A68 Comparison Study of the QIAcube® to Manual Differential Separation: Man Versus Machine

Jessica M. Lowney, BS, 800 Miller Dr, Oregon, WI 53575; Mark Guilliano, PhD, 20524 Lansing Ter, Ashburn, VA 20147; Joshua Stewart, MSFS, 1401 Forensic Science Dr, Huntington, WV 25701; and Pamela J. Staton, PhD, Forensic Science Center, 1401 Forensic Science Dr, Huntington, WV 25701*

After attending this presentation, attendees will have a better understanding of the uses of QIAGEN's QIAcube®, and may be better able to decide whether it is an appropriate instrument for use in their laboratories.

This presentation will impact the forensic science community by helping an analyst to streamline his or her workflow, as well as increasing consistency between analysts in sexual assault processing.

Sexual assault is a serious public safety concern worldwide, with the resulting caseload backlog posing significant challenges for forensic science laboratories. Each sexual assault kit is likely to contain a number of samples with female-male mixtures on which a differential extraction must be performed. Differential extraction is the process of separating sexual assault victim epithelial cells from the perpetrator sperm cells in order to obtain an assailant profile. Unfortunately, differential extraction is a lengthy process, requiring repeated pipetting and centrifugation. Furthermore, the quality and consistency of separation may be variable between individuals. Because of the reagent cost, time, and manual work involved in working with these cases, sexual assault backlogs have unfortunately become commonplace. In an effort to identify ways to reduce these backlogs and benefit a scientist's workflow, it is worth evaluating the qualities of automated processes. This study focused on determining the utility of the QIAGEN QIAcube® for differential separation of samples, and compared it to the current manual method. The QIAcube® was originally designed to extract nucleic acids and proteins, and it is capable of centrifuging, vortexing, pipetting reagents, and extracting a supernatant from a pellet. This study evaluated the QIAcube's® abilities, and a custom protocol, to perform differential separations on up to 12 mock sexual assault samples at a time. Experiments included a cross-contamination study using mixed female blood and semen; a sensitivity study based on a 1:3 serial dilution of semen, with and without female epithelial cells present; a reproducibility study, utilizing mixed female epithelial cells and semen; as well as a matrix or mock evidence study, consisting of a mixture of female epithelial cells and semen pipetted onto different fabric types and swabs. All studies were performed by a novice student using the QIAcube®. For comparison, the sensitivity and reproducibility studies were also performed by one or more experienced analysts, using a validated manual separation and wash procedure. Each method was evaluated with respect to cost-effectiveness, time efficiency, reproducibility, and sensitivity. The QIAcube® did prove to be a very efficient way to perform differential separations, with excellent sensitivity, and superior reproducibility. There was no sign of cross-contamination between samples, even though the tubes remain open all at once in the machine. Conversely, more reagents were wasted with the automated method. Furthermore, loading the instrument proved to be difficult at first; but it was easier to train a novice on the instrument than it was to train the novice to perform manual differential extraction. The instrument may not add hours of hands-free time, with the need to prepare the reagents and set up the instrument; however, it is possible to push "Go" and walk away for about 30 minutes while the machine performs all of the centrifuging and pipetting. Lastly, the factor of general human error—for example, bumping a tube and having to re-pellet sperm cells — is eliminated from the extraction process. In conclusion, the use of the QIAcube® has the potential to help a scientist work more efficiently simply by freeing an analyst or technician from repetitious pipetting and centrifuging.

Sexual Assault, Backlog, Automation

 ** Presenting Author*