Detection of Prostate Cancer Biomarker, Alpha-Methylacyl-CoA Racemase (AMACR), Using a Nanoparticle Electrochemical Biosensor

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The most common detection method at present for prostate cancer is prostate-specific antigen (PSA) testing. However, PSA detection is associated with numerous problems. Lack of specificity is a major shortcoming. Prostate cancer is not the only health issue that could result in elevated PSA level.[1] In addition, PSA is unable to differentiate between aggressive and indolent cancer.

A promising replacement for PSA is the detection of Alpha-Methylacyl-CoA Racemase (AMACR), a novel biomarker for the detection of prostate cancer. The association between AMACR and prostate cancer has been demonstrated repeatedly previously.[2,3] AMACR has great sensitivity and selectivity in differentiating prostate cancer from healthy and benign prostate cells. No clinically useful assay has been developed yet. In this study, we demonstrated the detection of AMACR using a single use, disposable nanoparticle biosensor. Our screen-printed IrO nano-catalyst sensor exhibits great sensitivity and selectivity toward the detection of hydrogen peroxide. Combining with the pristanic acid (a substrate for AMACR) to hydrogen peroxide pathway as shown in Figure 1, we successfully determined AMACR concentration from the detection of H_2O_2 produced from the substrate of pristanic acid.

Human blood samples were used to demonstrate the feasibility of our detection method. 24 samples were provided by the hospital and a blind measurement of AMACR level was performed. These samples were consisted of 5 prostate cancer patients, 9 healthy males, and 10 patients with high grade prostatic intraepithelial neoplasia (HGPIN). 100% accuracy was achieved in separating samples of prostate cancer patients from the rest. The average concentration of AMACR for healthy individuals and HGPIN patients were 0.005μg/μl and 0.0004 μg/μl respectively. In this study, we have demonstrated that the assay for AMACR detection using an electrochemical biosensor for reliable and repeatable detection measurements. .

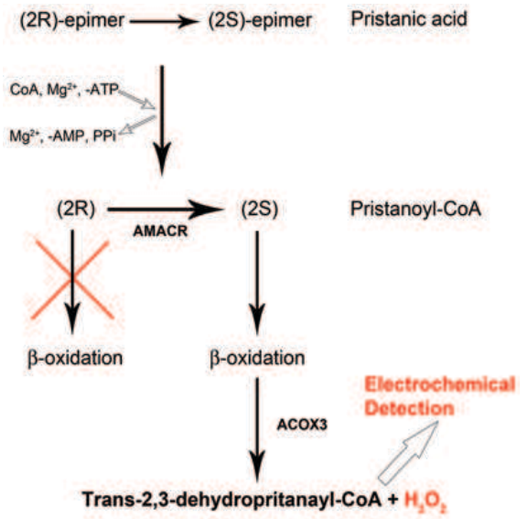

Figure 1. Pristanic acid to hydrogen peroxide pathway

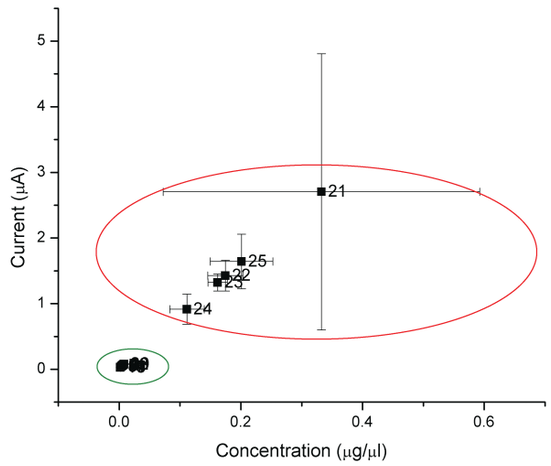

Figure 2 Biosensor reading from the 24 test subjects. Samples 1~9 are from healthy individuals. Samples 11~22 are from men with HGPIN. Samples 21-25 are from prostate cancer patients (Red circle includes sample from patients with prostate cancer. Green circle includes the rest. Note: Sample 10 is not available.)

Reference

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