G91 A Rapid Penta STR Screening Method by Microchip Capillary Electrophoresis

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After attending this presentation, attendees will understand the development of a fast and portable DNA screening method that uses microchip electrophoresis for forensic DNA applications. Attendees will gain an understanding for how this system operates, the limitations of the system, and how these limitations were surmounted to achieved the desired resolution on the microchip.

This presentation will impact the forensic community by development of a multi-loci penta DNA system in combination with an STR micro-chip electrophoresis system that provides a new tool for quick and portable screening in forensic DNA analysis.

Due to the ever-increasing forensic DNA caseloads and the potential need for remote forensic DNA analysis, DNA analysis systems that are both quick and portable are needed. While short tandem repeat (STR) DNA analysis by capillary electrophoresis is capable of high resolution and has a large power of discrimination in forensic identification, these instruments are not portable and require a relatively long sample run time. It is on this basis that this study aims to develop a rapid and portable DNA screening method using a commercially available microchip electrophoretic system. Generally speaking microfluidic systems require fairly long channels and complex detection systems for proper resolution and identification of forensic DNA. However there currently exists commercially available systems, such as the Agilent 2100 Bioanalyzer, which have a small footprint and utilize chips with short channels and reduced resolution. Such portable systems might be valuable in situations where evidence screening is necessary in remote locations. However due to its lower resolution, most STRs will not properly separate on such a system. In this project the development of mini-Penta STRs as potential tools for microfluidic analysis was investigated. These five base STRs should produce more consistent results in such circumstances.

The design and development of such a portable system capable for forensic DNA screening with high enough resolution for single allele separation required that the following issues be investigated in order to increase the resolution. First the analysis of the current Penta STR markers available from Promega Corporation and redesign of these primer sets to reduce amplicon size and improve the mobility and separation within the micro-channel. Secondly, the development of a denaturing polymer for single stranded DNA separation to be used on the microchip that would take advantage of the improved resolution in single stranded DNA assays. Finally, the development of a Penta multiplex STR kit that would increase the power of discrimination for forensic samples and become a more powerful forensic tool.

These studies were designed to overcome the limitations of current microchip systems for portable forensic applications by trying to increase the resolution of the short micro-channels. It is with these changes that the resolution of the system should be capable of separating between five base pair repeats accurately and robustly.

This research will address the problems and limitations encountered with the current systems such as poor resolution, large amplified DNA fragments, and the ability to only detect double stranded DNA on the currently commercial available microchip systems such as the Agilent 2100 Bioanalyzer. As a result of this research the development of a multi loci penta DNA system in combination with an STR microchip electrophoresis system should provide a new tool for quick and portable screening in forensic DNA analysis.

DNA, Penta STR, Microchip

 ** Presenting Author*