PHYSICIANS HAVE LONG KNOWN THAT HIGH DOSES OF ARSENIC WREAK HAVOC WITH OUR BRAINS, OUR SKIN, AND EVEN THE VERY DIVISION AND REPLICATION OF OUR CELLS. PHYSICIAN-SCIENTIST ANA NAVAS-ACIEN, MD, PHD, HAS MADE IT HER MISSION TO REVEAL WHAT EXTENDED LOW-DOSE EXPOSURE TO THE ELEMENTAL METAL DOES TO THE HUMAN HEART.

Most Americans understand heart disease as an artifact of lifestyle choices—too much couch time, not enough kale, too many cigarettes, not enough yoga. Research by Navas-Acien among indigenous communities residing in the Dakotas, Oklahoma, and Arizona suggests that arsenic, a naturally occurring element common in the soils of North America’s High Plains and in parts of South Asia, might also affect people’s susceptibility to the disease.

In 2016, Navas-Acien joined the Columbia Mailman School as a professor of Environmental Health Sciences and the director of Columbia’s Superfund Research Program (SRP). Since it was founded 18 years ago by Joseph Graziano, PhD, professor of Environmental Health Sciences and of Pharmacology, Columbia SRP has abided by the mission to provide high-quality research on the effects of arsenic and other toxic metals in the environment. The group investigates the effect on human health of arsenic and other co-occurring toxic metals in the groundwater and soil of rural communities, and works to reduce human exposure.

Columbia SRP was established in the aftermath of a 1970s-era campaign in Bangladeshi villages to replace polluted surface...
water sources with freshly dug wells. In the late 1990s, scientists traced skin lesions and a host of other maladies in the region to those wells, which had inadvertently exposed tens of millions of people to upward of 100 parts per billion (ppb) of arsenic in their well water. (The World Health Organization and Environmental Protection Agency have set a threshold of 10 ppb.)

In addition to their work in Bangladesh, Graziano and his team have linked less extreme arsenic exposure to reduced performance among elementary schoolers in rural Maine, revealed how chronic exposure affects human DNA, and developed methods of removing toxic metals from a superfund site in Dover, New Jersey. Last year, Graziano handed off leadership of Columbia SRP to Navas-Acien with an eye toward what she can bring to rural populations in the U.S. “In her work in Native American populations,” he says, “Ana actually replicated what we saw in Bangladesh.”

Navas-Acien has spent much of the past decade digging into data from the Strong Heart Study, a National Institutes of Health (NIH) project launched in 1988 to investigate the cardiovascular health of indigenous Americans. More recently, she’s become co-director of a spin-off project in three participating communities to investigate the adoption of water filtration systems, potentially the best way to mediate arsenic exposure in that region. Filtration is a comparatively straightforward proposition for municipal water districts. But for people who use private well water for drinking and cooking, filtration requires a point-of-access system installed in every home. And unfortunately, each system relies on a filtration cartridge that must be replaced every 3–12 months, at the residents’ expense.

As a result, mediation efforts often exacerbate the socioeconomic disparities already present in a community. “The state of New Jersey is providing a zero-interest-rate loan so that families can afford filtration systems,” says Navas-Acien. “But in American Indian communities, that’s really difficult. Most families can’t afford the point-of-entry filtration systems.” Even replacing the filters can be difficult for inhabitants of reservations, due to both financial and logistical barriers, due to the lack of nearby services and providers. In 2018, Navas-Acien launched a new project to assess the effect of very low arsenic exposure—often through food, primarily rice—in a multi-ethnic population in six urban settings across the U.S.

In addition to her work on arsenic, Navas-Acien investigates the role of other heavy metals in heart disease and strategies to ameliorate their health effects among those who have already suffered chronic exposure. In 2013, an NIH study demonstrated that chelation effectively removes many heavy metals from the human body; patients with a high risk of mortality before the trial showed profound improvement after chelation. “That was a bit of a major disruption to standard clinical practice,” says Navas-Acien, who sees particular promise for those with symptoms due to lead and cadmium exposure. Since 2016, Navas-Acien and her team have worked on a follow-up NIH chelation trial with Regina Santella, PhD, professor of Environmental Health Sciences and vice dean of Faculty Affairs and Research.

Throughout their involvement in the Strong Heart Study, Navas-Acien and her research partners have worked closely with tribal leaders and elders to ensure their sovereignty over their data and their communities, a process Navas-Acien says has been personally and professionally transformative. “We are in a time when data sharing is important, mandatory,” she says. After centuries of being the unwilling participants in hundreds of scientific investigations, indigenous communities are wary of being disenfranchised and dehumanized by the medical establishment. “They have really made me a better scientist because of understanding that we need to truly listen to and respect the participants in our studies. We’re trying to do this together.”

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