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Department of Chemistry
Kolthoff Lectureship in Chemistry

Professor Scott McLuckey

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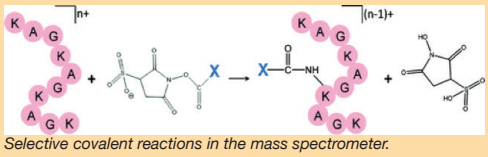
Faculty Host: Steven Kass

Scott McLuckey is the John A. Leighty Distinguished Professor at Purdue University. He earned his Bachelor of Science degree in chemistry from Westminster College in New Wilmington, PA, and his doctorate in chemistry from Purdue University. Professor McLuckey is an award-winning scientist whose honors include the American Chemical Society Field and Franklin Award in Mass Spectrometry, Fellow of the American Association for the Advancement of Science, ANACHEM Award from the National Federation of Analytical Chemistry and Spectroscopy, and American Chemical Society Division of Analytical Chemistry Award in Chemical Instrumentation. His service to the chemistry community includes serving as president of the American Society of Mass Spectrometry, and editor for the *International Journal of Mass Spectrometry*. His research initiatives are heavily directed toward relatively large polymeric species including peptides, proteins, oligonucleotides, and synthetic polymers. Current projects include the application of electrospray and ion/ion chemistry to the rapid sequencing of DNA, the study of the dissociation chemistry of multiply-charged macro-ions, and the combination of ion/ion chemistry and unimolecular dissociation chemistry for the rapid identification of proteins in complex mixtures.

Lecture #3

New Reactions for Tandem Mass Spectrometry II: Selective Covalent and Non-covalent Ion/Ion Reactions

9:45 a.m. Thursday, April 7, 2016, 331 Smith Hall



Selective covalent reactions in the mass spectrometer.

Chemical reactions have long played central roles in virtually all instrumental approaches in chemical analysis. Analyte species are commonly subjected to reactions to improved sensitivity, specificity, dynamic range, etc. Gas-phase ion/ion reactions involving multiply-charged ions is a relatively new class of chemical reactions that can be used in conjunction with mass spectrometry to address issues in (bio)chemical analysis. The prior lecture in this series described fundamental aspects of ion/ion reactions and illustrated a number of applications based on proton transfer and electron transfer reactions. Most of the described applications can be considered to be mature in the sense that they have been optimized and demonstrated with current analytical challenges. This lecture is intended to be forward looking and emphasizes what new opportunities there may be for gas-phase ion/ion reactions to enhance specificity and sensitivity in analytical mass spectrometry. This lecture therefore emphasizes reactions other than single proton or single electron transfer. In particular, reactions that provide a high degree of specificity, such as functional group specific covalent reactions, allow for the derivatization of analyte ions in the mass spectrometer. The ability to make such modifications in the mass spectrometer, as opposed to in solution, can provide many analytical advantages. Specific ion/ion reactions that have been discovered in the last few years include those for primary amines, arginine side-chains, carboxylic acid groups, carboxylate groups, methionine residues, etc. In some cases, analytical applications have already been developed and in other cases promising applications are being explored. The line of work presented in this lecture is intended to lead to a major expansion in the chemistries that can occur within the context of an MSn experiment. At this early stage, much of the spirit of the work is analogous to research in synthetic organic chemistry, where the objective is to make a particular bond of interest. Ultimately, the synthetic tools currently under development will enable powerful new methodologies for the structural characterization of bio-molecules via tandem mass spectrometry.

Izaak Maurits Kolthoff was born on February 11, 1894, in Almelo, Holland. He died on March 4, 1993, in St. Paul, Minnesota. In 1911, he entered the University of Utrecht, Holland. He published his first paper on acid titrations in 1915. On the basis of his world-renowned reputation, he was invited to join the faculty of the University of Minnesota's Department of Chemistry in 1927. By the time of his retirement from the University in 1962, he had published approximately 800 papers. He continued to publish approximately 150 more papers until his health failed. His research, covering approximately a dozen areas of chemistry, was recognized by many medals and memberships in learned societies throughout the world, including the National Academy of Sciences and the Nichols Medal of the American Chemical Society. Best known to the general public is his work on synthetic rubber. During World War II, the government established a comprehensive research program at major industrial companies and several universities, including Minnesota. Kolthoff quickly assembled a large research group and made major contributions to the program. Many of Kolthoff's graduate students went on to successful careers in industry and academic life and, in turn, trained many more. In 1982, it was estimated that approximately 1,100 doctorate. holders could trace their scientific roots to Kolthoff. When the American Chemical Society inaugurated an award for excellence in 1983, he was the first recipient.