Title:	Aptamer functionalized nanobioprobe based sensing platforms for cardiovascular diseases
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Abstract:	The research work in this thesis deals with the thorough investigation of various sensing approaches to develop an advanced aptasensing platform for the diagnosis of cardiovascular diseases, by targeting specific serum biomarkers (i) Myoglobin (ii) B-type Natriuretic Peptide (iii) Troponin I. In this study, DNA aptamers were chosen as the bioreceptors and different transducers were comparatively investigated to find the best candidate for the monitoring of cardiac diseases. For the generation of DNA aptamers, advanced variants of its generation method named Microtitre plate-SELEX & BLI-SELEX were developed and used to generate aptamers against Myoglobin, Troponin I & BNP. A plethora of nanomaterials & composites were synthesized to act as ultra-sensitive transducers for the biosensors, and a comparative analysis of fluorescence, electrochemical & Raman-based biosensors was performed for the detection of selected cardiac markers using their specific aptamers. The field applicability of the fluorescence-based platform was exploited by developing it into a smartphone based point-of-care device for myoglobin. Electrochemical transducers were found to be most suitable due to their wide range of detection (1pg/mL – 16 µg/mL on phosphorene-modified sensor), and ease of operation & field applicability, although Raman- based platform produced the lowest detection limit (10 fg/mL – 0.1 µg/mL on AuNP decorated WS 2 nanosheets). Based on this, a WSe 2 nanosheets based impedimetric biosensor was developed for the detection of B-type natriuretic peptide (0.1 ng/mL – 10 µg/mL). Finally, photolithographic microfabrication was used to develop a microfluidics device based on a dual cellular separation mechanism. The device showed remarkable ability of cellular separation (~99%) from whole/diluted blood samples, and was further developed into a multiplex device. The device was demonstrated for its multiplexing abilities for the simultaneous detection of myoglobin (1 ng/mL – 1 µg/mL) and troponin I (10 pg/mL – 10 ng/mL).
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