MODELING BACTERIAL TRANSPORT WITH HORIZONTAL GENE TRANSFER IN POROUS MEDIA

Tamir Kamai, University of California, (530) 752-1707, tkamai@ucdavis.edu

1. Tamir Kamai, University of California, Davis
2. Nanxi Lv, University of Illinois at Urbana-Champaign
3. Arash Massoudieh, The Catholic University of America
4. Thanh H. Nguyen, University of Illinois at Urbana-Champaign
5. Timothy R. Ginn, University of California, Davis

Horizontal gene transfer is widespread among bacteria and is an important component of microbial evolution and trait dispersal. Horizontal gene transfer can facilitate the dissemination of genetic traits such as antimicrobial resistance or p athogenicity. Soil surfaces provide a natural reservoir for transferrable DNA because adsorbed DNA is protected from enzymatic degradation. Bacteria motility can exert primary control on the frequency and residence time of bacteria to associate with soil surfaces, and therefore is likely to affect the frequency of horizontal gene transfer between bacteria and adsorbed DNA. Here we report preliminary experimental and modeling analyses of the relationship among bacteria motility, bacteria filtration, and gene transfer through natural transformation on surfaces of saturated porous media. Bulk scale data from column experiments highlights different behaviors of flagellated vs. non-flagellated strains in their respective accumulation on surfaces. Deposition of the flagellated strain in glass column exceeded that of the non-flagellated strain and the deposition rate coefficient (Kbp) increased 1 fold as ionic strength changed from 1 mM to 100mM; however, the non-flagellated strain Kbp did not show correlation with ionic strength. Modeling incorporates nonlinear attachment kinetics and projects the transformation kinetic rate expressions based on our recent prior results for conjugation, converted to accommodate dependence on residence-time on surfaces coated with DNA.