

A NEW faSTR FORENSIC DNA SYSTEM FOR PORTABLE, COST-EFFECTIVE STR PROFILING

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In 2006, we demonstrated that microfluidic technology could provide a 'lab-on-a-chip' solution for real-world genetic analysis with sample-in/answer-out bacterial detection in sub-30 minute analytical time¹. We extrapolated these technology developments to the analysis of short tandem repeats (STR) in human DNA, where our efforts led to the development of a commercializable system designed for implementation in crime labs for STR profiling reference samples². An intricate but functional microfluidic architecture allowed sample-to-profile to be achieved from a cheek swab in less than 80 minutes, using nanoliter flow control, infrared thermocycling and rapid electrophoretic separation of DNA with 5-color fluorescence detection. We have more recently focused on smaller, more-cost-effective STR analysis system designed for rapid limited-locus analysis. This has evolved in the form of the faSTR DNA Profiling System, where the key is simplification of the microfluidic device that is CD-sized, fabricated from overhead transparencies and driven by centrifugal motion³. This allows complex flow control without vacuum/pressure pumps or mechanical valves. Using a custom multi-locus panel in collaboration with Promega that provides the necessary RMP for the specific application, we demonstrate the ability to effectively type samples in ultrafast mode with cost-effective microfluidic discs and a portable instrument that is the size comparable to three stacked reams of paper and approaches 10 lbs. Capable of use by unskilled personnel, the potential for order of magnitude decrease in the cost of the instrument and of the consumable approaches reality, which will ultimately allow for a handheld STR profiling system.

¹Proc Natl Acad Sci 103(51):19272-7, 2006.

²Anal Chem 86(16):8192-8199, 2014.

³Nature Protocols 10(6):875-86, 2015.