The Forensic Odontology Section of the AAFS, the American Board of Forensic Odontology (ABFO), and the American Society of Forensic Odontology (ASFO) have collaborated on a response to the recently released NIST IR 8352 Report and the Center for the Integrity of Forensic Science (CIFS) Video.

All three forensic odontology organizations know the issues surrounding bitemarks and acknowledge past concerns. However, after review of both the report and video, we are concerned that these presentations include misleading broader conclusions by sensationalizing some portions of evidence and excluding others. Allowing this to continue without a strong response would be a severe injustice not only to forensic odontology but to the entire forensic community.

Critics continue to overlook the strides made over the past decade by forensic odontology to address these concerns. It is crucial to reiterate that the cases where odontologists misidentified bite perpetrators occurred in the 1980s and 1990s. Today's odontologists do not adhere to the standards that were in place during that era, yet we continue to be judged by them. An important unanswered question is how many bitemark opinions were ultimately confirmed by salivary amylase analysis and DNA. The ABFO, as the certifying body for forensic odontologists, has taken extensive measures to provide and update its standards and guidelines, which all forensic odontologists are expected to follow. Moreover, the ABFO has collaborated with the OSAC to establish and maintain standards, procedures, and best practice guidelines that promote appropriate methodologies and denounce unsupported opinions. Also noteworthy is the fact that the ABFO is accredited by the Forensic Specialties Accreditation Board (FSAB). This accreditation process includes rigorous evaluations of all ABFO guidelines and standards delineated in the ABFO Diplomate Reference Manual (updated annually) and follows standards outlined by ISO/IEC Standard 17024:2012. The ABFO completed the demanding FSAB re-accreditation process and was recently awarded accreditation for 2023-2028.

Before reviewing the NIST Report it is important to note that during a forensic exam there is a legal requirement to visually inspect the body for indications of injuries, marks, or other external signs of trauma or disease. The data gathered from the external exam can aid in directing the subsequent internal exam and assist in determining the cause and manner of death. This is a legal obligation that cannot be waived. Therefore, we hope others in the forensic community are equally concerned about medicolegal reports that either do not recognize these requirements or do not base them on the most recent updates in standards and guidelines. Thereby drawing conclusions not supported by underlying evidence that may be present.

This response is not a defensive reaction to criticisms. Forensic Odontology agrees with many details presented in the Report. However, the Key Takeaways drawn from those details are far broader than the data support. We attribute this to a significant shortcoming clearly stated in the Report: “The authors of this foundational review are neither lawyers nor forensic odontologists. This provides an opportunity for a neutral and fresh perspective, but also means that some material may have been missed in the review due to inaccessibility”. While we understand the challenging task given to NIST, we are worried that this difficulty may have caused them to disregard fundamental principles of inclusivity and consensus-building. Unfortunately, the Report's misuse of terminology and broad generalization, not supported by the underlying facts,

demonstrates an apparent lack of expertise in Forensic Odontology. Had they invited a few odontology experts from a broad range of perspectives to provide their opinions on the strengths and weaknesses of the Key Takeaways, it could have possibly prevented some of the broad conclusions and missed opportunities. This could have resulted in more valuable recommendations for improving patterned injury and bitemark analysis.

Although we could provide a comprehensive analysis of the NIST Report, we focused our response on the Key Takeaways, highlighting areas of agreement, concern, and missed opportunities. However, our review was based on the entirety of the Report.

KEY TAKEAWAY #1.1: Forensic bitemark analysis lacks a sufficient scientific foundation because the three key premises of the field are not supported by the data. First, human anterior dental patterns have not been shown to be unique at the individual level. Second, those patterns are not accurately transferred to human skin consistently. Third, it has not been shown that defining characteristics of that pattern can be accurately analyzed to exclude or not exclude individuals as the source of a bitemark.

Response: For many years the practice of assigning a bitemark to an individual has been abandoned by the Forensic Odontology community. In addition, the Report's concern that anterior dental patterns lack uniqueness is puzzling since the CSAFE Bitemark Thinkshop report reveals that the term 'uniqueness' isn't even used to describe teeth in this context. According to page 2 of the report, there was a discussion among the Thinkshop attendees about whether each person's dentition is unique. The consensus reached was that this question is irrelevant due to various factors. While the Report acknowledges the absence of absolute uniqueness, it overlooks multiple features that can be used to establish distinction and degrees of rarity. The lack of discussion is a significant shortfall of the Report and dismisses the usefulness of any biological metric that is not unique, such as height, weight, eye color, etc.

Odontology does agree that the accuracy of skin pattern transfer remains uncertain. This is not unique to bitemarks, but to any pattern transfer on any substrate, e.g., tool marks, tire marks, and fingerprints. However, the Report missed the opportunity to discuss whether there is no correlation between the transfer and its source or if the transfer is simply an inaccurate representation of the source. This is a critical question in evaluating an adult versus child bite. Its exclusion from the Report is disappointing.

Given the unresolved issues, the Report failed to discuss if it is necessary to question the basis of the validity of exclusion, a key component used to prevent wrongful convictions.

KEY TAKEAWAY #2.1: The entire human dentition is not represented in a bitemark. Bitemark patterns typically only represent the anterior teeth and thus not the full possible dentition of an individual, limiting the amount of information available for analysis.

Response: Not only are we uncertain about the relevance of this Takeaway, but other forensic sciences do not share NIST's concern. Examples are seen in many OSAC Registry-approved documents:

According to the Best Practice Recommendation for the Detection and Collection of Footwear and Tire Impression Evidence (ANSI/ASB Best Practice Recommendation 052, 1st Ed., 2022): "Partial impressions can, and often do, have evidentiary value."

According to Standard Method for the Examination and Documentation of Ammunition and Ammunition Components (ANSI/ASB Standard 096, 1st Ed. 2022), Pages 4&5: 4.6.3 Fired Cartridge Cases, 4.6.4 Fired Shotshell Cases, and 4.6.5 Fired Bullets/Projectiles "The examiner shall document the apparent characteristics of fired bullets/projectiles (e.g., shotshell components)." The sections all discuss the analysis of parts of ammunition.

Also, the field of ridgeology has demonstrated tremendous success with partial fingerprints.

Therefore, it is perplexing that the Report would mention such a Key Takeaway without further explaining its basis and relevance.

KEY TAKEAWAY #4.1: There is a lack of research into population frequencies, specific identifying characteristics, and measurements that support the notion that human anterior dental patterns as reflected in bitemarks are unique to individuals.

Response: We agree on the need to better determine the frequency of specific identifying characteristics to indicate that bitemarks are distinctive or unique. However, we are uncertain how this differs from Key Takeaway #1.1 part 1 (uniqueness) and the relevancy of drawing any key takeaways that are no longer advocated. Once again, NIST missed the opportunity to closely examine whether specific metrics, such as inter-canine distance, could help make determinations in evaluations.

KEY TAKEAWAY #4.2: Accurate transference of an anterior dentition pattern in the form of a bitemark on human skin can be limited by distortions caused by skin elasticity, unevenness of the biting surface, location of the bite, and movement of the biter and/or victim during the biting event.

Response: Forensic Odontology recognizes that varying degrees of distortion occur when different parts of the human body are bitten. However, the Report implies that this is universally problematic without discussing whether regions with higher substrate stability could produce sufficient levels of accuracy and be amenable to some type of forensic analysis.

KEY TAKEAWAY #4.3: Comparisons between bitemark patterns made on skin, for example multiple bitemarks from the same individual on the same victim, have shown that there exists intra-individual variation in bitemark morphology on the human body such that bitemarks from the same biter may not appear consistent.

Response: We understand the significance of this point, but the Report did not differentiate between consistency and incompatibility. While it is true that bitemarks may not be entirely consistent, it does not make any reference to the degree of distortion and the impact it could have in misinterpretation. For instance, would the distortion cause the mistaking of a child's bite for an adult's bite?

KEY TAKEAWAY #4.4: Bitemarks in cadaver-based research studies represent highly controlled experimental conditions, and these results may overestimate the accuracy of analysis methods. Bitemarks in actual cases, where controlled conditions are not present, are prone to higher levels of inaccuracy.

Response: While it is widely recognized that this type of research has inherent limitations, it is presently one of the viable options. In addition, limitations are encountered in almost every field of biological testing. However, despite such limitations, decisions based on these less-than-perfect models are vital for forensic and therapeutic purposes and have played a significant role in advancing medical science.

KEY TAKEAWAY #4.5: As reflected in research studies to date, bitemark examiners may not agree on the interpretation of a specific bitemark, including whether the injury is a bitemark, the features present, and the exclusion or non-exclusion of potential biters.

Response: The Report missed an opportunity to address concerns about the quality of some previous studies on bitemarks. It failed to document whether graders had clear criteria for defining bitemarks and whether they were calibrated for consistent interpretations. Additionally, there is no published criteria for minimum quality of photographic evidence to confirm their evidentiary value. Therefore, these studies may have highlighted the inadequacies in forensic odontology training rather than the interpretation of bitemarks. It is worth noting that one of the main references used by NIST was an unpublished and non-peer-reviewed study from 2016.

Forensic Odontology acknowledges that this is a major issue. An obstacle in moving forward with research in this area is getting IRB approval. This is understandably difficult given the problematic nature of generating ground-truth bitemark samples. In addition, based on NIST concerns, we had hoped that they would encourage, rather than discourage, the creation of standards on bitemark recognition to calibrate injury recognition based on specific class characteristics. Also, we agree with the need for significant funding and resources to address the stated gaps.

KEY TAKEAWAY #5.1: Repeated calls for additional data by critics and practitioners (since at least 1960) suggest insufficient support for accurate bitemark analysis and a lack of consensus from the community on the way forward."

Response: Forensic Odontology agrees and views this as an opportunity to formulate a comprehensive strategic plan.

Many opinions exist on bitemarks, even within the Forensic Odontology community. We have attempted to provide a balanced response to the NIST Report and not take a rigid stance for or against specific aspects of bitemark analysis. We acknowledge that DNA has shown that some of odontology's past opinions, like many other qualitative forensic science opinions, were incorrect. There are still many unanswered questions. However, we all agree that the universality of the term "bitemark" recognizes the existence of this type of patterned injury. Failure to address a

patterned injury as a bitemark due to historical errors in conclusions would be an injustice to both the victims and those who may be wrongly accused who could be exonerated by exclusion.

The following is specific to the CIFS Video. The cases referenced in the video cannot be dismissed. However, after review, the voice-over states that Bitemark MATCHING is unreliable, yet the text presents a broader and more generalized conclusion that Bitemark EVIDENCE should not be used in court. This occurs at least four times in the video at timestamps 0:50, 1:00, 4:53, and 6:52. The video also highlights the Stinson case, which mistakenly claims that the defendant was wrongfully convicted based solely on bitemark evidence. It fails to acknowledge that other evidence contributed to his conviction. Ironically, it also fails to mention that his case was overturned, at least in part, because of the pro bono work of forensic odontologists based on bitemark evidence. Why do our harshest critics oppose the admission of bitemark evidence in court for the prosecution yet solicit forensic odontologists to testify in cases where it benefits the defendant?

In addition, the video cites that the Innocence Project reports 31 flawed bitemark cases (timestamp 3:31). Yet the Innocence Project website (accessed April 16, 2023) only lists eight (3.9%) such cases out of a total of 204. It is worth noting that the same website listed 5 (2.4%) flawed DNA cases. Far more significant, it lists 58 (28.4%) serology and 51 (24%) hair analysis cases that are flawed.

Finally, as a community of forensic odontology professionals, we have regularly communicated updates on the evolving standards through informative presentations at the AAFS and ASFO annual scientific sessions. However, considering the unrelenting criticisms, we acknowledge that this approach may not be sufficient in scope to educate the broader forensic community about the changes made to our standards and guidelines over the last 30 years.

https://nvlpubs.nist.gov/nistpubs/ir/2023/NIST.IR.8352.pdf
CIFS Bite Mark Video is Now Available on YouTube - Forensic Resources
https://www.sciencedirect.com/science/article/abs/pii/S1752928X2300046X.