



Inside the Lab & Beyond

Turning Waste into Gold with Dr. William Tarpeh

By Julia Dinmore, The Water Research Foundation

A rare few people end up in the career they decided for themselves as children. More often, the question “What do you want to be when you grow up?” yields an answer upon which most of us look back with a smile, a laugh, a shake of the head. We make plans and find ourselves, years later, doing something entirely different from what our younger selves imagined. Dr. William Tarpeh, Assistant Professor of Chemical Engineering at Stanford University and head of the Tarpeh Lab, is no different. In an interview with The Water Research Foundation (WRF), William revealed his childhood dreams of digging up dinosaur bones. “I was always broadly interested in science, but the first science that caught my heart was paleontology.”

Thankfully for the water sector—and at the expense of paleontology—William’s interests shifted. “I wanted to solve problems that I could put my hands around, big and challenging problems,” and the “people-focused” nature of water and wastewater treatment enticed William more than anything else.

Dr. Tarpeh’s path to the water sector seems almost written in the stars. He grew up outside of Washington, D.C., just across the river from Blue Plains Advanced Wastewater Treatment Plant (now part of DC Water). William recounted what it was like crossing the bridge day after day, smelling Blue Plains: “Somewhere

along the way I thought, ‘Okay, water and wastewater treatment—they seem to be invisible, but clearly there are experts who do something with our water that we don’t see.’” Little did he know that he would soon be one of those experts. And not just any expert, but one paving a new way for the entire water sector.



How do you make a career in water?”

A high school service trip to Ethiopia, during which William witnessed and pondered the more intricate

workings of water infrastructure, and a globalization class covering quality of life disparities between different countries sealed the deal for William. “That was when I really thought: ‘Okay, I think I can do something about this.’” From there, he asked himself a question that would define the rest of his life: “How do you make a career in water?”

Dr. Tarpeh earned his Bachelor of Science in Chemical Engineering from Stanford in 2012 and went on to pursue his Master of Science and then PhD in Environmental Engineering at the University of California, Berkeley, completing his studies in 2017. William’s fledgling career in water quickly guided him to WRF. He served as Principal Investigator for WRF Project 4976, *Characterizing, Categorizing, and Communicating Next-Generation Nutrient Removal Processes for Resource Efficiency*, an undertaking that, unbeknownst to him, would pave the way for his future endeavors. This project yielded insights on the five major barriers to nutrient removal and recovery—insights that now help academics and industry practitioners determine impactful directions for the work they’re doing. In Dr. Tarpeh’s words, “We’re giving language to the valley of death that we talk about in broad terms.” With Project 4976, William and his team unveiled the questions so that his future work could aim for answers. Which brings us to today and the revolutionary research being conducted at the Tarpeh Lab.

We’re giving language to the valley of death.”

At WEFTEC 2023, the Water Environment Federation’s Technical Exhibition and Conference, Dr. William Tarpeh was awarded WRF’s esteemed Paul L. Busch Award for the work he and his students are doing to revolutionize wastewater resource recovery. The Paul L. Busch Award recognizes an individual for innovative research in the field of water quality and the water environment, with a special focus on those who show promise and make significant contributions in bridging research and its practical application. The Award carries with it a \$100,000 grant, allowing recipients to continue their work, take risks, and explore new directions. This Award has provided \$2.3 million in

funding to up-and-coming researchers making major breakthroughs in the water quality industry. Dr. Tarpeh will now constitute a part of this Award’s legacy. And rightly so.



The specific project for which Dr. Tarpeh was recognized—Selective, Regenerable Adsorbents for Electrochemical Wastewater Nitrogen Recovery—aims to optimize the processes by which nitrogen is recovered from wastewater. William explained it as solid recycling but with wastewater: “Our job is to design these boxes, or these processes, that wastewater can come into. And then we can produce high purity things like fertilizers, fuels, and commodity chemicals that industries buy and sell with this toolbox of really selective processes.” The lens through which William views wastewater is innovative in and of itself; to him, recovering different elements from wastewater need not be done in individual vacuums. Rather, he views the recovery of things like nitrogen, phosphorus, and potassium as similar problems. “We have to get molecular in terms of how to separate one thing at a time, but the principles we use are translatable between compounds.”

And the principles being put to the test at Tarpeh Lab are also breaking new ground. Dr. Tarpeh and his team are using electrochemistry to drive reactions and transformations. This technological innovation promises several benefits. Firstly, it’s modular, meaning these electrochemical techniques can be scaled up fairly easily. “Another huge benefit is that this makes water treatment really plug and play with renewable energy. If I can use electrons as the driving force and control current and voltage, I can, in simple terms, ‘hook



6 I spend a lot of time thinking about the beauty of building what I wish I'd had."

up' a technology to a solar panel." On top of that, William pointed out that "there's a huge push to electrify chemical manufacturing," begging the question: "Where can we use electricity rather than heat or huge pressure swings to produce chemicals?" With the Paul L. Busch Award, Dr. Tarpeh and his team are carving out a place for this kind of technology within wastewater treatment.

Beyond the lab, William spreads the wastewater gospel. "I spend a lot of time bringing water treatment to people who don't always think about it." With The Electrochemical Society, for example, he has helped run sessions about sustainability, separations, and water treatment at almost every conference over the past five years, "which I think is important because there are people who don't know that their skills can apply to water treatment." William has also collaborated with The American Chemical Society, spearheading conference sessions on electrified water treatment. "We get to see all the cool things people are doing with applying electricity to water and wastewater treatment, which is great because that was a session that didn't exist when I was a PhD student, but I would have loved to present my work at it." William told me, "I try to improve things for the next generation...I spend a lot of time thinking about the beauty of building what I wish I'd had."

This forward-thinking approach has defined Dr. Tarpeh's career and continues to shape the role he plays within the water sector and beyond. Part of his passion for building a stronger foundation for future generations stems from being underrepresented as a black man in science. "There have been times when I'm the only one in the room, which is not something I enjoy." Despite facing this deeply rooted and complex challenge, William persevered. "I found the pockets and places that really welcomed me and helped me do my best work. And now I feel very secure in that I belong, because this has been my community for a long time, and it really drives me to continue to open the door." With his open-minded approach to research and his passion for teaching, Dr. Tarpeh is creating a safe space for the next generation of water scientists to unleash their innovative ideas. "When I think about being a professor of color for students who walk into my intro to chemical engineering class, and they see me at the front of the room, I'm like, 'Wow, I would have really enjoyed that.' I would have felt like someone like me can do this."

Now, Dr. Tarpeh is demonstrating to young minds that anyone can do anything—whether that be digging up dinosaur bones or reinventing wastewater recovery. Having just welcomed his newborn daughter into the world, William is more inspired than ever to show the coming generations that what we view as "waste" now could be "liquid gold" tomorrow.

FOR MORE INFORMATION

www.waterrf.org
info@waterrf.org

6666 West Quincy Avenue
Denver, CO 80235-3098

1199 North Fairfax Street, Suite 900
Alexandria, VA 22314-1445

