Quantifying the Effect of Microbial Immigration in Engineered Water Systems

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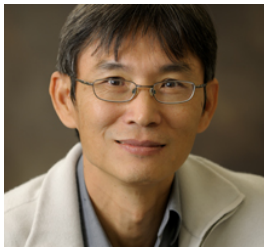
ABSTRACT

Immigration is a process that can influence the assembly of microbial communities in natural and engineered environments. However, it remains challenging to quantitatively evaluate the contribution of this process to the microbial diversity and function in the receiving ecosystems. Currently used methods rely on abundance profile to reveal the extent of overlapping between the upstream and downstream communities, and thus cannot suggest the quantitative contribution of immigrants to the downstream community function because activities of individual immigrants are not considered after entering the receiving environment. This limitation can be overcome by using an approach that couples a mass balance model with high throughput DNA sequencing, *i.e.,* ecogenomics-based mass balance. It calculates the net growth rate of individual microbial immigrants and partitions the entire community into active populations that contribute to the community function and inactive ones that carry minimal function. Linking activities of immigrants to their abundance further provides quantification of the contribution from an upstream environment to the downstream community. Considering only active populations can improve the accuracy of identifying key environmental parameters dictating process performance using methods such as machine learning.

Short bio:



Dr. Liu is a Professor Emeritus of Environmental Engineering & Science program at the Department of Civil and Environmental Engineering at the University of Illinois at Urbana-Champaign. His research focuses on "water microbiome" that describes the ecological roles of microbes in different water systems including watershed, drinking water systems, and wastewater treatment and reclamation systems. In studying water microbiome, the greatest scientific challenges are to fully understand the role of microbes and correlate the findings with comprehensive metadata in individual water systems. The knowledge can be further used to improve natural and urban water cycling and to protect the public health. Some of Dr. Liu's awards include the IWA-ISME Biocluster Award Grand Prize (2018) and Walter J. Weber, Jr. AEESP Frontier in Research Award (2020). He has published more than 250 articles in peer-reviewed journals and books (Google citation > 25000).