, David Goulding, Sandra Hackney, Cathy Oakley, Page Myers

Division of the National Toxicology Program — Sachin Bhusari, Janice Harvey, Hue-Hua Hong, Arun Pandiri, Thai Vu Ton

Cross-divisional Group Merit Awards

For improvements on NIEHS research facilities: Gary Bird, Debra Del Corral, Vickie Englebright, Clyde Hasty, Paul Johnson, Scott Merkle, Paul Poliachik, Nancy Powell, Michael Spencer, Amanda Thompson, Carmen Williams

For research addressing the health impacts of engineered nanomaterials: David Balshaw, Sally Eckert-Tilotta, Lisa Edwards, Stavros Garantziotis, Barbara Gittleman, Srikanth Nadadur, Patrick Mastin, Thaddeus Schug, Sally Tinkle, Michelle Victalino, Nigel Walker, Christopher Weis

For volunteer efforts with Citizen Schools — Spring 2012: Mercedes Arana, Nisha Cavanaugh, Sharon Beard, April Binder, Elena Braithwaite, John Ciencewicki, Shay Covo, Bret Freudenthal, Tim Gingerich, Ashley Godfrey, Michelle Heacock, Ed Kang, Kristin Lichti-Kaiser

Group Awards for Cross-NIH Efforts

- Brain Disorders (FIC): Annette Kirshner
- National Database for Autism Research Team (NIMH): Cindy Lawler
- NIH Blueprint Neurotherapeutics Team (NINDS): Cindy Lawler
- NCR/NCATS/ORIP Reorganization (OM): Pat Mastin
- NCR/NCATS/ORIP Reorganization (OD): Elizabeth McNair
- Common Fund Metabolomics Leadership Team (OD): David Balshaw

2012 NIH Office of the Director Awards

- 2011 Feds Feed Families: Monya Wells, Annette Rice
- Appropriations Law Training and Leadership Group: Antoinette Bridges, Charles Conrad, Cynthia Radford
- NIH Biospectrum Working Group: Elizabeth Denholm
- NIH Clinical Research Protocol Application Taskforce: Jane Lambert
- Research Performance Progress Report Group: Molly Puente
- RPC Scientific Review Office Technical Competencies Team: Janice Allen
- Team for Implementing the Animal Care and Use Guide at NIH: John Roberts



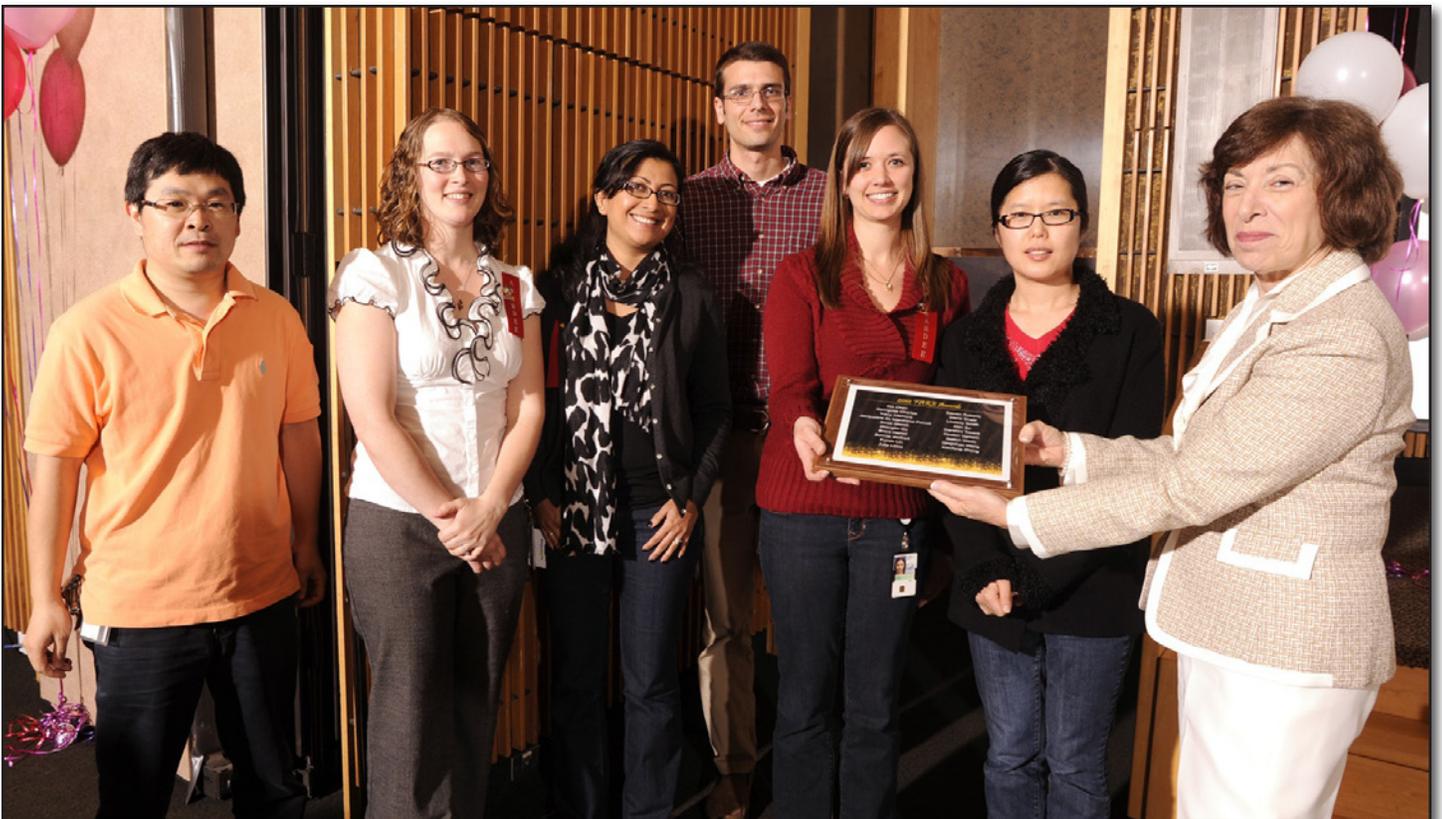
Huei-Chen Lao, left, received her Unsung Hero Award. (Photo courtesy of Steve McCaw)

2012 Fellows' Award for Research Excellence (FARE) Awardees

Kim Chan, Georgette Charles, Tracy Clement, Jaqueline de Marchena, Swati Ghosh, Zhenglin Gu, Brent Hamel, Bonnie Joubert, , Fumin Lin, Julie Lowe, Steven Roberts, Maria Shatz, Lindsay Smith, Dan Su, Darshini Trivedi, Kristen Verhein, Staton Wade, Qinghsan Wang, Xiaofeng Zheng



NIEHS recognized service to the Citizen Schools Program at nearby Lowes Grove Elementary School. The group included fellows, scientists, and staff volunteers who made the first year of the program a resounding success. (Photo courtesy of Steve McCaw)



FARE winners receive \$1,000 to use for professional development. In addition to their recognition at the annual NIH Research Fair last fall, the fellows were also honored at home. (Photo courtesy of Steve McCaw)

Following the awards ceremony, award winners and colleagues enjoyed refreshments and music by the NIEHS Band in the cafeteria.

(Ian Thomas is a public affairs specialist with the NIEHS Office of Communications and Public Liaison, and a regular contributor to the Environmental Factor.)



During refreshments and music in the cafeteria, two generations of service to NIEHS came together as Division Group Merit Award winner David Goulding, left, enjoyed a congratulatory hug from his mother Gina, a veteran biologist in a Division of Intramural Research lab. (Photo courtesy of Steve McCaw)



Shown left to right, Moore joined colleagues Darlene Dixon, D.V.M., Ph.D., Moore's mother, and Moore's sister for cake and ice cream. (Photo courtesy of Steve McCaw)



Cross-divisional Group Merit Award winners Ashley Godfrey, Ph.D., left, and Darshini Trivedi, Ph.D., were among the record number of trainees honored this year. Trivedi was also honored for her FARE award. (Photo courtesy of Steve McCaw)

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