A177 Rapid STR Amplification in Conventional and Biochip Systems

Eugene Tan, PhD, Network Biosystems, 1B Gill Street, Woburn, MA 01801*

After attending this presentation, attendees will become familiarized with recent advances in biochip based DNA analysis systems and, in particular, with a biochip-based rapid multiplex PCR module that enables STR amplification to be performed in approximately 17 minutes.

This presentation will impact the forensic community by demonstrating biochip-based multiplex amplification, a major step towards the development of a fully integrated, samples-in to results-out STR analysis system. The rationale for developing biochip-based DNA analysis tools is that a fully integrated system has the potential to reduce the time, labor, and cost of performing STR analysis. These advances may increase the capacity of forensic laboratories as well as reduce the current backlog of casework and database samples. Furthermore, a fully- integrated system that can be operated in the field offers the potential to expand the use of STR analysis beyond an evidentiary role at trial to an investigative role at the crime scene. A fully integrated STR analysis system based on microfluidic biochip technology for forensic laboratory and field-forward operation will be described. This system comprises three modules to perform: (1) DNA purification and human specific DNA quantification, (2) multiplexed STR amplification, and (3) separation and detection of the resulting amplicons.

The development of a rapid PCR amplification module that can be applied to both conventional tube- and biochip-based systems will be reported. Rapid biochip based multiplex amplification is accomplished by a custom thermal cycler that heats and cools reaction solutions within an accompanying biochip at rates of approximately 15°C/sec. The single- use disposable biochip processes 16 samples simultaneously and is fabricated by injection molding. Following optimization of amplification reaction components and thermal cycling protocols, the system allows thermal cycling to generate full profiles with commercially available STR primer kits in approximately 17 minutes. Similar results are achieved in conventional tube reactions with a fast commercial thermal cycler. All STR amplifications are characterized by separation and detection on a microfluidic biochip-based electrophoresis system, Genebench-FX™ Series 100.

Data will show the resulting STR profiles satisfy forensic interpretation guidelines for signal strength, inter-loci peak height balance, heterozygous peak height ratio, incomplete non-template nucleotide addition, and stutter. It will be demonstrated that rapid STR amplification can be utilized in forensic laboratories and that the biochip- based approach is well-suited for incorporation into a fully integrated microfluidic forensic DNA analysis system.

STR Analysis, Multiplex PCR, Biochip

 ** Presenting Author*