ELIMINATING THE RISK OF USER-ERROR, SAMPLE-SWITCHING AND CONTAMINATION DURING FORENSIC DNA EXTRACTION: DEVELOPMENTAL VALIDATION OF THE AUTOLYS STAR

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DNA extraction from crime scene samples involves many critical steps before the analysis of a DNA profile can be performed. When processing such samples, in particular those with trace amounts of DNA, most labs choose to perform the DNA extraction manually or semi-automated, since current automated protocols can lead to loss of DNA yield and/or quality. At the same time, manual DNA extraction is time-consuming, does not ensure full traceability, and increases the risk of contamination, sample-switching and other user errors. Although a large portion of the forensic DNA process has been successfully automated, two of the most critical steps are usually carried out manually: the lysis of a sample, and subsequent separation of the raw extract from its carrier material. These steps have always proven difficult to automate, nearly always add gaps in traceability, and are considered major bottlenecks for most casework labs.

The Netherlands Forensic Institute (NFI) has been intensively testing the new AutoLys STAR system, performing the developmental validation prior to its release. The NFI is a government-owned forensic lab and carries out the vast majority of forensic DNA casework in the Netherlands, including providing second opinions and analyses for cold cases. The NFI analyzes reference and casework samples covering high-volume and severe crime cases. Here, we will describe the validation study setup and present data comparing the AutoLys system with manually processed samples. Test samples include mock casework samples, e.g., blood, saliva and semen spotted on cotton swabs, pieces of clothing, cigarette butts and other commonly found samples from crime scenes. Our results show that DNA yields and quality are comparable or have improved, while greatly reducing risk for errors and contamination.

The AutoLys STAR is a fully automated lysis system solution from Hamilton Robotics designed to overcome the bottlenecks in the DNA extraction process. It is a single instrument platform capable of processing up to four 24-tube racks (96 samples) at once. The AutoLys uses Hamilton's new 'smart' spin column tubes, each equipped with a unique 2D-barcode, providing complete sample ID traceability. A set of four new unique robotic tools fully automate all on-deck sample handling, including: capping/decapping of spin tubes, all tube movements, and separation of inner- and outer-tubes. Four independent pipetting channels add extraction buffers before automated on-deck incubation in custom heated tube shakers. The pipettors also transfer cleared lysates to new tubes or plates for DNA purification when the lysis process is completed. The CORE gripper moves spin tube racks for 2D barcode scanning and on-deck centrifugation. Sample DNA purification can be on the same deck or transferred to another instrument for further processing. The AutoLys system is fully automated and can run overnight, without the need for any manual assistance. ⌘