Nanopore Sensing via Microfluidic Devices and Data Handling

Brian Sheetz, Robert B. Chevalier, James T. Hagan, Mellissa Morris & Jason R. Dwyer

Chemistry, University of Rhode Island, Kingston, RI

The ability to detect or sense the presence of a specific molecule is employed by almost every scientific field in some way. The sensitivity of these measurements is relative to the work being done, and for analytical sciences the limits of detection are constantly being tested and improved. The employment of nanopores to the sensing field has greatly increased the limit of detection and it has been proven that single molecules can be detected as they translocate nanopores[1]. Currently, analysis is carried out in "bulk" solution with channels leading to the pores. The scale of a nanopore is such that, nano, and does not require samples to be in a bulk form. Microfluidic methods have shown tremendous versatility when it comes to the manipulation of micro-scale fluids[2].

Combination of microfluidics and nanopores eliminates the bulk solution from the nanopore sensing methods and allows for single molecule sensitive detection to be implemented into the microfluidics realm. Secondly, the detection of single molecule translocations calls for fast and sensitive detection electronics. Currently, the most accurate method to analyze translocation data is to do it manually. The extensive time requirements needed to manually analyze data has created a need for a faster and less energy intensive method. A computer program capable of analyzing translocation data with the same or greater accuracy as manual analysis solves this problem and is explored.

[1]Ghosal, S., Sherwood, J. D. & Chang, H.-C. Solid-state nanopore hydrodynamics and transport. *Biomicrofluidics* 13, 11301 (2019).

[2]Chiu, D. T. *et al*. Small but Perfectly Formed? Successes, Challenges, and Opportunities for Microfluidics in the Chemical and Biological Sciences. *Chem* 2, 201–223 (2017).