Chemical Communication in Microbial Communities Probed by Correlated Raman and Mass Spectrometric Imaging

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Correlated chemical imaging is an emerging strategy for acquisition of images by combining information from multiplexed measurement platforms to track, visualize, and interpret *in situ* changes in the structure, organization, and activities of interesting chemical systems, frequently spanning multiple decades in space and time. Acquiring and correlating information from complementary imaging experiments has the potential to expose complex chemical behavior in ways that are simply not available from single methods applied in isolation, thereby greatly amplifying the information gathering power of imaging experiments. However, correlating image information across platforms presents a number of challenges. First, signals are obtained from disparate experiments with fundamentally different figures of merit, including pixel size, spatial resolution, dynamic range and acquisition rates. In addition, images are often acquired on different instruments in different locations, so the sample must be registered spatially so that the same area of the sample landscape is addressed. The signals acquired must be correlated in both spatial and temporal domains, and the resulting information has to be presented in a way that is readily understood. We are exploring the potential of heterocorrelated mass spectrometric (MS) and confocal Raman microscopy (CRM) chemical imaging, targeted to problems in microbial community development. This talk will center on the use of correlated CRM-MSI to understand the community behavior of *Pseudomonas seruginosa* and will illustrate how integrating the tools of modern molecular/cellular biology with advanced chemical imaging concepts can yield heretofore unknown (and unknowable) features of the collective behavior of bacteria.