Unraveling the spatial lipidome using gas-phase ion/ion reactions

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Imaging mass spectrometry is a powerful technology that enables the visualization of biochemical processes directly in tissues by combining the molecular specificity of mass spectrometry with the spatial fidelity of microscopic imaging. This label-free technology has proven exceptionally useful in areas of study such as cancer diagnosis, diabetes, and infectious disease. However, these types of modern imaging mass spectrometry studies are already stressing the limits of current analytical technologies and improvements in molecular specificity and sensitivity are crucial in order to answer increasingly complicated biological and clinical questions. Especially when studying lipids and metabolites, there are many isobaric and isomeric ions that complicate spectral analysis, with each isoform having a potentially unique cellular function. While traditional tandem mass spectrometry (MS/MS) approaches can distinguish amongst these compounds in select instances, this is often not the case. Additionally, the ion type most readily generated from tissue is rarely the type that affords the most chemical structural information upon MS/MS. Our group is developing gas-phase reactions that afford the ability to transform the ion type without manipulating the sample. While traditional analytical analyses oftentimes simply use the mass spectrometer as a detector of molecular mass, we instead use the mass spectrometer as a reaction vessel to perform unique gas-phase transformations to provide unparalleled levels of chemical resolution. These gas-phase transformations are fast, efficient, and specific, making them ideally suited for implementation into imaging mass spectrometry workflows.

Biography:

Boone M. Prentice received his B.S. degree in Chemistry with Honors and Distinction from Longwood University (Farmville, VA) in 2008 with minors in Biology and Mathematics. At Longwood, he conducted electroanalytical research focused on developing biosensors under the supervision of Professor Melissa C. Rhoten. He attended graduate school at Purdue University (West Lafayette, IN) under the mentorship of Professor Scott A. McLuckey and received a Ph.D. in Chemistry in 2013. His Ph.D. research focused on

ion trap mass spectrometry (MS) instrumentation development as well as gas-phase ion/ion and ion/molecule reactions involving biopolymers. Boone then worked as a postdoctoral research fellow in Professor Richard Caprioli's laboratory at Vanderbilt University (Nashville, TN) where he studied matrix-assisted laser desorption/ionization (MALDI) imaging mass spectrometry instrumentation and applications. Specifically, he worked on Fourier transform ion cyclotron resonance (FT-ICR) and time-of-flight (TOF) MS systems and applied imaging mass spectrometry to the study of diabetes, cancer, drug delivery, and infectious disease. Boone joined the Department of Chemistry at the University of Florida as an Assistant Professor in the fall of 2018. His research focuses on the development of instrumentation for gas-phase reactions as well as novel sample preparation workflows for imaging mass spectrometry in seeking to better understand the molecular basis of health and disease in areas such as infectious disease, diabetes, neurodegeneration, and sepsis.