A198 Demonstration of Rapid STR Separations on Microfluidic Devices With a Novel Detection System

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After attending this presentation, attendees will have learned about the development of rapid STR separations using microfluidic devices.

This presentation will impact the forensic science community by demonstrating how the development of rapid DNA separations on polymeric microfluidic devices will reduce the overall time and cost required for DNA typing.

The increase in demand for forensic DNA analysis services has led to a significant backlog of forensic casework samples due to time- consuming and laborious conventional analysis techniques. This backlog is driving the development of new analytical techniques that will reduce the time and cost associated with forensic DNA analysis. Conventional STR analysis requires extraction and quantitation of the genomic DNA, multiplexed PCR amplification of the STR loci, and electrophoretic separation of the amplified STR fragments. Currently, the electrophoretic separation is performed on a large capillary electrophoresis (CE) instrument and requires up to 40 minutes or more to complete. Decreasing the time and cost associated with the process can increase the throughput of a crime laboratory.

Microfluidic devices have the potential to address these throughput issues by offering a low-cost analysis with significantly shorter sample- to-answer time. The advantages of microfluidic devices come from the ability to integrate the analytical steps into a single device. This single device will require less user interaction than conventional processes and more efficiently transfers the sample from one analytical process to the next.

Microfluidic chips can perform STR separations in significantly less time than conventional CE methods. Additionally, the chip must be made from a low-cost, single-use substrate to minimize the cost per analysis. The work presented here compares high-resolution DNA separations on multiple substrates using different laser-induced fluorescence (LIF) detection methods completed in less than 10 minutes.

STR separations on a microfluidic device require a robust detection system capable of performing multiple separations simultaneously. Here,

comparison of a detection system on which integrated STR analysis has previously been demonstrated (Proceedings of the Micro-Total Analysis Systems Conference, 2009) with the next generation system capable of simultaneous multi-channel detection. The systems are compared on the basis of sensitivity, data acquisition rate, and the flexibility to scale up to multiple microfluidic separations.

In addition to minimizing sample-to-answer time, decreasing the cost-per-run is critical for crime laboratories increasing throughput. The cost of the chip substrate can account for a significant portion of the analysis cost. Alternative polymeric substrates that can provide a low- cost, single-use alternative to conventional glass microfluidic substrates will bw evaluated. The substrates are compared on a basis separation time and resolution of commercially available STR kits. The presented work on alternative substrates and scalable LIF detection systems represents significant progress toward an integrated microfluidic system capable of low-cost, simultaneous sample processing. **DNA, Separations, Microchip**

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