Title: Characterization of DNA Microarray Surfaces

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Abstract: DNA microarrays are powerful bioinformatics tools developed for the analysis of complex DNA samples and acquisition of expression information in biological research. While this microarray technology offers an enormous potential for obtaining sequence-specific information in a faster and inexpensive manner compared to traditional methods, it has several limitations in detection sensitivity and selectivity especially when dealing with complex biological samples (e.g. serum, cell lysate). We therefore propose to use the collective expertise offered by NESAC/Bio in high-resolution analytical methods such as X-ray photoelectron spectroscopy (XPS), time-of-flight secondary ion mass spectrometry (ToF-SIMS), near edge X-ray absorption fine structure (NEXAFS), and surface plasmon resonance (SPR) and PNNL in in situ neutron scattering to establish quantitative understanding about the composition, density, and orientation of the immobilized single-stranded (ss)-DNA probes and hybridized double-stranded (ds)-DNA molecules on microarray surfaces and correlate this information to DNA microarray performance. Some preliminary analysis of standards required for further investigation of DNA microarrays has already been done on thiolated ss-DNA probes self-assembled as thin layers onto gold surfaces. The outcome of this proposed research will provide new and useful quantitative molecular information for the rational design of future DNA microarrays and enhance our knowledge about the chemical and physical states of the immobilized DNA molecules on a microarray surface.