Abundance of Multidrug Resistant Genes (MDRs) in Suburban Residential Community Soil

Shah, Anand (School: Unionville High School)

Antibiotic resistance is a serious health concern that affects millions of patients globally. Over the last few years, Multidrug Resistant Genes (MDRs), have worsened the disease load that antibiotic resistant pathogens have placed on our society. Agricultural and polluted industrial soils are well-established reservoirs of MDRs. However, the presence of MDRs in non-agricultural, non-commercial residential soil has not been well-studied. This is the first reported study comparing the presence of MDRs in pristine soil to that in non-agricultural, non-commercial residential soil. qPCR studies were conducted on soil microbiomes to determine the level of prevalence of eight MDR genes. Microarray and shotgun metagenomic analysis were performed to further characterize MDRs in the soil microbiome. Results indicate that all MDR genes in residential soils were present at higher concentrations than pristine soils. Across the sampling locations, hotspots for individual MDRs can be observed, indicating heterogeneity of the prevalence of the genes. DNA microarray experiments confirm the parallels between the presence of MDRs and Antibiotic Resistance Genes (ARGs). Shotgun metagenomic sequencing indicates that efflux pump genes coding for proteins that are responsible for removing the drugs from the cells were the most prevalent MDR genes in the soil microbiome. Microbial community structure-biochemical functional analysis shows the presence of these genes in a wide array of soil bacteria. The presence of MDRs in residential soil is of concern as children and individuals directly interact with the soil, increasing the likelihood of being infected by multidrug resistant pathogens.

Awards Won: