A47 Streamlining and Optimizing the Procedures of a State Databank Lab

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After attending this presentation, attendees will gain an understanding of some of the challenges faced by databank laboratories, as well as possible alternative solutions to these problems. Attendees will also be shown examples of how one such laboratory is implementing these solutions to produce quality data with a minimum of expense.

This presentation will impact the forensic community by highlighting economical automated procedures and potential optimization studies that can be conducted.

Kansas legislature recently passed a law requiring DNA collection on all felony arrestees. With this influx, the requirement for sample processing methods that produce high quality data, and are also efficient and cost effective is imperative. The Kansas Bureau of Investigation (KBI) has chosen to investigate possible implementation of several procedures to try to meet this need. The number of backlogged samples can be reduced by employing high pH extraction, fluorometric quantitation, multiplex amplification, and expert system analysis for databank samples. These procedures will also decrease profiling costs significantly and increase analyst efficiency. To ensure that each protocol was fully optimized before validation, the extraction, quantitation, and amplification procedures were evaluated in preparation for the introduction of an expert system.

The streamlined process begins with the Bode DNA collectors for buccal samples, a Bode modified BSD-600 Duet punching instrument, and KOALA (Kansas Offender Arrestee Laboratory Application). KOALA is custom software which tracks sample barcodes and creates input plate maps for the BSD; this process increases punching efficiency and performs several quality control checks. Optimization experiments were designed to demonstrate consistent punches in the correct orientation, with no sample carry-over after cleaning strikes.

Next, extraction and quantitation are performed with the Biomek® 2000 liquid handler. The high pH extraction is a simple and inexpensive technique[1] that lyses buccal cells to release nuclear DNA into solution.[2]. This method utilizes heat, sodium hydroxide, and tris-hydrochloride. After the DNA is extracted, Quant-iT™ OliGreen® ssDNA reagent is added to quantitate the samples with a fluorometer. The simplicity of these procedures allows the user to extract and quantitate DNA on the same worksurface in less than 30 minutes. Reproducibility and accuracy studies were executed to prove this method was reliable and did not introduce carry-over.

Normalization and PCR set-up are also carried out with the Biomek® 2000 and Promega's Genetic Identity Normalization Wizard with previously validated methods.[3] Using a single multiplex kit such as PowerPlex® 16 rather than their current amplification kits, Profiler Plus® and COfiler®, reduces the number of plates necessary for these steps and those further downstream. Experiments were designed to assess concordance and reproducibility with PowerPlex® 16. By combining all these automated procedures with high-throughput capillary electrophoresis on the 3130*xl* Genetic Analyzer, an analyst can take a plate of samples from punching to data collection in a single workday. Following validation and implementation of these procedures, the KBI can focus on data collection for the validation of an expert system for data review. "For forensic DNA analysis, expert systems could easily be one of the most important advances in analyzing convicted offender samples.[4]" The manual data review process is lengthy and requires a significant time commitment of analysts; an expert system will alleviate some of the burden for single source samples.

As more states pass arrestee DNA collection laws, the forensic database laboratories are challenged with increasing sample throughput in a cost effective manner. If this challenge is successfully addressed, CODIS will continue to be an outstanding judicial system resource. Automated procedures can provide an economical solution, although optimization and validation are required. This presentation gives an example of one state databank laboratory's quest for cost effective methods that increase efficiency and data quality. It illustrates possible solutions to the challenges the forensic community faces.

References:

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Automation, Fluorometer, High pH Extraction

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