NATIONAL WATER RESEARCH INSTITUTE

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For more information, please contact:
Gina Vartanian, NWRI (714) 378-3278
www.NWRI-USA.org

TESTING FOR AND TREATING BACTERIA AND VIRUSES IN DRINKING WATER IS TOPIC OF 2016 CLARKE LECTURE

FOUNTAIN VALLEY, Calif. – Despite enormous strides in water quality testing and treatment during the last 150 years, many people still lack access to safe drinking water. And time is running short. With the United Nations Sustainable Development Goals calling for safe drinking water for everyone by 2030, researchers and policymakers need to do more, according to Mark D. Sobsey, the recipient of the 2016 NWRI Clarke Prize for excellence in water research.

Sobsey gave a lecture on advances in water quality testing and treatment at the Annual Clark Prize Award Ceremony, held by the National Water Research Institute (NWRI) on Thursday, Nov. 3 in Newport Beach. The lecture was titled, "Advances and Innovations to Achieve Microbially Safe and Sustainable Water: Detection, Treatment, and Risk Management."

Sobsey is the distinguished professor of environmental sciences and engineering at the Gillings School of Global Health at the University of North Carolina at Chapel Hill, and the twenty-third recipient of the $50,000 Clark Prize. The award is given annually to recognize research accomplishments that solve real-world water problems. Trained as a microbiologist and environmental health scientist, Sobsey has worked extensively on detecting and controlling waterborne viruses and bacteria.

In his lecture, Sobsey outlined the progress that humanity has made in ensuring clean, safe drinking water, and recommended several additional steps that would ensure safe drinking water for all people, including those in developing countries.

It was only in the mid- to late-1800s that scientists using microscopes, filters, and visual staining techniques were able to link certain recognizable diseases, such as typhoid fever, cholera and bacterial dysentery, to fecal contamination of water and inadequate sanitation, Sobsey said. Scientists recognized *Escherichia coli*, or *E. coli*, as a convenient indicator bacterium for fecal contamination in water. Water quality standards governing bacteria levels came into use in the early 1900s and are still used today.

But many places today do not test for the microbial contamination of water. One obstacle to testing for bacterial indicators is the lack of an easy-to-use portable test that even non-experts can conduct. In response, Sobsey developed a simple, self-contained, disposable, affordable test kit made up of a sterile, clear plastic bag with five internal compartments of different volume and a specific culture medium for *E. coli*. A person fills the bag with 100 milliliters of water to which

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the specific culture medium has been added to grow the bacteria, incubates it overnight, and then observes it for a distinctive blue or blue-green color change in each compartment that indicates the growth of *E. coli*. The compartments, whether positive and negative for *E. coli* growth, are compared to a table to determine the concentration of *E. coli* in the water. Chlorine tablets are used to decontaminate the kit afterwards.

Normally, water managers use central treatment systems to clean water from aquifers and reservoirs before conveying it to customers in closed, protected systems. But such centralized distribution systems are unavailable to many people in developing countries. Household water treatment and safe storage methods could help fill the gap, according to Sobsey.

People have treated water at the point-of-use for centuries, usually by boiling, settling, or filtering. Modern treatments, such as adding chlorine, are available in the developed world, but often not in developing countries. Increasing the adoption of household water treatment systems could increase access to safe drinking water. Particularly effective are microporous filters, such as ceramic pots and biosand filters, that do not require chemical additives and work continuously.

Viruses in human fecal waste have long been known to pose a significant threat to water sources and human health, but detecting them is difficult because of low concentrations and contaminating microorganisms, Sobsey said. Although advancements have been made in testing techniques, testing for all waterborne human enteric viruses that people shed in their fecal waste is still impractical. Fortunately, a group of fecal indicator viruses – coliphages, which infect *E. coli* bacteria – exists and functions similar to the way *E. coli* acts as a fecal indicator bacterium for pathogenic bacteria. Effective methods to test for coliphages in water already exist, but are not widely used.

Sobsey recommended increasing testing for both waterborne viruses and bacteria to, for instance, identify the bacterium that causes cholera. Researchers also should work on improving treatment methods. One promising method is the use of chitosans, which are chemical derivatives of the chitin from crustacean shells. Lastly, scientists should search for antimicrobial-resistant enteric bacteria in wastewater to determine their potential to cause infections.

Sobsey is the twenty-third recipient of the NWRI Clarke Prize, which 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 the 2016 Clarke 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 to 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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