

AN AUTOMATED SYSTEM FOR DNA EXTRACTION, QUANTIFICATION, NORMALIZATION, AND STR AMPLIFICATION OF FORENSIC EVIDENCE SAMPLES

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Automation has become an indispensable tool in forensic laboratories challenged with ever increasing workloads and the pressure to reduce turnaround times. Automated protocols help labs maintain precision, accuracy and consistency in sample processing and minimize errors. Forensic DNA analysis is a multi-step process involving extraction of DNA, quantification of human DNA, amplification using multiplex STR systems, separation of amplified products, and data analysis. Several platforms having the ability to automate some of these individual steps are routinely used by high throughput laboratories. However, due to steep investment costs, it is desirable to perform most operations in the forensic DNA analysis workflow on a single robotic unit, particularly for medium or low throughput laboratories.

We describe here an automated forensic sample processing station, the HID EVOLution™ Combination System, based on the Tecan Freedom EVO® 150 robotic platform, which automates DNA extraction, setup of qPCR to quantify human DNA, DNA dilution to normalize input amount, and setup of PCR reactions for amplification of STR multiplexes. This system combines two robotic manipulator arms: the LiHa, with 8 liquid handling channels (4 for DNA extraction and 4 for qPCR, normalization and PCR setup), and the RoMa, a robotic manipulator that transfers plates between a shaking/heating module (Te-Shake), and a 96-position ring magnet for particle separation. The worktable organizes tip holders, plates, tubes, reagent blocks and reservoirs for optimized speed, ease of accessibility, and reduced contamination potential.

This presentation summarizes the work performed to validate the HID EVOLution™ System for extraction of DNA using the PrepFiler™ Automated Forensic DNA Extraction Kit, quantification using the Quantifiler® Human and Y DNA Quantification Kits, and multiplex amplification using the AmpF!STR® PCR Amplification Kits. Using a variety of forensic sample types including blood stained FTA® paper, cotton fabric and denim, dried blood spiked with known PCR inhibitors, saliva on cotton swabs, and semen stains, we found that yields of human DNA were equivalent, and STR profiles obtained with Identifiler® were as consistent and highly reproducible as results obtained using manual PrepFiler™ extraction. Automated operation was clean, and no cross-contamination was detected. The HID EVOLution™ Combination System is a robust, reliable sample processing platform, easily adapted to forensic laboratory workflows. The system provides an optimized and comprehensive solution to forensic sample processing that will increase throughput, reduce turnaround time, streamline sample data transfer, minimize errors, and safeguard the integrity of forensic samples.