Rapid Protein Mixture Fractionation on RF Plasma Polymer Modified Sample Stages with Analysis by MALDI Mass Spectrometry

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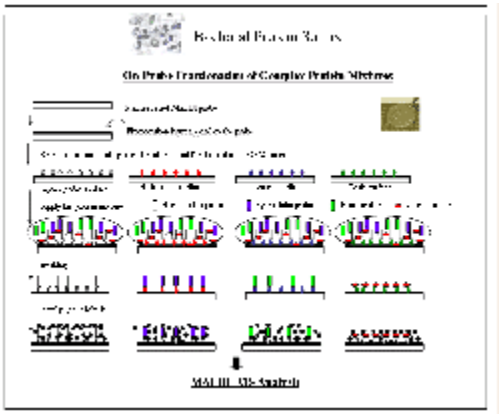
Now that the mapping of the genetic sequence of many organisms is well underway, many bioanalytical laboratories today are involved in the daunting task of attempting to characterize all proteins expressed by a given biological systems i.e., the so-called cellular proteome. In short, it is believed that mapping of targeted cellular proteomes, under various conditions, has the potential to yield new approaches for the diagnosis of disease, new targets for drug therapy, and new detection tools for chemical/biological weapons, among a host of other important outcomes. In these proteomic characterization efforts biological mass spectrometry (MS), and in particular matrix-assisted laser desorption / ionization (MALDI) MS, has emerged as an essential tool, allowing characterization of large numbers of proteins directly extracted from various organisms.

The research in our group focuses on expanding the utility of MALDI MS for these proteomic investigations through the development of high-performance surface modified MALDI probes that allow the rapid on-probe fractionation and analysis of the complex mixture of proteins targeted in a typical investigation. Our approach to the development of these devices involves the use of a radio frequency plasma to deposit polymer thin films directly on the surface of MALDI probes and the optimization of the conditions used to chemically or bioselectively fractionate protein mixtures prior to MALDI MS analysis. The rf plasma polymer deposition approach allows us to explore the utility of an extraordinarily rich array of surface chemistries for these proteomic fractionation applications, including non-fouling surfaces, temperature responsive surfaces, solvent responsive surfaces, etc. Our results confirm that this on-MALDI-probe fractionation approach to the characterization of cellular proteomes provides substantial enhancements in the information content of the mass spectral data and can be successfully used for the discovery of biomarkers indicative of cellular stress, disease, etc.



REU students will find themselves in an extraordinarily rich research environment, with the opportunity to gain hands-on experience in any of a number of areas, including modern mass spectrometry instrumentation, RF plasma polymer deposition equipment, thin-film surface characterization tools and cutting edge biological analysis apparatus. Specific projects that will involve REU students include (1) optimization of on-MALDI-probe fractionation conditions using control mixtures of peptides and protein, (2) isolation and mass spectrometric identification of bacterial peptides/proteins showing distinctive fractionation behavior within behavior/structure correlation studies, and (3)

creation and characterization of new RF plasma polymer surface films. These areas of research are well-established and the REU student will find themselves in a position to make contributions of significance to a variety of future professional publications and presentations.