

ECIS 2023 – Plenary
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Designing and translating nanomaterials for healthcare

This talk will provide an overview of our recent developments in the design of colloidal nanoparticles to detect disease biomarkers, such as abnormally regulated enzymes, to extend the detection window for early disease diagnostics and to develop sensitive detection assays that are simple, cost-effective and easy deploy to the point-of-care [1]. We are exploiting the sensing capabilities of nanoparticles to engineer paper-based lateral flow immunoassays (LFIAs) and nanosensors for in vivo disease diagnostics that produce a colorimetric response ideal naked eye read-out [2]. We are also integrating CRISPR-based preamplification-free multiplexed nucleic acid biomarker detection which has been validated for prostate cancer and cardiovascular disease (CrisprZyme) [3]. We integrate our portfolio of nanoparticle-based sensing probes for diagnosing and monitoring infectious and non-communicable diseases harnessing smartphone technology for transformative mobile health (mHealth) approaches [4]. We are also developing advanced characterisation techniques for high-throughput label-free characterization of single nanoparticles -SPARTA™ [5] which is becoming an integral tool for the design of nanotherapeutics [5] with recent examples including DOPC-containing lipid nanoparticles for nucleic acid delivery and dendrimersome-based systems for controlled delivery of antibacterial drugs, and for profiling extracellular vesicles (EVs) for detection of breast cancer through a minimally invasive liquid biopsy. I will also discuss the multi-scale approach that we use to understand how the incorporation of biological and topographical cues at the bio-interfaces enhance tissue regeneration, wound healing and cell differentiation [6]. Finally, I will discuss how we are actively engaging in efforts towards the democratisation of healthcare innovations [6].

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