

Point-of-Care Digital Microfluidics

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Point-of-care testing describes the analysis of patient samples at or near the patient, such as at the patient's bedside or in the clinic, rather than in a distant laboratory. Fundamental to many point-of-care tests is miniaturization of chemical analysis. Often, microfluidic technologies underpin these tests and offer the advantages of reduced reagent consumption and decreased sample volumes. There are many examples of point-of-care tests based on microchannels and paper-based microfluidics, but until recently, tests relying on a third microfluidic regime – digital microfluidics (DMF) – have been lacking.

Digital microfluidics is a liquid handling technology for the manipulation of discrete droplets of liquids on a generic array of hydrophobic insulated electrodes. In this regime, routines are “programmed” into the droplets, and software generated protocols are independent of the microfluidic chip architecture. By coupling sensors to probe droplets for chemical information, DMF can be used to miniaturize and automate routine chemical and biological assays. This talk will describe several efforts toward translating DMF from the research laboratory to a point-of-care setting, including a field trial of a DMF immunoassays in a refugee camp as well as methods for integrating of a variety of electrodes for electrochemical sensing. Results from the field trial showed good (>80%) clinical sensitivity and specificity. Also, electrochemical immunoassays performed on DMF devices with integrated nanostructured microelectrodes had limits of detection on the same order of magnitude as chemiluminescent methods.