CarC SPY: Non-Invasive Early Stage Multi-Cancer Detection Using AI-based Electrochemical Biosensor to Detect Circulating Tumor Cells (CTCs)

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Current Cancer Diagnostic methods are inaccurate and time-consuming with invasive procedures, mostly resulting in late-stage detection. In contrast, we have strong evidence that treating cancer early has higher prognosis. So, a reliable early cancer diagnostic is much needed. CarC SPY is an AI-based electrochemical biosensor that accurately detects cancer-specific biomarkers (proteins) secreted in an organism's cell culture or blood plasma to determine cancer. CarC SPY biosensor uses antibodies to detect these biomarkers called bio-receptors to detect and generate a signal upon existence of atto-concentration of these biomarkers. CarC SPY, also has an Artificial Intelligence engine built-in to increase the sensitivity of the biosensor during biomarker detection from Circulating Tumor Cells (CTCs) and simultaneous multiple cancers. A FET circuit board, signal conditioning unit, transducers, and python-based data processing algorithms were implemented to fabricate the biosensor. Further, Western Blots and Auto Dock Vina (for correlational statistical analysis, $p = 0.002$, R-squared = 0.97) were used to determine ideal cancer biomarkers and respective bio-receptors for 9 cancer types studied in this research. CarC SPY was successfully tested to detect specific cancers in a multi-biomarker situation with CTCs using the blood plasma of a model organism Planaria, simulating the diagnostic like a simple blood test. Sensitivity of the biosensor was improved further with an integrated AI-engine (96% test accuracy) that optimized the biosensor environment through pH and temperature modifications, which maximized binding efficacy with biomarkers. CarC SPY, with above results, has the potential to create a new wave of innovation in the field of early cancer diagnostics.

Awards Won:
Second Award of $2,000