In Situ Correlated Molecular Imaging of Chemically Communicating Microbial Communities

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This project is exploring the potential of heterocorrelated mass spectrometric (MS) and confocal Raman microscopy (CRM) chemical imaging, as targeted to the problem of microbial/environmental processes. Specifically we are: (1) enhancing the functionality and performance of secondary ion mass spectrometry (SIMS) and laser desorption ionization (LDI) via tandem MS and improving the spatial resolution and analyte range by introducing a high-flux C_{60} source along with improved stage control and automated collection routines; (2) developing nanoparticle-enhanced correlated imaging with heightened spatial/temporal resolution and increased sensitivity; (3) developing a laboratory testbed for the *in situ* (natural) system to enable the simultaneous investigation of all components (bacteria-root-fungus) of a three-component rhizosphere model. Initially, we are examining the bacterium *Pseudomonas aeruginosa*, starting with the "relatively" simple case of *P. aeruginosa* group motility on idealized surfaces, imaging of homoserine lactones and surface remodeling with rhamnolipid and then transitioning to a more complex three-component system, composed of a bacterium (*P. aeruginosa*), a fungus (*Laccaria bicolor*) and model root derived from *Populus deltoides*. This poster will report on initial results based on chemometric approaches to Raman spectral devolution in complex matrices and enhancements to sensitivity in both LDI-MS and SIMS imaging.