Cellular organisms are composed of complex highly regulated biochemical networks including various metabolites that exist over a wide concentration range with diverse physical and chemical properties. This presents analytical challenges for achieving a high coverage of the metabolome. Due to the exquisite sensitivity and selectivity mass spectrometry (MS), it has been at the forefront for the detection and quantitation of biomolecules from complex biological mixtures and tissue sections. Due to their biochemical plasticity, microorganisms are being explored as alternative sources to fossil fuels and conventional nitrogen based fertilizers to support sustainable practices. New technologies need to be developed capable of rapid metabolic screening of genetically-induced mutant strains, and identify the most desired microbes to improve biomass production for biofuels and biological nitrogen fixation (BNF).

My research entails the development of new matrix-free MS techniques for improved molecular coverage, and implementation of nanophotonics for MS-imaging (MSI) and subcellular analysis. Laser ablation electrospray ionization (LAESI) MS is an emerging technique for the detection and molecular imaging of metabolites, lipids, and peptides from intact biological samples at ambient conditions. To improve the molecular coverage, ion mobility separation (IMS) has been coupled with LAESI to resolve isobaric species within milliseconds. This technology allows us to screen for unique metabolite and lipid profiles from genetically modified *Chlamydomonas reinhardtii* and the well-characterized interaction between soybean (*Glycine max*) and a soil bacterium (*Bradyrhizobium japonicum*). To study metabolism in highly heterogeneous tissues LAESI can be combined with brightfield and fluorescence microscopy for the selective targeting of specific cell types. Additionally, through pulse-chase experiments, the turnover rate of these lipids in microalgae has been determined by LAE-SI-IMS-MS by detecting and monitoring the abundance of nitrogen labeled compounds as a function of time. To mitigate spectral interferences and ion suppression effects encountered in matrix-assisted laser desorption ionization MS, laser desorption ionization (LDI) from enhanced nanophotonic platforms has been introduced. For example, LDI from silicon nanopost array (NAPA) platforms has been applied for molecular imaging of mouse brain tissue sections and subcellular analysis of mammalian lamellipodia structures. Recently we have extended the capabilities of the NAPA platform by introducing elevated bowtie arrays that have exhibited improved ionization efficiency by enhanced near-field effects within the nanoscale gap regions of the bowties.

**BIO**

Sylwia Stopka received her BS in Biochemistry from The State University of New York at Oswego, where she studied polybrominated diphenyl ethers within environmental samples using gas chromatography. Currently, at the George Washington University her research entails developing new instrumentation and methods for the high-throughput mass spectrometric analysis of single cells with increased molecular coverage, and enhanced nanophotonic ionization for ultra-trace analysis.

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*Friday, October 13, 2017*
SEH B1220
2:00 - 3:00 p.m.
Refreshments will be served at 1:45 p.m.