POCKET: A Multiplexing Point-of-Care Kinetic Electrochemical Test Using Aptamers for Accessible, Rapid Diagnostics

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Nearly half of the world's population, 47%, has little to no access to diagnostic testing, which can delay care until conditions become critical. This gap in diagnostic access limits timely screening for common conditions and harms resource-limited settings. Current methods such as ELISA, lateral flow assays, and qPCR that attempt to bridge this gap are expensive, inaccurate, or require professional training, making them unjustifiable for patients with mild or ambiguous symptoms. To mitigate these problems, we propose POCKET, an affordable, rapid platform that delivers multiplexed diagnostics in one step. POCKET's system begins with a passive microfluidic module that filters whole blood to plasma. Plasma is then led to a disposable, gold screen-printed sensor coated in an XPS verified surface chemistry, containing an antifouling layer and DNA aptamers to target two biomarkers. Aptamers are attached to distinct redox tags to generate electrochemically separable peaks, read by a custom-made, portable PCB potentiostat. Signals from the potentiostat are transmitted via Bluetooth to a mobile application where voltammograms are processed to generate a diagnosis that can be shared with clinicians and family members, enabling a rapid response. Our device is $30, requires <15 minutes, and has LODs of 40 pg/mL and 127 pg/mL for TNF-a and VEGF respectively, making it as cheap as a lateral flow assay and as accurate as an ELISA kit being within 10% of its LOD. POCKET is the first sensor that has the potential to revolutionize point-of-care diagnostics by serving as the first scalable, end-to-end system of care.

Awards Won:
Third Award of $1,200
Sigma Xi, The Scientific Research Honor Society: First Physical Science Award of $1,200