Analytical Chemistry Seminar

Tuesday, November 28, 2023
3:30 p.m. ~ WTHR 320

"Navigating the Storm: Machine Learning Meets Microfluidics for COVID-19 Cytokine Storm Detection"

Maura Wimsatt

Graduate Student, Purdue University

Maura Wimsatt is a second year graduate student. She graduated from the University of Maryland, College Park with a Bachelor of science in chemistry and a minor in atmospheric chemistry. During her time as an undergraduate student, Maura interned at the Food and Drug Administration, Center for Veterinary Medicine, Office of Research, Division of Residue Chemistry. In this role, she studied drug stability of popular veterinary drugs using high-performance liquid chromatography and mass spectrometry. Last fall, Maura joined the Garth Simpson group for nonlinear optics. Her research currently focuses of diffusion imaging of different polymer and drug systems with amorphous solid dispersions (ASDs) using Fourier transform fluorescence recovery after photobleaching (FT-FRAP)

Abstract:

Cytokine storm, an aggressive inflammatory response of the immune system characterized by an elevated release of cytokines, has been associated with life-threatening complications in severe COVID-19 patients, including multiple organ failure, respiratory distress, and death. Current methodology, enzyme linked immunosorbent assay (ELISA), for detecting and profiling cytokine storms lacks in sensitivity, accuracy, practicality, and timely results, making it difficult for patients that have developed cytokine storms to be diagnosed and treated effectively. To accommodate for these methods, microfluidic nanoplasmonic digital immunoassays assisted by machine learning have been proven to be accurate for cytokine storm detection in COVID-19 patients. This developed immunoassay solves the limitations presented by the ELISA method. The microfluidic microarray patterning technique allows for high throughput, low sample consumption and multiplex detection of six different types of cytokines. The nanoplasmonic digital imaging using silver nano cubes for signal transduction, improves the sensitivity allowing for lower concentrations of cytokines to be detected. Machine learning assisted image processing using convolutional neural networks shortens the processing time and maintains higher accuracy compared to commercial methods. This method has demonstrated its efficacy by being tested with many severe COVID-19 patients, providing them with a diagnosis for proper treatment.

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