



Criminalistics Section – 2005

B98 Development of a Semi-Automated Robotic Platform for the Extraction of Forensic Evidentiary Samples Using the Tecan Genesis 150

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Attendees will learn a cost-effective, semi-automated robotic extraction platform designed to improve throughput and reduce the labor costs commonly associated with manual extraction procedures.

This presentation will impact the forensic community and/or humanity by providing the forensic community with a method by which to implement a robotic extraction platform.

With the vast number of backlogged evidence samples and the infusion of NIJ funding with which to process these samples, the forensic DNA community has been challenged to develop a higher throughput approach to sample processing in response to a growing demand for its services. While the utility of robotic platforms has been clearly demonstrated in clinical laboratories and more recently in the extraction of forensic database samples, automated DNA extraction techniques have now broadened in scope to include forensic evidence samples. Robotic alternatives to the conventional manual techniques must be designed such that the automated systems are as adept at handling the diverse variety of forensic samples as their manual extraction counterparts. Previous validation studies in the laboratory and others have demonstrated that the Qiagen DNA extraction kit is a suitable alternative to the organic method of DNA extraction. It was the objective of this validation to develop a robotic alternative to the liquid handling steps in the Qiagen DNA extraction protocol.

After the manual addition of lysis buffers to the sample and the subsequent incubation, the lysates are then transferred to the Tecan Genesis 150 for the remainder of the Qiagen procedure. When the extraction is complete, the samples are eluted in a microtiter plate and an aliquot of the extracted DNA is robotically transferred to a second plate for quantitation. Because the customary elution volume from the Qiagen column is 200 μ l, evidence samples are subsequently concentrated using a plate-based microcon. Standard samples usually contain sufficient quantities of DNA and no further concentration steps are necessary. All of the liquid transfer steps in the Qiagen DNA extraction protocol have fixed volumes with no variation from sample to sample. When the volumes vary (i.e., quantitation setup), a worklist containing sample specific volumes and well locations is generated by an internal LIMS system and is exported to the Gemini (Tecan) software.

Ensuring that the robotic sample handling schematic is free of contamination is at the forefront of the developmental process. Once the liquid transfer steps were defined and the instrument performance files were optimized, the deck layout was designed to facilitate the most efficient movement of the robotic arm as well as to minimize the occurrence of tips crossing over open sample tubes and reagent troughs. Because of the wide variety of DNA amounts encountered in evidence samples, a comprehensive contamination study was performed to ensure that any occurrences of contamination would be detected. A series of runs using highly concentrated DNA samples arranged in a checkerboard pattern were performed to detect contamination that may have occurred during robotic processing.

To evaluate the efficiency of the robotic versus manual extraction method, lysates from individual samples were evenly divided into two tubes. One tube was extracted manually and the other robotically. A quantitative comparison of DNA recovery showed no significant differences in recovery between the robotically extracted samples and those that were extracted manually.

While the immediate benefits of extraction automation can be realized in terms of reduced labor cost and higher throughput, the downstream advantages are often overlooked. By eluting samples in a microtiter plate format, subsequent plate-based sample transfers (i.e., amplification and/or instrument sample preparation) are more readily performed using a multichannel pipette, improving efficiency and precluding the need to label tubes.

This poster will show that the extraction efficiency of the Qiagen kit coupled with the versatility of the Tecan Genesis Liquid Handling robot makes the extraction of standard and evidence samples very amenable to automation. Additional automation considerations including low volume pipetting, optimization of liquid classes and the judicious choice of deck layout will be presented.

Tecan Genesis, Qiagen, Automated DNA Extraction