Integration of Best Practices for Criminal Offender Databases
A Fixed-Tip Automated DNA IQ™ System with Real-Time PCR Quantitation: Practical Implications for a Break and Enter DNA Processing Unit

C. Frégeau, M. Lett, J. Elliott and R. Fourney
Royal Canadian Mounted Police, National Police Services, Forensic Laboratory Services, National DNA Data Bank of Canada, Ottawa, Ontario

Criminal offender databases have, over the past few years, fine-tuned their processing of DNA samples to derive high-throughput automated efficiencies for forensic investigations. The recent challenge of the forensic community has been to incorporate the best practices and past experiences of criminal database analysis and apply this knowledge to meet new challenges, such as mass disaster victim identification or the specific needs of forensic DNA support for high-volume criminal investigations. Careful planning and strategic alignment of resources and experience to meet and maximize these benefits has been undertaken by the Forensic Laboratory Services of the RCMP. This paper highlights, through example, one such endeavor involving the National DNA Data Bank of Canada and the Biology Operations Section of the Forensic Laboratory Services of the RCMP.

The role of the National DNA Data Bank as an investigative tool was expanded to assist Biology Operations in processing break and enter (B&E) samples from non-suspect cases. To this end, an entirely new DNA extraction process was developed, adapted for our TECAN Genesis 150 Robotic Workstations and optimized to allow processing of the various types of samples collected at B&E scenes (e.g. cigarette butts, chewing gums, swabs from handled objects, bloodstains). The magnetic bead extraction technology from Promega (DNA IQ™) was evaluated using typical B&E-type samples. Modifications to the extraction protocol were required to optimize binding of the DNA onto the magnetic beads to encompass all sample types. Using our modified and automated protocol, the Promega DNA IQ™ allowed the isolation of very limited amounts of DNA (as little as 0.01 ng/µL) from very compromised samples. Excellent results were obtained from blood swabs prepared with various types of soil. Promega DNA IQ™ appears to clean the DNA very efficiently resulting in very balanced peaks across all STR loci tested.

As the necessity to determine the amount of human DNA present in the B&E samples became an issue, the decision was made to incorporate real-time quantitative PCR (Q-PCR) technology into the process for sample quantitation. The Quantifiler™ Human Quantitation Assay developed by Applied Biosystems 1) quantitates human DNA specifically by using human specific primers for a single copy gene and 2) ascertains the presence of PCR inhibitors in the DNA extract upon failure to amplify an internal positive control. The amplification assay set up has been incorporated at the end of the extraction routine on our TECAN robotic workstation followed with actual cycling and detection in an ABI PRISM® 7000 SDS instrument. This assay is extremely simple to automate yet is very sensitive detecting down to 0.008 ng/µL of DNA. This automated protocol combining Promega DNA IQ™ and ABI Q-PCR technology represents a unique

way to process B&E samples in a very efficient and cost effective manner. A full batch of 86 samples plus controls (88 in total) can be extracted in approximately two and a half hours following overnight lysis, and quantitated in approximately two hours as well (30 minutes to set up the reactions on the robotic workstation and 1 hour 36 min for amplification and detection in the ABI PRISM® 7000 SDS instrument).