

Response to PCAST Call for Additional References from OSAC Materials Subcommittee

The Organization of Scientific Area Committees (OSAC) Materials (Trace) Subcommittee has read the 2016 United States President's Council of Advisors on Science and Technology (PCAST) report and would like to offer up points of discussion and additional resources to facilitate a dialogue about the scientific comparison of hair.

We agree that there is a need to be clear regarding scientific methods and results. Science is not static and will always benefit from continued research; in fact, we welcome additional research to strengthen the scientific basis for the examination and interpretation of comparative hair analysis. As the training and experience of a hair examiner is crucial to the reliability of this discipline, we strongly encourage the National Institute of Standards and Technology (NIST), National Institute of Justice (NIJ), and academic researchers to include qualified hair examiners in their future research projects involving hair. This is especially important to ensure any new research will be useful for forensic applications. Consensus standards for best practices and training are currently used in the forensic community and will continue to be updated as findings from new research become known. We are aware of the limitations of hair comparisons and as such, agree that those limitations should be clearly addressed in every report, as is the current practice.

In regard to the issue of validity and reliability of methods: Microscopy has been a standard method of scientific investigation for hundreds of years on a myriad of natural and manmade materials and has not been shown to be outdated or invalid. Microscopical analysis is routinely used in numerous scientific fields (e.g., medicine, botany, material science) with an expected and acknowledged degree of observer subjectivity. Microscopical hair analysis is not a method that will lead to individualization, but rather uses class characteristics to differentiate samples and to narrow the field of potential sources. Empirical studies of hair collected from different populations around the world were done by early anthropologists¹⁻¹¹ and their research was published in peer-reviewed scientific journals. Research and reviews regarding the validity and reliability of microscopical identification and comparison of hairs for forensic purposes have also been conducted and published in technical reports and peer-reviewed scientific journals¹²⁻¹⁵. These publications are cited in forensic hair training programs, such as those written by Scientific Working Group for Materials Analysis (SWGMA) and currently in revision by the OSAC Materials Subcommittee for submission to ASTM International. For a more detailed bibliography, please refer to the SWGMA hair bibliography

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We agree with the spirit of many of the recommendations for advancing the feature-comparison techniques; however, the scientific studies published to date have not yet demonstrated that computerized systems are as discriminating as experience-based visual comparison¹⁶⁻¹⁸.

In regard to the 2002 study by Houck and Budowle – we believe that study was misunderstood by the committee. The study was not a re-examination, but rather research undertaken to evaluate the need to conduct both microscopical and mitochondrial DNA analysis (mtDNA). A microscopical hair analysis was first conducted and then a separate examination was done to compare the mtDNA of the hair. We recognize that hair comparisons are not a form of identification and state those limitations within our reports and testimony. This study reported that for 80 microscopical associations, only nine were found to be further differentiated by mtDNA. Moreover, this study demonstrates that there is value in microscopical comparisons and the combination of two separate examinations provides more information than either technique does alone. It should also be noted that the Houck and Budowle

study was performed using forensic case work samples and as such, the true sources of the questioned hairs were not known.

Although error rates for microscopical hair comparison might never be known with accuracy, what is known is that microscopy can eliminate possible hair donors that mtDNA cannot and vice versa. Accordingly, the combination of microscopy with mtDNA analysis of hair will afford a higher level of discrimination, thereby reducing the pool of individuals who can be included as a possible source of a hair. We believe that DNA analysis can be and should be performed on hair but ONLY after an initial microscopical assessment. DNA analysis should always be considered in those cases where the source of a hair is crucial to an investigation.

Human variation is a fact that has been discussed in numerous scientific studies. The appearance of human scalp hair can change over time in regards to the variable presence and positioning of microscopic characteristics visible within a person's hair. It is not feasible to track the proportion of individuals with similar characteristics at any one point in time, as those characteristics will change over the lifetime of an individual, and may be influenced by an individual's environment and personal cosmetic preferences. Within a reasonable time frame between the commission of the crime and collection of the known hairs, comparisons can be valuable in including or excluding an individual as a possible source.

Although we readily acknowledge that an error rate for microscopical hair comparison is not currently known, this should not be interpreted to suggest that the discipline is any less scientific. Stating an error that would be applicable for all examiners and laboratories would not be appropriate at this time. Trace Evidence examinations are primarily comparisons based on class characteristics. As such, it is known that mass-produced items submitted as evidence are not unique and biological materials like hair have a range of variation that may be found in samples of similar form. A comparison of these types of materials leads to conclusions that a particular reference/known sample can be included as a possible source of the evidential item or it can be potentially excluded. Class evidence cannot be individualized to one source. Despite not being individualizing; class evidence is valuable information that a jury can use to evaluate the evidence within the context of a case. We recognize the forensic community and stakeholders need to have an in-depth understanding of the limitations of a technique, and the proper steps that need to be taken to minimize potential sources of error. We offer the reference list below to start the discussion as to how best to strengthen the scientific foundation of this class evidence.

The FBI hair review is not complete and we caution citing this review until the final report has been released. The review has not yet provided clear examples of the range of issues leading to their preliminary conclusions.

The OSAC Materials (Trace) subcommittee encourage PCAST to continue to further study the scientific foundation and the technical application of forensic microscopical hair examinations, use their platform to encourage more research, and identify gaps, but caution the committee on dismissing the current scientific methodology and/or its utility. We offer additional publications¹⁹⁻²² that exemplify research seeking to quantify hair features and support the scientific validity and reliable scientific methodology of microscopical hair examinations. It should be noted that much of this research is conducted not just in forensic science but in biological, cosmetological, and anthropological disciplines.

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