B94 Variation in DNA Mixture Interpretation: Observations From NIST Interlaboratory Study Results

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After attending this presentation, attendees will better understand the history and lessons learned from the National Institute of Standards and Technology (NIST) interlaboratory studies on mixture interpretation, including the two most recent studies, in 2005 (MIX05) and in 2013 (MIX13).

This presentation will impact the forensic science community by helping the forensic DNA community to: (1) determine the current "lay of the land" regarding Short Tandem Repeat (STR) mixture interpretation across the United States; and, (2) learn where future training and research could help improve mixture interpretation and reporting.

DNA mixtures of two or more individuals can be challenging to interpret for the forensic DNA scientist. Historically, laboratories have developed protocols to interpret mixtures based upon a combination of multiple areas of investigation including (to name a few): internal validation studies, information present in the scientific literature, training from workshops and scientific meetings, and guidelines as reported by scientific working groups such as the Scientific Working Group on DNA Analysis Methods (SWGDAM) or the DNA Commission of the International Society of Forensic Genetics.

Interlaboratory studies enable examination of "big picture" views across many laboratories. In 2005 and again in 2013, interlaboratory challenge exercises were conducted by the Applied Genetics Group at NIST. The 2005 MIX05 study involved data interpretation of DNA mixtures representing four different mock sexual assault case scenarios while the 2013 MIX13 study involved data interpretation for five different case scenarios. Data from these scenarios were generated at NIST with multiple STR kits and provided to laboratories as electrophoretic data. In each MIX05 case, the "evidence" sample result, which was a mixture of genomic DNA from one "perpetrator" and one "victim," were provided along with the single-source "victim" reference sample. All data were generated on six different STR kits (Profiler Plus®, COfiler®, SGM Plus®, Identifiler®, PowerPlex® 16, and PowerPlex® 16 BIO) from the same lot of genomic DNA mixtures. The MIX05 and MIX13 study designs and sample selection processes will be described along with a summary of results obtained from 69 laboratories with MIX05 and 108 laboratories with MIX13.

In MIX05, NIST focused on electronic data for analysis to control for the variation observed in previous studies with extraction and quantification.[1-3] One observation in the analysis of the results was the wide range of approaches to interpreting the same data among the different laboratories.[4] With the publication of the 2010 SWGDAM Autosomal STR Interpretation Guidelines, many laboratories established analytical and stochastic thresholds for mixture interpretation.[5]

The MIX13 interlaboratory study was conducted to determine the current "lay of the land" in regard to STR mixture interpretation across the community. NIST also wanted to gauge the consistency in mixture interpretation across the United States after the publication of the 2010 SWGDAM guidelines. Examples of the mixture interlaboratory study will be shared along with ideas for future training and research to improve mixture interpretation and reporting in the United States.

References:

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2. Kline MC, Duewer DL, Redman JW, Butler JM (2003) NIST mixed stain study 3: DNA quantitation accuracy and its influence on short tandem repeat multiplex signal intensity. *Anal. Chem*. 75: 2463-2469.
3. Duewer DL, Kline MC, Redman JW, Butler JM (2004) NIST Mixed Stain Study #3: signal intensity balance in commercial short tandem repeat multiplexes. *Anal. Chem.* 76: 6928-6934.
4. Butler JM and Kline MC (2005) "NIST Mixture Interpretation Interlaboratory Study 2005 (MIX05)" poster at the 16th International Symposium on Human Identification (Grapevine, TX), September 27-28, 2005.
5. SWGDAM (2010) Autosomal STR Interpretation Guidelines — available at: http://www.swgdam.org/Interpretation_Guidelines_January_2010.pdf

DNA Mixtures, Mixture Interpretation, Forensic DNA