Soil and Environmental Microbiology

Characterizing Antibiotic Resistance Genes in Soil and Surface Water

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Threats associated with antibiotic resistant pathogens in the environment are well known. However, antibiotic resistance genes (ARGs) are now recognized as emerging environmental threats that may require prevention and mitigation strategies to protect human health. Both animals and humans, may excrete up to 95% of antibiotics in an unaltered state. While, some antibiotic removal has been observed in wastewater treatment plants and in agricultural waste treatment systems, none of the systems are designed to remove antibiotics. As a result, residual antibiotics are released into the environment where they may exert selection pressure for resistance to develop in indigenous and pathogenic microorganisms. Complicating the issue, when antibiotic selection pressure ceases, typically, ARGs remain in the microbial populations.

Critical information on the circulation of ARGs of clinically relevant pathogens will be determined by evaluating microbial community DNA from soil and surface waters impacted by agricultural waste (e.g. swine lagoon effluent) and/or municipal waste (wastewater treatment plant effluent/biosolids). Samples from nearby “control” sites where soils and surface waters were unlikely influenced by agricultural/municipal waste will be evaluated for ARGs of clinically relevant pathogens for comparison.

Our goals are to (i) Survey the distribution and occurrence of a broad spectrum of ARGs including four clinically relevant pathogens (methicillin resistance gene meca of staphylococci, β-lactam resistance gene ampC of Enterobacteriaceae, carbapenem resistance gene blaVIM of Pseudomonas aeruginosa, and the vancomycin resistance gene vanA of enterococci) in soil and surface water samples. (ii) Evaluate the trends of the distribution and occurrence ARGs according to sample type (soil, water) and waste influence (agricultural, municipal) and (iii) Determine the need for ARG monitoring in soil and surface waters.