



B19 Guidelines for the Interpretation and Reporting of STR Profiles: A Hypothesis-Driven Approach

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After attending this presentation, participants will learn about the adoption of a hypothesis-based testing model for the interpretation and reporting of DNA STR profiles.

We consider it vital to carry out all forensic biology casework processes, including the interpretation and reporting of STR profiles, in consideration of the hypothesis being tested. We will show how we have adapted our guidelines to take various elements of the case history into account in the interpretation and reporting stages of the analysis, and how these in turn lead to clearer reports.

This poster will describe the guidelines used at the Centre of Forensic Sciences for the interpretation and reporting of STR profiles, recently revised and written within the framework of a hypothesis-based approach to forensic casework. This approach can be summarized as a mechanism to test hypotheses, determine if the results support such proposals and to report the conclusions in a manner reflective of the hypotheses being tested.

It is the role of the scientist to address the pertinent questions being asked, relevant to the events recorded in the case history, and to then make a decision as to whether the testing of particular items would allow one to draw valid inferences in relation to the hypothesis. The assumptions that can be made during an interpretation may be based on both the DNA results themselves and/or on elements of the case history. Scientists however must also be prepared to address their conclusions under a different hypothesis with a different set of assumptions.

Examples of the interpretation process will be provided, along with respective supporting rationales. Illustrations of the following steps in the process will be provided:

- (1) Deriving constituent DNA profiles from mixtures.

Dual source mixture: one source known or assumed. Dual source mixture: both sources unknown.

Dual source mixture: equivalent major contributions of 2 unknown sources.

- (2) Determining if a DNA profile is suitable for comparison purposes.

When making this determination, factors to consider individually or together include the amount of DNA detected, a lack of peak height concordance, a prior expectation of background DNA (e.g. on clothing) and the total number of contributors. If the determination is made that the DNA profile is not suitable for comparison, the reporting of this finding should reflect the reasons why this is so, for example:

“Due to uncertainty with respect to the number of contributors and/or due to the low amounts of DNA detected, this DNA profile is not suitable for comparison.”

- (3) Reporting of results when a DNA profile is suitable for comparison.

Once a DNA profile is determined to be suitable for comparison, one of two different formats of reporting will be required depending on whether comparison samples from known individuals are available.

(i) Can an individual in question be excluded as the source? The significance of an individual not being excluded as a source is routinely expressed in the form of a random match probability (RMP) statement (excepting results from familial analyses). For example:

“Mr. X cannot be excluded, at 9 STR loci, as the contributor of the DNA profile from item 1. The probability that a randomly selected individual unrelated to X would coincidentally share the observed DNA profile is estimated to be 1 in Y.”

(ii) If no known comparisons are available the DNA profile's suitability for comparison at a later date can be reported in a number of ways depending on its rarity:

“This DNA profile is suitable for comparison.”

“This DNA profile is suitable for comparison, though it may be of limited forensic significance due to its relatively high frequency of occurrence. * This DNA profile is expected to occur in the population with a frequency of greater than 1 in 1000.”*

- (4) Assessing the forensic significance of a DNA profile or of one or more constituents in a mixture.

A determination is made as to whether the interpretation of each constituent profile in a mixture is necessary, based on the sample type and case history. Reporting of results are worded to reflect this determination.

Examples will be given for the application of this assessment as relevant to: Intimate samples – DNA analysis of an intimate sample (defined as swabs from body orifices, skin swabs, fingernail scrapings and underwear in certain circumstances) will generally be expected to yield the DNA profile of the donor, in addition to DNA from someone else. The presence of DNA from the person from whom the sample was taken is not of forensic significance (unless the source of the sample is itself questioned). However, given the prior expectation of detecting the donor's DNA, this knowledge can be used in the derivation of any additional contributing DNA in the mixture. Examples of wording such findings include:



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"No DNA, other than that which is attributable to Ms X, was detected on a swab of her skin."

"In addition to DNA attributable to Ms X, a male DNA profile was determined at 9 STR loci from a swab of her skin and is suitable for comparison."

Clothing – it is not unusual to find detectable levels of DNA on items of clothing and as a consequence clothing can often be examined to determine if it can be associated to a particular individual at some point in time, in the absence of testing for a body fluid. However, as clothing is often examined solely for the purpose of determining the source of a body fluid stain there may or may not be significance to any additional DNA coincidentally detected in the background. It should be noted nonetheless that in some instances a minor level of background DNA might indeed be of forensic significance, depending on the hypothesis being tested and the elements of the case history. An example of wording to account for this possibility would be:

"Mr. X cannot be excluded as the source of the bloodstain on the jeans. [insert RMP statement]. An additional minor source of DNA was also detected in the sample. Since it is not unusual to detect low levels of DNA on clothing, this finding may be incidental and of no forensic significance."

It is recognised that the development of guidelines for interpretation is a continually evolving process requiring constant review and that the scientific laboratory itself should play a role in determining how best to provide the results to the clients in a forensically relevant and time efficient format.

Interpretation Guidelines, STR, Hypothesis Testing