E11 Analysis Using Applied Biosystems® Quantifiler® Trio With a Y-Screening Technique at the West Virginia State Police Forensic Laboratory

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After attending this presentation, attendees will understand how the Applied Biosystems® Quantifiler® Trio DNA Quantification kit can be used with a Y-screening technique.

This presentation will impact the forensic science community by discussing how Quantifiler® Trio can be used with a Y-screening technique in addition to or in place of traditional serology to assist in determining which samples will advance to DNA testing. This presentation will also discuss the efficiency and cost effectiveness of Quantifiler® Trio as a Y-screening technique.

DNA evidence can be key to identifying the perpetrator in sexual assault cases. Forensic examination of the victim is performed in which intimate samples are collected. As these samples are collected from the victim, these samples can be expected to contain high levels of victim DNA. In cases in which a female is sexually assaulted by a male, screening tests can assist in determining what samples possess male DNA and should therefore go on to DNA-based human identification testing. These screening tests, commonly referred to as semen serology tests, include the Acid Phosphatase (AP) test, the Abacus ABAcard® p30 test, and the microscopic identification of human spermatozoa. The AP test is a presumptive test for the presence of the acid phosphatase enzyme, present in seminal fluid.[1] The p30 test is a confirmatory test for the presence of prostate -specific antigen, also known as the p30 molecule, which is produced by the male prostate gland.[1] Spermatozoa can be identified on prepared slides using the Christmas tree Staining procedure. Both AP and p30 can be found in body fluids other than semen.[1] The p30 test has a sensitivity of 4 ng/mL.[2] Quantifiler® Trio can also assist in determining what samples possess male DNA and should advance to DNA testing through either a differential separation or simple extraction. Quantifiler® Trio can be used as a Y-screening tool to screen for male DNA in casework samples as it includes two autosomal targets (small and large), as well as a Y-chromosome target. Although there is some cross reactivity of Quantifiler® Trio with the DNA of higher primates, the supported quantification range is from 5pg/µL to 100 ng/µL, making Quantifiler® Trio more specific and more sensitive than forensic serology tests.[3]

In completing this analysis, several studies were performed. A Y-screening technique developed for the West Virginia State Police Forensic Laboratory was used throughout this study. A sensitivity study was performed in order to determine if this Y-screening technique using Quantifiler® Trio was more sensitive than traditional serology and also to determine at what DNA concentration the profile obtained was no longer probative. A cost-benefit analysis was performed in order to compare the costs of traditional serology to the costs of Y-screening. A contamination study was performed by running reagent controls, free of human DNA, with each test that was performed to test for any extraneously introduced DNA contamination. A mixture study was performed by creating known mixtures of male and female DNA to determine at which mixture ratio and concentration Y-Chromosomal

Short Tandem Repeats (Y-STRs) should be performed instead of autosomal STRs. A non-probative study was performed using mock casework samples to demonstrate that the Y-screening technique will perform as expected on casework samples. Finally, a second mixture study was performed by preparing mock samples that contained mixtures of male and female DNA.

The sensitivity study revealed that this Quantifiler® Trio Y-screening technique was more sensitive than the AP test, the p30 test, and the microscopic identification of spermatozoa. It also illustrated that even at the lowest concentration point used in the study (with concentrations ranging from 16ng/µL to 0.015625ng/µL), a probative profile was still obtained.

It can be concluded that the Y-screening technique is more sensitive than traditional serology and may be expected to be adopted by laboratories, including the West Virginia State Police Forensic Laboratory, in the future for the testing of sexual assault evidence.

Reference(s):

1. Noureddine M. Forensic tests for semen: What you should know. *Forensic Resources.* 2011.
2. Abacus Diagnostics®. Compare the strengths and weaknesses of various technologies. http://www.abacusdiagnostics.com/compare.htm.
3. Applied Biosystems. Quantifiler® HP and Trio DNA Quantification Kits User Guide. 2015.

DNA, Y-Screen, Serology