Numerous biomarkers are now available for identification of complex and heterogenic diseases, such as cancers, along with biomarkers that are linked to different stages of disease progression. For screening and disease identification, the clinical laboratory requires rapid, sensitive, accurate measurement of biomarkers in blood samples. Presently, enzyme-linked immunosorbent assays (ELISAs) using biomarker antibodies are the standard for clinical analysis of disease biomarkers. Although sensitive, ELISAs are slow and laborious, taking many hours to complete, requiring labeled, detection molecules and a significant amount of blood sample.

Technology Description

Dr. Atashbar has developed a Bio-Sensor Microsystem for detecting blood-borne biomolecules. This integrated system incorporates; a micropump for delivering a sample to the microsensor, a microcontroller for regulating the micropump, a microheater for maintaining the temperature of the sample, a microsensor for detecting the presence of a target biomarker in the sample, and a signal processor for analyzing the microsensor signal. The micropump is based on acoustic streaming, in which the fluid flows in the direction of a generated acoustic wave, eliminating pump valves and diffusers. The microsensor generates shear horizontal surface acoustic waves (SH-SAW) that are perturbed by protein binding, changing the substrate mass and altering the SH-SAW associated electrical field. The microsensor utilizes single wall carbon nanotubes (SWNT), functionalized with antibodies or complementary oligonucleotides to bind the target biomarker with high specificity.

The Bio-Sensor Microsystem accurately measures low picomolar quantities of biomolecules in a blood sample as small as 10 µl. Miniaturizing biomarker assays using this device offers many advantages, including requiring less sample and reagents, short reaction times, high sensitivity, portability, and no external valves, pumps or hoses. In addition, no labeled, detector molecules are required for sensitive and accurate biomarker measurement.

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Potential Benefits

- Single unit that pumps, heats and measures target molecules in sample volumes as small as 10 µl

- Uses functionalized SWNTs for highly specific binding of target biomarkers

- Instantaneous measurement of a blood-borne biomarker down to low picomolar concentrations

- No labeled detector molecules are required for biomarker measurement