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What you see is not what you get: the deceptive nature of E. coli plate counts in water quality monitoring

by

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Host: Dr Bae Sung Woo
Department of Civil and Environmental Engineering

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College of Design and Engineering
National University of Singapore
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*** All are welcome and admission is free***

Abstract

Fecal pollution is the leading cause of waterborne diseases in developed and developing countries. For decades, governments worldwide have relied on culture-dependent enumeration of fecal bacteria, including *Escherichia coli*, to indicate fecal pollution in water resources. In this method, individual cells of fecal indicator bacteria in water samples grow into visible colonies on a culture plate. The number of colonies observed for a given volume of sample is compared into an index of health risk that has been determined a prior using epidemiological studies. Although the method is straightforward and incurs low capital and operational, it suffers from several limitations and biases, leading to inaccurate water quality assessments. One major source of error is due to phenomenon of bacteria entering the viable-but-not-culturable state when exposed to environmental stress, such as chlorine disinfection of sewage effluent. This can result in an underestimation of *E. coli* plate count and hence an overestimation of disinfection efficacy in sewage effluent. Another source of error is the naturalization of *E. coli* in the environment after pollution events and the presence of cryptic clades of *Escherichia* that naturally exist in unpolluted environments. These phenomena can result in high *E. coli* counts even in the absence of recent pollution. This presentation will provide an overview of the research in my group that seeks to understand the science behind these phenomena and identify ways to overcome the limitations that culture-dependent enumeration causes in water quality monitoring. The multi-omics approach, including genomics, transcriptomics, and proteomics, are used in conjunction with lab experiments and field observations. The goal is to develop more accurate and reliable methods for water quality monitoring, which will improve public health and ensure the safety of water resources for all.

Speaker's Biography

Stanley Lau is a marine microbiologist by training. He obtained a PhD degree in Biology at the Hong Kong University of Science and Technology by investigating the chemical and biological interactions between marine bacteria and marine invertebrates. Following his PhD, he worked as a postdoc at HKUST, the Max Planck Institute for Marine Microbiology in Germany with a fellowship awarded by the German Research Foundation, and finally the National University of Singapore. Currently, he is an Associate Professor and Acting Head in the Department of Ocean Science at the Hong Kong University of Science and Technology. He is also the Director of Ocean Research Facility, and the Director of the MSc Global Marine Resources Management program, which is a newly established dual degree program together with the University of Southampton in the UK. His current research seeks to understand the impacts of sewage pollution on the function and diversity of marine bacterial communities in coastal marine environment. For example, the horizontal transfer of antibiotic resistance genes, the resilience of the indigenous bacterial community to pollution perturbation, the fate of pathogens that are resistant to chlorine disinfection, and the development of molecular biology tools for the assessment of pollution impacts. Besides education and basic research, he contributes to the society by providing expert advice to a number of government agencies for the management of the seawater quality and marine ecosystem in Hong Kong.

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