NATIONAL WATER RESEARCH INSTITUTE
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2017 CLARKE PRIZE LECTURE FOCUSES ON SOLVING PATHOGEN-RELATED WATER AND WASTEWATER QUALITY CHALLENGES

FOUNTAIN VALLEY, Calif. – According to Dr. Charles N. Haas, the recipient of the National Water Research Institute's 2017 Clarke Prize, pathogens—disease-causing microorganisms in water and wastewater—remain a significant public health concern in the twenty-first century. His Lecture, "An Engineer to Biologists, and a Biologist to Engineers," which was delivered during NWRI's twenty-fourth Annual Clarke Prize Award Ceremony on October 19, in Irvine, California, focused on addressing water quality challenges using a multi-disciplinary approach.

Increasing Concern Over Pathogens

Haas began his Lecture by explaining that issues related to identifying and controlling pathogens remain a challenge to the water industry, despite significant scientific advances over the last century. These issues, as highlighted by the water crisis in Flint, Michigan, have increased the public's awareness of pathogens and required water scientists to address the need for more thorough risk assessment of the safety and quality of water supplies. Risk assessment involves the process in which scientists estimate the potential risk of the effects of pathogens to public health.

Haas has spent much of his career addressing this issue and is known for developing Quantitative Microbial Risk Assessment (QMRA), which involves hazard identification, dose response, exposure assessment, and risk characterization. This valuable tool has influenced the development of public health guidance and policies by prominent organizations both nationally and internationally. The U.S. Environmental Protection Agency has cited Haas' research in the Surface Water Treatment Rule and its iterations (including the Long Term 2 Enhanced Surface Water Treatment Rule) and Ground Water Rule (2006). Haas also used his expertise in QMRA to help the World Health Organization develop both the *Guidelines for Drinking Water* and *Guidelines for the Safe Use of Wastewater, Excreta, and Greywater*. Today, Haas is known as the "Father of QMRA."

Haas drew from his multi-disciplinary background as both a biologist and an engineer to address issues regarding pathogens in water and wastewater. As described in the Lecture, his solution was to meld risk assessment with molecular biology, noting it "will allow more rapid and near real-time assessment of water quality."

Tackling Antibiotic Resistance

In the Lecture, Haas also explored the ability of some pathogens to resist antibiotics, which is emerging as a major public health concern. Pathogens like *Klebsiella* and *Staphylococcus aureus* continue to multiply because antibiotics have lost the ability to control or kill them. As an example, methicillin-

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resistant *Staphylococcus aureus* (MRSA) now represents over 50 percent of *S. aureus* infections in the United States, with half a million hospitalizations per year. Haas stressed the need for more engineering-based quantitative analysis to better understand the role that water management may or may not play in spreading antibiotic resistance and to help define control strategies for addressing this emerging challenge in water and wastewater.

Questions of Climate Change

Another challenge highlighted in the Lecture was the effect of climate change on waterborne pathogens. Haas had become interested in the link between climate change and pathogens through the work of Dr. Joan Rose and other colleagues, who have been analyzing the occurrences of reported drinking water disease outbreaks with preceding precipitation events. He described his own research on infectious water diseases and climate change in suburban counties, and explained that the use of epidemiological tools led him to discover that humidity, rather than temperature, was a better predictor of pathogens in water and wastewater.

He stated that there are more questions than answers regarding climate change, but one possible solution is the creation of better quantitative models that address pathogen-related challenges resulting from climate change, particularly focusing on temperature, precipitation, humidity, and wind-blown dust.

A Proposed Multi-Disciplinary Approach to Risk Assessment

Haas noted that QMRA is a great tool for developing quantitative, engineering-based solutions to water issues, but that it is "an evolving field of practice." Again, he stressed the need to approach biological problems with multi-disciplinary education. For instance, he stated that more collaboration is needed between water scientists and mathematical epidemiologists to understand the link between QMRA and transmission models of contagious diseases.

Haas concluded the Lecture with a quote from Louis Pasteur, who wrote that "Chance favors only the prepared mind." That is, educators need to prepare students to have expertise in one discipline, but understand enough of other disciplines to communicate and interact with researchers in different fields as they work together to solve transdisciplinary water challenges around the globe.

Haas is the twenty-fourth recipient of the NWRI Clarke Prize, which is given annually to recognize research accomplishments that solve real-world water problems. The Clarke Prize is named after NWRI co-founder Athalie Richardson Irvine Clarke, a Southern Californian philanthropist who helped establish the City of Irvine and the University of California, Irvine. More information about the Clarke Prize, including downloadable copies of Haas' Lecture, is available at www.clarkeprize.com.

A 501c3 nonprofit, the National Water Research Institute (NWRI) was founded in 1991 by a group of California water and wastewater agencies in partnership with the Joan Irvine Smith and Athalie R. Clarke Foundation to promote the protection, maintenance, and restoration of water supplies and tor protect the freshwater and marine environments through the development of cooperative research work. NWRI's member agencies include Inland Empire Utilities Agency, Irvine Ranch Water District, Los Angeles Department of Water and Power, Orange County Sanitation District, Orange County Water District, and West Basin Municipal Water District.

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