



Contribution ID: 88

Type: **Flash Talk**

miRNA biomarker detection in the fight against Cardiovascular Disease

Thursday, 18 November 2021 16:30 (10 minutes)

miRNAs are small, 22 nucleotide long RNA sequences. They are found in every cell type and perform the role of regulating gene expression. Research in the field has also identified free miRNA in a variety of bodily fluid. Their availability and their role in gene regulation make them attractive targets as biomarkers for the advanced detection of many diseases such as CVD, one of the leading causes of death globally. Changes in gene expression is the earliest marker for cells entering a disease state and as such miRNA can offer earlier markers than traditional protein biomarkers. This work describes the detection of miRNA related to cardiovascular disease using a sandwich assay design. The use of gold nanoparticle functionalized carbon ink screen-printed electrodes allows the electrode surface to be readily functionalised with capture strands of RNA, and simultaneously provides a low background substrate for the assay. The sandwich assay design uses platinum nanoparticles to catalyse the degradation of hydrogen peroxide. The current generated in this reaction is then quantified using chronoamperometric measurement which correlates with the amount of target miRNA concentration. Micromolar levels of miRNA can be detected using the assay design. The platform also offers single use functionality and rapid testing times (2 minutes total) with the aim of creating an ultrasensitive miRNA quantitative assay. These are both significant advances to gold standard qPCR assays for nucleic acid detection of disease biomarkers.

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Session Classification: Day 2

Track Classification: Sensors