



B99 A Forensic Laboratory Tests the Berkeley Microfabricated Capillary Array Electrophoresis Device

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The objective of this presentation is to demonstrate to the forensic community that ultra-fast capillary electrophoresis can be achieved in the forensic laboratory by the use of a microchip capillary array electrophoresis device.

This presentation will impact the forensic science community by providing a better sense of how the microchip is operated, how well it performed, and what this may portend for the future of DNA typing of forensic casework.

The Berkeley microfabricated capillary array electrophoresis (μ CAE) device, a 96 microcapillary array capable of simultaneously separating and capturing data for PowerPlex[®] 16 amplified samples in less than 30 minutes, was demonstrated at Berkeley to provide high quality STR profiles using both simulated and non-probative casework samples.^[1] A pre-commercial prototype instrument was installed at the Virginia Department of Forensic Science (VDFS) for testing by forensic scientists as part of a collaboration between VDFS, the Palm Beach County Sheriff's Office (PBSO) and the Mathies' laboratory. The initial step was mastery of the instrument operation which was verified by the successful electrophoresis and short tandem repeat (STR) profiling of concordance samples amplified with PowerPlex[®] 16. The practical application of the μ CAE device was then demonstrated by accurate analysis of nineteen non-probative casework samples, the results of which were consistent with previous typing data. Both sensitivity series and mixture samples were successfully typed with Powerplex[®] 16 as well as mock sexual assault samples analyzed using PowerPlex[®] Y. Both a student intern and a scientist from PBSO were able to successfully operate the μ CAE system following several days of training.

The microchip instrument performance was assessed as a function of both resolution and precision. Resolution measurements were performed following the protocols outlined in Buel *et. Al.*^[2] Successful replacement of the Hjerten capillary coating method with a dynamic coating polymer (polyDuramide) was assessed using resolution measures and ultimately adopted given its improved ease of use and the greater number of successful capillaries.

This mastery of operation of the μ CAE device by forensic scientists establishes the capacity of this technology to be transported out of the research venue and into a practitioner laboratory. Moreover, it demonstrates the feasibility of the paradigm shift from large conventional capillary electrophoresis systems to microfabricated devices. Next generation microcapillary systems slated for testing will contain additional integrated features, such as sample clean-up prior to capillary injection^[3] and on-chip PCR, thus propelling the development and potential usefulness of the microchip capillary system for forensic sample analysis.

References:

- 1 Yeung SHI, Greenspoon SA, McGuckian AB, Crouse CA, Emrich CA, Ban J, Mathies RA. Rapid and high-throughput forensic short tandem repeat typing using a 96-lane microfabricated capillary array electrophoresis microdevice *J. Forensic Sci.* 2006;51: 740-747.
- 2 Buel E, LaFountain M, Schwartz M, Walkinshaw M. Evaluation of capillary electrophoresis performance through resolution measurements. *J Forensic Sci* 2001; 46(2):341-345.
- 3 Blazej RG, Kumaresan P, Cronier SA and Mathies RA Inline- Injection Microdevice for Attomole-Scale Sanger DNA Sequencing. *Anal Chem.* 2007;79(12):4499-506.

Micro-Chip, Capillary, Electrophoresis