



B204 Advances in Biochip-Based STR Analysis: A Rapid Field-Based Approach

Paul Pyzowski, BSEE, MBA, and Eugene Tan, PhD, Network Biosystems, 1 Gill Street, Suite B, Woburn, MA 01801*

After attending this presentation, attendees will be familiar with recent advances in biochip-based DNA analysis systems that enable STR analysis to be performed at a crime scene.

This presentation will impact the forensic community and/or humanity by demonstrating that DNA evidence can be analyzed at crime scenes in only a few hours. By doing so, STR data collected in real-time can be utilized to identify and apprehend suspects within days or hours of the commission of a crime. By apprehending suspects more quickly, the time and costs of criminal investigations would decline substantially. Even more importantly, rapid apprehension would limit recidivism, significantly improving public safety.

It has long been a goal of forensic scientists to analyze DNA evidence at crime scenes, reducing the time from discovery to a fully characterized short tandem repeat (STR) profile and impacting the investigation from its outset. Recently, this goal was achieved using Genebench-FX™ - a DNA analysis system built by Network Biosystems demonstrating that DNA evidence could be collected and analyzed at crime scenes within four hours, in one case leading to an arrest forty minutes later.

The primary challenge in bringing biochip-based DNA analysis tools to the forensic community has been in developing a robust, commercial instrument that offers reliable and reproducible performance when operated in the field by forensic lab personnel.

Genebench-FX™ uses a biochip for separation of DNA fragments. Genebench-FX™ accepts samples of extracted DNA that have been amplified and prepared with a commercial STR kit, and identifies the alleles present in the sample(s). The system is designed to be readily transported to and operated in the field. The mechanical chassis includes special features to protect the optical system during transport. The run time temperature of the matrix is held to within a degree even with wide swings in ambient temperature. Additionally, the system only requires power from the equivalent of one standard 120V/240V outlet, so it can be readily deployed in mobile operations.

Operating data will be presented that demonstrates that the system meets or exceeds all requirements for analysis of STRs with respect to both technical operation and reproducibility. This includes:

- Representative data from both CODIS and European commercial STR kits
- Resolution of rare single-base alleles (e.g. TH01) without increased analysis times
- Sensitivity to a wide range of DNA template concentrations, including extremely low concentrations
- Inter- and intra-run precisions of between 0.1 and 0.25 bp

The presentation will discuss the challenges – technical and logistical – in implementing a mobile DNA forensics lab, based on experiences implementing such a system with an actual forensics lab. It will also highlight areas where continuing developments will further enhance the ability of biochip technologies to impact forensic investigations.

DNA Typing, Short Tandem Repeats (STRs), Polymerase Chain Reaction (PCR)