American Cancer Society – Institutional Research Grants 2013

"Ultra-sensitive protein detection for early cancer diagnostics using magnetic tunnel junction (MTJ) biosensors"

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The practice of medicine is approaching the stage where molecular testing dictates not only the diagnosis of disease but also the corresponding treatment regimen. With the rapid evolution of molecular medicine, illnesses previously classified as single disease states like breast cancer, actually include many molecular variations where each variant has its own root of origin. Accordingly, each molecular variant may carry a unique prognosis and a unique response to therapy. The ability to categorize cancers into precise molecular subtypes may dramatically improve patient outcomes by providing individuals with targeted therapy. Current methods for protein biomarker detection, however, are limited by their sensitivity, multiplexing capacity, or, their uncontrollable response to the composition of complex biological samples. Thus there exists a strong need for technologies that are capable of addressing all of these unmet needs allowing earlier diagnosis and subtyping of cancers.

The long term goal of this research effort is design, build, and demonstrate an ultra-sensitive (femtomolar and lower concentration), multiplex (8-24 biomarkers), matrix insensitive protein biomarker detection platform capable of providing physicians with a patient's molecular signature to dictate therapy, instead of relying upon a patient's subjective set of signs and symptoms. The objective of this proposal is to lay the groundwork and demonstrate several of the key concepts and high risk items of this platform on a small scale. The proposed research is divided into three Specific Aims. Aims 1-2 focus on key aspects of technology development and Aim 3 concerns the integration and demonstration of the technology platform.