

Analytical Chemistry Seminar

Tuesday, December 5, 2023
3:30 p.m. ~ WTHR 320

"Rapid Susceptibility Testing of Single Cells by Stimulated Raman Spectroscopy"



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Abstract:

Bacterial and fungal infections are major causes of mortality and morbidity in healthcare environments where compromised immune systems are common. To analyze an infection's susceptibility to various drugs the current gold standard is the broth microdilution (BMD) analysis. This analysis takes approximately 24-48 hours to obtain results while the patient is still fighting the infection. Reducing the time for a positive identification is crucial for providing effective treatment and reduce patient mortalities. Dr. Weili Hong of Beihang University has utilized Stimulated Raman Spectroscopy (SRS) to reduce the analysis time to hours with a femtosecond laser setup and growth method. For antimicrobial susceptibility testing (AST) the single-cell metabolism inactivation concentration (SC-MIC) was found and compared to BMD results with an overall categorical agreement of 86.5% under broth growth conditions. Following the positive SC-MIC determination urine and blood samples confirmed the viability of the analysis in a clinical setting. Antifungal susceptibility testing (AFST) can be used to determine single-cell metabolic responses for different classes of drugs. The single-cell minimum change concentration (SC-MCC) for reduced metabolic activity was found with Amphotericin B (AMP) however increased metabolic activity was observed for fluconazole (FLC). To further probe the increased activity micafungin and voriconazole were analyzed for the SC-MCC with similar results. Finally positive blood cultures were analyzed to determine the efficacy of this method. The results demonstrate that SRS is a rapid and sensitive technique capable of running clinical samples.

Bio:

Thomas Sams is a second-year graduate student studying Mass Spectrometry in the Dr. R. Graham Cooks Lab. While attending the University of Utah he performed undergraduate research in the Dr. Peter B. Armentrout Laboratory. Research in this lab involved ionization source development for thermochemical analysis of small molecules. Upon graduation in 2018 with a B.S. in Chemistry he worked as an Environmental Analytical Chemist at ALS Laboratories performing semi-volatile analysis. In 2019 he found a position as a Field Service Engineer at LC-GC Scientific Inc. which involved the maintenance, repair, qualification, and sales of chemical instrumentation with a focus on mass spectrometry. Currently his research in Aston Labs focuses on the integration of high throughput analysis and two-dimensional tandem mass spectrometry.