

Nanomonitors: A miniature electronic biosensor for early disease diagnosis

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Heart disease more specifically vulnerable coronary plaque rupture, which is the cause of acute coronary syndromes stroke, peripheral vascular limb ischemia, and other end-organ ischemic diseases, is one of the leading causes of death in Kansas. Approximately 50% of Kansas population lives in rural areas and 13% of Kansas population are above 65 years, an age group where ACI (Acute Coronary Insufficiency) is one of the major causes of death. More importantly approximately 13% of Kansas population does not have health insurance. Hence, it becomes essential to develop technologies, which enable rapid and cost effective diagnosis of ACI in a pre-symptomatic state.

The primary purpose of this research is to develop an inexpensive and user friendly 'point-of-care' (POC) device for pre-symptomatic diagnosis of ACI through the detection of two proteins that have been identified as biomarkers for this disease.

Inflammation and thrombosis are key mediators of vulnerable coronary plaque and NT-BNP and Troponin-T are two proteins which are biomarkers of this condition.

We have utilized nanoporous alumina membranes to generate high surface area to volume structures for trapping protein biomolecules. We employ the protein specific capacitance measurement method as the basis for protein biomarker detection. We demonstrate device performance parameters for protein biomarker detection in purified and spiked serum samples to be comparable to the current gold standard: ELISA.