

When you look at the stars and the galaxy, you feel that you are not just from any particular piece of land, but from the solar system.

Kalpana Chawla, space shuttle *Columbia* astronaut (1962–2003)

MEETING REPORT

Summit Focuses on Pharmaceuticals in Drinking Water

Keeping our drinking water clean and contaminant-free is a concern of many policy makers and scientists, and it was the headlining topic at the inaugural Environmental Health Summit of the Research Triangle Environmental Health Collaborative held 10–11 November 2008 in Research Triangle Park, North Carolina. With nearly 150 attendees representing government, research, academia, public interest groups, and the pharmaceutical industry, the stage was set for a constructive dialogue designed to identify key issues for future discourse and action.

In his opening remarks to the conference attendees, chairman and former NIEHS director Kenneth Olden discussed the origins of the collaborative, originally conceptualized in 2005 as an independent forum that would advise government and private industry on emerging environmental threats and concerns. This goal helped shape the current summit's focus on pharmaceuticals in drinking water, he said.

North Carolina congressmen Bob Etheridge and David Price also spoke, as did experts from the U.S. Geological Survey, Food and Drug Administration, and Environmental Protection Agency (EPA), who provided

scientific background and information on the current regulatory landscape regarding pharmaceuticals in drinking water supplies. Only 1 pharmaceutical—nitroglycerin—appears on the EPA's current Drinking Water Contaminant Candidate List. John Sumpter, head of the Brunel University Institute for the Environment in the United Kingdom, discussed the European perspective on the issue, where there is still limited regulation but greater awareness of the issue, with media covering the problem more extensively than U.S. outlets.

An estimated 41 million Americans are exposed to trace pharmaceuticals in their drinking water, according to the results of an Associated Press investigation published online 9 March 2008. A significant amount of these trace pharmaceuticals are unmetabolized drugs that are excreted as waste. Others are unused medications that people have flushed down the toilet. Veterinary drugs, usually from large farming operations, are also present in drinking water. Not all water treatment methods currently in use can remove all pharmaceuticals in water.

Jim Hagan, vice president of Glaxo-SmithKline's Environment, Health and Safety Department, says the pharmaceutical industry has known about this problem for years. "[O]ur internal working groups routinely assess both the environmental fate and effects [of new products]. The only difference is that now the analytical

sciences have advanced to the point where we can accurately measure parts per trillion in water."

Rachel Golden-Smith, an education program manager with the North Carolina Department of Environment and Natural Resources, pointed out the advantages of direct communication between pharmacists and consumers to determine how different medications should be discarded. When people are given enough digestible information about the hazards of flushing medications down the toilet, they are less likely to do so, she says. She adds, however, that "drug return programs may incorrectly imply to the public that by returning their unused drugs, the problem of pharmaceuticals in the water is being solved. It is important to balance providing avenues for people to help solve the problem with honest communication about where most pharmaceuticals in the water are coming from."

The attendees participated in 4 work-group sessions throughout the 2-day summit to articulate a plan of action for future areas of focus. On the second day, the group made and prioritized recommendations based on their discussions. The highest priorities included starting a public policy discussion of the issue and drafting a brief written response that water treatment facilities and pharmacies can provide to consumers who ask about the safety of their drinking water: "If your drinking water meets current U.S. standards, your drinking water is considered safe and drinkable. However, trace amounts of pharmaceuticals and other chemicals have been found in water. These substances are coming from a variety of sources and are difficult to remove. There is limited information on how they affect humans and wildlife. U.S. standards for safe drinking water may need to change as more information becomes available." The collaborative is also developing a website with more information on pharmaceuticals in drinking water.

Olden said the collaborative also plans to brief Congress on the outcome and goals of the summit and will submit the conference proceedings to a peer-reviewed journal for publication. For more information on the collaborative and the summit, visit <http://www.environmentalhealthcollaborative.org/>. —Tanya Tillett



Traces of pharmaceuticals end up in drinking water by a variety of routes.

Pattie Califfy/Stockphoto

AGING

Environmental Threats to Elders' Neurologic Health

Age-related chronic diseases will put unprecedented stress on U.S. society with a near-doubling of the number of people aged 65 years and older by 2030, according to the U.S. Administration on Aging. These diseases are also complex. An October 2008 report, *Environmental Threats to Healthy Aging: With a Closer Look at Alzheimer's & Parkinson's Diseases*, now describes in greater detail how a lifetime of environmental factors from conception onward shapes our health in our later years.

The report, published by the Greater Boston Physicians for Social Responsibility and the Science and Environmental Health Network, uses a broad definition of *environment*, encompassing the physical, biological, social, and cultural contexts in which our lives are rooted. These contexts influence biological pathways that determine various outcomes, from good health in old age to chronic health issues including cardiovascular disease, diabetes, obesity, metabolic syndrome, and neurodegenerative disorders such as Alzheimer disease (AD) and Parkinson disease (PD). The authors suggest that environmental improvements, from our diet to our access to quality health care, could reduce, delay, or someday perhaps prevent diseases associated with aging.

"I think this report is exceptionally well done and valuable," says Peter J. Whitehouse, a professor of neurology at Case Western Reserve University. "It will contribute in a major way to the reframing of AD, which desperately needs it."

But the inclusion of neurodegenerative diseases among potentially preventable diseases gives pause to some researchers. "It's tempting to believe what they're saying with regard to AD and PD, but it has not been proven to be true," says Robert Butler, president and CEO of the non-profit International Longevity Center—USA in New York City. "I applaud the concept of what they've done but with the proviso that it has not yet been established."

The report authors are confident that the possibility for prevention exists, though. They began their analysis with an interest in neurodegenerative diseases, but they quickly realized that the underlying mechanisms mirrored those involved in a suite of other disorders, including diabetes, obesity, metabolic syndrome, and cardiovascular disease—the so-called Western disease cluster. Those disorders share



Health in later years depends on a lifetime's worth of environmental factors.

common biological pathways such as up-regulation of inflammation and oxidative stress and disruption of insulin signaling.

Citing numerous published studies, the authors describe multiple ways in which the environment feeds into these pathways and ultimately into the Western disease cluster. Likewise, environmental factors that act via these pathways could promote neurodegenerative diseases, says coauthor Ted Schettler, science director of the Science and Environmental Health Network, a consortium of U.S. environmental groups.

For example, he says there is ample evidence that oxidative stress and inflammation contribute to dopaminergic neuron loss in the substantia nigra, a hallmark of PD. "And given the strong body of evidence finding pesticides to be a risk factor for PD, along with mechanistic data from animal [studies] showing the role of oxidative stress and inflammation, our conclusions are not mere speculation but are based on several lines of evidence," he says. Additionally, conditions such as diabetes and obesity are associated with increased risk for dementia and cognitive decline.

"We should begin to think of cognitive decline and AD as being related to the same causal pathways that are leading into obesity, diabetes, and cardiovascular disease, which are so prevalent in today's society," says Schettler. "Our conclusion is that we're sitting at the cusp of an explosion of neurodegenerative and related diseases, not only because of an aging population but also because we have set the stage through all of the things that are contributing to diabetes, obesity, and cardiovascular disease."

To meet and perhaps prevent the anticipated surge in age-related disease incidence, the authors outline potential cross-cutting solutions. Communities need to bolster access to healthful foods, which encompasses everything from providing business opportunities for groceries and food co-ops to supporting nursing mothers. Communities also need to support planning and development that incorporate green spaces and parks, public transport, and pedestrian and bicyclist safety.

Nationally, farm policies need to support sustainable production of healthful foods. Meaningful federal oversight is needed for phasing out known toxics, acting on early warnings of adverse effects, and keeping the public informed and protected. However, the authors emphasize, strategies cannot be adopted in isolation from one another with the expectation that they'll be successful.

Julie Andersen, a professor at the non-profit Buck Institute for Age Research in Novato, California, notes that the report consolidates information in a way that's accessible to an educated lay audience. "The authors present information that is probably unknown to researchers outside specific areas and that almost certainly has not reached health care providers," she says.

S. Jay Olshansky, a professor of epidemiology at the University of Illinois at Chicago School of Public Health, adds that the authors bring to the forefront the concept that we are capable of creating a better environment for healthy aging. "There's a lot of low-hanging fruit," he says. "We just need to pick it."

—Julia R. Barrett

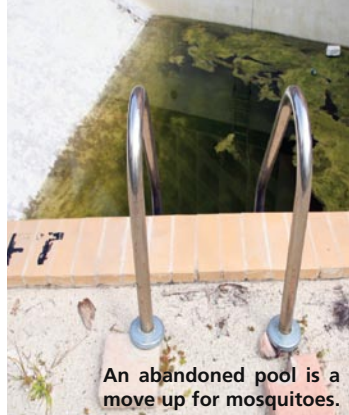
INFECTIOUS DISEASE

WNV Thrives in Financial Crisis

Criminal, civil, and journalistic investigators “follow the money” to identify the culprit of a crime. Public health detectives sometimes follow suit, since income is a well-known indicator of relative healthiness. In a new twist on this association, the worldwide financial crisis appears to be affecting human health in some settings, according to a team of researchers reporting in the November 2008 issue of *Emerging Infectious Diseases*. They studied home foreclosure and West Nile virus (WNV) incidence in the Bakersfield, California, area for 2006 and 2007 and found a parallel rise in both. Notices of delinquency rose 300%, soaring from 500 in the middle of 2006 to 1,500 in the middle of 2007. In the same period, documented human WNV cases rose 276%, peaking at 140.

The rise in WNV cases was a surprise, because the usual predictors—temperature, moisture, and infection rate and population of WNV hosts such as birds and vectors such as mosquitoes—initially pointed to a lower-risk period. The authors attribute the rise in WNV in part to a high number of abandoned homes with swimming pools, hot tubs, and ornamental ponds, many of which became breeding grounds for mosquitoes.

The correlation between abandoned water features and mosquito-borne diseases has been strongly suspected, but there had been little hard proof of the link. States with high foreclosure rates such as Arizona, California, and Florida are working to deal with problem pools. However, Rebecca Shultz, the Arthropod-borne Disease Surveillance Coordinator for the Florida Department of Health, points out that the California findings don't currently apply to Florida because the latter state has had virtually no WNV for the past 3 years. One distinguishing factor may be that Florida's surge



An abandoned pool is a move up for mosquitoes.

in abandoned pools doesn't add significantly to the total breeding area for mosquitoes, as the state is already naturally laced with water bodies, even during long-term drought.

Another factor may be a shift in California's bird host makeup. William Reisen, the California study's lead author and a research entomologist at the Center for Vectorborne Diseases at the University of California, Davis, says that persistent drought, WNV, and other diseases such as avian pox virus had contributed to the decimation of two important local WNV hosts, western scrub jays and house finches. But a third competent host, house sparrows, wasn't hit as hard and rebounded strongly during 2007 with an abundance of young birds who are vulnerable to WNV.

As a followup to the study, Reisen's team is working with the National Aeronautics and Space Administration, Google Earth, and four mosquito control districts representing diverse California settings to study abandoned pools and ponds, and to correlate their observed mosquito-breeding status with satellite images of the water bodies. Once this initial “ground-truthing” has been accomplished, satellite images themselves can provide a quick way to determine problem areas and circumvent typical barriers to effective surveillance such as climbing over fences around pools or relying on neighbors to report problems. If this works for California, Reisen anticipates the methodology could then be available for other states.

Although Florida isn't currently in the same boat as California, Shultz says she is looking forward to having this new tool: “Any time you can speed up the timeline of getting data in, it's very helpful.”

The interactions of natural and human forces in WNV and other emerging infectious diseases are complex, and much remains unknown. But Reisen says his team's study, though limited in a number of ways, illuminates one small example of why such diseases are on the rise: the foreclosures, he says, are “just one aspect of anthropogenic factors altering the ecosystem.” —Bob Weinhold

The Eelman/Stockphoto

The Beat

by Erin E. Dooley

In the Forecast: Better Meningitis Control in Africa

In Africa's Meningitis Belt, which stretches from Senegal to Ethiopia, epidemics of the often-fatal disease occur periodically, generally beginning with the start of the dry season in December and ending with the onset of the rainy season



African Meningitis Belt

in May. A pilot project involving an international team of scientists, funded by a grant from Google's Predict and Prevent Program, will provide longer-term weather forecasts to health agencies in the region so they can better coordinate meningitis vaccination measures. A new vaccine being used by the agencies is currently in limited production, and vaccination efforts are hampered by the need to reach people in remote areas; this effort will help identify the populations most at risk. Though the forecasting methods being used are not new, the meteorologists involved have greater confidence in the accuracy of their predictions than in the past. The project will begin in 2009 in Ghana, a country that has been hit hard by meningitis in the past, and will then roll out to other nations.

Dioxin Found in Irish Meat

In December 2008, Ireland recalled all pork produced in the preceding 3 months after several pork products were found to contain up to 200 times the legal limit of dioxin, a known human carcinogen. The chemical was also

found in Irish beef cattle at up to 400 times the legal limit, but no beef recall was required. The dioxin was traced to a single feed supplier whose product contained dioxin-contaminated oil. In a statement issued December 10, the European Food Safety Authority declared even the most highly exposed consumers were unlikely to experience adverse health effects, given consumption levels and the uncertainty factor built into the European tolerable intake threshold for dioxin. Pork products were back on shelves by December 17.

PM May Feed Tornado Formation

Springtime heralds the onset of tornado season across the U.S. Midwest. In Volume 35, Issue 23 (2008) of *Geophysical Research Letters*, researchers present computer models illustrating how particulate matter can increase the likelihood of tornado formation. In one model representing a relatively clean atmosphere, a rotating cloud formed, but no twister developed. In another model representing 10 times more atmospheric dust, twisters developed. The lack of particles in the

Centers for Disease Control and Prevention

CHILDREN'S HEALTH

National Children's Study Begins Recruitment

After nearly a decade of planning, the National Children's Study is finally set to launch. Scientists hope this 20-year nationwide study will unravel the mysteries of some of today's most significant threats to children's health.

"The National Children's Study will help us understand the biological, genetic and environmental factors that make preterm births so difficult to reduce," says study director Peter Scheidt, medical officer with the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD). "It will help us understand much more about the causes of autism, learning disabilities, asthma, even schizophrenia."

Impetus for the study began in the 1990s with growing evidence that infants and fetuses are particularly vulnerable to environmental toxicants, and that effects of early exposure may not appear until years later. To assess those risks, the President's Task Force on Environmental Health Risks and Safety Risks to Children in 1998 proposed a nationwide longitudinal study. Congress authorized the study in 2000, and in fiscal year 2007 appropriated funding of \$69 million to begin implementation. Another \$110.9 million was appropriated in fiscal year 2008.

The researchers will collect data on the mothers' pregnancies, including their diets, emotional stress, pregnancy problems, and chemical exposures. The unprecedented study will eventually track the health and development of 100,000 children from birth to age 21. Researchers plan to examine the impacts of the children's physical, chemical, psychosocial, and biological environments. They also will investigate the role genetics may play in their subjects' susceptibility or resistance to environmental assaults. Subjects will be enrolled from 105 locations nationwide

to provide a population with ethnic, economic, geographic, and racial diversity.

Study enrollment will begin in January 2009 in Queens, New York, and Duplin County, North Carolina, where workers will go door-to-door enlisting women who are pregnant or soon plan to be. In April, recruitment will expand to parts of Pennsylvania, South Dakota, Minnesota, California, Utah, and Wisconsin. By year's end, researchers hope to have enrolled 1,700 women.

Scheidt and his colleagues view this year's recruitment as a pilot to refine the study before taking it nationwide in 2010, a recommendation mirrored in a study review by the National Academy of Sciences. "We'll learn how we can encourage women to stay with us for the entire twenty-one years," says Scheidt.

The federal agencies coordinating the study include the NICHD, the NIEHS, the Environmental Protection Agency, and the Centers for Disease Control and Prevention (CDC). Universities and hospitals will serve as study centers, enlisting and interviewing subjects, and collecting air, water, dust, and other environmental samples, as well as biological samples including blood, urine, hair, and fingernail clippings. The study directors expect to meet their goal of 100,000 child participants in 2016.

Although the study will span more than two decades, statistically significant data are expected as early as 2012. These early data "will help our understanding of factors related to maternal and child health," says Kimberly Gray, an epidemiologist and administrator at the NIEHS. "We'll learn more about reducing pregnancy complications and poor birth outcomes."

Leaders of the National Children's Study expect independent researchers to use the data for their own studies, the same way many now do with data from the CDC's National Health and Nutrition Examination Surveys. "It will stimulate research," Gray says. "The value will be incredible to the research community." —Cynthia Washam



"clean" model allowed rain to wash out the storm's core, killing the downdrafts that lead to tornadoes. Coauthor David Lerach of Colorado State University says further research in real-world settings, especially in polluted urban areas, is needed to prove the hypothesis.

EPA Forges Medical Waste Regs

In December 2008 the EPA announced revised regulations that will cut the amount of pollution released by U.S. medical waste incinerators by 468,000 pounds each year. Annual

emissions of mercury, a neurotoxicant, will be reduced by 637 pounds, and emissions of dioxin, a known human carcinogen, will be reduced by 40 grams. For almost every pollutant, emissions allowed from medical incinerators will be lower by at least a factor of 10.

Seeing into the Future of CO₂

A group of climate scientists estimates that of CO₂ emitted from fossil fuel burning may linger in the atmosphere far longer than originally believed. Using computer models, the group calculates that more than one-third of anthropogenic CO₂ could remain in the atmosphere for more than 2 millennia. They also confirmed earlier findings that, even if fossil fuel consumption ends, temperatures will plateau at a new higher temperature for at least 500 years. Their results appear in the 2009 *Annual Review of Earth and Planetary Sciences*.

Phthalate Levels Decreasing in Beauty Products

A Little Prettier, a new report by the Campaign for Safe Cosmetics, reveals that 9 of 12 products

tested had reduced or eliminated their phthalate content and that none of the products contained more than 1 phthalate. The report focused on the 12 products identified in a 2002 study as having the highest levels of phthalates. Phthalates are often used to make fragrances last longer; they are not required to be listed on product labels. Diethyl phthalate (DEP), the phthalate most commonly used in cosmetics, has been linked to developmental and reproductive effects in animal studies, and research is beginning to point toward subtle effects in humans.



Some fragrances are using fewer phthalates.