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Label-Free Sensors/Fluorescence Imaging
Engineering
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Our technology is a label-free protein and microarray technique. Direct monitoring of primary molecular binding interactions without the need for secondary reactants would markedly simplify and expand applications of high-throughput label-free detection methods. We developed a simple interferometric technique - Spectral Reflectance Imaging Biosensor (SRIB) - that monitors the optical phase difference resulting from accumulated biomolecular mass. [1]. Dynamic measurements were made at ~10 pg/mm2 sensitivity. We have also demonstrated simultaneous detection of antigens and antibodies in solution using corresponding probes on the SRIB surface as well as label-free measurements of DNA hybridization kinetics. Recently, we demonstrated that our technique is quantified and calibrated [2]. The observable detection signal can be directly translated to biological mass on the surface.

Regarding implications in cancer diagnosis and treatment: Development of an integrated platform for the analysis of nucleic acids for label-free, rapid-testing of breast cancer biomarkers, combining multiple-gene testing on a single chip, thus enhancing reliability and specificity while reducing the time, cost and complexity of testing. The first application can be targeted at gene expression (mRNA) biomarkers, but the technology is expandable to include other nucleic acid markers, including genomic DNA and microRNA (miRNA).

Clinical Benefit: The result will be simple, cost effective test that gives the doctor all the needed information in a single test, and which paves the way toward including addition information that may help the clinician determine the best treatment plan for a particular patient.

Outcome: The outcome of this effort will be an integrated platform that combines a multiplexed SRIB chip with a microfluidic nucleic acid extraction device, optimized for on-chip sample preparation and detection near the point of care. This test platform will deliver important information about tumor biomarkers without the need for fixing and paraffin embedding of biopsy tissue and the readout will be label-free, thus greatly accelerating time to result.

1. Ozkumur et al, "Label-free and dynamic detection of biomolecular interactions for high-throughput microarray applications," PNAS, 105, pp. 7988-7992 (2008).

2. Ozkumur et al, "Quantification of DNA and protein adsorption by optical phase shift," Biosensors and Bioelectronics, Vol. 25, September 2009, pp. 167-172 (2009).