Forensic Bitemark Identification Evidence in Canada

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Abstract

Recent reviews by peak scientific bodies have concluded that forensic bitemark identification is not a demonstrably valid science. In the United States, the practice of forensic bitemark identification has been linked to at least 14 wrongful convictions and has been the subject of considerable academic study. Much less is known about the use of forensic bitemark identification in Canadian courts. To remedy this lack of knowledge, we performed an exhaustive search of the reported Canadian case law. We found 14 cases in which courts relied on a forensic bitemark identification, a number that likely underestimates the use of this practice. Still, in the cases we found, forensic bitemark experts overstated the accuracy and reliability of their practice, and did not appear to disclose the considerable controversy in the field. Furthermore, and despite repeated directions from the Supreme Court of Canada that trial judges should exercise a robust gatekeeper role in the face of invalid science, none of the courts excluded bite mark analysis, nor expressly questioned the scientific validity of the practice. We discuss these findings and provide recommendations based on the principle of transparency.

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Part I. Introduction

> [The President's Council of Advisors on Science and Technology] finds that bitemark analysis
> does not meet the scientific standards for foundational validity, and is far from meeting such
> standards. To the contrary, available scientific evidence strongly suggests that examiners
> cannot consistently agree on whether an injury is a human bitemark and cannot identify the
> source of bitemark with reasonable accuracy.[1]

The forensic sciences are widely depicted as being precise and rigorous,[2] a portrayal that often diverges from their true epistemic status.[3] Indeed, recent reports from leading scientific bodies have found that several forensic scientific fields were never adequately tested and demonstrate unacceptably high error rates.[4] Forensic bitemark analysis is a prime offender in this respect. In 2016, a report from the President's Council of Advisors on Science and Technology (the "PCAST Report") provided the above quote. It confirmed findings from a 2009 report of a committee of the National Academy of Sciences (the "NAS Report") that issued similar warnings against using bitemark identification as inculpatory evidence in court.[5] Despite the

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[1] United States, President's Council of Advisors on Science and Technology, *Forensic Science in Criminal Court: Ensuring Scientific Validity of Feature-Comparison Methods* (Washington, DC: Executive Office of the President, 2016) at 87 [PCAST Report]. Find a lucid summary of the PCAST Report in Stephen Cordner, David Ranson & Richard Bassed, "The Foundations of the Comparison Forensic Sciences: Report of the President's Council of Advisors on Science and Technology" (2016) 24 Journal of Law and Medicine 297-302.

[2] Tom R Tyler, "Viewing CSI and the Threshold of Guilt: Managing Truth and Justice in Reality and Fiction" (2006) 115 Yale LJ 1050-1085; Jason Chin & Larysa Workewych, "The CSI Effect" in Markus Dubber, ed, *Oxford Handbooks Online* (New York: Oxford University Press, 2016).

[3] National Research Council, *Strengthening Forensic Science in the United States: A Path Forward* (Washington, DC: National Academies Press, 2009) [NAS Report]; PCAST Report, *supra* note 1; and see Barack Obama, "The President's Role in Advancing Criminal Justice Reform" (2017) 130:3 Harv L Rev 811 at 860: "Contrary to the perception on TV dramas, forensic science disciplines are subject to varying degrees of uncertainty and misinterpretation."

[4] NAS Report, *ibid*; PCAST Report, *supra* note 1.

[5] NAS Report, *ibid* at 174-176. See also: Michael J Saks et al, *Forensic bitemark identification: weak foundations, exaggerated claims*, 3:3 Journal of Law and the Biosciences 438-575 [Saks et al]; David L Faigman et al, Modern Scientific Evidence (Thomson Reuters, 2016-2017) at §35:17 [Modern Scientific Evidence].

clear prejudice such evidence presents to the criminally accused, there has been no systematic

study of its use in Canadian courts.[6] In this article, we endeavor to fill that void.

The (mis)use of bitemark analysis has been well-documented in the United States.[7]

There, the practice has been implicated in at least 14 DNA-supported exonerations of wrongfully

convicted individuals.[8] Less is known about the experience in Canada – both with respect to the

use of forensic bitemark analysis specifically[9] and the forensic sciences more broadly.[10]

Bitemark analysis provides a useful starting point for this broader inquiry because it is a

discipline that has received some of the most piercing scientific criticism. For instance, while the

PCAST Report suggested that various other forensic disciplines could improve, it was the least

optimistic – indeed, fatalistic – when it came to bitemark analysis: "…PCAST considers the

prospects of developing bitemark analysis into a scientifically valid method to be low. We advise

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[6] The only review we are aware of is three paragraphs in Gary Edmond et al, "Admissibility Compared: The Reception of Incriminating Expert Evidence (i.e., Forensic Science) in Four Adversarial Jurisdictions" (2013) 3 University of Denver Criminal Law Review 31-109 at 75-76 [Edmond et al]. See also a lucid critical discussion of the practice in Alan D Gold, *Expert Evidence in Criminal Law: The Scientific Approach*, 2nd ed. (Toronto: Irwin, 2009) [Gold] at 7-8, 152-153.

[7] Erica Beecher-Monas, "Reality Bites: The Illusion of Science in Bitemark Evidence" (2009) 30:4 Cardozo Law Review 1369-1410 at 1389-1401; Modern Scientific Evidence, *supra* note 5 at §35:5-35:7; Saks et al, *supra* note 5 at 543-550.

[8] Modern Scientific Evidence, *ibid* at §35:7; More generally, one study estimates that invalid forensic science is present in 60% of wrongful convictions: Brandon L Garrett & Peter J Neufeld, "Invalid Forensic Science Testimony and Wrongful Convictions" (2009) 95:1 Va L Rev 1-97.

[9] Again, we are only aware of the three paragraphs in Edmond et al, *supra* note 6 at 75-76. It was generally inconclusive, pointing out that Canadian courts grant forensic odontologists considerable scope when testifying and that they permit exculpatory bitemark analysis to be admitted.

[10] In the U.S., the treatise *Modern Scientific Evidence* spans volumes and systematically details the use of forensic science in American courts. Excellent Canadian work exists, but it is typically spread across several works focused on specific issues, see: Edmond et al, *ibid* at 69-78; Gary Edmond & Kent Roach, "A Contextual Approach to the Admissibility of the State's Forensic Science and Medical Evidence" (2011) 61:3 UTLJ 343 [Edmond & Roach]; Lisa Dufraimont, "New Challenges for the Gatekeeper: The Evolving Law on Expert Evidence in Criminal Cases" (2012) 58:3&4 Crim LQ 531 [Dufraimont Gatekeeper]; Emma Cunliffe & Gary Edmond, "Gaitkeeping in Canada: Mis-steps in assessing the reliability of expert testimony" (2013) 92 Can Bar Rev 327 [Cunliffe Gaitkeeping]; Gold, *supra* note 6.

against devoting significant resources to such efforts."[11] If there is any modern forensic field that courts should be on notice about, it is bitemark identification.

To address these issues with the forensic sciences, both the PCAST and NAS reports recommended that these sciences and their regulatory bodies receive greater funding to strengthen their practices.[12] In early 2017, however, the subsequent American administration decided to defund such programs.[13] As a result, it has never been more important for the judiciary to understand the limits of the current forensic practices. Canadian courts and organizations can be expected to play a vital role in these endeavors in the coming years.

In light of these scientific revelations and political transitions, it is important to know how Canadian courts are using bitemark analysis, how extensive that use is, and if that use is at all sensitive to the severe limitations of the practice. Although most scholars are profoundly pessimistic about the impact that legal standards have on admissibility decisions,[14] there may be reason to believe bitemark analysis is less problematic in Canada. For instance, Canadian expert witnesses may be more cautious in their opinions or defence counsel more skilled at rebutting such evidence.[15] Moreover, the Canadian justice system boasts a long and respected history of

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[11] PCAST Report, *supra* note 1 at 9.

[12] NAS Report, *supra* note 3 at 19-33; PCAST Report, *ibid* at 16.

[13] Spencer S Hsu, "Sessions orders Justice Dept. to end forensic science commission, suspend review policy", *The Washington Post* (2017), online: < https://www.washingtonpost.com/local/public-safety/sessions-orders-justice-dept-to-end-forensic-science-commission-suspend-review-policy/2017/04/10/2dada0ca-1c96-11e7-9887-1a5314b56a08_story.html?utm_term=.8d5130ad2014>.

[14] Jane Campbell Moriarty & Michael J Saks, "Forensic Science: Grand goals, Tragic Flaws, and Judicial Gatekeeping" (2005) 44 Judges J 16 at 29: "The single most important observation about judicial [gate-keeping] of forensic sciences is that most judges under most circumstances admit most forensic science"; Edmond et al, *supra* note 6 at 89: "Formal admissibility standards do not seem to make much difference".

[15] In the context of eyewitness identification evidence, one scholar suggests that such evidence is less problematic in Canada than the United States because defence counsel are more skilled in Canada, see: Lee Steusser, "Experts on Eyewitness Identification: I Just Don't See It" (2006) 31 Man LJ 543-553: "When one looks to our high profile wrongful conviction cases, such as Milgaard, Sophonow and Morin, one sees that these accused were represented by some of the best defence counsel in their respective provinces. Bad lawyering, therefore, is not as significant a factor in Canada."

commissioning public inquiries in response to its failures.[16] Two of these inquires focused especially on failures of forensic science.[17] It is possible that these have had some impact on the use of bitemark analysis. Finally, uncovering just a few Canadian decisions that are critical of bitemark analysis would be useful to accused who may be confronted with such evidence. Indeed, courts generally seem to be more likely to follow precedent than embark on any form of scientific inquiry.[18]

In what follows, we will present our review and analysis of the use of forensic bitemark identification evidence in Canadian courts. In Part II, we will briefly discuss the putative scientific foundation of bitemark identification. Then, in Part III, we turn to the law of expert evidence in Canada. We then build on that context to fulfil two aims: Part IV's comprehensive review of the published Canadian case law on forensic bitemark evidence and Part V's critical examination of those decisions. Part VI concludes with our recommendations for reform that are based around the principle of transparency.

Part II. A Forensic Bitemark Identification Primer

Before discussing the Canadian jurisprudence, a brief primer on the highly contested practice of forensic bitemark identification is useful in setting the scene. In this part, we first

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[16] Kent Roach, "The Role of Innocence Commissions: Error Discovery, Systematic Reform, or Both" (2010) 85 Chicago-Kent L Rev 89 at 104: The Canadian model is the "pioneer and gold standard of the systemic reform model"; Emma Cunliffe & Gary Edmond, "Reviewing Wrongful Convictions in Canada" (2017) Crim LQ 474-486; Emma Cunliffe & Gary Edmond, "What Have We Learned? Lessons from Wrongful Convictions in Canada" in Benjamin Berger, Emma Cunliffe and James Stribopoulos (eds), *To Ensure Justice is Done: Essays in Memory of Marc Rosenberg* (Toronto: Carswell, forthcoming 2017).

[17] Ontario, *Report of the Kaufman Commission on Proceedings Involving Guy Paul Morin* (Toronto: Ministry of the Attorney General, 1998) (The Honourable Fred Kaufman) [Kaufman Report]; Ontario, *Inquiry into Pediatric Forensic Pathology in Ontario: Report* (Toronto: Ministry of the Attorney General, 2008) vols 1–4 (The Honourable Stephen T Goudge) [Goudge Report]. On Canadian wrongful convictions, see Bruce A MacFarlane, "Wrongful Convictions: Determining Culpability When The Sands Keep Shifting" (2014) 472 UBC Law Review 597-636 [MacFarlane]; Bruce MacFarlane, "Convicting the Innocent: A Triple Failure of the Justice System" (2005) 31:3 Manitoba LJ 403-488.

[18] Edmond et al, *supra* note 6 at 102, 106.

describe what it is that practitioners of forensic bitemark analysis (i.e., forensic odontologists) do,[19] and why their task is so challenging. We then go on to summarize the research that has sought to measure the validity of forensic bitemark identification. This review will be brief because, as discussed above, the NAS and PCAST Reports recently provided thorough accountings of forensic bitemark analysis.[20] Moreover, shortly before the PCAST Report was published, Michael Saks and several other leading scientists and legal scholars published an overview of bitemark analysis and its impact on U.S. courts.[21]

Along with techniques like DNA and fingerprint analysis, forensic bitemark analysis falls under a class of forensic methods that rely on feature-comparison.[22] Using such methods, analysts compare an evidentiary sample, such as one found at a crime scene, to a known sample, such as one taken from a suspect. Their goal is to determine if the two samples came from the same source.[23] Forensic odontologists compare a bitemark, often found on skin, to a known set of dental impressions. Much of this comparison is based on the arrangement of the front teeth, which are those that are typically engaged in the bites found in criminal investigations.[24]

Matching a bitemark found on human skin to a suspect's dentition is a very difficult task. The found bitemark itself is almost invariably incomplete and of a poor quality.[25] While adults

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[19] Less controversially, forensic odontologists assist in identifying remains of accidents and typically do so more accurately than identifications made based on bitemarks found on human skin, see: Modern Scientific Evidence, *supra* note 5 at §35:9; Saks et al, *supra* note 5 at 543. For simplicity, we will refer to bitemark analysis, identification, and comparison interchangeably. But our discussion should not be taken to encompass the less-contested practices of identifying remains and swabbing bitemarks for DNA. See Richard Souviron & Leslie Haller, "Bite mark evidence: bite mark analysis is not the same as bite mark comparison or matching or identification" (2017) Journal of Law and Biosciences 617–622 [Souviron & Haller].

[20] See: NAS Report, *supra* note 3 at 173-176; PCAST Report, *supra* note 1 at 83-87; Saks et al, *supra* note 5.

[21] *Ibid*.

[22] PCAST Report, *ibid* at 1, 23.

[23] *Ibid* at 23.

[24] PCAST Report, *ibid* at 83; Saks et al, *supra* note 5 at 554-555.

[25] Saks et al, *ibid* at 554-556.

typically have 32 teeth, only the edges of the front teeth are involved in biting.[26] Further, skin

(i.e., the substrate) is not a good medium on which to create accurate impressions: "bite marks on

the skin will change over time and can be distorted by the elasticity of the skin, the unevenness

of the surface bite, and swelling and healing."[27] Indeed, a systematic research program using

bitemarks made on human cadavers has found substantial variation in those bitemarks.[28]

Another complicating factor is the lack of a standardized and rigorous methodology. For

instance, there is currently no standardized criteria for determining whether the bitemark and

dentition are sufficiently similar.[29] On this topic, the NAS Report concluded: "there is still no

general agreement among practicing forensic odontologists about the national or international

standards for comparison."[30] Further, "blinding", or keeping the analyst unaware of whether the

sample is from a suspect or not, is not common in practice.[31]

This flexibility granted to practitioners in how they come to their decisions opens the

door for cognitive bias.[32] One form of such bias is "contextual bias", which occurs when

irrelevant information about the case unconsciously affects the forensic scientist's judgment.[33]

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[26] *Ibid* at 554-555.

[27] NAS Report, *supra* note 3 at 174.

[28] E.g., see Mary A Bush et al, "A Study of Multiple Bitemarks Inflicted in Human Skin by a Single Dentition Using Geometric Morphometric Analysis" (2011) Forensic Science International 211. See also Sherie A Blackwell et al "3-D Imaging and Quantitative Comparison of Human Dentitions and Simulated Bite Marks" (2007) 121 International Journal of Legal Medicine 9-17; Modern Scientific Evidence, *supra* note 5 at §35:18-35:19, §35:22.

[29] PCAST Report, *supra* note 1 at 83: "The bitemark standards do not provide well-defined standards concerning the degree of similarity that must be identified to support a reliable conclusion that the mark could have or could not have been created by the dentition in question. Conclusions about all these matters are left to the examiner's judgment."

[30] NAS Report, *supra* note 3 at 176; and see PCAST Report, *ibid*.

[31] Saks et al, *supra* note 5 at 550; NAS Report, *ibid* at 174-175.

[32] NAS Report, *ibid* at 122-124, 184-185; Goudge Report, *supra* note 17 at 387-390; PCAST Report, *supra* note 1 at 31; Gary Edmond et al, "Contextual Bias and Cross-contamination in the Forensic Sciences: the Corrosive Implications for Investigations, Plea Bargains, Trials and Appeals" (2014) 13 Law, Probability & Risk 1 [Contextual Bias]; Itiel Dror et al, "The Bias Snowball and the Bias Cascade Effects: Two Distinct Biases That May Impact Forensic Decision Making" (2017) 62:3 Journal of Forensic Sciences [Dror et al].

[33] Contextual Bias, *ibid* at 2; PCAST Report, *ibid*; Itiel Dror et al, "Contextual Information Renders Experts Vulnerable to Make Erroneous Identifications" (2006) 156 Forensic Science International 74.

The current practice of forensic odontology provides a perfect storm of conditions for such bias – examiners have wide discretion in their decision-making and are often aware of the identity of the suspect.[34] Heightening these concerns is the reality that bitemark cases typically arise in some of criminal law's most viscerally evocative factual situations: murder and sexual assault (indeed, these were the subject matter of 9 of the 14 cases we reviewed, see Part IV).[35] In such cases, the desire to identify and punish the culprit is quite high.

Even if forensic odontologists were appropriately blinded and their approach was more systematic and defined, their conclusions would be undermined by the fact that "no thorough study has been conducted of large populations to establish the uniqueness of bite marks."[36] In other words, there may be many others – those who could have been the actual biter – with visibly identical dentition as the suspect. Without such data, it is impossible to say how often one would expect two bitemarks to appear identical by chance alone.

In light of the serious challenges inherent in the bitemark analysis process, both the PCAST Report and the NAS Report concluded that bitemark analysis was not a demonstrably valid science. Furthermore, the PCAST Report stated that bitemark analysis was unlikely to ever develop into a valid science.[37] In the remainder of this part, we will review the existing failed attempts at establishing the field's validity.

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[34] This appeared to be the case in *R v Kines* case, see Part V below.

[35] See Modern Scientific Evidence, *supra* note 5 at §35:27.

[36] NAS Report, *supra* note 3 at 174; Saks et al, *supra* note 5 at 558-561; A recent review of 13 studies of dental uniqueness was inconclusive, with 9 of the studies concluding dentition is not unique, see: Ademir Franco et al, *The Uniqueness of the Human Dentition as Forensic Evidence: A Systematic Review*, 129:6 International Journal of Legal Medicine 1277-1283 (2015); Modern Scientific Evidence, *supra* note 5 at §35:20, §35:23.

[37] PCAST Report, *supra* note 1 at 87.

Scientific validity can be parsed into two components: foundational validity and applied validity.[38] Foundational validity focuses on the methodology, asking if it produces accurate results: does the conclusion that a bitemark matches a set of dental impressions accord with the "ground truth".[39] In other words, when the method reports an identification, are the two samples actually from the same individual? Foundational validity also requires reliability: does the method consistently lead to the same results across both time and the forensic odontologist applying the method? Once it is determined that a method is foundationally valid, applied validity must be assessed.[40] Applied validity requires that the specific forensic odontologist be capable of applying the method with a low degree of error (usually supported through periodic and realistic proficiency testing) and have faithfully applied it in the instant case.[41]

In assessing the claims of bitemark analysis, it is important to recognize that it is a predominantly subjective methodology; its conclusions hinge on human judgment. As a result, it must be assessed differently than more objective procedures, like DNA analysis of samples from single sources. For instance, whereas such DNA analysis is typically an automated process that operates according to a predetermined set of procedures that are open to scrutiny,[42] bitemark analysis occurs in the black box[43] of the odontologist's mind. Accordingly, proponents of the process must establish its validity through largescale validation studies to demonstrate that the methodology yields accurate results. By comparison, validation is currently underway with

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[38] *Ibid* at 47-59.

[39] *Ibid* at 5-6; Jason M Tangen et al, "Identifying Fingerprint Expertise", (2011) 22 Psychological Science 995 at 997 [Tangen].

[40] PCAST Report, i*bid* at 56-59.

[41] *Ibid*.

[42] But note there has historically been more subjectivity in interpreting samples containing DNA from multiple sources, see *ibid* at 76-81.

[43] Black box is a term of art that reflects the difficulty of observing and scrutinizing subjective mental processes, see PCAST Report, *ibid* at 5, 7, 9, 11-12, 46, 48. See also Brandon L Garrett & Gregory Mitchell, 'The Proficiency of Experts' (forthcoming) 166 University of Pennsylvania Law Review.

fingerprint identification.[44] Several large peer-reviewed and published studies indicate that the error rates of that methodology are around 5%.[45] As we will see, the outlook for bitemark analysis is less optimistic.

Beginning with foundational validity, studies of reliability ask if forensic odontologists provide conclusions that agree with each other. The most recent study of this type is a 2016 investigation of the American Board of Forensic Odontologists (the "ABFO").[46] The ABFO is one of the key professional organizations responsible for regulating forensic dentists and provides board certification to those members wishing to seek it.[47] This study asked 38 ABFO-certified forensic odontologists with an average of 20-years experience to consider 100 bitemarks. They were to opine on (1) if there was enough information to say if the source of a bitemark was human, (2) if it was indeed human-made, and (3) if there were distinct identifiable characteristics. These are key threshold questions to making an identification. The results were deeply problematic. As reported by the PCAST:[48]

> Among the 38 examiners who completed the study, it was reported that there was unanimous
> agreement on the first question [whether there was enough information to say it was a human
> bite mark] in only 4 of the 100 cases and agreement of at least 90% in only 20 of the 100 cases.

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[44] *Ibid* at 87-97

[45] See: Bradford T Ulery et al, "Accuracy and Reliability of Forensic Latent Fingerprint Decisions" (2011) 108:19 Proceedings National Academy Sciences 7733 at 7733–38; Tangen, *supra* note 39; and see PCAST Report, *ibid* at 91-95 for a review.

[46] The ABFO has not made the raw data of this study publicly available but it has provided the raw data to select individuals. We rely on descriptions provided by the PCAST Report, *ibid* at 84-85 and Saks et al, *supra* note 5 at 562-563.

[47] NAS Report, *supra* note 3 at 173.

[48] PCAST Report, *supra* note 1 at 85. A 2013 qualitative study came to a similar conclusion, with 15 forensic odontologists providing widely divergent opinions about bitemarks from actual cases, see: Mark Page, Jane Taylor & Matt Blenkin, "Expert Interpretation of Bitemark Injuries – A Contemporaneous Qualitative Study" (2013) 58:3 Journal of Forensic Sciences 664-672. See also: Ian A Pretty & David Sweet, "Digital Bitemark Overlay – An Analysis of Effectiveness" (2001) 46 Journal of Forensic Science 1385-1391 [Pretty].

Across all three questions, there was agreement of at least 90 percent in only 8 of the 100 cases.

Other studies have focused on accuracy, comparing forensic odontologists' opinions to the ground truth, to determine how likely they are to form the correct judgment. Most of these studies suffer from methodological limitations (e.g., use of imprints made in non-human skin substrates, like cheese and pig skin) that, if anything, biased them towards finding that bitemark analysis is accurate.[49] Still, these studies demonstrate unacceptably high rates of error.[50] We will focus on error as measured by the false-positive rate (FPR), or the chance of declaring a match when the samples are not, in fact, from the same source. In the context of criminal law, which is guided by the principle of avoiding wrongful convictions, the FPR is particularly important.[51] The PCAST Report suggested that FPRs should be, at the very most, 5%.[52]

In one study of accuracy, 26 certified ABFO diplomates (i.e., the best-regarded in the field)[53] viewed photographs of bitemarks made in human skin from three criminal cases and one bitemark made in cheese.[54] Accuracy was generally quite poor, with an average FPR of 63.5%.[55] And in another study of ABFO diplomates, the experimenters used bitemarks made on pig skin as the stimuli. Such studies likely understate error rates because the bites do not occur in the

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[49] Saks et al, *supra* note 5 at 565.

[50] PCAST Report, *supra* note 1 at 87.

[51] *Ibid* at 151-152.

[52] *Ibid*; for a review of the legal significance of different conceptualizations of error, see: Jason M Chin & Helena Likwornik, "*R v Bingley* and the Importance of Scientifically Guided Legal Analysis" (2017, forthcoming) Queen's LJ [Chin & Likwornik].

[53] Modern Scientific Evidence, *supra* note 5 at §35:13.

[54] *Ibid* at §35:12-13; Kristopher L Arheart & Iain A Pretty "Results of the 4th ABFO Bitemark Workshop – 1999" (2001) 124 Forensic Science International 104-111.

[55] Note that these are corrected figures reported in Modern Scientific Evidence, *supra* note 5 at §35:13. The original report did not correct for the fact that participants could make every incorrect identification but still appear accurate: "What is not made evident by that number is the fact that the poorest level of performance that examiners could achieve in this study—if they got every single answer as wrong as they could get it—would still make them appear to be accurate 71% of the time. That is because if an examiner failed to match a bitemark with the correct dentition (one error) and linked it instead with the dentition of an innocent suspect (second error) he still gets the remaining five dentitions "right" by not erroneously inculpating them."

course of a struggle. Still, FPRs were unacceptably high, averaging 15.9% and ranging up to 45.5%.[56]

Reflecting on the above studies, the PCAST Report concluded: "Among those studies that have been undertaken, the observed false positive rates were so high that the method is clearly scientifically unreliable at present."[57] Given the field's lack of demonstrable foundational validity, any discussion of applied validity is premature. Still, it is worth noting that the immense variance in accuracy found in the above studies suggests a skill that varies greatly between forensic odontologists. As such, it is problematic that the field has resisted proficiency testing as a means to determine whether practitioners can accurately employ their methodology: "Previous attempts by the ABFO to achieve some measure of bitemark examiner outcome calibration have repeatedly been repudiated by the organization. The ABFO is silent regarding establishing a mandatory testing of its membership"[58]

Part III. Canadian Scientific Evidence Law

The current state of knowledge in bitemark identification is deeply uncertain. Practitioners come to divergent opinions, not just about whether a bitemark resembles a suspect's dentition, but if that bitemark comes from a human. Despite this fact, the majority of practitioners remain confident in the methodology's efficacy.[59] These experts, garbed in the "mystique of science",[60] can (and do) confidently tell factfinders that a bitemark found on a victim matches an accused's dentition.[61] This is the prejudicial content without probative value

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[56] Pretty, *supra* note 48 at 1388. See also PCAST Report, *supra* note 1 at 86.

[57] *Ibid* at 87.

[58] Modern Scientific Evidence, *supra* note 5 at §35:13.

[59] NAS Report, *supra* note 3 at 175.

[60] *R c J (J)*, [2000] 2 SCR 600 at para 55, (sub nom *R v J (J-L)*), 148 CCC (3d) 487 [*JLJ*].

[61] See Jason M Chin, Jan Tomiska & Chen Li, "Drawing the Line Between Lay and Expert Opinion Evidence" (2017, forthcoming) 63:1 McGill LJ [Chin et al] for a review of this hazard.

that the law of evidence is designed to guard against.[62] In this part, we will briefly review evidence law in Canada as it pertains to forensic bitemark analysis.

Trial judges have a variety of tools for regulating expert evidence. They can choose to admit the evidence and let any flaws go to weight. Those flaws would presumably be explored in cross-examination or in the judge's instructions to the jury.[63] The trial judge can also admit the evidence but with a limited scope. For instance, the expert may only be permitted to speak to certain issues, using certain assumptions and specific language.[64] Finally, the trial judge can exclude the evidence altogether. These decisions are governed by opinion evidence law.

At least notionally, the rules for admitting expert evidence into Canadian courtrooms has grown more precise and demanding over the past 20 years.[65] In reviewing the relevant jurisprudence, the Supreme Court recently remarked on this trend towards enhanced gatekeeping: "The unmistakable overall trend of the jurisprudence, however, has been to tighten the admissibility requirements and to enhance the judge's gatekeeping role."[66] We will now briefly review that trend.

Canada's foundational expert evidence decision is *R v Mohan*, a 1994 decision of the Supreme Court.[67] Prior to *Mohan*, admission of expert evidence largely followed the English common law tradition, which required relevance and helpfulness.[68] As to scientific evidence,

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[62] *R v Seaboyer*, [1991] 2 SCR 577 at para 44, 4 OR (3d) 383; Hamish Stewart, "Justice Frank Iacobucci and the Revolution in the Common Law of Evidence" (2007) 57:2 University of Toronto Law Journal 479-497 at 481-483.
[63] Or, in an ideal world, be disclosed by the experts themselves.
[64] See *R v Abbey*, 2009 ONCA at paras 62-70, 97 OR (3d) 330 [*Abbey* ONCA 2009].
[65] Goudge Report, *supra* note 17 at 471-487; Dufraimont Gatekeeper, *supra* note 10; Edmond & Roach, *supra* note 10 at 381-387.
[66] *White Burgess Langille Inman v Abbott and Haliburton Co*, 2015 SCC 23 at paras 20, [2015] 2 SCR 182 [*White Burgess*].
[67] *R v Mohan*, [1994] 2 SCR 9, 114 DLR (4th) 419 [*Mohan*].
[68] See: *Mohan*, *ibid* at paras 22-49 for a review of the expert evidence jurisprudence that led to *Mohan*; Edmond et al, *supra* note 6 at 69-72.

pre-*Mohan* courts tended to agree that in addition to those requirements, the evidence had to be "reasonably reliable".[69] In assessing reasonable reliability, some Canadian courts[70] referred to *indicia* found in *U.S. v Williams*, an American decision.[71] These *indicia* include the error rate of the science and, generally, the degree to which it had been vetted by other scientists.[72]

Justice Sopinka, writing for the Court in *Mohan*, held that expert evidence must meet four requirements for admission: (1) relevance; (2) necessity in assisting the trier of fact; (3) absence of an exclusionary rule; and (4) a properly qualified expert.[73] Furthermore, trial judges have a residual discretion to exclude evidence when its benefits (e.g., its reliability and necessity) are outweighed by its costs to the trial process (e.g., confusion it may cause and the consumption of time).[74] When the expert evidence is novel scientific evidence, Justice Sopinka held that it should receive "special scrutiny to determine whether it meets a basic threshold of reliability".[75]

The Supreme Court of Canada's 2000 decision in *R v J (L-J)* elaborated on what that special scrutiny entails.[76] In *JLJ*, the Court characterized a physiological test that purported to identify pedophilia as novel science and applied four factors found in the leading U.S. decision, *Daubert v Merrell Dow Pharmaceuticals Inc*.[77] Those factors are: (1) whether and how the science has been tested; (2) the error rate associated with the science; (3) whether and how the

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[69] *Béland v R*, [1987] 2 SCR 398 at para 112, 43 DLR (4th) 641 [*Béland*]; *R v Legere* (1994), 95 CCC (3d) 139 at para 54, 401 APR 321; *R v Johnston* (1992), 69 CCC (3d) 395 at para 65, 12 CR (4th) [*Johnston*]; *R v Singh*, 23 WCB (2d) 558, 1993 CarswellBC 3097 [*Singh*]; *Grant v Dube*, [1993] 2 WWR 41 at para 11, 36 ACWS (3d) 75 [*Grant*]; In British Columbia the test was couched in "trustworthiness" as opposed to reliability, see: *R v Richards*, [1994] BCWLD 1818, 24 WCB (2d) 177.

[70] *Johnston*, *ibid* at para 34; *Grant*, *ibid* at para 19; *R v Baptiste*, [1992] BCWLD 2553 at paras 11-12, 17 WCB (2d) 453.

[71] 583 F 2d 1194 (2d Cir, 1978) [*Williams*]. These *indicia* were subsequently endorsed and expanded upon in *U.S. v Jakobetz*, 747 F Supp 250 at 254-255 [*Jekobetz*].

[72] *Williams*, *ibid* at 1198; *Jekobetz*, *ibid* at 255.

[73] *Mohan*, *supra* note 67 at paras 18-21.

[74] *Ibid* at para 22.

[75] *Ibid* at para 32.

[76] *JLJ*, *supra* note 60 at para 33. See also Goudge Report, *supra* note 17 at 482-483.

[77] 125 L Ed 2d 469, 113 S Ct 2786, 509 US 579 (US Cal Sup Ct, 1993) at 595 [*Daubert*].

science has been peer reviewed; and (4) whether the science has been generally accepted in its field.[78] The court determined the physiological test was not valid because of (among other shortcomings) its high error rate and lack of rigorous testing.[79] Later in *R v Trochym*, the Supreme Court seemed to broaden the ambit of scientific evidence that would receive *Daubert* scrutiny to contested science, applying it to the process of hypnotically retrieving memories.[80] Such evidence was not novel, having been admitted into court several times, but rather had seen its scientific foundations eroded by subsequent findings.[81]

The most recent thorough Supreme Court enunciation of the expert evidence rules is in *White Burgess Langille Inman v Abbott and Haliburton Co*.[82] In that case, the Court adopted and refined a two-stage reformulation originally developed by the Court of Appeal for Ontario in *R v Abbey*.[83] At the first stage, the evidence's proponent must demonstrate four threshold criteria: the logical relevance of the evidence and the final three factors from *Mohan*.[84] At the second stage, the trial judge must determine if the evidence is "sufficiently beneficial to the trial process to warrant its admission despite the potential harm to the trial process" that may flow from admitting it.[85] Importantly for our discussion, the Court noted that reliability enters into the calculus at both stages. At the first stage, "novel or contested science or science used for

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[78] *Ibid* at 592-595.

[79] *Ibid* at paras 51-55.

[80] *R v Trochym*, 2007 SCC 6, [2007] 1 SCR 239 [*Trochym*].

[81] *Ibid* at para 32: "While some forms of scientific evidence become more reliable over time, others may become less so as further studies reveal concerns."

[82] *Supra* note 66. See the summary of these rules in Ontario, *Harmful Impacts: The Reliance on Hair Testing in Child Protection Report of the Motherisk Commission* (Ontario: Ministry of the Attorney General, 2018) (The Honourable Judith C Beaman) at 32-34 [Beaman Report].

[83] *Supra* note 64.

[84] These are: necessity in assisting the trier of fact, absence of applicable exclusionary rules and a properly qualified expert. See *White Burgess*, *supra* note 66 at para 23.

[85] *Ibid* at para 24, quoting *Abbey* ONCA 2009, *supra* note 64 at para 76. This elaborates on the same costs and benefits weighing from *Mohan*, *supra* note 67 at para 22.

a novel purpose"[86] requires special scrutiny. And at the second stage, reliability should be factored into the costs and benefits of the opinion, and thus inform the trial judge's ongoing gatekeeping duty.[87]

Besides generally clarifying the rules, *White Burgess*'s most important doctrinal advances were in enunciating the expert's duty to objectively assist the court or tribunal. In particular, the Court explained the rules of evidence as they relate to evidence that is purportedly biased, partial, and non-independent.[88] The Court held that expert evidence that did not meet a threshold level of impartiality and independence should be excluded under the properly qualified expert criterion and further that such bias militated towards exclusion at the discretionary stage of the analysis.[89]

As we will discuss further in Parts V and VI, screening evidence for partiality represents another safeguard against unreliable expert evidence. This is because partiality can distort expert evidence – the experts, consciously or unconsciously,[90] may conduct their analysis and present their findings in a way that favours the side that tendered them.[91] This adversarial bias is not a new concept: Sir George Jessell remarked in 1873 that witnesses feel a "natural bias to do

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[86] *White Burgess*, *ibid* at para 23. Two years after *White Burgess*, the Supreme Court in *R v Bingley*, 2017 SCC 12 at para 22, 135 WCB (2d) 356 [*Bingley*] dropped the contested science language. Thus, the trigger for *Daubert* scrutiny remains unclear. This distinction matters: Bitemark analysis may not be novel science, but there is no question it is contested, see: Part V below; Chin & Likwornik, *supra* note 52.

[87] *White Burgess*, *ibid* at para 24. See also *R v Sekhon* 2014 SCC 15 at para 51, 367 DLR (4th) 601, indicating that evidence based purely on an investigator's anecdotal experience lacks probative value and should be excluded.

[88] *White Burgess, ibid* at para 32. It defined those terms as follows: "The expert's opinion must be impartial in the sense that it reflects an objective assessment of the questions at hand. It must be independent in the sense that it is the product of the expert's independent judgment, uninfluenced by who has retained him or her or the outcome of the litigation. It must be unbiased in the sense that it does not unfairly favour one party's position over another."

[89] *Ibid* at paras 52-54. *White Burgess* was presaged by academic work suggesting the *Mohan* test did not adequately deal with bias, see: David M Paciocco,"Unplugging Jukebox Testimony in an Adversarial System: Strategies for Changing the Tune on Partial Experts" (2009) 34 Queen's LJ 565 [Paciocco Jukebox]; Paul Michell & Renu Mandhane, "The Uncertain Duty of the Expert Witness" (2005) 42:3 Alberta Law Review.

[90] Paciocco Jukebox, *ibid* at 567, refers to the latter as "unconscious partisanship".

[91] For a review, see David E Bernstein, "Expert Witnesses, Adversarial Bias, and the (Partial) Failure of the Daubert Revolution" (2008) 93 Iowa Law Review 451-489 at 452-459.

something serviceable" for the party employing them.[92] While adversarial bias often occurs

unconsciously, Justice Goudge described an express "think dirty" mantra within the Office of the

Chief Coroner of Ontario whereby examiners would assume some wrongdoing had occurred.[93]

Despite these apparent enhancements to expert evidence law, the approach taken by

courts in the past several years has been mixed. For example, *R v Abbey*, which we noted above

for its development of the two-stage approach, has been repeatedly relied upon by parties to

admit scientific evidence of dubious validity.[94] At issue in *Abbey* itself was a sociologist's

opinion that tear drop tattoos (which the accused had) meant that the bearer had killed a rival

gang member.[95] At trial, Justice Archibald applied *Daubert* and excluded the evidence, in part

because there was no error rate associated with the evidence and because he was not convinced

the expert's interviews with urban youth applied to the gang in question.[96] In 2009, the Court of

Appeal reversed this decision, holding that Justice Archibald should not have applied *Daubert*

because the evidence was not science, but "specialized knowledge".[97]

At the second trial, the evidence was admitted and Abbey was convicted.[98] In 2017,

however, the Court of Appeal considered fresh evidence that had come to light in the Crown's

cross examination of the expert when he appeared as a defence witness in an unrelated case.[99]

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[92] *Abinger v Ashton*, 17 LR Eq 358 at 374 (Ch 1873), quoted in *White Burgess*, *supra* note 66 at para 11.

[93] Goudge Report, *supra* note 17 at 33.

[94] *R v Aitken*, 2012 BCCA 134, 92 CR (6th) 384 [*Aitken*]; *R v Awer*, 2016 ABCA 128, 2016 CarswellAlta 827 [*Awer*], rev'd in 2017 SCC 2, [2017] 1 SCR 83; *R v Woodcock*, 2010 ONSC 671, 87 WCB (2d) 630 [*Woodcock*]; *R v Reid*, 2017 ONSC 4082, 140 WCB (2d) 649 [*Reid*]. For a review, see: Jason M Chin & Scott Dallen, "*R v Awer* and the Dangers of Science in Sheep's Clothing" (2016) 63 Crim LQ 527 at heading "*Abbey* Road" [Chin *Awer*]; Cunliffe Gaitkeeping, *supra* note 10; Gary Edmond & Emma Cunliffe, "Cinderella Story? The Social Production of a Forensic 'Science'" (2016) 106:2 J Crim L & Criminology 219 [Edmond & Cunliffe Cinderella].

[95] *R v Abbey* [2007], 73 WCB (2d) 411 at para 21, 2007 CarswellOnt 376 (Ont SC) [*Abbey* ONSC 2007]. Find a helpful summary of the expert's evidence in *R v Abbey* 2017 ONCA 640 at para 41, 2017 CarswellOnt 12134 [*Abbey* ONCA 2017].

[96] *Abbey* ONCA 2017, *ibid* at paras 13-15; *Abbey* ONSC 2007, *ibid* at para 4.

[97] *Abbey* ONCA 2009, *supra* note 64 at para 108.

[98] See *Abbey* ONCA 2017, *supra* note 95 at paras 16-36.

[99] *R v Gager*, 2012 ONSC 1472, 100 WCB (2d) 285.

The fresh evidence showed that the expert had misrepresented his sample size (i.e., the number of interviews he conducted) and had not disclosed other flexibilities in his analysis.[100] In light of this fresh evidence, the Court held that expert's evidence should be excluded and ordered a third trial.[101]

The 2009 *Abbey* decision initially received some academic criticism[102] and time has only amplified those worries. The "specialized knowledge" distinction in *Abbey* has been used to admit several types of seemingly invalid evidence.[103] For instance, in *R v Aitken*, a British Columbia court classified an untested forensic technique known as "gait analysis" as specialized knowledge and admitted it, noting that the technique had been admitted in English courts.[104] Forensic gait analysts compare (often CCTV) footage of unknown people walking and match that to the gait characteristics of known individuals (e.g., the accused).[105] Like bitemark evidence, there is no credible evidence this task is possible.[106] Further, *Abbey* has been used to justify admitting expert evidence of police opining on whether people in CCTV footage are carrying guns and the habits of drug users.[107]

In parallel with these cases following *Abbey*, several other courts have excluded expert evidence, and have often done so (in part) on the basis of the extended discussion of impartiality and independence in *White Burgess*. For instance, in *Bruff-Murphy v Gunawardena*, the Court of

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[100] These flexibilities included seeming to create new categories of gang membership to support his theory and changing charts from their original published state. See *ibid* at paras 44-70.

[101] *Abbey* ONCA 2017, supra note 95 at para 155.

[102] Edmond & Roach, *supra* note 10 at 391-395.

[103] See the cases and articles cited in *supra* note 94.

[104] *Aitken*, *supra* note 94 at para 87-96. See the criticism of this practice in Cunliffe Gaitkeeping, *supra* note 10.

[105] See Edmond & Cunliffe Cinderella, *supra* note 94 at 232-234

[106] *Ibid* at 245-256.

[107] *Woodcock*, supra note 94; *Reid* supra note 94. The same specialized knowledge characterization was used to admit evidence about the amount of DNA that is transferred by direct contact in *Awer*, supra note 94. The Supreme Court reversed this decision (without commenting on *Abbey*) because the trial judge appeared unduly critical of the defence witness while too deferential to the Crown witness who proffered the DNA transfer evidence.

Appeal for Ontario held that the defendant's psychiatric expert witness should have been
excluded because his interview with the plaintiff and tests he performed on her seemed
myopically focused on attacking her credibility.[108] Similarly, the Court Appeal for British
Columbia held that an advocate for children's rights,[109] employing methods that appeared
scientifically unfounded,[110] should not have been admitted to opine on whether children had been
sexually abused. Finally, in *R v McManus*, an appellate court held that a police officer tendered
as an expert should have been excluded because he had known one accused for four years and
believed him to be a drug trafficker.[111]

In summary, Canada's approach to expert evidence has been mixed. *Trochym* and *JLJ*
seemed to signal a move towards more active judicial scrutiny of the scientific foundations of
expert evidence (e.g., error rates, testing, peer review). Since those case, however, several forms
of evidence that do not pass scientific muster have been admitted as "specialized knowledge".
Still other decisions demonstrate a willingness to scrutinize the expert's lack of impartiality.

So, how does bitemark analysis stack up against these trends? First, there has never been
any credible scientific foundation supporting bitemark identification and existing research finds
it lacks accuracy. On this point, the practice is difficult to distinguish from the error-prone (and
inadmissible) tests for pedophilia in *JLJ* and hypnotically-retrieved memories in *Trochym*.

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[108] 2017 ONCA 502 at paras 42-70, 414 DLR (4th) 65 [*Bruff-Murphy*].

[109] *JP v British Columbia (Children and Family Development)*, 2017 BCCA 308 at paras 161, 175, BCLR (6th) 17
[*JP v BC*]. See Emma Cunliffe, "A New Canadian Paradigm? Judicial Gatekeeping and the Reliability of Expert
Evidence," in Paul Roberts & Michael Stockdale, eds, *Forensic Science Evidence and Expert Witness Testimony:
Reliability Through Reform?* (Cheltenham, UK: Edward Elgar, forthcoming 2018) [Cunliffe Paradigm] for a review
of *Bruff-Murphy* and *JP v BC*.

[110] *JP v BC*, *ibid* at paras 165-173

[111] *R v McManus* 2017 ONCA 188 at paras 69-72, 353 CCC (3d) 493 [*McManus*]. The Ontario Court of Justice in *R
v Livingston*, 2017 ONCJ 645 at paras 41-68, 356 CCC (3d) 514 followed *McManus* to exclude a computer expert
(and retired police officer) who worked closely with a police investigatory team (e.g., he provided strategic advice
for questioning witnesses).

Moreover, in *R v Oickle*, the Supreme Court reinforced the inadmissibly of polygraph tests because of their lack of reliability.[112]

On the other hand, bitemark analysis is also difficult to distinguish from untested techniques like forensic gait analysis that have seen uncritical acceptance based, in part, on foreign precedent.[113] To make matters worse, forensic odontologists, with board certifications and dentistry degrees, may possess a patina of credibility. They also do not typically (appear to) advocate in their spare time[114] or present as hired guns,[115] making it more difficult to make out a case for express bias (most bias will typically be implicit contextual, confirmation, and adversarial bias, as discussed above).

Part IV. A Systematic Review of Forensic Odontology in Canadian Courts

The uncertain state of forensic bitemark analysis (Part II) and evolution of Canadian scientific evidence law (Part III) raise several questions. Most notably, would these scientific revelations and changes in the legal standard be reflected in judges' decisions to admit or exclude bitemark analysis? Would the evolution of the law from *Mohan* to *JLJ* and *Trochym*, and later to *Abbey* and *White Burgess* play any role? And did the remarkably critical and widely-discussed[116] NAS Report have any impact?

To address these questions, and to generally shine light on the use of bitemark evidence in Canadian courts, our study followed two steps. First, we collected and reviewed all of the

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[112] 2000 SCC 38 at para 95, 187 NSR (2d) 201 [*Oickle*].

[113] *Aitken*, *supra* note 94 at para 87-96. Similarly, bitemark analysis has widespread acceptance in courts in the United States, see Modern Scientific Evidence, *supra* note 5 at §35.

[114] *JP v BC*, *supra* note 109.

[115] *Bruff-Murphy*, *supra* note 108. See Paciocco Jukebox, *supra* note 89.

[116] At least in academic circles, see: Jennifer L Mnookin, "The Courts, the NAS, and the Future of Forensic Science" (2010) 75:4 Brook L Rev 1209 and David H Kaye, "Probability, Individualization, and Uniqueness in Forensic Science Evidence: Listening to the Academies" (2010) 75:4 Brook L Rev 1163.

reported[117] Canadian decisions that have considered the admissibility of bitemark identification evidence. This examination provided us with an understanding of the way bitemark identification is presented to courts and how courts deal with such evidence (i.e., our "systematic review"). We found that bitemark analysis does appear in Canadian courts. Half of these cases included unsupportable absolute statements of identification or misleading testimony. Moreover, not a single court excluded these opinions. Similarly, none expressly entertained questions regarding the practice's scientific validity. We only found one reference to the NAS Report, and that was in one expert's testimony and report.[118] Second, and in light of step one, we analyzed these decisions to determine the source of these troubling findings (Part V).

We obtained the decisions in our sample by searching the WestlawNext Canada[119] "all cases and decisions" database. We employed a thorough and adaptive search procedure with no date restriction.[120] Specifically, we started with search strings (see Appendix A) that we expected to return results on the basis of our review of the science. We then used keywords found in those cases to search for other cases. For example, we began by searching terms such as "forensic dentistry" and "bitemark analysis". Those cases revealed the names of forensic dentists that give bitemark evidence. Then, in subsequent searches, we searched the names of those dentists. We also searched the relevant French terms to capture the Quebec decisions (see Appendix A).

We then reviewed the cases we found for inclusion in our study. The criterion for inclusion was whether the court considered a forensic bitemark *identification*. In other words, we only included cases in which the forensic odontologist sought to opine about the degree of

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[117] In a major Canadian database, see note 119 below.
[118] Despite this expert's advertence to the report, the trial and appellate justices did not seem to consider the unproven state of bitemark identification, see notes 166-167 below.
[119] Online: <http://www.westlawnextcanada.com/>.
[120] Our results are current as of March 6, 2018.

similarity between found and known dentition.[121] We excluded non-identification uses of

forensic odontology, such as determining the source of facial injuries made by objects.[122] In the

course of our search, we reviewed cases in which the court did not have the opportunity to

consider the admissibility of a particular bitemark identification, but did endorse the approach.

For instance, in *R v Stillman*,[123] the New Brunswick Court of Queen's Bench reflected on the

apparent accuracy of bitemark analysis. This finding buttressed the Court's judgment that a

statute, which would require suspects provide dental impressions to the police, was legal.[124] We

did not include *Stillman* in the present sample, but will review it in our discussion of the general

judicial response to bitemark evidence.

The trends we identify should be read with caution due to the limitations inherent in the

population of decisions available to search. For instance, one recent estimate of the percent of

Canadian criminal cases reported in commercial databases was 2%.[125] This is not a random

subsection, but one with systematic biases built into it. First, a jury's reasons are not reported.

Second, there will typically be no decision (other than a sentencing decision) when the accused

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[121] In all but three of the included cases, the forensic odontologists' evidence went directly to the identification of the accused. In the other cases, the identification called into question the accused's defence in some other way. In *R v VanEindhoven*, 2007 NUCJ 1, 72 WCB (2d) 24 [*VanEindhoven*], identity was not at issue. Rather, the bitemark match weakened the accused's account of the events, which he argued resulted in his partner's suicide. Still, the bitemark's relevance flowed from its association with the accused. In *R v Unger*, [1993], 85 Man R (2d) 284, 83 CCC (3d) 228, the bitemark analysis inculpated one accused by excluding the other. *R v Toulejour*, 2016 SKQB 84, 130 WCB (2d) 210 was a sentencing decision, with the bitemark identification supporting a dangerous offender application.

[122] See: *R v Smith*, 2005 BCSC 1624, [2006] BCWLD 1299. The forensic odontologist (Dr. Sweet) in *Smith* opined about whether a boot was the source of injuries to the mouth. There does not appear to be any scientific basis for such a judgment. Still, our analysis (and review of the science) was specific to bitemark identification, and thus cases like *Smith* fell outside our ambit.

[123] *R v Stillman* [1997] 196 NBR (2d) 161 at para 24, NBJ No 544 [*Stillman* retrial]; R v *Stillman*, [1997] 1 SCR 607 at para 178, 185 NBR (2d) 1 [*Stillman* SCC].

[124] *Criminal Code*, RSC 1985, c C-46 at s 487.092(1) [*Impression warrant provisions*].

[125] Jennifer Chandler "The use of neuroscientific evidence in Canadian Criminal proceedings" (2015) 2:3 Journal of Law and the Biosciences 550 at 556.

pleads guilty.[126] We therefore may be missing cases in which the spectre of invalid bitemark evidence produced a plea. Importantly, we suspect many mid-trial oral decisions to exclude, admit, or establish the scope of expert evidence go unreported. As a result, our research may underestimate the prejudice bitemark analysis has introduced into the Canadian legal system. We are also, except for one case, relying on the judge's decision rather than the trial transcript itself. The report may misrepresent the expert's actual opinion. Still, the population of cases available in Westlaw are meaningful. Most notably, they are the world of cases available to practitioners and courts. Therefore, the precedents within them will regularly guide the outcome of legal decisions.[127]

We identified 14 cases (encompassing 16 total proceedings) meeting our criterion. Table 1 contains a list of these 14 cases and their key results. Perhaps the most notable finding, which we will discuss in-depth in Part V is that we found no decision in which a court reported a challenge to the method's scientific validity. And while two courts expressly held that bitemark analysis passed the *Mohan* standard,[128] the decisions in the other cases provided no indication that the admissibility of the bitemark analysis (based on any legal standard) was disputed. The NAS Report was available in six of the proceedings, but courts did not refer to it (although one expert did do so in his report and testimony).[129]

[**Table 1 about here**]

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[126] There may also be cases in which there is no final decision on the merits because the Crown dropped the charges. For instance, Justice Goudge, in his Report, described the troubling case of *R v Reynolds*, in which Charles Smith initially opined that marks on a child were stab wounds, whereas several other experts supported the accused mother's account that they were dog bites. See Goudge Report, *supra* note 17 at 26.

[127] While this is common in practice, factual precedent is, of course, not binding: Allison Orr Larsen, "Factual Precedents" (2013) 162 U Pa L Rev 59 [Larsen].

[128] *R c Taillefer* [1995], 40 CR (4th), 100 CCC (3d) 1 [*Taillefer* QBCA]; *R v Kines* [2012], QB File No CR 09-05-00219, available online: <https://osf.io/nvprj/> [*Kines* Trial].

[129] *Kines* Trial, *ibid* at volume 10, p 62-63 and volume 9 pp 23, 30.

More generally, the use of bitemark identification has occurred steadily over the past three decades, with no apparent slowdown after *Daubert* was adopted in 2000 and after the NAS Report in 2009. The first reported use was in 1983 in *R v Longtin*.[130] However, the found bitemark in *Longtin* was in cheese, which is a more stable substrate and thus a more scientifically justifiable use.[131]

Identification of a bitemark on human skin did not appear in a reported decision until the early 1990s, the most notable case being *R c Taillefer*.[132] In *Taillefer*, the co-accused, Taillefer and Duguay, were tried for murder. The Court of Appeal for Quebec upheld a trial judge's decision to admit the bitemark evidence.[133] Eight years later, the Supreme Court of Canada quashed these convictions following a review by a public commission that found the police and Crown failed to disclose evidence favourable to the defence case.[134] This case will be discussed in Part V in relation to the absolute statement of identification given by the forensic odontologist, a level of certainty that bitemark identification cannot provide. In fact, 6 of the 14 cases we found contained such absolute statements of identification.[135]

Since *Taillefer*, forensic bitemark analysis has appeared consistently in the reported Canadian jurisprudence. The majority of cases (11 of the 14) have occurred in the criminal sphere, with the rest being guardianship cases (see Table 1). One of the criminal cases was a breaking and entering, one was an aggravated assault, and the remainder involved murder and

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[130] [1983], 41 OR (2d) 545, 5 CCC (3d) 12 [*Longtin*].

[131] See Saks et al, *supra* note 5 at 565.

[132] *R c Taillefer*, 2003 SCC 70, [2003] 3 SCR 307 [*Taillefer* SCC]; *Taillefer* QBCA, *supra* note 128.

[133] *Taillefer* QBCA, *ibid* at para 102.

[134] *Taillefer* SCC, *supra* note 132 at paras 2, 26-28, 134-135. The Court ordered a stay of proceedings in Duguay's case. The Crown ultimately did not pursue a retrial of Taillefer.

[135] But note that one of these cases was a sentencing decision following a guilty plea. See note 276 below. In *Kines Trial*, *supra* note 128 at volume 9, p 16, the expert did not make an absolute identification but still failed to properly blind himself to the identity of the accused and ultimately changed his opinion.

sexual assault charges. The forensic bitemark analysis found in our sample was used as inculpatory evidence in 11 of the 14 cases.[136]

Part V. Overstepping Experts, Failed Gatekeeping, and the Role of Counsel

Despite expert evidence rules that require scientific evidence be demonstrably valid, inculpatory forensic bitemark identification evidence consistently appears in the Canadian case law. In this section, we will examine these cases through three perspectives, each of which provides distinctive lessons and possibilities for reform. We begin with the experts, who have consistently overstepped the limits of their discipline to provide conclusive identifications. They have also failed to communicate the uncertainty in their field. We then go on to discuss the roles played by the trial judge, Crown lawyers, and defence lawyers. Each has proven ineffective at limiting the evidence proffered by forensic odontologists. This analysis suggests an information asymmetry that could be ameliorated by greater transparency and enhanced scrutiny of expert impartiality.

Overstepping Experts

As we reviewed above, absolute statements of bitemark identification are unsupportable.[137] However, this has not prevented forensic odontologists from providing such evidence in Canadian courts. Perhaps the best-known example of an absolute identification is in the aforementioned *Taillefer* case. At trial, the Crown called a forensic odontologist, Dr. Dorion, to provide expert testimony about the bitemarks found on the victim. Dr. Dorion concluded that

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[136] It was used as exculpatory evidence in: *R v Turner* [1995], 164 NBR (2d) 241, 27 WCB (2d) 586; *R v Streiling*, 2015 BCSC 597, 124 WCB (2d) 139; *Unger*, [1993], 85 Man R (2d) 284, 83 CCC (3d) 228. See Edmond et al, *supra* note 6 at 75-76.
[137] NAS Report, *supra* note 3 at 175; Saks et al, *supra* note 5 at 553.

three of the bite marks *were* made by the co-accused Duguay.[138] The accused called two of their

own witnesses, who "expressed doubt about whether the marks were made by bites."[139] As noted

above, the Supreme Court ultimately quashed the convictions in *Taillefer* following findings that

the police and Crown failed to disclose exculpatory evidence.[140] Some of this evidence was

odontological: Dr. Dorion had also matched the same bitemarks to the co-accused's father in a

previously undisclosed report.[141]

 Taillefer also illustrates a less obvious danger, that scientifically invalid evidence will

reinforce other invalid or weak evidence, thus building a speciously strong case. Indeed, research

finds that jurors do not treat evidence independently, and instead let their view of one piece of

evidence colour their view of the rest of the evidence.[142] In *Taillefer*, the Crown also relied on

hypnotically retrieved memories[143] and a confession given under what the accused contended

were oppressive circumstances.[144] Both hypnosis and recanted confessions received intense

scrutiny in subsequent Supreme Court decisions for their lack of reliability.[145]

 Other cases with absolute statements of identification by forensic odontologists are *R v*

Longtin and the guardianship case *Children's Aid Society of Nipissing and Parry Sound*

(Districts) v D(LA). In *Longtin*, Dr. Kogan testified for the Crown that "the bite marks on the

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[138] *Taillefer* QBCA, *supra* note 128 at para 23.

[139] *Ibid* at para 20.

[140] In addition to the bitemark identification, this evidence consisted primarily of police interviews that cast serious doubt on the Crown's theory of the case. See *Taillefer* SCC, *supra* note 132 at paras 29-38.

[141] *Ibid* at para 36. The Supreme Court quashed both convictions, directed a stay of proceedings in Duguay's case and ordered a retrial in Taillefer's case. See paras 134-135.

[142] Lisa E Hasel & Saul M Kassin, "On the Presumption of Evidentiary Independence: Can Confessions Corrupt Eyewitness Identifications?" (2009) 20:1 Psychological Science 125.

[143] *Taillefer* QBCA, *supra* note 128 at paras 38-59.

[144] *Taillefer* SCC, *supra* note 132 at para 19.

[145] As noted above, the Court in *R v Trochym* held that due to the uncertain science of hypnosis, memories retrieved through that process are presumptively inadmissible. See *Trochym*, *supra* note 80 at para 61. Subsequent Supreme Court decisions reviewed the science of false confessions and developed new rules for admitting contested confessions. See: *Oickle*, *supra* note 112; *R v Hart*, 2014 SCC 52, 461 NR 1.

cheese [found at the crime site] *were* made by the accused."[146] Although cheese is a more stable

substrate for receiving dental impressions, the unsupported assumption of dental uniqueness still

precludes the unqualified conclusion that the accused made the bitemark.[147] And in *DLA*, the

Children's Aid Society's forensic odontologist stated his opinion at trial as "No one other than

[the child's father] could have caused this bite mark."[148] While this opinion was not given in the

criminal context, removing a child from a parent has been referred to as child protection law's

"capital punishment".[149]

In some cases, we found that the expert did not seem to expressly make a conclusion

about the biter's identity as against all the world, but used terminology that would lead a lay

person to think that was the case. The most notable is the word: "match". According to the

ABFO, the term match means "Some concordance, some similarity, but no expression of

specificity intended."[150] On the other hand, research finds that lay people interpret match to mean

the strongest possible linkage.[151] We found two instances of the use of this term. First, and also

in the guardianship context, Dr. Smyth opined that "teeth of the mother S.M. were a match for

the bite marks while those of the father M.G. were not."[152] And in the murder trial *R v*

VanEindhoven, a forensic dentist testified that the profile of the bite marks found on the victim

"matches the bite profile of the accused."[153]

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[146] *Longtin*, *supra* note 130 at para 2.
[147] Saks et al, *supra* note 5 at 559-561.
[148] *Children's Aid Society of Nipissing and Parry Sound (Districts) v D(LA)*, 2008 ONCJ 464 at para 12, 2008 CarswellOnt 5768 [*DLA*].
[149] Beaman Report, *supra* note 82 at xxii-xxiii, quoting Justice Susan E Lang. Further, the rules of evidence (notionally) apply to child protection trials (but not some preliminary hearings), see Beaman Report at 34-37.
[150] Saks et al, *supra* note 5 at 552.
[151] Dawn McQuinston & Michael J Saks, "Communicating Opinion Evidence in the Forensic Identification Sciences: Accuracy and Impact (2008) 59 Hastings LJ 1159.
[152] *New Brunswick v G(M)*, 2008 NBQB 139 at para 31, 166 ACWS (3d) 268 [*GM*].
[153] *VanEindhoven*, *supra* note 121 at para 77.

Even when experts expressly qualify their opinions, those opinions may still be derived in a scientifically invalid manner.[154] This phenomenon was most apparent in *R v Kines*.[155] The case against the accused in *Kines* hinged on the bitemark identification provided by Dr. Sweet. Mr. Kines was accused of the murder and sexual assault of his partner's three-year old daughter, who suffered multiple bruises and bites. She was ultimately reported dead by her mother.[156] The forensic pathologist reported the cause of death as "multiple blunt force injuries".[157] The only evidence linking Mr. Kines to the crimes was the putative bitemark identification and his co-habitation in the house he shared with the deceased's mother and her other children.[158] One witness reported seeing the mother abusing the deceased the day before the death was reported.[159]

Rather than providing Dr. Sweet with a line-up including Mr. Kines' dental cast and similar others, the police sent him casts from the four children who lived in the household and the mother (along with Mr. Kines' casts).[160] This was because, at that point in the investigation, the police believed that the list of perpetrators was restricted to those individuals.[161] Dr. Sweet "immediately"[162] excluded the four sets of children's teeth as the source of the bite (they were too small) and also excluded the mother with "absolute certainty."[163] He eventually identified

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[154] For instance, failure to follow scientific procedures like blinding introduce an unreportable amount of error into the examiner's decision, see Mnookin, *supra* note 116 at 1227.

[155] *Kines* Trial, *supra* note 128; *R v Kines*, 2012 MBCA 97, 284 Man R (2d) 236 [*Kines* MBCA].

[156] *Kines* MBCA, *ibid* at paras 1-3.

[157] *Kines* Trial, *supra* note 128 at volume 7, p 61; *ibid* at para 3.

[158] *Kines* Trial, *ibid* at volume 11, pp 39-42.

[159] *Ibid* at volume 11, p 12 and volume 5, pp 4-17.

[160] *Ibid* at volume 9, p 16.

[161] In other words, they assumed a "closed-population". This more defensible use of bitemark analysis is akin to the field's role in identifying victims of mass accidents and disasters, see Souviron & Haller, *supra* note 19.

[162] *Kines* Trial, *supra* note 128 at volume 9, p 16.

[163] *Ibid* at volume 10, p 54.

Mr. Kines as the "probable" [164] biter due to Mr. Kines' "highly unusual"[165] dentition. To his credit, Dr. Sweet did testify that he was reluctant to provide absolute identifications in light of the NAS Report and so instead provided the strongest identification available to him (i.e., probable).[166] He did not mention the NAS Report's discussion of the field's high error rates and the effect of cognitive bias.[167]

Dr. Sweet's testimony provides a tangible example of how forensic odontology is often performed in a scientifically invalid manner. Sweet should have insisted on examining Mr. Kines' dentition against similar foils, rather than in comparison to five wildly different sets of teeth.[168] He quickly eliminated the children and thus the probability of picking Mr. Kines' cast by chance alone was 50%. In fact, Dr. Sweet admitted that a blinded identification among similar foils was best practice, but refused to admit that the failure to follow that procedure impacted his confidence.[169] Moreover, even the probable biter conclusion is unsupportable under the current state of knowledge in bitemark identification. There is, for instance, no systematic understanding for how common sets of dentition are in the population.[170] And even if that was known, skin distorts bitemarks in unpredictable ways.[171]

Despite these flaws in the expert evidence, the trial judge in *Kines* ultimately admitted Sweet's evidence.[172] He found, however, that it was not strong enough to support a conviction

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[164] *Ibid* at volume 10, p 62; *Kines* MBCA, *supra* note 155 at para 3.

[165] *Kines* Trial, *ibid* at volume 10, p 94; *Kines* MBCA, *ibid*.

[166] *Kines* Trial, *ibid* at volume 10, p 62-63 and volume 9 pp 23, 30.

[167] As to the NAS Report specifically, Sweet merely said: "It's still going to be a statistical inference, but that's what the National Academy of Science has said to us as odontologists in 2009, that they want us to replicate the model that's been established by DNA." See *ibid* at volume 9, p 23.

[168] Saks et al, *supra* note 5 at 550; NAS Report, *supra* note 3 at 174-175.

[169] *Kines* Trial, *supra* note 128 at volume 9, p 16.

[170] See sources at *supra* note 36.

[171] *Ibid*.

[172] *Kines* Trial, *supra* note 128 at volume 10, pp 1-5.

and thus directed an acquittal.[173] In a deeply troubling decision, the Court of Appeal for Manitoba, in this post-NAS Report case, sent the case back to trial because the trial judge did not give *enough weight* to the bitemark evidence.[174]

In another example of bitemark analysis' lack of reliability,[175] Dr. Sweet substantially shifted his own opinion after trial. During the trial, he testified that his opinion assumed a closed group of potential biters (the residents of the house Kines shared with the deceased's mother). However, he was twice asked if his opinion that Kines was the probable biter would change if that assumption was violated. He stated, quite definitely, that it would not:[176]

> Well, I was asked that question earlier. And I want to answer it exactly the same. That it would have an effect if the teeth were not as really unusual as they are in this case. But the fact that they're so unusual and this tooth is out of position in combination with all the other traits, that **I'm still confident even if you said that it was an open population**.

Despite Dr. Sweet's apparent confidence – a characteristic that would likely be persuasive to a lay jury – he ultimately changed his opinion.[177] After the appeals court ordered a new trial, the Crown obtained a revised opinion from Dr. Sweet.[178] He concluded that Kines was no longer the probable biter, but that he could not be excluded as the biter. Sweet's

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[173] *Ibid* at volume 12, p 8.

[174] *Kines* MBCA, *supra* note 155 para 4, disagreeing with the trial judge's decision at *Kines* Trial, *ibid* at volume 12, p 8.

[175] Recall that in *Taillefer*, Dorion matched the found bitemarks to one co-accused and the other co-accused's father. See *Taillefer* SCC, *supra* note 132 at para 36.

[176] *Kines* Trial, *supra* note 128 at volume 10, p 94-95.

[177] Research finds that jurors are sensitive to a witness's confidence. See: Gary L Wells, R C L Lindsay, Tamara J Ferguson, "Accuracy, confidence, and juror perceptions in eyewitness identification" (1979) 65 J Appl Psychol 440-448; Anthony Champagne, Daniel Shuman & Elizabeth Whitaker, "An empirical examination of the use of expert witnesses in American courts" (1992) 31 Jurimetrics J 375-392.

[178] David Sweet Revised Report, August 29, 2014, online <https://osf.io/rsbnc/> [Sweet Report]: "When dealing with an undefined population of suspects, it is generally accepted that the available conclusions from comparative analysis must be limited and relatively more conservative compared to a defined population of suspects. Taking this and all of the issues previously mentioned into account, I am submitting this supplemental report with new conclusions about the six original defined suspects."

overconfidence in the bitemark analysis methodology and in his own ability to ignore biasing information reflect well-documented psychological phenomena in both psychology and law.[179]

The defence obtained their own opinion from Dr. Dorion, which largely contradicted Sweet's report. Dorion found that due to the low evidentiary value of the bites, none of the biters could be excluded. With regards to one of the injuries, Dorion even went as far as to state that "Suspect 6 [Jason Kines] cannot have the alignment of upper to lower teeth demonstrated" by Dr. Sweet "without dislocating his jaw."[180] Upon counsel for the accused sharing this report with the Crown, it entered a stay of proceedings. This experience provides a real-world example of the recent ABFO study showing deep disagreement over whether bitemarks carry sufficient evidentiary value.

The decisions we have reviewed in this subsection suggest that courts are accepting a distorted version of bitemark analysis. This raises a number of red flags, many of them with the issue of transparency. In particular, the experts were apparently not transparent about the many limitations of their practice (e.g., the impossibility of absolute identifications, the effect of skin distortion and the effect of cognitive bias). These are factors the factfinder must know in order to properly assign weight to the evidence.[181] We have the most information about the expert's testimony in *Kines*, and thus know that the expert mentioned the NAS Report, but did not discuss the many criticisms found in that report. The situation in *Taillefer* was even more dire – there the factfinder was deprived of the expert's earlier identification of another biter.[182] The child

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[179] In psychology, see overconfidence effects in David Dunning et al, "Flawed Self-Assessment: Implications for Health, Education, and the Workplace" (2004) 5:3 Psychological Science in the Public Interest 69-106. In law, see witnesses' lack of conscious access to their unconscious cognitive processes in Chin et al, *supra* note 61.

[180] Robert BJ Dorion Expert Report, August 28, 2014, online <https://osf.io/p8ydz/>.

[181] Gary Edmond, "Forensic Science Evidence and the Conditions for Rational (Jury) Evaluation" (2015) 39 Melbourne University Law Review 77-127.

[182] In *Taillefer*, the Crown and police should have disclosed this evidence, but the expert (Dorion) also should have been candid about his earlier identification in his testimony.

protection cases appear to mirror the findings found in the recent report of the Motherisk Commission. Justice Beaman found that "[t]est results were often admitted into evidence without the usual checks and balances of the legal system", in part because the defence could not afford to challenge the evidence.[183] We cannot say if funding was an issue in our cases, but it appears a likely candidate for the court's uncritical acceptance of bitemark evidence.

Beyond the comparisons to the Motherisk cases, the bitemark experience parallels that in *Abbey*. Recall that in *Abbey*, the expert did not disclose a great deal of flexibility and uncertainty in his methodology. These uncertainties were only revealed by the Crown's own cross-examination in a subsequent case (and later introduced as fresh evidence, approximately ten years after the initial trial). Consider also the recent *R v Bornyk* decision in British Columbia.[184] In that case, the fingerprint examiner did not mention the NAS Report and other research describing uncertainties in his field. Rather, he indicated that fingerprint examiners make no errors and conclusively reported that the partial print was indeed left by the accused.[185] The trial judge eventually became aware of the NAS Report and similar others. He concluded that, in light of the new evidence, "troubling aspects" arose from the examiner's initial testimony.[186] These included the expert failing to disclose subjectivity in fingerprint analysis, the fact that errors do occur, unconscious bias, and discrepancies in his own analysis.[187]

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[183] Beaman Report, *supra* note 82 at 64-66, 113-115. See also The Honourable Susan E Lang, *Report of the Motherisk Hair Analysis Independent Review* (Toronto: Ministry of the Attorney General, 2015).

[184] 2013 BCSC 1927, 7 CR (7th) 211 [*Bornyk*].

[185] *Ibid* at paras 18, 23.

[186] *Ibid* at para 39.

[187] *Ibid* at paras 40-58. Bornyk was acquitted at this first trial. The Crown appealed on the basis that the trial judge improperly took judicial notice of the NAS Report and other research. Bornyk was convicted at the retrial, see *R v Bornyk*, 2017 BCSC 849, 139 WCB (2d) 384.

This lack of transparency in expert testimony is troubling because the experts are the best placed to identify limitations in their evidence.[188] They also owe a duty to impartially assist the court that supersedes their duty to the party that tendered them.[189] While breaches of this duty have typically been found in testimony that actively advocates for one side or in a pre-existing relationship with a party, we contend that the duty of impartiality should be conceived of more broadly. In fulfilling their duty to the court, experts should be frank about the limitations of their evidence. They should describe findings that may cast doubt on their opinion. They should admit that biasing information may have clouded their judgment (rather than deny it).[190] We will return to this proposal to increase transparency in Part VI.

Failures of Gatekeeping

When experts are proffered to provide a scientific opinion that is unduly prejudicial or lacks demonstrable scientific validity, a responsibility falls to the trial judge to exclude that evidence. This job is especially important in the criminal law context, where defence counsel are often overburdened, poorly funded, and unlikely to be experts in the science at question.[191] As we described above, several Supreme Court of Canada decisions since *Mohan* have reinforced the trial judge's gatekeeper role with respect to scientific evidence. Despite these holdings, we were unable to find a single case in which a court even seemed to question the scientific validity

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[188] The U.S. Department of Justice recently introduced a program aimed at reviewing forensic testimony to determine if it is accurate, which may help alleviate some of our concerns with transparency, see online <https://forensicsforum.net/2018/02/25/testimonial-monitoring/>.

[189] *White Burgess*, *supra* note 66 at para 46.

[190] *Kines* Trial, *supra* note 128 at volume 9, p 16.

[191] *R v D(D)*, 2000 SCC 43 at para 54, [2000] 2 SCR 275 [*DD*]: "The danger of attornment to the opinion of the expert is further increased by the fact that expert evidence is highly resistant to effective cross-examination by counsel who are not experts in that field."; Edmond & Roach, *supra* note 10 at 386; Bernstein, *supra* note 91 at 461: "These attorneys often do not have the resources to investigate, much less challenge, forensic testimony proffered by the prosecution"; The Honourable Mr Justice Ian Binnie, "Science in the Courtroom: The Mouse That Roared" (2007) 56 UNB LJ 307 at 315 [Binnie]. And in the child protection context, see Beaman Report, *supra* note 82 at 113-115.

of bitemark identification. These cases coincide with the findings of the Motherisk Commission, in which Justice Beaman found that uncritical acceptance of invalid hair tests that purported to identify drug use had a devastating effect on families across Canada.[192]

Much of the permissive judicial attitude towards bitemark identification can be traced back to the Court of Appeal for Quebec's decision in *Taillefer*, which was decided a year after *Mohan* was issued.[193] On appeal, the defence attacked the validity of the Crown's bitemark analysis. In particular, the defence relied on *R v Carroll*,[194] a decision of the Queensland Court of Criminal Appeal. The Court in *Carroll* was critical of bitemark identification, and ultimately found that a properly instructed jury could not convict on the basis of such evidence.[195]

Despite adverting to *Carroll* and *Mohan*, the Court of Appeal for Quebec held that, because the defence had admitted the expert's credentials, they were foreclosed from attacking his method: "the appellants admitted that the expert Dorion was qualified in forensic odontology…As a result, I do not see how they can now complain about the reliability of this technique"[196] This decision, even on the most charitable reading, fundamentally misunderstands expert evidence law. *Mohan* expressly provides that a properly qualified expert and reliability of a new scientific technique are two separate criteria.[197] Dorion could certainly be a certified forensic odontologist (he was),[198] but be employing an invalid methodology (he was).

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[192] Beaman Report, *supra* note 82.
[193] *Taillefer* QBCA, *supra* note 128.
[194] (1985) 19 A Crim R 410 [*Carroll*]; *ibid* at para 99.
[195] *Carroll*, *ibid* at 413-417.
[196] *Taillefer* QBCA, *supra* note 128 at para 99.
[197] *Mohan*, *supra* note 67 at paras 23, 31.
[198] Recall that forensic odontologists provide many scientifically supportable functions, see Souviron & Haller, *supra* note 19.

Kines also represents a stark failure of gatekeeping. The Court of Appeal overlooked an opportunity to make a statement about the validity of bitemark identification. Rather, the appellate court overturned the trial judge's decision and ordered a retrial, placing significant weight on Dr. Sweet's identification.[199] There is no excuse for this 2012 decision, which had the benefit of the 2009 NAS Report. In successfully arguing that Dr. Sweet's evidence should be admitted at trial,[200] the Crown relied on *Stillman*.[201] Recall that we did not include *Stillman* in our systematic review because it concerned the police's authority to compel a suspect to provide a dental impression, rather than the bitemark analysis itself. Still, the New Brunswick court's favourable (but mistaken) comments about bitemark identification in *Stillman* proved useful to the Crown's argument in *Kines*. They merit a brief discussion.

In *Stillman*, the accused did not consent to the police taking his dental impression and sought to exclude them on that basis.[202] He initially succeeded when the Supreme Court of Canada found that the common law power of search and seizure did not extend to bodily samples.[203] Later that year, however, new legislation was passed allowing such samples to be taken, thus obviating reliance on the common law power.[204] *Stillman* subsequently challenged

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[199] *Kines* MBCA, *supra* note 155 at para 3.

[200] *Kines* Trial, *supra* note 128 at volume 9, p 73.

[201] *Stillman* Retrial, *supra* note 123.

[202] *Stillman* SCC, *supra* note 123 at para 17.

[203] *Ibid* at para 49. Note that Justice L'Heureux Dubé, in dissent, would have extended the common law power, in part because she seemed to equate DNA and bitemark evidence, at para 178: "Where indicia such as bodily fluids or a human bite marks are found on the victim's body, the possibility of resorting to DNA typing analysis or forensic odontology serves, in my opinion, society's substantial interest in deterring such crimes."

[204] *Impression warrant provisions*, *supra* note 124: "A justice may issue a warrant in writing authorizing a peace officer to do any thing, or cause any thing to be done under the direction of the peace officer, described in the warrant in order to obtain any handprint, fingerprint, footprint, foot impression, teeth impression or other print or impression of the body or any part of the body in respect of a person if the justice is satisfied…"

the constitutionality of the legislation at the New Brunswick Court of Queen's Bench.[205] It was this later decision that the Crown relied on in *Kines*.

At the Court of Queen's Bench, Justice Larlee found the legislation was constitutional, and in doing so, factored in bitemark analysis's apparent validity. In particular, Justice Larlee noted that his analysis required balancing "the principle against self-incrimination and the principle of search for the truth."[206] He found that bitemark analysis indeed advanced the search for the truth. For instance, Justice Larlee relied on Dr. Fenton Smyth's testimony that bitemark analysis "could result in an exact match."[207] Further, he cited eight American decisions in which forensic odontology was admitted:[208]

> **These cases are persuasive by their number**. The use of dental impressions to match bite marks is accepted in numerous American jurisdictions. **The probative value of these matches has been compared to the probative value of fingerprints**.

We now know that the factual basis for the New Brunswick court's decision was wrong. Forensic bitemark analysis cannot provide an exact "match" and fingerprint analysis has been much more thoroughly vetted and possesses a relatively low error rate.[209] Furthermore, the "persuasiveness by number" reasoning is undermined by the fact that, since that decision was issued, one of the cases, *State v Stinson*,[210] was identified as a wrongful conviction.[211] In 2009, Robert Lee Stinson was exonerated by DNA evidence.[212] With the factual foundations of

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[205] *Stillman* Retrial, *supra* note 123 at paras 6-7.

[206] *Ibid* at para 45.

[207] *Ibid* at para 24.

[208] *Ibid* [emphasis added].

[209] PCAST Report, *supra* note 1 at 87-103.

[210] 397 NW2d 136 (US Wis Ct App 1986).

[211] Innocence Project, online: <https://www.innocenceproject.org/cases/robert-lee-stinson/>.

[212] *Ibid*.

Stillman eroded, it may be time to re-visit the constitutionality of this section of the *Criminal Code* allowing warrants for teeth impressions.

The Crown in *Kines* relied on *Stillman* to argue that forensic odontology had been previously vetted by courts and thus was not novel science:[213]

> …so it's not novel science is what I was trying to say. I wasn't, I don't think that Stillman would stand for the proposition that it's, that it's you know (inaudible) you have to accept the evidence. What I'm saying is that it's not new, it's just arisen now; that's essentially what that was about.

What the Crown appeared to be getting at is that bitemark analysis need not be scrutinized by the trial judge because such scrutiny was reserved for novel science.[214] While it is impossible to say if this specific line of argument was successful, the Manitoba trial court certainly did not subject Dr. Sweet's bitemark to any scientific scrutiny.[215]

More generally, *Kines* suggests that a "novel science" trigger for scrutiny of scientific evidence is inadequate (recall that foreign acceptance of gait analysis in *Aitken* also militated towards its admittance).[216] The scientific understanding of methods can change over time and so it is dangerous to take a (legal) precedent-based approach to admitting expert evidence.[217] This is troubling because in a 2017 Supreme Court of Canada case, *R v Bingley*, the majority removed

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[213] *Kines* Trial, *supra* note 128 at volume 9, p 73. The same science by legal precedent argument carried the day for the prosecution in: *State v Schwartz*, 447 NW2d 422 (Minn 1989); *People v Quaderer*. 2003 WL 22801204 (Mich Ct App 2003).

[214] Recall that *Mohan* dictates that novel science receive special scrutiny, see *supra* note 67 at para 32.

[215] This was likely a mistake in law. As noted above, in 2007, the Supreme Court in *Trochym*, *supra* note 80 at paras 36-54 seemed to extend special scrutiny to science that was not novel, but had seen its assumptions eroded by subsequent findings. In 2015, the Supreme Court in *White Burgess*, *supra* note 66 at para 23, confirmed this interpretation, but the position was less clear when *Kines* was decided in 2012.

[216] *Supra* note 94 at paras 87-96.

[217] *Trochym*, *supra* note 80 at para 36-54. The authors of Modern Scientific Evidence, *supra* note 5 at §35:6 remark: "Why should non-novelty, by itself, shelter from re-examination erroneous scientific claims that have lost the support of the field or fields from whence they came?"

the "contested" language in its statement of the rules for admitting expert evidence.[218] Hopefully, this was mere inadvertence. But the majority's decision in *Bingley* was also uncritically accepting of a contested, but well-established practice of roadside identification of drug use employed by police officers trained to observe several subjective criteria.

The Role of the Crown and Defence

An important thread running through the bitemark cases (and *Abbey* and *Bornyk*) is that traditional safeguards in the criminal justice system failed. That failure was most stark in *Taillefer*, in which the Crown and police did not disclose important evidence. But it also occurred in *Kines*, in which the defence failed to cross-examine the scientific status of bitemark evidence, the expert did not disclose this information, and trial and appellate courts found the evidence admissible. These failures suggest an information asymmetry, and one that the typical trial process does not appear well-equipped to deal with. In particular, the expert and Crown are both better placed than the defence to identify shortcomings and uncertainties in the expert's evidence. But while they are also both subject to an overriding duty to see justice done,[219] adversarial and cognitive bias can be difficult to overcome.[220]

The defence also has an important role to play in cross-examining the expert. However, short of both time and resources,[221] it is a lot to ask defence attorneys to research and challenge the conclusions of experts draped in the "mystique of science"[222] and who do not disclose the shortcomings of their work. Other than the *Taillefer* appeal,[223] it did not appear that the defence

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[218] *Bingley*, *supra* note 86 at para 22; Chin & Likwornik, *supra* note 52.

[219] For experts, see *White Burgess*, *supra* note 66 at para 26. For the Crown, see: *R v Boucher* [1955] SCR 16 at para 26, 110 CCC 263; *R v Stinchcombe*, [1991] 3 SCR 326 at para 11, 83 Alta LR (2d) 193.

[220] Paciocco Jukebox, *supra* note 89 at 566-584.

[221] See Bernstein, *supra* note 91 at 461.

[222] *Mohan*, *supra* note 67 at para 23; See also *DD*, *supra* note 193 at para 41.

[223] *Taillefer* QBCA, *supra* note 128 at para 99.

challenged the validity of bitemark evidence in any of the cases we reviewed. In *Kines*, the defence did not cross-examine Dr. Sweet as to the scientific status of bitemark analysis, but rather focused on the relevance of his evidence (note a different defence counsel handled the appeal and obtained the independent export that ultimately led to the Crown dropping the charges against Kines).

Fortunately, awareness of the uncertainties in forensic science is growing. This awareness has promoted academic work aimed at assisting parties in situations like that in *Kines*. For instance, a group of academics recently published an article titled "How to cross-examine forensic scientists: A guide for lawyers".[224] It contains concrete suggestions that would have assisted in *Kines*, such as "These limitations, described by the National Academy of Sciences, were not included in your report/testimony, were they?"[225] As awareness of the dangers that bitemark analysis presents continues to grow, we hope defence lawyers in Canada will be more prone to adopt such questioning.

The Crown should also consider whether, given recent scientific revelations, it should proffer bitemark identification evidence at all. It should also consider if weaknesses in this evidence should be actively disclosed.[226] These decisions are difficult because the Crown may struggle to fully understand the intricacies of the expert's evidence. And when the information is complicated and ambiguous, it may be easier to rationalize it away as irrelevant and thus not worth disclosing. But in cases like *Kines*, in which expert evidence played such an important part in the case, these questions must be asked.

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[224] Gary Edmond et al, "How to cross-examine forensic scientists: A guide for lawyers" (2014) 39 Australia Bar Review 174-197.
[225] *Ibid* at 189.
[226] The Motherisk Commission also suggested more active disclosure, see Beaman Report, *supra* note 82 at 116-117.

Part VI. Conclusion: A Case for Enhanced Transparency

It is tempting to think that reports from authoritative bodies like the PCAST and NAS will have a substantial and lasting impact on criminal justice.[227] In Canada, however, Justice Kaufman's report on the wrongful conviction of Guy Paul Morin identified many of the same issues with forensic science[228] that were later found in Justice Goudge's inquiry into the practices of forensic pathologist Charles Smith.[229] Smith's employer, Toronto's Hospital for Sick Children, housed the laboratory that performed the invalid hair analysis that was the subject matter of the Motherisk Commission.[230] It is becoming increasingly untenable to deny that there are systemic problems with the treatment of expert evidence in court. As the forensic bitemark case law suggests, much of the problem lies in what the experts are not telling the court.

Forensic odontological witnesses are, in many respects, the most biased people imaginable.[231] They are not selected randomly, but because they are a proponent of a disputed method (i.e., selection bias).[232] They are then subjected to adversarial bias, feeling a natural inclination to support the party employing them.[233] Finally, confirmation and contextual bias

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[227] PCAST Report, *supra* note 1; NAS Report, *supra* note 3. See also Barack Obama, "The President's Role in Advancing Criminal Justice Reform" (2017) 130:3 Harv L Rev 811 at 860-862.

[228] Kaufman Report, *supra* note 17 at 83.

[229] Goudge Report, *supra* note 17.

[230] Beaman Report, *supra* note 82. And see MacFarlane, *supra* note 17 for the role of scientific evidence in wrongful convictions.

[231] Here, we are drawing on statistician Eric-Jan Wagenmakers' description of the researcher who generated a theory and conducted an experiment as the "galaxy's most biased analyst". See Eric-Jan Wagenmakers, "The Case for Radical Transparency in Statistical Reporting" Presentation given at the annual meeting of the American Statistical Association, Bethesda, Maryland, October 12, 2017, online: <https://ww2.amstat.org/meetings/ssi/2017/onlineprogram/ViewPresentation.cfm?file=304107.zip>.

[232] Bernstein, *supra* note 91 at 454; Paciocco Jukebox, *supra* note 89 at 575-577; There are more skeptical forensic odontologists who envision a much more limited use for the practice. For instance, Dr. C Michael Bowers drafted the cautious and skeptical section in *Modern Scientific Evidence* about bitemark analysis, *supra* note 5 at §35. See also Mark Page, Jane Taylor & Matt Blenkin, "Reality Bites – A ten-year retrospective analysis of bitemark casework in Australia" (2012) 216 Forensic Science International 82-87 describing a conservative approach to bitemark analysis in Australia.

[233] Bernstein, *ibid* at 454-459; Paciocco Jukebox, *ibid* at 577-581; *White Burgess*, *supra* note 66 at paras 11-13.

enter when experts are exposed to suggestive case-specific details, like the identity of the suspect and the fact that it was a brutal crime.[234] But this bias is far from apparent to the factfinder (and to the experts themselves).[235] Unlike other cases,[236] they are difficult to characterize as advocates and they are not members of the police force. Their bias is, in fact, most apparent from what they do *not say* – that there is deep disagreement within the sciences about the very nature of what they do. As we discussed above, this results in an information asymmetry.

One remedy for this asymmetry is enhanced transparency. Safeguards aimed at bringing the previously undisclosed aspects of the expert's testimony to light. There are already structures in place that would enhance transparency. For instance, the *Federal Courts Rules* require that expert reports include "any caveats or qualifications necessary to render the report complete and accurate, including those relating to any insufficiency of data or research and an indication of any matters that fall outside the expert's field of expertise".[237] Such positive attestations make it more difficult for experts to omit disconformity findings and flexibilities in the research while still viewing themselves as honest.[238] In fact, similar issues in the mainstream sciences have arisen with undisclosed flexibility in analyses causing irreproducible research. As a result, many journals are implementing procedures similar to that of the *Federal Court Rules*.[239] These require

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[234] PCAST Report, *supra* note 1 at 31-32; Gold, *supra* note 6 at 98.

[235] Kathleen A Kennedy & Emily Pronin, "Bias Perception and the Spiral of Conflict" in Jon Hanson and John Jost, eds, *Ideology, Psychology, and Law* (Oxford: Oxford University Press, 2012) [Kennedy Bias Perception].

[236] See, for example, *JP v BC*, *supra* note 109; *Bruff-Murphy*, *supra* note 108; *McManus*, *supra* note 111.

[237] (SOR/98-106) at s 52.2 Schedule [*Federal Court Rules*]; The courts in Victoria, Australia have similar rules, Forensic Evidence Working Group, Practice Note: Expert Evidence in Criminal Trials (County Court of Victoria, updated June 24, 2014) online: <https://www.countycourt.vic.gov.au/sites/default/files/forms/Practice%20Note%20-%20Expert%20Evidence%20in%20Criminal%20Trials_FINAL%20%28June%202014%29_0.pdf>.

[238] See Nina Mazar & Dan Ariely, "Dishonesty in Everyday Life and Its Policy Implications" (2006) 25:1 Journal of Public Policy & Marketing 117-126.

[239] See: Brian A Nosek et al, "Promoting an open research culture" (2015) 348:6242 Science 1422-1425; Marcus R Munafò et al, "A Manifesto for Reproducible Science", (2017) 0021 Nature Human Behaviour 1-9 at 4-5.

that authors fully report their methodology and make their data open for scrutiny, such that peer-reviewers and consumers of the science can rationally evaluate it.[240]

The experience in the mainstream sciences suggest such rules aimed at transparency will help. We encourage other jurisdictions to adopt similar rules. In the meantime, it is likely within the provincial superior courts' inherent jurisdiction to amend their practice directions to require experts to make similar attestations when submitting their reports.[241] These steps flow directly from the expert's duty to the court, recently affirmed in *White Burgess*.[242] With respect to the *Family Law Rules*, Justice Beaman suggested they be similarly amended in the recent Motherisk Commission.[243] This was, in part, because an underfunded defence could not be expected to identify the uncertainties in the science.[244] This observation is no less meaningful for forensic science in criminal proceedings.

As far as the rules for gatekeeping expert evidence are concerned, the current trend, following from *White Burgess*, appears to be greater scrutiny of the witness's impartiality and independence.[245] Indeed, we suspect many lawyers are simply more comfortable cross-examining the expert's credibility, as opposed to that of the science. Justice Binnie (writing extrajudicially) made exactly this observation: "The skillful cross-examiner may have soaked up elements of the science at issue in the particular case, but will often find it easier and more effective to discredit the expert witness…"[246]

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[240] *Ibid*.

[241] E.g., the Ontario Superior Court of Justice is a superior court of record, *Courts of Justice Act*, RSO 1990, c C43 at s 11(1)-(2).

[242] *Supra* note 66 at paras 26-33.

[243] Beaman Report, *supra* note 82 at 110-115.

[244] *Ibid*.

[245] See Cunliffe Paradigm, *supra* note 109; *McManus*, *supra* note 111.

[246] Binnie, *supra* note 193 at 312-313.

We suggest that impartiality may be taken a step farther than it has in the current case law.[247] Following from the expert's duty to be "fair, objective and nonpartisan", he or she should transparently disclose any material shortcomings of the evidence.[248] This includes the findings of peak reports like that of the NAS that cast serious doubt on the methodology being employed. Failure to do so should be cause for exclusion (rather than simply reduced weight).[249] Even evidence characterized as specialized knowledge should be held to this standard of transparency.[250] Moreover, the expert's duty of impartiality should also include unconscious bias.[251] Recall, for instance, that Dr. Sweet said in *Kines* that it was best practice to be subjected to a lineup of potential biters, blind to the identity of the suspect.[252] He denied, however, that his opinion was contaminated.[253] In fact, he could not have reasonably cross-examined his own bias.[254] In cases like this, courts should follow the example of *Bruff-Murphy* and exclude that (unconscious) partiality once it becomes apparent.[255]

With each instance of invalid science impacting a legal decision, lessons should be learned. The bitemark analysis cases we reviewed reveal a particularly difficult problem: (apparently) eminent experts with a long history of testifying in Canadian criminal proceedings are providing inculpatory evidence that has no scientific support. One answer, with increasing

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[247] Courts typically look for express indications of partiality, such as in *Bruff-Murphy*, *supra* note 108 and *JP v BC*, *supra* note 109. Still, there may be some role to exclude witnesses for unconscious partisanship. See, for instance, *McManus*, *supra* note 111 at para 70 where the court seemed to suggest the expert would succumb to such bias "despite his best intentions".

[248] *White Burgess*, *supra* note 66 at para 46.

[249] This may be discovered through the defence's cross examination, see "The Role of the Crown and Defence", *supra*.

[250] This accords with the question provided by Justice Doherty in *Abbey* 2009 ONCA, *supra* note 64: "To what extent are the reasoning processes underlying the opinion and the methods used to gather the relevant information clearly explained by the witness and susceptible to critical examination by a jury?".

[251] Paciocco Jukebox, *supra* note 89 at 567.

[252] *Kines* Trial, *supra* note 128 at volume 9, p 16.

[253] *Ibid*.

[254] See Kennedy Bias Perception, *supra* note 237.

[255] *Bruff-Murphy*, *supra* note 108 at para 65.

support in meta-science,[256] jurisprudence,[257] and regulations,[258] is to demand transparency. That

is, courts should insist that experts provide the court with enough information to rationally

evaluate their evidence, cavities and all.

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[256] See the sources at *supra* note 239.

[257] *White Burgess*, *supra* note 66; *JP v BC*, *supra* note 109; *McManus*, *supra* note 111; *Bruff-Murphy*, *supra* note 108.

[258] *Federal Court Rules*, *supra* note 239.

Appendix A

Appendix A. Search terms used in the systematic review and the corresponding number of results. All results are current as of March 6, 2018. Results were reviewed for inclusion by the first author and cross-checked by the second author.

Search term	Number of results
"forensic odontology"	10
"bite mark"	438
"bitemark analysis"	0
"bite mark analysis"	3
"forensic dentistry"	6
"forensic odontologist"	15
"forensic orthodontist"	0
"forensic orthodontology"	0
"teeth impression"	54
"Dr. David Sweet"	9
"Dr. Robert Wood"	42
"Dr. Frank Stechey"	1
"Dr. Robert Dorion"	2
"Dr. Fenton Smyth"	3
"Dr. Norman Sperber"	1
"Dr. Paul Romansen"	1
"Dr. Cheevars"	1
"Dr. Kogan"	12
"Carla Penner"	1
"doctor David Sweet"	0
"doctor Robert Wood"	2
"doctor Frank Stechey"	0
"doctor Robert Dorion"	0
"doctor Fenton Smyth"	0
"doctor Norman Sperber"	0
"doctor Paul Romansen"	0
"doctor Cheevars"	0
"doctor Kogan"	0
"doctor Penner"	2
"Dr. Sweet" AND "bite"	7
"Dr. Sweet" AND "teeth"	8
"Dr. Sweet" AND "bitten"	3
"Dr. Dorion"	22
"Dr. Doiron"	4
"Dr. Romansen"	1
"Dr. Penner" AND "bite"	1
"Dr. Penner" AND "odontologist"	0
"Dr. Penner" AND "dentist"	7

"ondontologist"	2
"orthdontologist"	0
"dentition" AND "bite"	27
"dentist" AND "bite" AND "identified" OR "match" OR "identification" + Criminal and Family law filters applied	75
"Mohan" AND "bite"	42
"forensic" AND "odontology"	12
"odontologie médico-légale"	2
"odontologie médicolégal"	0
"odontologie medicolegale"	0
"point de morsure"	2
"morsure humaine"	11
"morsure" W/40 "identifie"	1
"morsure" W/40 "identifer"	1
"morsure" W/40 "identifee"	5
"empreintes dentaires" AND "morsure"	9
"dentiste" AND "morsure" AND "criminel"	9

Table 1

Table 1. This table includes the style of cause, the year the proceeding was decided, the type of proceeding, the level of probability attached to the identification and whether the identification was inculpatory or exculpatory.

Style of Cause	Year	Proceeding	Bitemark Evidence	Use
R v Longtin[259]	1983	Criminal appeal	Absolute ID (cheese)	Inculpatory
R v Unger[260]	1993	Criminal appeal	Absolute exclusion	Inculpatory & Exculpatory[261]
R v Taillefer[262]	1995	Criminal appeal	Absolute ID	Inculpatory
R v Turner[263]	1995	Criminal trial	Bite is self-inflected	Exculpatory
R v Fisher[264]	1999	Criminal motion to exclude	Insufficient evidence for ID but likely human	Inculpatory
P(A), Re[265]	2002	Guardianship	Bitemarks "identified" as those of the mother's spouse[266]	Inculpatory
R c L(D)[267]	2004	Criminal trial	Inconclusive	N/A
R v VanEindhoven[268]	2007	Criminal trial	"Match"	Inculpatory
New Brunswick v G(M)[269]	2008	Guardianship	"Match"	Inculpatory
Children's Aid of Nipissing v D(LA)[270]	2008	Guardianship	Absolute ID	Inculpatory
R v Kines[271]	2012	Criminal trial and *voir dire*	Probable ID	Inculpatory
R v Kines[272]	2012	Criminal appeal	Probable ID	Inculpatory
R c Meunier[273]	2014	Criminal appeal	Bitemark is "compatible"[274]	Inculpatory
R v Streiling[275]	2015	Criminal *voir dire*	Absolute exclusion	Exculpatory
R v Streiling[276]	2015	Criminal trial	Absolute exclusion	Exculpatory
R v Toulejour[277]	2016	Sentencing	Absolute ID	Inculpatory

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[259] [1983], 41 OR (2d) 545, 5 CCC (3d) 12.

[260] [1993], 85 Man R (2d) 284, 83 CCC (3d) 228.

[261] The bitemark analysis excluded the co-accused Unger as the biter, thus calling into question the co-accused's (Houlahan's) account of the events: "The evidence shows the bite marks were not those of Kyle Unger. One can draw the inference to a virtual certainty that the bite marks were occasioned by Houlahan who…did not provide…a sample of his bite mark… See *ibid* at paras 9, 149-155.

[262] [1995], 40 CR (4th), 100 CCC (3d) 1.

[263] [1995], 164 NBR (2d) 241, 27 WCB (2d) 586.

[264] 1999 SKQB 88, 44 WCB (2d) 193.

[265] [2002] JQ no 8363, JE 2003-791.

[266] *Ibid* at 31: "ces ecchymoses ont été causées par un objet contondant étroit et par des morsures dont six ont été identifiées comme étant celles de M... B..., après analyse des empreintes dentaires." This translates to: the bruises were caused by a narrow, blunt object and by bites, six of which were identified as those of M(B) after analysis of dental impressions.

[267] [2004] JQ no 13167, JE 2005-397.

[268] 2007 NUCJ 1, 72 WCB (2d) 24.

[269] 2008 NBQB 139, 166 ACWS (3d) 268.

[270] 2008 ONCJ 464, 170 ACWS (3d) 320.

[271] 2012, QB File No CR 09-05-00219.

[272] 2012 MBCA 97, 284 Man R (2d) 236.

[273] 2014 QCCA 1681, JE 2014-1680.

[274] *Ibid* at 21: "Les morsures… sont Compatibles" translates to "the bitemarks are compatible".

[275] 2015 BCSC 597, 124 WCB (2d) 139.

[276] 2015 BCSC 1044, 123 WCB (2d) 356.

[277] 2016 SKQB 84, 130 WCB (2d) 210. Mr. Toulejour pled guilty at trial, but the bitemark evidence was used to support a dangerous offender application. While Toulejour admitted to several bites, he contended that his partner made some of them, see para 23. In any event, individuating the source of the bite mark to Toulejour was scientifically invalid.