

# HOPE COLLEGE CHEMISTRY SEMINAR

Mass Spectrometric Imaging of Antibiotics, Proteins, and Metabolites in Bacterial Biofilms and Animal Tissue

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## *Abstract*

Mass spectrometric (MS) imaging has been developed to provide spatially resolved chemical analysis of intact animal and plant tissue [1] as well as bacterial biofilms [2,3]. Bacterial biofilms are structured communities of microbes encapsulated within a self-developed polymeric matrix which adhere to surfaces and display genetic expression distinct from freely floating bacteria. Matrix assisted laser desorption ionization (MALDI-MS) [1] and laser desorption postionization (LDPI-MS) [2,3] are used to probe the chemical constituents of intact bacterial biofilms and antibiotics introduced into those biofilms. MALDI-MS is used to detect proteins and peptides expressed by bacterial biofilms, using methods previously developed for animal tissue [1]. The motivation for single photon ionization via vacuum ultraviolet radiation in LDPI-MS is described, then the method is used to detect antibiotics and other products in biofilms. Femtosecond laser ablation is demonstrated for depth profiling of animal tissue, as evidenced by both MALDI-MS and LDPI-MS. Finally, a new laser ablation MS is demonstrated on test samples and its future use is projected for three dimensional MS imaging of intact biological samples.

## *Biography*

*Luke Hanley is Professor and Head of the Department of Chemistry at the University of Illinois at Chicago (UIC). He received his B.Sc. and Specialist in Chemistry from the University of Toronto in 1983 and his Ph.D. in physical chemistry from the State University of New York at Stony Brook in 1988. His U.S. National Science Foundation Postdoctoral Research Fellowship in Chemistry was completed at the University of Pittsburgh from 1988 to 1990, with Professor John T. Yates, Jr. In addition to his appointment in Chemistry, he is also an adjunct professor of Bioengineering at UIC, where he has been a faculty member since 1990. In 2009, he was awarded the UIC Researcher of the Year Award and was elevated to a fellow of the American Vacuum Society. He was a NSF Young Investigator in Chemistry from 1994 to 1998 and a University of Illinois Scholar during this period. His research focuses on the surface modification and analysis of organic thin films. He has co-authored over 110 refereed papers on topics related to laser desorption, laser ionization, surface science, mass spectrometry, analytical chemistry, and bioengineering. He develops and applies advanced instrumental methods to modify and characterize materials surfaces. His recent research projects have included the development of new methods in mass spectrometric imaging, organic-inorganic nanocomposite materials for optoelectronic applications, the surface chemical modification and analysis of biomaterials, and probing antimicrobial transport from biomaterials into bacterial biofilms. He has also had extensive collaborations at Lawrence Berkeley, Argonne and other U.S. national laboratories.*