RAPID STR SCREENING USING SHORT MICROCHIP CAPILLARY ELECTROPHORESIS

Maurice J. Aboud, MS.[1], Marcus Gassmann, PhD[2], Saman Saleem[1], Bruce McCord, PhD[1]
[1]Florida International University, Department of Chemistry and Biochemistry, University Park, Miami Fl 33199
[2]Agilent Technologies, Hewlett-Packard Strasse 8, 76337 Waldbronn, Germany

While analytical systems using multicapillary sequencers are well adapted for large-scale sample collection from blood or buccal swabs, these systems are neither portable nor flexible enough for use in applications such as border crossings or police stations where time to result is critical nor are they sufficiently portable for use in screening evidence at mass disaster sites. Currently such screening is done by fingerprinting, however DNA typing is a far more powerful tool and could replace or enhance the capability of border agents and police agencies across the world to rapidly identify persons of interest if sufficiently fast and portable systems could be developed.

These reasons, amongst others within the scientific community, have lead to great interest in the development of rapid microfluidic chip based screening and genotyping. A small subset of the full cadre of DNA markers could be used to quickly screen submitted samples for DNA. Stains containing non-probative DNA from the victim and other household members can be eliminated using this technique, saving time and valuable reagent costs. Another reason for interest in microfluidic genotyping is its portability. Portable genotying systems would be of great value in mass disasters for rapidly determining the identity of victims.

The goal of this project is to develop a method for the rapid high resolution genotyping of single-stranded DNA samples, using denaturing gel electrophoresis on a modified Agilent 2100 Bioanalyzer equipped with a thermal heat plate and dual laser detector. Because of its high speed, small footprint and portability, this system can be an effective tool to quickly screen and identify individuals detained at ports of entry, police stations and mass disasters. This poster describes our efforts to optimize the resolution and sizing precision of the microfluidic system. The system utilizes a 12-channel electrophoretic chip and associated software capable of performing genetic analysis of up to 7 multiplexed CODIS STR loci. Using elevated temperatures and a specially engineered polymer system we can resolve all components in the allelic ladder with a precision better than 0.15bp. The system has the capability to distinguish individuals with a power of discrimination of greater than 1 in 10^5 with an electrophoretic separation time of under 80 seconds per sample, making it more than sufficient to presumptively identify individuals at border crossings and checkpoints.