B65 Evaluation of Fabrics for Development of a Low Copy Number Sampling Swab

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The goal of this presentation is to compare different fabrics that were tested in the development of a swab for the High Sensitivity Laboratory.

This presentation will impact the forensic community and/or humanity by developing a swab to improve recovery of DNA from Low Copy Number DNA samples such as fingerprints. The shape of this swab also accommodates robotics, and thus promotes the processing of large numbers of evidentiary samples.

In order to maximize the recovery of DNA from surfaces potentially containing Low Copy Number (LCN) DNA samples, such as fingerprints, several fabrics were evaluated based on their ability to absorb and subsequently release cells. These fabrics were also compared regarding their compatibility with the laboratory's high throughput system.

Studies conducted previously tested a wide variety of commonly available fabrics including but not limited to cotton, polyester, and microfiber, and Dacron® and cotton swabs, which are currently utilized for sample collection. Initially, microfibers recovered the most DNA from fingerprints. Cotton and Dacron® absorb liquid very well, and their poor DNA yield from LCN samples suggests that they trap DNA and liquid within their fibers.

The Dacron® and the cotton swabs were also not compatible with the optimized extraction protocol, unlike the microfiber swab. This procedure consists of a sample digestion step followed by purification and concentration with a microcon 100 (Millipore). Moreover, this procedure can be automated through the robotic removal of the digested DNA from the swab and transfer to the microcons, assembled into a 96 well plate, the Microcon 96 Retentate® Assembly Plate (Millipore). The Dacron® and cotton swabs tended to clog the pores of microcons hindering sample concentration. Moreover, the microcon elution volumes were inconsistent, often unnecessarily diluting the samples.

Since the microfiber also had some problems with liquid retention, additional candidate fibers were selected based on their high absorption potential coupled with the likelihood that their structure promoted fluid release. A series of five analogous, natural fabrics (A-E) were evaluated for potential use for the LCN swab. Fabrics A and B have similar shapes, but had few variations in their weaves, whereas fabrics C, D and E had different shapes, but had few variations in their weaves. To test absorbance, the fabrics were immersed in 10 uL of control DNA in a microfuge tube. When the tube appeared dry, the fabrics were discarded and water was added to the tubes to resuspend any DNA left behind. In order to test the release of DNA, control DNA was deposited directly onto the fabrics, and allowed to be absorbed into the fabric for ten minutes. The fabric was then placed in sterile water and shaken at room temperature for 20 minutes. Following sample concentration, DNA was measured and the percent recovery was calculated. Based on the results, Fabric B and Fabric C were superior. To confirm this finding, fingerprints were collected from volunteers, and were swabbed with each of the two fabrics. Comparable yields resulted.

Subsequently, the fabrics were compared with respect to their performance with the robotic system. Prior to this testing, the optimal length of the fabrics for DNA recovery was determined, although, regarding robotics, the smallest length possible is best. Lengths of 1 cm, 2 cm and 3 cm were used to swab dried cells from a surface and extracted. Fortunately, the shorter lengths of fabrics yielded the most DNA. Therefore, the sample digests were removed from Fabrics B and C on the Biomek 2000. However, Fabric B caused a malfunction whereas Fabric C was compatible with the process, and was selected as the candidate swab fabric.

LCN samples, DNA, Automation

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