NISTIR 8351-DRAFT DNA Mixture Interpretation: A NIST Scientific Foundation Review

A preparatory guide for court

The information presented in this document is intended to provide STRmix™ users with guidance on some of the important scientific topics relating to *NISTIR 8351-DRAFT DNA Mixture Interpretation: A NIST Scientific Foundation Review* that may be encountered in the court setting (predominantly based on the US court experience). It should not be relied upon as the sole source of court preparation for STRmix™ evidence, which should also include, but not be limited to seeking the appropriate advice from trained legal professionals where appropriate.

This draft report was published in June 2021. NIST hosted a webinar to discuss the report and its findings on July 21, 2021. The report authors are John M. Butler, Hari Iyer, Rich Press, Melissa K. Taylor, Peter M. Vallone, and Sheila Willis. None of the authors has experience in forensic DNA casework[1] and none has published original science investigating forensic DNA interpretation methods, including mixture interpretation[2]. The report acknowledges a DNA Mixture Resource Group (listed in Table 1.2) that includes technical leaders, university researchers and forensic DNA analysts. This resource group were "not asked to provide consensus advice or recommendations, sign off on [the] final report, or endorse its conclusions" (line 1188 from the report).

The report is currently in DRAFT pending public comment (the 60-day comment period closes 9 August 2021). We are aware of a number of formal responses in preparation in addition to our own including one from an ad hoc working group from SWGDAM. NIST have undertaken to make all relevant submitted comments publicly available.

NIST have stated that unlike SWGDAM or OSAC they do not act as a 'regulatory body'.[1] They cannot impose requirements, conditions, or restrictions on the forensic community, they do not set standards nor enforce them.

Their key conclusion is there is not enough publicly available data to enable an external and independent assessment of the degree of reliability of DNA mixture interpretation practices (key takeaway 4.3). They define "publicly available" as findable by an internet search. They specify significant detail in these data which challenges privacy considerations in many cases. We cannot find a definition of "external and independent" in their report.

NIST did *not* conclude that PG methods are unreliable.

There is a considerable body of peer reviewed information published in respected journals supporting the reliability of PG methods[3]. This represents external and independent peer

[1] As stated by Butler during a Q+A session on the report July 21, 2021
[2] Evidenced by a review of published scientific literature
[3] Dr Buckleton maintains a list on his webpage at https://johnbuckleton.files.wordpress.com/2021/04/peer-reviewed-publications-for-strmix-iv.pdf

review. In the report, NIST themselves acknowledge this as (line 2457) "an original goal of this project – to develop a comprehensive, curated bibliography on DNA mixtures – proved unfeasible as a result of the constantly growing literature."

Publicly available (on the internet) information is not the entire body of work available describing the theory, evaluation of, and the performance of PG methods. Data is not made publicly available mostly for privacy reasons. Some data is simply not published by a journal due to lack of novelty. Many of these data could have been provided or made available to NIST had they been requested directly from the publishing author or source. NIST also appear to have missed a large number of published internal validations. We attach the list at the end of this document. This requirement by NIST is novel and neither a part of the Frye nor the Daubert standards.

In the course of their foundational review (FR), NIST have not requested such data from laboratories or developers of probabilistic genotyping software. Such data can, in some circumstances be disclosed on websites. ESR have sought to provide additional data firstly in response to PCAST and now in response to the NIST FR in support of STRmix™ reliability and use. The data is now publicly available at https://figshare.com/articles/dataset/ESR_response_to_NISTIR_8351_-_DRAFT_DNA_Mixture_Interpretation_A_NIST_Scientific_Foundation_Review/15062907.

NIST have stated that they will not review any data supplied[4]. We are also unaware of anyone else willing and qualified to do this examination. Despite the demand for a large amount of extremely detailed data we are unable to distil what tests NIST want performed. However, there has been external and independent review. As mentioned above a great many STRmix™ papers are externally peer reviewed. In addition, as part of an accreditation assessment, auditors can, and have, looked at many internal laboratory validation studies.

NIST have stated that it is the user of the data who must decide "whether sufficient information exists for judgement of reliability relative to the intended application." (line 2933). When deciding on which method to utilize for forensic casework and when performing an internal validation studies, the user is the forensic scientist, and hence determines reliability of the method. Eventually the court becomes the user of the data. The court desire reliable testimony from the analyst that proper testing has been undertaken.

SWGDAM provides forensic DNA laboratories with detailed guidelines for the internal validation of probabilistic genotyping software. STRmix™ has published their developmental validation activities following these guidelines[5]. Accredited forensic DNA laboratories must have internal validation studies reviewed during assessments to fulfil accreditation requirements.

As of 1 August 2021, 131 US laboratories have purchased STRmix™ and 65 are using STRmix™ in casework. A further 23 laboratories outside of the US are using STRmix™ for casework including in Canada, the UK, Europe, Asia, the Middle East, Australia, and New Zealand. This means at least 88 laboratories have completed internal validation and implemented STRmix™, with many more laboratories having completed or who are in the

[4] As stated by Butler during a Q+A session on the report July 21, 2021

[5] Bright J-A, Taylor D, McGovern CE, Cooper S, Russell L, Abarno D, et al. Developmental validation of STRmix™, expert software for the interpretation of forensic DNA profiles. Forensic Sci Int Genet. 2016;23:226-39

process of completing internal validation. This unpublished data represents a significant body of work, not reviewed by NIST.

Probabilistic genotyping software has achieved acceptance in the United States Federal court system in addition to other international courts. Numerous state and county-level courts within the US have admitted results from probabilistic genotyping methods after Frye and Daubert challenges. All legal challenges allow for the review of a laboratory's internal validation of PGS and an assessment of the appropriate application of PGS in the context of the case.

List of PG internal validation documents available online as at July 2021

1. California Department of Justice DNA Laboratory (Richmond, CA), STRmix v2.06 (Identifiler Plus, ABI 3130/3500), https://epic.org/state-policy/foia/dna-software/EPIC-16-02-02-CalDOJ-FOIA-20160219-STRmix-V2.0.6-Validation-Summaries.pdf
2. Erie County Central Police Services Forensic Laboratory (Buffalo, NY), STRmix v2.3 (PowerPlex Fusion, ABI 3500), https://johnbuckleton.files.wordpress.com/2016/09/strmix-implementationand-internal-validation-erie-fusion.pdf and STRmix v2.3 (Identifiler Plus, ABI 3500), https://johnbuckleton.files.wordpress.com/2016/09/strmix-implementationand-internal-validation-erie-id-plus.pdf
3. Michigan State Police (Lansing, MI), STRmix v2.3.07 (PowerPlex Fusion, ABI 3500/3500xl), https://johnbuckleton.files.wordpress.com/2016/09/strmix-summary-msp.pdf
4. Office of Chief Medical Examiner Forensic Biology Laboratory (New York City, NY), STRmix v2.4 (PowerPlex Fusion, ABI 3130xl), https://www1.nyc.gov/site/ocme/services/validation-summary.page
5. Palm Beach County Sheriff's Office (West Palm Beach, FL) STRmix v2.4.06 (PowerPlex Fusion, ABI 3500xl), http://www.pbso.org/qualtrax/QTDocuments/4228.PDF and STRmix v2.6.2 (PowerPlex Fusion 6C, ABI 3500xl), https://www.pbso.org/qualtrax/QTDocuments/10787.PDF
6. San Diego Police Department Crime Laboratory (San Diego, CA), STRmix (GlobalFiler, ABI 3500), STRmix v2.3.07; STRmix v2.4.06, https://www.sandiego.gov/police/services/crime-laboratory-documents
7. Virginia Department of Forensic Science (Richmond, VA) TrueAllele Casework (PowerPlex 16, ABI 3130xl), https://epic.org/state-policy/foia/dna-software/EPIC-15-10-13-VA-FOIA-20151104-Production-Pt2.pdf
8. Department of Forensic Sciences (Washington, DC), STRmix v2.3 parameters & validation report (Identifiler Plus, ABI 3500), https://dfs.dc.gov/page/fbu-validation-studiesperformance-checks and STRmix v2.4 parameters & validation report (GlobalFiler, ABI 3500) https://dfs.dc.gov/page/fbu-validation-studiesperformance-checks

9. Los Angeles County Sheriff's Department Scientific Services Bureau Biology Section - Validation of STRmix v2.5.11 using the PowerPlex Fusion 6C kit https://indefenseof.us/uploads/LASD-STRmix-2.5.11-Validation-Summary.pdf *
10. Jefferson County Regional Crime Laboratory - Internal Validation of STRmix v2.6 for the Analysis of GlobalFiler Profiles, https://indefenseof.us/uploads/Jefferson-County-STRmix-Validation-V2.6-V2.6.3.pdf *
11. Sacramento County District Attorney's Crime Laboratory - Internal Validation of STRmix v2.4, https://indefenseof.us/uploads/Sacramento-Cty-DA-STRmix-V2-4-internal-validation-summary.pdf *
12. Las Vegas Metropolitan Police Department - Internal Validation of STRmix v2.6, https://indefenseof.us/uploads/LVMPD-Summary.pdf *
13. Colorado Bureau of Investigation - Internal Validation of STRmix v2.5, https://indefenseof.us/uploads/Colorado-Bureau-Investigation-2018-STRmix-Validation_Summary.pdf *
14. Wisconsin State Crime Laboratory - Internal Validation Summary for STRmix Probabilistic Genotyping Software, https://indefenseof.us/uploads/Wisconsin-STRmix-Validation-Summary-Part-1-Single-Single-Source-to-Three-Person-Mixtures.pdf *
15. Oregon State Police, Forensic Services Division, Portland Metro Laboratory - Validation Study for STR Analysis Volume 67—2016 Validation – STR Casework Analysis using GlobalFiler, the 3500xl, and STRmix, https://indefenseof.us/uploads/Oregon-State-Police-Portland-Metro-Lab-DNA-Val-067-GlobalFiler-STRmix-Summary_Redacted.pdf *

The seven marked * were not reported within the NIST FR document.