Prostate Cancer Diagnostic Device: The Application of Multiplex Lateral Flow Immunoassay for the Detection of Prostate Specific Antigen (PSA)

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Prostate cancer (PCa) is the second most common cancer found in men globally and has the highest mortality rate in men when compared to other cancers. However, early diagnosis of PCa has led to a decrease in the mortality rate. Nevertheless, current PCa diagnostic methods are expensive and highly invasive. Recently, the incorporation of microfluidics in PCa diagnostics has led to a drastic decrease in costs—but these decrease in costs have also led to a decrease in accuracy of these devices. In this research, a diagnostic device is developed using the principles of lateral flow immunoassay (LFA) to detect multiple PCa biomarkers (PSA variants) within a sample of blood. The three PCa biomarkers that were used in the device were free PSA, total PSA, and PSA/ACT. Through molecular engineering principles, gold nanoparticles (GNP) were conjugated to PSA antibodies through EDC/NHS chemistry for the purposes of: 1) acting as a vehicle to carry PSA conjugated with anti-PSA to the immobilized anti-PSA test site, 2) utilizing GNP's unique optical property of local surface plasmon resonance to enhance the colorimetric results given by horseradish peroxidase (HRP). Using ELISA, the proposed biochemical mechanism was tested and validated. When tested on 52 patient blood samples, the diagnostic device had an accuracy of 92.3%, sensitivity of 95.5%, false positive rate of 5.8%, and false negative rate of 1.9%. This diagnostic device makes the testing for PSA simple, fast, and effortless—with potential for greatly reducing the costs of Prostate cancer diagnosis and the mortality rate.

Awards Won:
Third Award of $1,000