

Workshop advances arsenic research and prevention

By Eddy Ball

The NIEHS Superfund Research Program (SRP) hosted a meeting Mar. 3-4 that gave scientists across a range of disciplines a venue for laying the foundation for the next generation of arsenic research.

The "[Health Effects and Mitigation of Arsenic: Current Research Efforts and Future Directions](#)" workshop attracted nearly 150 leading experts from universities and other organizations throughout the world, as well as scientists from NIEHS, NTP, and the U.S. Environmental Protection Agency (EPA). The participants worked toward a common goal - to better understand how low levels of arsenic impact human health, and how to best prevent exposure to arsenic, whether it occurs naturally or as a consequence of human activity.

Speakers reported findings from their work in labs, through cohort studies of mothers and children, and with prevention and remediation efforts on the ground, from abandoned mines in the southwestern U.S. to arsenic hotspots in Asia, Mexico, and South America.

NIEHS Health Scientist Administrator Danielle Carlin, Ph.D., led the careful planning behind the workshop and responded quickly to an unexpected snowstorm, which forced cancellation of the panel discussions and squeezed two full days of work into two five-hour sessions.

Charting a course for arsenic work to come

In her opening comments, NIEHS and NTP Director Linda Birnbaum, Ph.D., set the tone for the presentations and panel discussions planned for the two-day meeting. She underscored the global extent of the problem; described the importance of a transdisciplinary approach for SRP projects, in both work underway and planned for the future; and shared new insights into the health threats posed by exposure to arsenic.

"Pretty much every system [of the body] is involved," she said, adding that the fundamental question of dose has yet to be answered satisfactorily. "How much is too much?" she asked, referring to the dramatic reassessment of U.S. regulatory standards in 2006, lowering the so-called safe level in water from 50 to 10 micrograms per liter - a standard most of her listeners still consider much too lenient.

Birnbaum concluded by issuing the workshop a challenge - to determine the current state of the science in arsenic research and identify the knowledge gaps that will inform future arsenic research programs.

Among the giants in arsenic research and prevention

The workshop's keynote speaker, University of North Carolina at Chapel Hill (UNC) Chancellor [Carol Folt, Ph.D.](http://chancellor.unc.edu/), kicked off 22 presentations by scientists from the world's leading research organizations. Folt's colleagues at Dartmouth College

joined their counterparts from the University of Arizona (UA), Columbia University, and several other biomedical research centers, to update others on their accomplishments, challenges, and ongoing struggles, especially in the area of compliance with remediation programs.

Topics ranged from engineering innovations to reduce deposits of arsenic from irrigation in rice fields, mode of action, and speciation, to longitudinal studies of the association of early exposures with diseases developing late in life, due to epigenetic modifications of gene expression. Presentations also addressed multiple sources of exposure, remediation strategies, and stabilization of abandoned mining sites with vegetative cover.

In the meeting's final presentation, Columbia University geochemist Alexander van Geen, Ph.D., described some of the frustration his team has experienced with compliance in their work in Asia, helping residents find and use arsenic-free sources of water by translating research into prevention.



Carlin managed to give all scheduled speakers an opportunity to present their research findings. Her quick thinking and engaging sense of humor helped ensure that the meeting ran smoothly, in spite of cancellations due to the inclement weather. (Photo courtesy of Steve McCaw)



Despite the many other demands on her time, Birnbaum was on hand for the entire program. "This was a great workshop," she said afterwards. (Photo courtesy of Steve McCaw)

"It's a cycle of excitement and disappointment," he said. "We've been there more than a decade and the problem hasn't gone away."

Moving forward

NIEHS SRP Director Bill Suk, Ph.D., concluded the meeting with final thoughts. "This [widespread exposure to arsenic] is a significant global health problem that can only be effectively addressed by approaches that are cross-disciplinary, multidisciplinary, and transdisciplinary," he said.

Suk pointed to questions that still need to be answered in terms of launching more effective strategies for prevention, explicating major exposure routes, raising community awareness, and addressing the role of government, business, and industries in preventable exposures to arsenic.

As the meeting came to a close, attendees looked forward to new collaborations and workshop products, including a published commentary and an upcoming series of webinars.



On her way to the podium, Folt embraced Birnbaum, who had donned a UNC Carolina-blue cap to introduce the keynote speaker. Folt returned to NIEHS Mar. 20 to present the 13th annual Spirit Lecture. (Photo courtesy of Steve McCaw)



Among NTP and NIEHS scientists at the meeting was biologist Erik Tokar, Ph.D., who is part of the NTP Laboratories Inorganic Toxicology Group, headed by Mike Waalkes, Ph.D. Waalkes' group has produced several of the seminal studies on arsenic that were referenced by presenters. (Photo courtesy of Steve McCaw)



Lund University postdoctoral fellow Karin Engstrom, Ph.D., described her research into the gene-environment interactions involved in arsenic metabolism and toxicity. Her talk was part of the susceptibility to arsenic effects session. (Photo courtesy of Steve McCaw)



Following the meeting, Suk, left, enjoyed a talk with Aposhian. In his closing remarks, Suk said about Aposhian, "[His pioneering work with arsenic] is the reason why we are here." (Photo courtesy of Steve McCaw)



Each of the workshop's four sessions was moderated by an EPA scientist. Following his talk in the global environmental cycling and bioavailability session, North Carolina State University soil scientist Matt Polizzotto, Ph.D., left, joined moderator Karen Bradham, Ph.D., for questions. (Photo courtesy of Steve McCaw)



NTP Neurotoxicology Group postdoctoral fellow Ruben Orihuela, Ph.D., left, described his group's findings. Along with lead researcher Jean Harry, Ph.D., and other members of the group, Orihuela explored the alteration of immune function involved in brain development and repair, triggered by exposure to inorganic arsenic. (Photo courtesy of Steve McCaw)



Although the formal poster competition was one of the things cancelled because of the weather, the posters were still on display. NIEHS Reproductive Developmental Biology Group biologist Karina Rodriguez, Ph.D., left, and lead researcher Humphrey Yao, Ph.D., took advantage of a break to look at posters. They collaborated with NTP scientists on a study of arsenic and altered mammary gland development, also on display in the session. (Photo courtesy of Steve McCaw)



Among the leading figures in arsenic research and remediation at the workshop were, from left, UA emeritus professor of molecular and cell biology Vasken Aposhian, Ph.D.; pharmacologist Joseph Graziano, Ph.D., of Columbia University; UA environmental microbiologist and SRP Director Raina Maier, Ph.D.; and nutritional biochemist Mary Gamble, Ph.D., of Columbia University. (Photo courtesy of Steve McCaw)

Superfund - shaping scientific research and scientific careers

In her keynote address, Folt wove her vision for the future of arsenic work into her personal history, with a presentation on "Arsenic and Children's Health: A Multidisciplinary Approach From Superfund to Children's Centers." She was the first of many speakers who praised the NIEHS SRP for its pioneering support of interdisciplinary arsenic research.

Folt also credited SRP with helping shape her career as a woman scientist and leader in a field long dominated by men. By mandating a broad approach to complex problems, and by emphasizing translation and problem solving, she said, SRP promoted diversity and teamwork, challenged academic hierarchy, and required scientists to communicate their research to people affected by environmental exposures.

SRP continues to be a driving force behind big science, Folt said. As a result, she added, "We [now] have to talk about convergent science."

As van Geen noted in his presentation on reducing arsenic exposure from drinking well water in South and Southeast Asia, SRP also remains the primary funder of this kind of research, despite growing support from other organizations.

"The level of support by SRP has not been matched by any of the others," he told the audience, as he acknowledged some recent support from the National Science Foundation, U.S. Agency for International Development, and the U.K. Department for International Development.

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