A Digital Twin for Quantitative Immunoassays

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Project ID: 2228cd1398 (You will need this ID for your application)

Research Theme: Healthcare Technologies

UCL Lead department: London Centre for Nanotechnology (LCN)

Department Website

Lead Supervisor: Michael Thomas

Project Summary:

Lateral flow assays have received significant attention in recent years owing to their critical role in patient self-testing for SARS-CoV-2. Typically these devices are considered qualitative or semi-quantitative analytical tools that are challenged by sample handling, liquid properties, mixing of components, stability of reagents and limited dynamic range. This means they are not considered appropriate for measuring the quantity of a particular analyte of interest in a patient sample, only whether it is present above a certain threshold. This limits the application of such devices in settings where the concentration of analyte has a clinical, scientific or industrial significance – for example, lateral flow devices are inadequate in commonplace testing for dysregulation of host markers in primary care settings, and in in situ testing of complex samples during environmental studies and bioprocess monitoring. This project aims to apply mass transport models for the development of a Digital-Twin that replicates the behaviour and response of lateral flow assays, and other immunoassay devices to facilitate optimisation and innovative design to support rapid design-test-build cycles. Supported by in-device calibration and novel measurement modes the project seeks to enable quantitative lateral flow diagnostic development to realise devices capable of mitigating their low-cost manufacturing limitations to yield accurate and quantitative measures of analyte concentration in biological samples. The project builds off our existing expertise in paper-based biosensor development for ultrasensitive diagnostics and fluid dynamics modelling. The project is multidisciplinary in nature and would require a student with a background in a STEM discipline. The student will work primarily within the London Centre for Nanotechnology with Dr. Michael Thomas as well as the Department of Mathematics with [Dr. Philip Pearce] (https://www.ucl.ac.uk/~ucahppe/group.html).
