

The National Academy of Sciences, Canadian DNA Jurisprudence and Changing Forensic Practice

S O R E N F R E D E R I K S E N *

I. INTRODUCTION

In 2009, the National Research Council of the National Academies released a report entitled *Strengthening Forensic Science in the United States*. Empowered by Congress, the Forensic Science Committee was explicitly tasked with evaluating the current status of forensic evidence and making recommendations for the future development of the field of forensics. Congress dictated that the model for this process was to be the one that was used in the development of two previous reports on the evaluation of forensic DNA evidence. The recommendations in the final report of the Forensic Science Committee reflect this, using forensic DNA as a model for many of its recommendations in the area of traditional forensics.

This paper examines how the translation of DNA-based forensic science methodology to the traditional forensic sciences, if implemented, will affect the kind of evidence presented in criminal courts and the way that evidence is presented. It argues that this would represent a change in the scientific paradigm that underlies forensic testimony. Further, this paper examines how this change in the scientific and methodological paradigm for forensic evidence proved difficult for Canadian courts when DNA evidence was first introduced, suggesting potential difficulties in the future as Canadian courts try to adapt to new ways of thinking about forensic evidence.

II. THE FORENSIC SCIENCE COMMITTEE

In November 2005, Congress tasked the National Academy of Sciences (NAS) with conducting a study to evaluate the status of forensic science in the United States, recognizing that there was a need for improvement in this area.¹

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¹ US, National Research Council: Committee on identifying the needs of the forensic science community, *Strengthening Forensic Science in the United States* (Washington DC: National

The evaluation was specifically designed to mirror the NAS's work in evaluating forensic DNA evidence.² The NAS therefore established a Forensic Science Committee, which was instructed by Congress to:

- (1) [A]ssess the present and future resource needs of the forensic science community, to include State and local crime labs, medical examiners, and coroners;
- (2) make recommendations for maximizing the use of forensic technologies and techniques to solve crimes, investigate deaths, and protect the public;
- (3) identify potential scientific advances that may assist law enforcement in using forensic technologies and techniques to protect the public;
- (4) make recommendations for programs that will increase the number of qualified forensic scientists and medical examiners available to work in public crime laboratories;
- (5) disseminate best practices and guidelines concerning the collection and analysis of forensic evidence to help ensure quality and consistency in the use of forensic technologies and techniques to solve crimes, investigate deaths, and protect the public;
- (6) examine the role of the forensic community in the homeland security mission;
- (7) [examine] interoperability of Automated Fingerprint Information Systems [AFIS]; and
- (8) examine additional issues pertaining to forensic science as determined by the Committee.³

The Committee eventually made a series of thirteen recommendations.⁴ Characteristic of many of these recommendations and their rationales was a concern with the normalization of forensic science into mainstream research science. The Committee, responding to a variety of concerns over traditional forensic science evidence, proposed far-reaching changes in the way those sciences work; from the structure of professional organizations and the way results are presented and validated, to the way research into forensics is funded. These changes would, if implemented, move the traditional forensic sciences closer to the DNA-forensics model in terms of their relationship to mainstream science,⁵ their use of formal validation studies, and their presentation of results.

Academies Press, 2009) online: National Criminal Justice Reference Service <<https://www.ncjrs.gov/pdffiles1/nij/grants/228091.pdf>> at 1.

² See US, National Research Council: Committee on DNA Technology in Forensic Science, *DNA Technology in Forensic Science* (Washington DC: National Academies Press, 1992) online: National Academies Press <<http://www.nap.edu/openbook.php?isbn=0309045878>> [NRC 1992] and US, National Research Council: Committee on DNA Technology in Forensic Science, *The Evaluation of Forensic DNA Evidence: An Update* (Washington DC: National Academy Press, 1996) online: National Academies Press <http://www.nap.edu/catalog.php?record_id=5141> [NRC 1996].

³ US, Committee on Appropriations of the Senate, *Report on Departments of Commerce and Justice, Science, and Related Agencies Appropriations Bill, 2006* (S Rep No 109-88) (Washington DC: 2005), at 46, as cited *supra* note 1, at 1.

⁴ *Supra* note 1 at 19-33.

⁵ By mainstream science I mean science as practiced by research scientists in universities, as distinguished from that practiced by forensic scientists.

Should traditional fields of forensics accept the sort of changes that are being proposed by the NAS, it would make for a paradigmatic change⁶ in the way the forensic sciences function. It will also fundamentally change the context in which forensic evidence is presented in courtrooms. Lawyers, courts, police officers, prosecutors, and all the legal actors who have become accustomed to forensic evidence presented in a particular way will have to adjust to a new way of thinking about forensic evidence. The model for the way this evidence may end up being presented should follow the model adopted by DNA evidence, and thus we might expect that DNA evidence and the way it is evaluated, presented, and validated will become the dominant paradigm for forensic evidence generally. This would represent a fundamental, normative change in the way forensic science is practiced by forensic science and in the way that it is presented to the courts.⁷

It seems likely that any changes to forensic practice resulting from the NAS report will likely spread to Canadian forensics as it has implications for all forensic practitioners, whether they are in the United States or elsewhere. Anecdotally, in my conversations with Canadian forensics practitioners they already talk about its impact.

For the law generally, the switch to a DNA-style model of forensic practice may not at first seem to be problematic. It appears to be a welcome improvement for a type of evidence that has seemed increasingly inadequate in recent years.⁸ The law has had to adapt to the coming of DNA evidence, so one might think that it would be well prepared for the “DNAification” of forensic evidence more generally.

Looking at Canadian law, it is not clear that this latter assumption is true. As this paper will show, Canadian courts had some specific difficulties with DNA evidence, and it is probable that some of these difficulties may resurface when they are confronted with traditional forensics translated to fit the DNA paradigm. In particular, questions related to how judges, juries, and the law more generally confront probabilistic evidence will become germane. These are questions that, this paper will show, were only partially addressed during the initial phases of DNA acceptance in Canada, and it is reasonable to expect that similar questions may be raised when and if traditional forensics disciplines begin to follow the

⁶ Paradigmatic change refers to the process whereby a normative model of scientific practice (or paradigm) changes. See Thomas Kuhn, *The Structure of Scientific Revolutions*, 3rd (Chicago: University of Chicago Press, 1996).

⁷ See Paul C Giannelli, “Forensic Science: Under the Microscope” (2008) 34 Ohio NU L Rev 315 and Michael J Saks & Jonathan J Koehler, “Review, The Coming Paradigm Shift in Forensic Identification Science,” (2005) 309: 5736 Science 892 for a discussion of the potential for a paradigm shift in the way forensic evidence is handled in the United States.

⁸ There is a developing literature aimed at the American defence bar that focuses on demonstrating limitations with conventional forensic evidence techniques. See Adina Schwartz, “Challenging Firearms and Toolmark Identification” (2008) 32 *Champion* 10 for an example of the approaches being taken.

DNA model. In particular, concerns over the statistical validation of particular forensic techniques and over the trial presentation and interpretation of match statistics seem likely to come to the fore should the DNA model be applied more broadly.

In the Manitoba context, DNA evidence and how it should be interpreted is a current subject due to the high profile trial of Mark Edward Grant for the 1984 murder of Candace Derksen.⁹ Questions about the interpretation of DNA, other forms of forensic evidence, and the jury charge have formed the basis of his appeal of his conviction.¹⁰ While DNA evidence has largely become routine in Canadian courts, *R v Grant* demonstrates how concerns over the use of relatively marginal DNA samples allow the defence to unpack the technique itself and questions about the limits of technology, expertise, and interpretation come to the fore.¹¹ While this paper will argue that DNA is likely becoming the model that all other forensic techniques will have to follow, it is important to keep in mind that it, like all other forensic techniques, remains only circumstantial evidence that must be interpreted by the fact-finder in the context of a trial.

The following paper will start by describing the recommendations made by the National Academy of Sciences Committee and how, if implemented, these recommendations would result in a change in the scientific approach or paradigm used by forensic science generally. The second section of the paper will introduce DNA evidence and the scientific controversies that were current during the period that Canadian courts were first evaluating its admissibility. The third will describe some of the early Canadian DNA jurisprudence to identify some of the difficulties Canadian courts had when confronting these controversies. The concluding section will discuss how this experience with DNA could help identify potential difficulties with post-NAS Report forensic science.

III. THE NATIONAL ACADEMY OF SCIENCE'S REPORT ON FORENSICS

This section will show how the NAS report argues for major changes in the way forensic science is practiced and how the Report proposes a series of recommendations aimed towards specific forms of forensics. It will argue that the factor that links these recommendations is the use of DNA as a model and that, taken together, the NAS recommendations argue for making all forensic science

⁹ James Turner, "Schoolgirl trial awash in DNA testimony", online: CBC News <<http://www.cbc.ca/news/canada/manitoba/story/2011/02/03/man-derksen-trial-dna-testimony.html>>.

¹⁰ *R v Grant*, Notice of Application of Leave to Appeal and Notice of Appeal.

¹¹ "Faulty DNA testing attacked at murder trial", online: CBC News <<http://www.cbc.ca/news/canada/manitoba/story/2011/02/11/mb-dna-testing-faulty-grant-derksen-winnipeg.html>>, "DNA doubted at murder trial", online: CBC News <<http://www.cbc.ca/news/canada/manitoba/story/2011/02/08/mb-dna-derksen-murder-trial-winnipeg.html>>.

more like forensic DNA. This, it will be argued, represents a major and perhaps even a paradigmatic change in the way forensic science would be practiced.

There has been little academic writing on the NAS Report. What has been written suggests that the report would, if followed, lead to a significant change in the way forensic science is practiced in the United States and, because of the close relationship between forensics professions and practices in the two countries, Canada.¹² Simon Cole, for example, suggests that, in the field of fingerprinting, the Report represents the triumph of mainstream or institutionalized science norms over those of traditional forensics.¹³ Erin Murphy notes how DNA formed a pivotal role in the development and execution of the Committee's mission and that it has become a model of appropriate forensic science practice.¹⁴ The section that follows echoes Cole's observation from the field of fingerprinting and suggests that, taken as a whole, the Report represents a call for all fields of forensic science to shift to methods from mainstream as opposed to forensic science. Further, these methods are derived by comparison with DNA typing, and thus represent, following Murphy, a shift to using DNA as the model for forensic practice.

It is illustrative of the general approach taken by the Committee that the analysis of specific scientific disciplines opens with a discussion of biological evidence, and focuses specifically on DNA evidence. In its summary, the Committee focuses on the reasons for which DNA analysis is to be considered scientifically sound. It is worth citing this summary at length:

Unlike many forensic techniques that were developed empirically within the forensic science community, with limited foundation in scientific theory or analysis, DNA analysis is a fortuitous by-product of cutting-edge science. Eminent scientists contributed their expertise to ensuring that DNA evidence offered in a courtroom would be valid and reliable (e.g. in the 1989 New York case, *People v Castro*), and by 1996 the National Academy of Sciences had convened two committees that issued influential recommendations on handling DNA forensic science. As a result, principles of statistics and population genetics that pertain to DNA evidence were clarified, the methods for conducting DNA analyses and declaring a match became less subjective, and quality assurance and quality control protocols were designed to improve laboratory performance. DNA analysis is scientifically sound for several reasons: (1) there are biological explanations for individual-specific findings; (2) the 13 SR loci used to compare DNA samples were selected so that the chance of two different people matching on all of them would be extremely small; (3) the probabilities of false positives have been explored and quantified in

¹² For example, Canadian DNA testing relies on the American CODIS software protocol for the DNA testing used at the National DNA Databank. National DNA Bank "Technology" online: National DNA Bank <http://www.nddb-bndg.org/techno_e.htm> accessed August 2, 2011.

¹³ Simon A Cole "Who Speaks for Science? A response to the National Academy of Sciences Report on forensic science" (2010) 9:1 Law, Probability and Risk 25.

¹⁴ Erin Murphy, "What 'Strengthening Forensic Science' today means for tomorrow: DNA exceptionalism and the 2009 NAS Report" (2010) 9:1 Law, Probability and Risk 7. Murphy notes this in the context of her concern that DNA may not receive sufficient critical scrutiny because of this privileged role.

some settings (even if only approximately); (4) the laboratory procedures are well specified and subject to validation and proficiency testing; and (5) there are clear and repeatable standards for analysis, interpretation, and reporting.¹⁵

The Committee's assessment of the chemical analysis of controlled substances is similarly positive. Again, the importance of a strong link to mainstream science is apparent: "The analytical methods used have been adopted from classical analytical chemistry, and there is broad agreement nationwide about best practices."¹⁶ However, it identified problems with the way these sorts of results are reported in court, taking issue with the practice of reporting a result without stating either the methodology or the sampling methodology used: "From a scientific perspective, this style of reporting is often inadequate, because it may not provide enough detail to enable a peer or other courtroom participant to understand and, if needed, question the sampling scheme, process(es) of analysis, or interpretation."¹⁷

While the Committee is generally favourable towards the practices used in the fields of forensic DNA testing and chemical analysis of controlled substances, its assessments of other fields of forensic practice are considerably less positive.¹⁸ For example, the conclusions reached for friction ridge analysis (fingerprinting) are critical of the practices of forensic professionals in this field.¹⁹ In particular, the Committee criticizes latent fingerprint examiners for not developing or using statistical models to provide probabilistic descriptions of match criteria:

Current published statistical models, however, have not matured past counts of corresponding minutia and have not taken clarity into consideration. (This area is ripe for additional research.) As a result, the friction ridge community actively discourages its members from testifying in terms of the probability of a match; when a latent print examiner testifies that two impressions "match," they are communicating the notion that the prints could not possibly have come from two different individuals.²⁰

The Report also quotes extensively from J.L. Mnookin's assessment of latent fingerprinting:

Given the general lack of validity testing for fingerprinting; the relative dearth of difficulty proficiency tests; the lack of a statistically valid model of fingerprinting; and the lack of validated standards for declaring a match, such claims of absolute, certain confidence in identification are unjustified.²¹

In their summary assessment, while emphasizing the plausibility of fingerprint analysis and its utility as a forensic tool, the Committee stressed the

¹⁵ *Supra* note 1 at 133 (footnotes omitted).

¹⁶ *Ibid* at 134 (footnote omitted).

¹⁷ *Ibid* at 135.

¹⁸ *Ibid* at 130-173.

¹⁹ *Ibid* at 142-145.

²⁰ *Ibid* at 141.

²¹ Jennifer Mnookin, (2008) "The validity of latent fingerprint identification: confessions of a fingerprinting moderate" 7:2 Law, Probability and Risk 127, quoted *supra* note 1 at 142.

lack of information about its error rates.²² This lack of information, coupled with fingerprint examiners' claims of a zero error rate, a claim the Committee considered untenable, represent the greatest challenges facing fingerprinting as a discipline.²³

None of these problems were considered unsolvable, and the approach to solving this problem that was suggested in the Report was to mobilize scientific research to fill in the gaps in fingerprinting methodology.²⁴ The Committee proposed research into the variability of fingerprint ridges themselves, research into the means used to discriminate fingerprint ridges, and into the means by which latent prints may be made and such prints deformed.²⁵ Appropriate statistical modeling of fingerprints themselves and of errors made by fingerprint examiners, along with the development of better, formalized, practice guidelines were seen as the appropriate approach to improving fingerprinting.²⁶ In the case of fingerprinting, the Committee was bullish on the likelihood that a proper statistical analysis of the underlying variability of fingerprints would support the use of them for forensic purposes.²⁷ It was less positive on the sorts of natural variability that underpin other forms of pattern evidence: "there is consensus on regarding the number of individual characteristics needed to make a positive identification, and the committee is not aware of any data about the variability of class or individual characteristics that must match in order to have any particular degree of confidence about the source of the impression."²⁸

The preference for non-statistical reporting of probability by most shoe-print and tire track examiners was noted along with European studies that found that different examiners did not reach identical conclusions, and the FBI has recommended the use of a series of descriptive terms to indicate the degree of reliability of a particular conclusion.²⁹ The Committee's proposed solution to these problems lies in more scientific research to provide the statistical descriptors and standards need to better understand the limits of these techniques. The Committee makes clear that questions about what kind of research needs to be done and by whom have not been addressed by the forensics community.³⁰ This, coupled with the criticism of the existing research being conducted in forensics laboratories and published in trade journals presents the clear implication that a more scientific normative approach, one that is compatible with the norms of

²² *Supra* note 1 at 142-145.

²³ *Ibid* at 142-143.

²⁴ *Ibid* at 143-144.

²⁵ *Ibid*.

²⁶ *Ibid*.

²⁷ *Ibid*.

²⁸ *Ibid* at 149.

²⁹ *Ibid* at 147-148.

³⁰ *Ibid* at 148-149.

mainstream science, must be taken with this research and that the current reliance on experience-based judgment is inadequate.³¹

Similar problems were identified in toolmark and firearms identification, with additional difficulties caused by the need to identify the kinds of marks that are unique from those that are characteristic of a particular class or sub-class of tools or firearms.³² Another National Academies report, *Ballistic Imaging*, has found that the “validity of the fundamental assumptions of uniqueness and reproducibility of firearms-related toolmarks has not yet been fully demonstrated” and that “a significant amount of research would be needed to scientifically determine the degree to which firearms-related toolmarks are unique or even to quantitatively characterize the probability of uniqueness.”³³

For hair evidence, the Committee again cites the lack of scientific studies to validate statistically the assumptions about diversity of identifiable hair characteristics that underlie the method, and, furthermore, what studies exist raise doubts about the reliability of the technique more generally as well as about the kind of testimony given by forensic hair examiners.³⁴

In these areas of forensic practice, as well as in the fields of fiber analysis, handwriting analysis, paint, explosives and fire debris, and forensic odontology, the committee focused on the need for scientific research to develop a statistical understanding of the underlying assumptions behind the techniques.³⁵ In short, the Committee was remarkably consistent with its suggestions for improving forensic practice, focusing on bringing the underlying research into the mainstream and developing appropriate statistical models to validate forensic techniques.

These changes would bring other forensic sciences in line with forensic DNA practice and holds out that technique as an example for other forensic scientists to follow. The types of changes the NAS proposes for other forms of forensic science are changes that seem designed to bring them into line with DNA’s approach. It is perhaps not an overstatement to suggest that the model or paradigm for good forensic science in the NAS report is forensic DNA.

Taken as a whole, the changes suggested by the NAS represent something more than subtle tinkering with the methods used by forensic examiners. The questions they ask demand a change in the way forensic techniques are developed and validated. Whereas before a preponderance of expert opinion might be sufficient to validate a technique, now, as we have seen, statistical descriptions of

³¹ *Ibid* at 149-150.

³² *Ibid* at 154.

³³ US, National Research Council: Committee to Assess the Feasibility, Accuracy and Technical Capability of a National Ballistics Database, *Ballistic Imaging* (Washington DC: National Academies Press, 2008) at 3, as quoted *supra* note 1 at 154.

³⁴ *Ibid* at 160.

³⁵ *Ibid* at 161-176.

the proposed technique as well as basic science on the phenomenon that underlies it are necessary. It is no longer sufficient for experts to state their opinions as to the likelihood of a forensic match; such likelihoods must be expressed statistically. Forensics is being asked to accede to the methods and research patterns of mainstream science, as the methods and research patterns of forensic science are held to be inadequate.³⁶ In other words, the NAS is demanding that the epistemic foundation of forensic claims change from one of practiced expert opinion to one more in keeping with that of mainstream science.

This is not a small change. If implemented it may be a shift in the scientific paradigm³⁷ that underlies forensics resulting from a translation³⁸ of DNA's methodologies to other forensic fields. This kind of paradigmatic change would be represented by a change in the shared understanding by forensic scientists of what is good forensic science. Seen from this viewpoint, one wonders how the elements of mainstream science, as translated to forensic DNA, might take on different meanings when translated into the scientific and legal framework of other types of forensic science. What do scientific controversies, the use of statistical descriptions of evidence, and the adoption of mainstream science's

³⁶ Simon Cole, in one of the first papers to respond to the NAS Report (*supra* note 13), suggests that the Report represents the response of mainstream institutionalized science to a controversy between the judicial/forensic community and the scientific community over the validity of fingerprint identification. My reading of the Report would take the characterization farther and apply it to the Report as a whole.

³⁷ The notion of a scientific paradigm was developed by Kuhn, *supra* note 6.

³⁸ Translation is an important element in actor network theory, one theoretical framework that has been developed to understand scientific practice. The explanation here is drawn from Michael Callon, "Some elements of a sociology of translation: domestication of the scallops and the fishermen of St. Brieuc Bay" in John Law, ed, *Power, Action, and Belief: a new sociology of knowledge?* (London, UK: Routledge, 1986) 196. During the process of translation, "the identity of the actors, the possibility of interaction, and the margins of maneuver are negotiated and delimited." Translation involves four "moments" in Callon's vocabulary: problematization, intersement, enrolment, and the mobilization of allies. All four elements are presented in the context of his analysis of the development of the domestication of scallops in the Bay of St. Brieuc, starting with a method already in use in Japan.

During the process of problematization, actors set out a question that may be answered and at the same time make themselves essential to answering that question by the way they define and identify the actors needed to answer the question. This process serves a political purpose by making the researchers a necessary part of the problematization itself.

The second stage is intersement. At this stage the actors who were made part of the problematization can allow themselves to be captured and defined by the plan or resist its definition in some manner. It should be emphasized that the actors need not be human, and Callon describes how scallop larvae resist the intersement device of a collector much as he describes the intersement of scientific colleagues and fishermen's professional organizations.

Third, even once trapped or cajoled into intersement, scientists still need to form a series of alliances to allow the program to be completed. This process is enrolment.

In the final stage, the spokesmen who speak for the other actors are identified, and they allow the diffusion of what happened during the process of translation and the result of the consensus that occurred among the actors during the process.

more skeptical view of forensic techniques mean as this new forensic science makes its way into Canadian courts? Might they, for example, have difficulty with the new emphasis on statistics that this approach would require? How will they respond to controversies that might be engendered by this transition, such as those that develop when standards of practice are in flux? In this instance, we have an advantage in that we can study a similar type of forensic evidence: DNA.

As we have seen, the NAS report demonstrates how different forensic DNA is from other forms of forensic evidence. While it might be a model for other forensic techniques, that does not mean that it was without its own difficulties when it was introduced to Canadian courts. If other forensic techniques are to follow the DNA model, might they expose cracks in Canadian law's approach to forensic science that will become evident when these other techniques begin to adopt DNA methodology as their model? If so, understanding the difficulties that might be raised by the adoption of DNA as a model for forensic science will require revisiting the difficulties that were encountered when DNA was first introduced into Canadian courts.

IV. QUESTIONING FORENSIC DNA TECHNOLOGY

When forensic DNA technology was first introduced, there were questions about the interpretation of the sort of evidence given by DNA experts.³⁹ DNA evidence depends on probabilistic statements of the likelihood of a false claim that two DNA samples came from the same individual.⁴⁰ These probabilistic statements require statistical, empirical verification and cannot be validated solely based on individual clinical experience. The types of probabilistic claims made by DNA evidence have raised a series of difficulties for courts concerned with the potential for misuse of probabilistic claims. In the field of criminal forensics the way DNA experts resorted to probabilistic statements in qualifying their claims represented a significant change in the sort of evidence heard in the criminal courtroom.

This section will characterize some of the debates that occurred in the context of the early development of DNA technology, which are the debates that drove the Canadian DNA cases.

Courtroom analysis of scientific expert evidence is constrained by the nature of the technology used to produce and empirically validate the opinion evidence presented by the putative experts in the particular specialty in question. For example, a fingerprint examiner can identify an individual from an arrest record

³⁹ See David H Kaye "The Admissibility of DNA Testing" (1991) 13 *Cardozo Law Review* 353 for a brief, relatively early American discussion of the issues facing courts confronted with forensic DNA.

⁴⁰ NRC 1996, *supra* note 2 at 89-90.

based upon his or her fingerprints, a process notionally quite different from that of connecting a crime-scene partial print to a record.⁴¹ In the case of DNA evidence several types of forensically relevant statements can be drawn from the comparison of two DNA samples.

The two samples might simply confirm identity, having been drawn directly from the same person at different times. While issues of inclusion and exclusion criteria will come up in this situation, the declaration of a match will not be circumstantial evidence for the commission of the crime itself. The evidence might be exculpatory; DNA evidence left at a crime scene may not match that of the defendant. In this case the primary issue for the courts is whether the exclusion criteria are robust. Alternatively, the evidence may be inculpatory; DNA left at the crime scene may link the defendant to the commission of a crime. In this instance the inclusion criteria are at issue.

These types of statements are generally similar to those that might be made by other forensic experts and generate similar issues in terms of validating the inclusion and exclusion criteria used by the expert who makes the conclusion. However, techniques such as fingerprinting have usually not depended upon statistical verification of specific claims of accuracy in order to be considered valid by the courts. Forensic techniques like fingerprinting instead depended upon the clinical judgment of the individual expert, a judgment that was historically supported by the visual demonstration of match criteria to a judge and jury.⁴² In this way, DNA is fundamentally different from most existing forensic techniques.

Although DNA examiners have used visual aids in explaining their match criteria,⁴³ their claims of a valid match are dependent upon a variety of factors including the prevalence of certain genetic traits in human populations, a comparison that can only be made statistically. DNA examiners are thus in the business of producing numbers and in particular probabilistic statements. Not only can they declare a match or non-match, they can also tell the trier of fact something about the likelihood of that declared match being incorrect, a likelihood that might be expressed in words but is ultimately derived from a numerical probability figure.⁴⁴ This allows DNA examiners to provide several new

⁴¹ Soren D Frederiksen, *The Mediating Discourses of the Expert Witness: Science, Fingerprinting, and the Law* (Masters of Political Science Thesis: Carleton University, 2000). This is related to the history of fingerprint adoption: as a simple identification technique, fingerprinting represents a drop-in replacement for Bertillonage, a precursor identification technique also based on measuring body characteristics. Solving crimes using latent partial-prints changes the legal status of a fingerprint by making it circumstantial evidence of the crime itself and raises a series of questions as to just how much of a partial print is required to declare a match. This last issue has been addressed in detail by Cole, *supra* note 36.

⁴² Simon A Cole, *Suspect identities: a History of Criminal Identification and Fingerprinting* (Cambridge, Mass: Harvard University Press, 2001) at 191.

⁴³ NRC 1996, *supra* note 2 at 68.

⁴⁴ NRC 1996, *supra* note 2 at 192 – 202.

types of evidence not historically available to other forensic examiners: the likelihood that a match could have occurred by chance between two random individuals in that population, given certain theoretical assumptions and population characteristics.

This type of statement raises serious issues of interpretation both in terms of admissibility and in terms of weighting, since its forensic meaning is less clear than the more traditionally expressed match or no-match results. However, if other forensic techniques move towards the DNA model, similar probabilistic statements may be made concerning their conclusions as well. Thus, issues raised by DNA technology are likely to become relevant to other forensic disciplines.

We often speak of the use of forensic DNA testing as though a single technique was involved, but while the initial forensic use of DNA for identification purposes was developed in England in 1985,⁴⁵ further techniques based on differing methodologies were quickly found. A full discussion of the technologies behind DNA testing is beyond the scope of this paper.⁴⁶ However, as most of the cases discussed here involve one of the following two techniques of DNA matching, they will be briefly described before a discussion of the early case law in the United States and the United Kingdom.

In 1985, Alec Jeffreys developed DNA profiling, which was the first technique that came into general forensic use.⁴⁷ This technique came to be described as “DNA fingerprinting” and was based on the variation in restriction fragment length in areas of great genetic variability. This “restriction fragment length polymorphism” (RFLP) technique produced profiles that were said to be unique between individuals, leading to the comparison with fingerprints.⁴⁸ It was almost immediately used to prove paternity in an immigration case in the UK, in 1986 it was used to exonerate a murder suspect, and in 1987 the first DNA conviction was obtained.⁴⁹

The second technique uses the polymerase chain reaction (PCR) to amplify a variable area of DNA and then uses a series of genetic probes to identify specific genes that may or may not be present.⁵⁰ Using this technique, different areas of the human genome can be examined by using genetic probes that indicate the presence of particular sections of DNA. One of the earliest methods using the PCR technique was the DQ-alpha system developed by Dr. Edward Blake of

⁴⁵ Leonard J Deftos, “*Daubert & Frye: Compounding the Controversy Over the Forensic Use of DNA Testing*” (1994) 15 Whittier L Rev 955 at 955.

⁴⁶ See NRC 1996, *supra* note 2 for such a discussion.

⁴⁷ David L Faigman, “The Tipping Point in the Law’s Use of Science: The Epidemic of Scientific Sophistication that Began with DNA Profiling and Toxic Torts” (2001) 67 Brooklyn L Rev 111 at 116-117.

⁴⁸ William C Thompson, “Evaluating the Admissibility of New Genetic Identification Tests: Lessons from the “DNA Wars” (1993) 84:1 Crim L & Criminology 22 at 26-27.

⁴⁹ *Supra* note 47 at 117.

⁵⁰ *Supra* note 48 at 28.

Forensic Sciences Associates in 1986,⁵¹ although it was not in widespread use until the 1990s. Today, PCR techniques dominate.

When looking at scientific evidence generally, forensic DNA evidence seems to differ in kind as much as in quality. It seems almost infallible, providing its claims of accuracy in the form of numerical probabilities. It also arose at a time when scientific evidence was increasingly prevalent in American courts, and DNA evidence became part of a process of what Faigman describes as reaching the “tipping point” for a change in the law’s relationship with scientific evidence; a change that Faigman argues led to the *Daubert* decision.⁵² In that decision, the United States Supreme Court radically altered the federal procedure for admitting scientific evidence, requiring that courts adopt a gatekeeping role to prevent the admission of questionable scientific evidence.⁵³ This represented an important change in the way courts dealt with scientific evidence. Similarly, the Supreme Court of Canada has also clarified the procedure for admitting novel scientific evidence in *R v Mohan*.⁵⁴ Faigman’s contention is that these important changes in evidence law are, in part, the result of DNA evidence changing the parameters and expectations surrounding the use of scientific evidence.⁵⁵

DNA evidence has clearly helped courts to make more just decisions. This was demonstrated clearly in its power to help free the unjustly convicted.⁵⁶ In Canada, perhaps the most obvious example of this phenomenon is the case of Guy Paul Morin where DNA evidence not only freed Mr. Morin, it also implicated another person in the crime for which he had been convicted.⁵⁷ The importance of this in the rhetorical basis for accepting DNA evidence is apparent:

DNA evidence of identification is often touted by its proponents (including prosecutors) as a great tool for the exclusion of innocent suspects. This argument is usually dismissed by opponents (including defence attorneys) of the technology, who apparently consider this observation disingenuous, as if protecting the civil liberties of individuals is not properly the province, or the concern, of prosecutors. Criminal defence attorneys (and hence those who align themselves with the defence in criminal cases) seem to discount the power of DNA to absolve

⁵¹ *Ibid* at 29.

⁵² *Supra* note 47 at 116-118.

⁵³ *William Daubert et al v Merrell Dow Pharmaceuticals Inc*, 509 US 579, 113 S Ct 2786, 125 L Ed 469 (SCOTUS 1993) [*Daubert*].

⁵⁴ *R v Mohan*, [1994] 2 SCR 9, 18 OR (3d) 160 [*Mohan*].

⁵⁵ *Supra* note 47 at 117-118.

⁵⁶ For a review of the American experience, see C Ronald Huff, “Wrongful Convictions: The American Experience” (2004) 46:2 Can J Crim & Crim Just 107.

⁵⁷ See R Overstall, “Mystical Infallibility: Using Probability Theorems to Sift DNA Evidence” (1999) 5 Appeal 28 at para 17 for how this may have influenced the *Terceira* decision at the Ont CA.

the innocent suspect from suspicion because they have never had a client who was exonerated by this evidence.⁵⁸

While the use of forensic DNA evidence was most visible in the context of criminal cases, it was also immediately and widely used in family law to determine paternity, where it provided an unquestionable alternative to the earlier blood-typing methods.⁵⁹ This unerring means of determining paternity (the ability of DNA tests to determine paternity was never seriously challenged) has led to a perhaps inappropriate emphasis on biological relatedness in family law.⁶⁰ This sense that DNA somehow provides important and private information about a person has led to privacy concerns in Canada over the operation of DNA databanks.⁶¹ Coupled with the forensic power of DNA technology, these sorts of issues likely increased the cultural stakes involved in the use of DNA in criminal cases.

It is therefore perhaps not surprising that DNA evidence almost immediately came under serious question and by 1991 the journal *Science* published an issue devoted to it.⁶² The National Research Council published a report in 1992 that sought to address a series of controversies over the use of DNA.⁶³ To that end it was not a notable success and controversy remained through the mid-1990s, when better population data and changing technologies, including the increased use of PCR methods and better standardization, in part the result of a second National Research Council report in 1996,⁶⁴ brought the controversy largely to an end.

What were the kinds of controversies that emerged from these early DNA debates? Writing in 1993, Thompson identified three major areas of criticism related to RFLP: the adequacy of standards and controls for assuring the reliability of the forensic tests, the adequacy of the procedures used by forensic laboratories to determine whether DNA profiles “match”, and the accuracy of the procedures used to determine the statistical frequency or rarity of DNA profiles.⁶⁵ He also

⁵⁸ Jeffrey Baird, “Forensic DNA in the Trial Court 1990-1992: a Brief History” in Paul R Billings, ed, *Genetic Identification and Criminal Justice*, (Cold Spring Harbor Laboratory Press, Plainsview, New York: 1992).

⁵⁹ Timothy Caulfield, “Canadian Family Law and the Genetic Revolution: A Survey of Cases Involving Paternity Testing” (2000) 26 *Queen's LJ* 67.

⁶⁰ *Ibid* at 73.

⁶¹ Julianne Parfett, “Canada's DNA Databank: Public Safety and Private Costs” (2002) 29:1 *Man LJ* 33 at 34.

⁶² See L. Roberts, “Fight Erupts Over DNA Fingerprinting” (1991) 254 *Science* 1721 for a description of the debate from an editor's perspective as well as a summary of the various positions taken.

⁶³ NRC 1992, *supra* note 2. See David H Kaye “The Forensic Debut of the NRC's DNA Report: Population Structure, Ceiling Frequencies, and the Need for Numbers” (1995) 96 *Genetica* 99-105 for one of many critiques of this report.

⁶⁴ NRC 1996, *supra* note 2.

⁶⁵ *Supra* note 48 at 28.

identified similar issues with the PCR DQ-alpha technique developed by Forensic Science Associates:

Although no one questions the theory underlying the procedure, concerns have arisen about its susceptibility to errors caused by inadvertent contamination of samples or poor "fidelity" of DNA amplification. Concerns have also been raised about some of the procedures used by FSA for interpreting results and for estimating the frequency of DQ-alpha types.⁶⁶

As a result of his analysis, Thompson argues that under certain circumstances the finding of a match should be excluded where it can be reasonably argued that the match criteria should have been more narrowly set.⁶⁷ The most likely reason for doing so would be because the examining procedures did not take into account varying levels of diversity in particular genetic markers in different human subpopulations. Match probabilities are dependent on variation in the particular traits identified in the population of the accused and other possible suspects.⁶⁸ If these individuals belong to a smaller group of people that are different from that used by the forensic examiner to generate the match probabilities then, Thompson argues, there is reason to doubt the forensic claims made.⁶⁹ This was called the "subpopulation problem".

Some objections were procedural, objecting to an American legal regime coming out of the *Castro*⁷⁰ decision that had radically changed the way pre-trial hearings were held. This procedure was one that at least one observer saw as constituting "judicial abdication of the court's role" since it allowed an appellate court to overturn a trial court decision because the "scientific landscape" had changed since the trial decision.⁷¹ Kaye, while rejecting Thompson's call to exclude forensic DNA in certain circumstances, argued that if his logic were to be carried forward then match claims themselves should be eliminated and replaced with probabilistic statements.⁷²

⁶⁶ *Ibid* at 29 [footnotes omitted].

⁶⁷ *Ibid* at 57-59.

⁶⁸ NRC 1996, *supra* note 2 at 89.

⁶⁹ Roberts, *supra* note 62, identifies the specific problem as related to the lack of information on genetic variation within ethnic subpopulations. See also Paul E Tracy & Vincent Morgan, "Big Brother and his Science Kit: DNA Databases for 21st Century Criminal Control?" (2000) 90:2 *Crim L & Criminology* 635, David H Kaye, Michael E Smith & Edward J Imwinkelried, "Is a DNA Identification Database in your Future?" (2001) 16:3 *Crim Just* 4, and Jonathan J Koehler, "The Psychology of Numbers in the Courtroom: How to make DNA-match statistics seem impressive or insufficient" (2001) 74:5 *S Cal L Rev* 1275. For further contemporary discussions of this and other problems in DNA profiling see Deftos, *supra* note 45, and Kaye, *supra* note 63. *People v Castro*, 144 Misc 2d 956, 545 NYS 2d 985 (NY Sup 1989).

⁷¹ Rockne P Harmon, "Legal Criticisms of DNA Typing: Where's the Beef?" (1993) 84:1 *Journal of Criminal Law and Criminology* 175 at 177-178.

⁷² David H Kaye, "The relevance of "matching" DNA: is the window half open or half shut?" (1995) 85:3 *Crim L & Criminology* 676 at 694.

Even once the controversy over how DNA match statistics should be computed was resolved, these probabilistic statements themselves were seen as problematic by many observers, leading to a significant push to bar the discussion of match statistics in front of juries.⁷³ One of the worries associated with presenting probabilistic evidence is the danger of committing logical fallacies, that is of the trier of fact reaching conclusions that appear to make sense but are actually logical errors. In the case of DNA evidence, the best-known example of this sort of problem is known as the “prosecutor’s fallacy” where the probability of a random DNA match is conflated with the probability of innocence of the accused.⁷⁴ While the prosecutor’s fallacy is a mistake that can be made by any trial actor, jury behavior has come under particular scrutiny with the idea that juries tend to overweight evidence presented numerically. Mock-jury studies have to at least some extent supported this idea and even suggested that the precise wording used to present such evidence may significantly influence jury deliberation.⁷⁵ DNA evidence seems to place significant demands on all legal actors, including juries, that they may or may not be able to meet.

Defence lawyers also face challenges when DNA evidence is presented. One of the biggest problems noted has been the tendency of defence counsel to not adequately challenge DNA evidence⁷⁶ and make inappropriate or unnecessary plea agreements.⁷⁷ While this “blackboxing” occurs with other forms of forensic evidence,⁷⁹ it is particularly notable with forensic DNA. This may occur as much because of a lack of the resources required to retain qualified experts to evaluate the quality of the forensic DNA evidence provided. This is particularly a problem for public defenders in the United States as their workload has increased, and at least one office has adapted to this problem by developing in-house expertise among their own legal staff to be able to perform at least limited evaluations of such evidence.⁸⁰ Any lack of adequate defence review is troubling since errors in

⁷³ See, for example, Harmon, *supra* note 71, at 185.

⁷⁴ See Vincenzo Rondinelli, “Three Card Monty: Presenting DNA Statistical Evidence To Juries” (2002) 3 CR (6th) 52 for a summary of the logical problems possible when DNA evidence is used.

⁷⁵ See Koehler, *supra* note 69, for an example of this sort of study.

⁷⁶ William C Thompson et al, “Part 1: Evaluating Forensic DNA Evidence: Essential Elements of a Competent Defense Review” (2003) 27 Champion 16 online: National Association of Criminal Defense Lawyers <<http://www.nacdl.org/Champion.aspx?id=771>>.

⁷⁷ William C Thompson et al, “Part 2: Evaluating Forensic DNA Evidence: Essential Elements of a Competent Defense Review: Breaking Open the Black Box: How to Review the Electronic Data” 26 Champion 24 online: National Association of Criminal Defense Lawyers <<http://www.nacdl.org/Champion.aspx?id=786>>.

⁷⁸ “Blackboxing” here refers to a situation where the internal elements of a test become invisible and the focus is only on the result.

⁷⁹ See Janine Arvizu, “Shattering the Myth: Forensic Laboratories” (2000) 24 Champion 18.

⁸⁰ Michele Nethercott, “Faulty Forensic Evidence” (2003) 27 Champion 61 online: National Association of Criminal Defense Lawyers <<http://www.nacdl.org/Champion.aspx?id=816>>.

laboratory procedure and even fraud are as possible with forensic DNA testing as with any other form of forensic evidence.⁸¹ There is also the potential for prosecutorial interference.⁸²

V. EARLY FORENSIC DNA IN CANADIAN COURTS

Canadian courts have shown interest in all three questions Thompson identified. Stated slightly differently from the way he presented them, three issues stand out in the review of the Canadian DNA evidence cases that follows. The first is a concern with the subpopulation problem, one that may be particularly acute when potential suspects are part of a small relatively homogenous population, such as among Canada's Native people. The second is a concern over how juries will respond to the complexities of evaluating DNA evidence. Third, Canadian courts have shown some interest in laboratory standards and procedures. The focus will be on the first two, since they show more general methodological concerns that are applicable to techniques other than forensic DNA itself. In their handling of these issues, Canadian courts encountered difficulties that were never fully resolved. It is these difficulties that may hinder the use of a DNA-derived methodology in other forensic sciences in Canada.

This section is a study of the early cases concerning the use of DNA evidence in Canada. As we will see, this history shows that the adoption of DNA was not a smooth one and that some of the decisions made, although ultimately reasonable given the extraordinary quality of forensic DNA as a technique, should be seen as highly problematic. Canadian courts have had a series of difficulties in addressing the requirements of using forensic DNA evidence and it is in the causes of these difficulties that one finds hints as to the future of post-NAS Report forensic science.

One of the earliest Canadian cases to discuss DNA evidence was *R v Parent*,⁸³ a multiple sexual assault trial in Edmonton. In this case, both the defence and prosecution accepted the admissibility of forensic DNA evidence that was presented by the defence as exculpatory. The DNA evidence excluded the accused in four out of the eleven counts with which he was charged and helped to establish a reasonable doubt over several of the other charges because of the Crown's reliance on similar fact evidence.⁸⁴ The accused was ultimately convicted on only one count for which he admitted guilt.

⁸¹ See Harmon, *supra* note 71, and Thompson, *supra* notes 76 and 77, for examples of fraud in DNA laboratories.

⁸² See Peter J Neufeld, "Have You No Sense of Decency?" (1993) 84:1 Journal of Law and Criminology 189 for examples of prosecutorial interference with forensic DNA procedure.

⁸³ *R v Parent*, [1988] 91 AR 307, 46 CCC (3d) 414.

⁸⁴ *Ibid.*

The first case to deal explicitly with the admissibility of forensic DNA in the context of a criminal trial was *R v McNally*.⁸⁵ In a brief decision during the *voir dire*, Ontario District Court Judge Flannigan admitted forensic DNA by analogizing the results obtained from this novel technique to those of other forms of forensic evidence that were commonly admitted:

It seems to me [DNA] is no different from evidence of fingerprints, fibre expertise, blood analysis or any of the expert evidence that the Court hears from time to time. ... As I said at the outset, it seems to me that it is on no greater, or lesser, footing than any other expert evidence that is to be put to a trier of fact, in this case the jury, to decide whether or not they will accept the evidence present[ed] to them just as it will be for them to decide whether or not they will accept, or reject, the evidence of the complainant as to identification or the evidence of the other expert witnesses as to hair samples, et cetera.⁸⁶

This decision leaves the major task of evaluating scientific evidence to the trier of fact at the weighting end of the analysis.

In *R v Bourguignon*,⁸⁷ Claude Bourguignon was the uncle of a two year old child who had been sexually assaulted and strangled and then left in a dumpster near his home. Originally suspicion had focused on the child's father and the two-year-old's uncle, but the father's testimony coupled with the DNA evidence from semen left on the child's bed pointed to the uncle,⁸⁸ and the DNA evidence was crucial to establishing a circumstantial case.

The judge in *Bourguignon* relied heavily on the available American and British jurisprudence, citing *New York v Castro*⁸⁹ for the general admissibility of DNA evidence:

- 1) There is general scientific acceptance of the theory underlying D.N.A. identification.
- 2) D.N.A. forensic identification techniques and experiments are generally accepted in the scientific community and can produce reliable results. Hence, the *Frye* standard of admissibility is satisfied.
- 3) A pre-trial hearing should be conducted to determine if the testing laboratory substantially performed the scientifically accepted tests and techniques, yielding sufficiently reliable results to be admissible as a question of fact for the jury.⁹⁰

While referring briefly to *McNally* and to one other unnamed case from the "western provinces" (perhaps *Parent*), the judge relied primarily on US and British jurisprudence in the decision. Using *Beland*⁹¹ for the idea that an expert witness was to provide a "ready-made inference" for the trier of fact, the judge suggested an important difference between an investigative, as opposed to a forensic, technique:

⁸⁵ *R v McNally*, [1989] OJ No 2630 (QL) [McNally].

⁸⁶ *Ibid.*

⁸⁷ *R v Bourguignon*, [1990] OJ No 1205 (QL) [Bourguignon].

⁸⁸ *Ibid.*

⁸⁹ *Supra* note 70.

⁹⁰ *Supra* note 87, at para 12.

⁹¹ *R v Beland*, [1987] 2 SCR 398, 43 DLR (4th).

This is the constant problem of determining when an investigative tool, such as the polygraph, should become a forensic tool. For example, the A.L.E.R.T. machine is an investigative tool whereas the breathalyzer machine is a forensic tool. And because it is such, strict guidelines have been inserted in the Criminal Code to govern the admissibility of the results, including its make, the qualifications of the technician and the preliminary steps to its operational use. Similarly, with respect to the admissibility of blood samples [sic, this was an oral decision].⁹²

Courtroom use of a technique requires a higher level of reliability than investigative use by the police, and this is expressed in the case of the breathalyzer with a strict statutory framework.⁹³ The comparison is not to fingerprinting but to the statutory framework adopted for drunk driving prosecutions,⁹⁴ and therefore suggests a preference for a statutory framework for DNA evidence.

The judge then addressed the admissibility of probability evidence. The judge clearly showed skepticism about the qualifications of the forensic DNA expert as an expert in probability. Relying on a statement from *McWilliams on Evidence*⁹⁵ that forensic DNA examiners have a tendency to improperly calculate or present match-likelihood, Judge Beaulne suggested that the expression of these probabilities requires a different sort of expertise than that possessed by the DNA examiner Dr. Wayne.⁹⁶ Therefore, following *Castro*, the judge ruled as follows:

- 1) There is general scientific acceptance of the theory underlying D.N.A. identification.
- 2) D.N.A. forensic identification techniques and experiments are generally accepted in the scientific community and produce reliable results.
- 3) Mr. Barnes, in his extensive cross-examination has questioned the technique used by Doctor Wayne, particularly as to the probes used, the database, the lack of peer cross-checks and the existence of band shifting. Notwithstanding the short comings (sic) indicated previously, Doctor Wayne performed (sic) the tests which he has testified are scientifically accepted tests and techniques yielding in his opinion sufficiently reliable results to be admissible as a question of fact for the jury.
- 4) As a matter of fact and of law, Doctor Wayne's opinions as they relate to the theory of probabilities are inadmissible in law.⁹⁷

While DNA evidence is admissible, probability evidence would thus only be admissible through a specially trained expert, presumably a statistician or population biologist.

Bourguignon seems to have established that probability evidence as to the likelihood of a match should not be routinely admitted into Canadian courts.

⁹² *Supra* note 87, para 18.

⁹³ See *Criminal Code* (RSC, 1985, c. C46) s 254.

⁹⁴ *Supra* note 87.

⁹⁵ Peter K McWilliams, *Canadian Criminal Evidence*, 3d ed, (Aurora, Ont: Canada Law Book, 1988) at 9-32.

⁹⁶ *Supra* note 87, para 28.

⁹⁷ *Ibid* para 35.

However, in *R v Légère*, a New Brunswick case that was decided shortly thereafter, this limitation was rejected.⁹⁸

While these early DNA cases all discussed admissibility requirements, they lacked a rigorous examination of the elements required to allow the admissibility of forensic DNA testing. These were either assumed using the analogy to already admissible forms of forensic evidence as in *McNally* or were determined by reference to the American jurisprudence as in *Bourguignon*. None of them make much attempt to delve deeply into the science of DNA fingerprinting.

*R v Baptiste*⁹⁹ is the first case in which a Canadian court undertook a deeper analysis of DNA evidence. In this case, the judge first looked into the theory and application of DNA testing and in doing so provided us with the first glimpse of the Canadian concern over the sub-population problem. To explain the basic theory of forensic DNA typing, Justice Hamilton compared the individuality of a person's DNA to the individuality of their fingerprints, thus establishing an analogy to a technique long in use in the criminal courts as well as explaining the underlying theory of the forensic use of DNA.¹⁰⁰ After a fairly detailed discussion of the process of DNA typing, two issues were identified:

This issue in DNA testing is twofold. First[ly], from what database is the probability of a match estimated; and, secondly, is that database an appropriate standard to be used in determining the frequency with which a specific gene, that is, a specific sequence of base pairs of DNA, is found in a particular population?

In this case the principal attack on the admissibility of the DNA testing is that because the accused is a native Indian from the interior of British Columbia there is insufficient data available with which to compare his DNA to allow a scientifically based opinion to be given.¹⁰¹

While fingerprints may be susceptible to visual comparison, DNA techniques require some sort of statistical estimation of the random likelihood of a match in

⁹⁸ *R v Légère*, [1991] NBJ No 729 (QL) (NBQB) [*Légère Trial*], appealed on the issue of whether illegally seized hair samples used in the DNA analysis should have been barred at trial, appeal dismissed in *R v Légère*, [1994] NBJ No 579 (QL) (NBCA) [*Légère Appeal*].

⁹⁹ *R v Baptiste*, [1991] BCJ No 3945 [*Baptiste Trial*]; note that this case was appealed in *R v Baptiste* (1994), 88 CCC (3d) 211, 51 BCAC 31 [*Baptiste Appeal*], a decision that will be discussed later in this paper.

¹⁰⁰ Justice Hamilton had earlier made reference to much of early fingerprint jurisprudence in the UK, including *R v Castleton* (1909), [1910] 3 Cr App 74 (Eng), *R v Bacon* (1915) 11 Cr App 90, and the Blackburn Baby Case (see George Godwin, *The Trial of Peter Griffiths* (University of Wisconsin, Madison: 1995)). This jurisprudence appears to be used only to establish the long provenance of scientific identification evidence in Anglo-Canadian law, but the lack of reference to any of the contemporaneous American cases, cases that might otherwise be considered more closely linked to Canadian fingerprinting developments is interesting, and suggests these cases may also be part of an attempt at distinguishing Canadian and American expert evidence law. However, the development of fingerprinting technology in Canada is very closely linked to that of the United States (see Frederiksen, *supra* note 41).

¹⁰¹ *Baptiste Trial*, *supra* note 99.

order to validate their claims of a match.¹⁰² These probabilities are computed based on a database of DNA samples that is used to predict the variability of specific DNA traits in human populations. The problem in this case was that Mr. Baptiste was a member of a subpopulation of Native Canadians. Concern existed that such a group might not share the same random distribution of probe sites as the population used to develop the database used by the testing laboratory. The judge therefore was forced make a scientific judgment, whereas in all his earlier analysis he could easily rely on the reasoning of other courts and use legal modes of reasoning, as seen in his use of legal analogy by including the traditional fingerprinting cases in his analysis. However, he set the admissibility standard below that of scientific acceptability: "...I note the distinction between the scientific concern with a very high degree of accuracy and the lower legal standard for permitting evidence to be considered by a jury."¹⁰³ This low standard for admissibility effectively removed the need for the judge to inquire further into the scientific validity of the evidence in question and left that question for the jury. The use of a low admissibility standard, that is a low legal standard for admissibility, allowed the judge in this case to avoid deciding on the larger issue of the scientific reliability standard for DNA evidence.

In presenting his evidence, the Crown expert had not provided statistical match probabilities due to the ruling in *Bourguignon* and because the Aboriginal DNA database used was based on Coastal British Columbia peoples as opposed to the Interior Nations of which Baptiste was a member.¹⁰⁴ Due to these two factors, he had instead characterized the possibility of another individual having produced the same two samples as "extremely remote" and "remote."¹⁰⁵ When pressed for the probability figures, he provided figures of 1 in 250 000 000 for a blood sample and 1 in 9000 for a semen sample taken from the body of the deceased.¹⁰⁶ While not expressed directly to the jury, the expert opinion that there was a DNA match was logically dependent, if not on the precise accuracy of these figures, then on their general reasonableness as ballpark figures.¹⁰⁷

The defence did not challenge the validity of the procedure used by the RCMP in analyzing the DNA samples. Rather, the defence expert emphasized not only the limitations of the databases but also hypothesized that there was an extremely limited genetic variability of BC interior Aboriginal populations as a

¹⁰² The requirements are less stringent for the use of exculpatory DNA evidence, which may in part explain the less elaborate analysis of cases such as *Bourguignon*.

¹⁰³ *Baptiste* Trial, *supra* note 99.

¹⁰⁴ *Ibid.*

¹⁰⁵ *Ibid.*

¹⁰⁶ *Ibid.*

¹⁰⁷ *Ibid.*

result of the smallpox and influenza epidemics of the nineteenth and early twentieth centuries.¹⁰⁸

In deciding on this issue, Justice Hamilton relied on the case of *United States v Yee*¹⁰⁹ where the validity of the FBI DNA database had been upheld after a wide range of expert testimony from both the defence and prosecution, the judge concluded that “more likely than not that the FBI’s probability estimates were reasonably accurate.”¹¹⁰ Following this decision and similar US jurisprudence, and while recognizing some difficulty with extending DNA population findings to differing sub-populations, Justice Hamilton admitted the DNA evidence and ruled that evidence as to the limitations of this particular set of DNA tests may be led as to weight as an issue for the trier of fact.¹¹¹

In *Baptiste*, as in the earlier Canadian DNA cases, we see a reliance on reasoning by analogy to support the proposition that DNA evidence is generally admissible. *Baptiste* also went farther, developing a necessity and reliability test for novel scientific evidence. That DNA typing evidence fulfills this test is supported by specific reference to early English fingerprint decisions.¹¹² The historical nature of these cases suggests that the analogy is not strictly legal but also historical and that the judge felt that he was in a moment similar to that experienced by jurists in the early history of that technology. This reasoning was supported by reference to American and British decisions where DNA evidence was admitted.¹¹³ The admissibility standard is finally set rather low leaving much of the work of weighing it to the trier of fact, an approach made easier since evidence of match probabilities was not led during the *voir dire*. This overall approach seems to rely primarily on traditional legal reasoning tools of precedent and analogy and leaves any serious inquiry into the scientific viability of the evidence to the trier of fact, deliberately setting the threshold for admissibility below that used by scientists.

This case was appealed, and on the issue of the DNA evidence, the British Columbia Court of Appeal found that the relevance and trustworthy test was met and that the DNA evidence was admissible and could be weighed by a jury.¹¹⁴ The defence argued that, considering the lack of any population data for *Baptiste*’s particular sub-population, there was no basis for any statement as to the likelihood of a match in words since proper statistical comparisons were not available.¹¹⁵ The testimony of the witnesses succeeded in turning this question into one of a professional clinical opinion:

¹⁰⁸ *Ibid.*

¹⁰⁹ *United States v Yee*, 129 FRD 629 (USDC ND Ohio 1990).

¹¹⁰ *Ibid.*

¹¹¹ *Baptiste* Trial, *supra* note 99.

¹¹² *Ibid.*

¹¹³ *Ibid.*

¹¹⁴ *Baptiste* Appeal, *supra* note 99.

¹¹⁵ *Ibid* at para 31-32.

Q: You wouldn't use the Caucasian database in attempting to make any conclusions with regard to Inuit, for example?

A: Not to give a definitive statistic, I would not.

Q: ...[I]n other words, you wouldn't be able to say whether it was one in ten or remote or rare or something like that?

A: I certainly would not give a figure such as one in ten, but one could qualitatively say in my estimation this is a rare finding.¹¹⁶

This was the cross-examination of the defence witness, and on this basis the Court of Appeal had no trouble supporting the trial judge's admission of this evidence. A new trial was ordered on other grounds;¹¹⁷ however, what is most interesting is how a technique that is explicitly dependent on statistical verification by reference to a population database became one that is dependent on the professional or clinical judgment of practitioners of the technique.

Subsequent cases adopted a variety of approaches to admissibility. This continued until 1994 when the Supreme Court of Canada in *R v Mohan* clarified the rules for the admissibility of novel scientific evidence.¹¹⁸ For example, in the case of *R v Lafferty*, the Northwest Territories Supreme Court was faced with the problem of an individual who came from a very small sub-population and as in *Baptiste* the defence once again raised objections to the limited sub-population data available, although by this time there were substantial databases of other Native populations.¹¹⁹ No special test for the admissibility of novel scientific evidence was applied, and a relevance and helpfulness test was used.¹²⁰ The DNA evidence, including the expression of match statistics, were found to meet this test and the population genetics arguments were found to be questions of weight for the trier of fact. Analytically, the judge in this case separated the claim of a DNA match from the expression of a statistical description of the probability of that match.¹²¹

In the case of *R v Legere*, the trial judge followed *Baptiste* and allowed the DNA evidence to be admitted with little comment.¹²² The New Brunswick Court of Appeal accepted this approach to admitting the DNA match claims, but felt compelled to discuss the probability figures at some length as the issue of subpopulations was raised again in this case.¹²³ The prosecution had provided evidence that sub-population effects were not forensically significant and the trial

¹¹⁶ *Ibid* at para 35.

¹¹⁷ *Ibid* at para 51-52.

¹¹⁸ *Supra* note 54.

¹¹⁹ *R v Lafferty*, [1993] NWTR 218, [1993] 80 CCC (3d) 150.

¹²⁰ *Ibid* at para 42.

¹²¹ *Ibid*.

¹²² *Légère Trial*, *supra* note 98.

¹²³ *Légère Appeal*, *supra* note 98.

judge pointed to this evidence during jury instruction.¹²⁴ The Court of Appeal described this instruction in the following terms:

In effect, what he was telling the jury was to not get tripped up by such words as discrete alleles, Hardy-Weinberg Equilibrium, polyzygotes and even monozygotes. He pointed out that it is difficult to understand these matters and that jury members are not scientists. He correctly pointed out that what jurors have to do is look at the evidence of the scientists and decide on the basis of it whether or not they will accept it.¹²⁵

This analysis seemed to express a real willingness to let juries make determinations of what weight to apply to scientific evidence yet there also seemed to be an unwillingness to see such a determination as scientific.

R v Terceira, first heard in 1991, was a DNA evidence case that ultimately went to the Supreme Court of Canada. John Carlos Terceira was a part-time janitor at an apartment building who was charged with the murder and sexual assault of a six-year-old girl whose body was found in a boiler room of her building ten days after being reported missing. Very few people had access to this room¹²⁶ and all but Terceira were eliminated as suspects using standard blood analysis of samples of semen and blood found on the little girl's clothes.¹²⁷ DNA fingerprinting identified Terceira as the culprit.¹²⁸

That *Terceira* was ultimately going to be about the admissibility of scientific evidence was obvious to all parties. At the pre-trial hearing the Provincial Court judge showed evident discomfort at the prospect of an in-depth review of the DNA evidence, suggesting that the court should neither "turn itself into a scientific laboratory, nor make its decision on the basis of a "nose count".¹²⁹ While the DNA evidence was deemed admissible and the case proceeded to trial, there is some suggestion from this decision that the judge was not clear that statistical analysis was required for the declaration of a DNA match.¹³⁰

When the case went to trial, Campbell J embarked on a rather sophisticated analysis of the issues related to the validity of the then-current DNA matching techniques. This was fuelled in part by the tactic used by the defence. Rather than question the entire technique, the defence chose to question the specific methodology and results obtained by the Centre for Forensic Sciences in this particular case.¹³¹ In particular, they chose to focus on the then-ongoing scientific controversy over the Research Council report¹³² that had questioned many of the

¹²⁴ *Légère Trial*, *supra* note 98.

¹²⁵ *Légère Appeal*, *supra* note 98 at para 84.

¹²⁶ *R v Terceira* (1998), 38 OR (3d) 175, 123 CCC (3d) 1 (Ont CA) at para 7.

¹²⁷ *Ibid* at para 9.

¹²⁸ *Ibid* at para 9.

¹²⁹ *R v Terceira*, [1991] OJ No 2664 (QL) (Ont Ct J (Prov Div)),

¹³⁰ *Ibid*.

¹³¹ *R v Terceira*, [1992] OJ No 3719 (QL) at paras 35 (Ont Ct J (Gen Div)).

¹³² NRC 1992, *supra* note 2.

commonly used techniques and assumptions in DNA testing in the early 1990s.¹³³ While Campbell J clearly felt that many of the objections raised in that report were relevant, he held that: "The NRC report does not detract from the admissibility of Ms. Newell's [the forensic DNA examiner] evidence, however strongly it may go as to the weight of the number she would propose to use."¹³⁴

The Ontario Court of Appeal decision of 1998 supported the decision of Campbell J at trial and dismissed the accused's appeal. Two major grounds of appeal concerned the admissibility of the DNA evidence. In the first, the appellant argued that the test and the courtroom procedure used by the trial judge in finding the DNA evidence admissible were incompatible with the rules for the admission of novel expert testimony as developed in *Mohan*. The second ground of appeal related to the DNA evidence was that the jury instructions were inappropriate.¹³⁵

On the question of admissibility, the case of *R v Mohan* had been decided in 1994, after the trial decision in this case but before the appeal.¹³⁶ *Mohan* established a four-part test to determine the admissibility of novel scientific testimony: relevance, necessity in assisting the trier of fact, the absence of an exclusionary rule, and a properly qualified expert.¹³⁷

In contesting the admissibility decision made by the trial judge the appellant argued that a *voir dire* was required and that the threshold for admissibility used by Campbell J was incompatible with *Mohan*.¹³⁸ As seen in the discussion of the trial judgment, the defence conceded the basic validity of DNA technology and the attack was not on the process used by the Centre for Forensic Sciences. Rather it was on the ability of the Centre to properly determine the likelihood of a random match.¹³⁹ Specifically, the appellant attacked the sufficiency of Ms. Newall's credentials in this specific area as revealed from her cross-examination; her reliance upon hearsay reports and the results of tests performed by others; and the trial judge's failure to make findings as to her credibility and the weight to be given to her evidence.¹⁴⁰

On the question of Ms. Newall's credentials, Justice Finlayson declined to pre-empt the trial judge and reassess the reliability of her evidence.¹⁴¹ As to point (b) Justice Finlayson found "abundant authority for the proposition that an expert can rely on hearsay reports and tests within the scope of his or her expertise."¹⁴²

¹³³ *Supra* note 131 at paras 36-37.

¹³⁴ *Ibid* at para 38.

¹³⁵ *Supra* note 126 at para 94.

¹³⁶ *Ibid* at para 16.

¹³⁷ *Supra* note 54 at 11, as cited *supra* note 126 at para 20.

¹³⁸ *Supra* note 126 at paras 13 & 19.

¹³⁹ *Ibid* at para 30.

¹⁴⁰ *Ibid* at para 31.

¹⁴¹ *Ibid* at para 36.

¹⁴² *Ibid* at para 32.

The Court of Appeal decided that the trial judge need only find that the Crown expert had sufficient skill, knowledge, or expertise to provide an opinion that would be helpful to the trier of fact in reaching a just decision. Once the basic methodology was deemed admissible, it was the role of the jury to determine if this particular application of the methodology was appropriate.¹⁴³ The standard for qualification of an expert was found to be on the balance of probabilities even when novel science was in question.¹⁴⁴ Furthermore, Finlayson JA held that no special burden should be placed on DNA evidence in that it was only another form of identification evidence, analogous to other commonly used forms of identification such as fingerprints and dental impressions.¹⁴⁵

The appellant also argued that whether or not the DNA evidence was deemed to be admissible, there was significant danger of the jury interpreting the probability estimates provided by the DNA expert witness as representing the probability of the appellant's innocence.¹⁴⁶ He also argued that DNA evidence deserved a special hearing and a higher standard of proof, using *Mohan's* conclusion that as expert testimony approaches the ultimate issue it deserves greater scrutiny.¹⁴⁷ The Court found that the danger of this "mystic infallibility" of DNA evidence was amply handled by the testimony of defence experts as to its limitations and possible problems and through appropriate jury instruction.¹⁴⁸

The Court of Appeal generally accepted the trial judge's shift of most of the scientific analysis to the trier of fact.¹⁴⁹ The admissibility inquiry at the *voir dire* is thus a procedure with a relatively low threshold requirement. This requirement in this case was largely met by the admission on the part of the defence of the general admissibility of DNA evidence generally as well as by the credentials of Ms. Newall. The jury instructions become vital, and after an analysis of the jury instruction Finlayson JA set out the requirements for an appropriate jury instruction where DNA evidence is proffered:

At the conclusion of the evidence, the trial judge in his instruction should advise the jury in the normal way as to the limits of the expert evidence and the use to which it can be put. Additionally, in the case of DNA evidence, he or she would be well advised to instruct the jury not to be overwhelmed by the aura of scientific infallibility associated with scientific evidence. The trial judge should tell them to use their common sense in their assessment of all of the evidence on the DNA issue and determine if it is reliable and valid as a piece of circumstantial evidence.¹⁵⁰

¹⁴³ *Ibid* at para 32.

¹⁴⁴ *Ibid* at paras 45-46.

¹⁴⁵ *Ibid* at para 47.

¹⁴⁶ *Ibid* at para 58.

¹⁴⁷ *Ibid* at para 48.

¹⁴⁸ *Ibid* at para 55-57.

¹⁴⁹ *Ibid* at para 56.

¹⁵⁰ *Ibid* at para 65.

Terceira was appealed to the Supreme Court of Canada, and in a short oral judgment, Iacobucci J held that the Court was in substantial agreement with the Court of Appeal's decision and with Campbell J's approach at trial, and no further reasons were provided.¹⁵¹

VI. LATER FORENSIC DNA IN CANADIAN COURTS

In the early DNA cases, courts were faced with a series of problems when confronted by the question of whether or not to admit DNA evidence. In general Canadian courts have been willing to admit DNA, generally on the basis of its acceptance in other jurisdictions, and often without very deep analysis. However, several specific issues have caused Canadian courts to conduct deeper analyses of the science behind DNA testing and have echoed some of the issues that became apparent in the "DNA wars" of the 1980s and 1990s. In particular, the issue of subpopulations in sampling regimes was vitally important to Canadian courts confronted with Aboriginal defendants. Although the cases do show some awareness of this underlying controversy, the approaches taken seem more designed to avoid rather than directly address the underlying scientific disagreement.

By the time serious attention was given to the subject of DNA admissibility, in the 1990 case of *R v Bourguignon*, there was already a considerable body of American case law and a growing controversy over admissibility in that country. It is therefore not surprising to see a significant reliance on American case law and in particular on the *Castro* decision for its analysis of the properties of this new form of evidence.¹⁵² Despite this reliance on American case-law, *Bourguignon* rejected the American approach to the general rules surrounding expert evidence and instead relied on the Supreme Court of Canada's decision in *Béland*, the then-leading case on the admissibility of expert evidence. In this case, as in others, the general admissibility of forensic DNA evidence was not really at issue and Canadian courts seem quite content to rely on American decisions and in particular *Castro* for this proposition. Therefore, the basic validity of the science behind DNA testing is not at issue.

What is at issue in *Bourguignon*, and indeed in many of the DNA cases, is not whether the expert evidence is useful and relevant but rather how it ought to be expressed in the courtroom. In the Canadian cases this debate has not only been about whether and how probability figures ought to be presented but also whether such figures are accurate when small populations are involved. It is not accidental that *Bourguignon*, *Lafferty*, *Baptiste*, and *Legere* involved Aboriginal defendants who argued that the existing DNA databases could not be used to accurately predict

¹⁵¹ *R v Terceira*, [1999] 3 SCR 866, 46 OR (3d) 96.

¹⁵² *Supra* note 87 at para 18.

chances of a random match in their smaller and genetically understudied communities. Not only was how DNA matches ought to be reported (if indeed they ought to be reported numerically at all) at issue, the accuracy and reliability of those very same numbers was also the subject of significant question. These were not questions unique to the courts. A significant scientific controversy had developed in the early 1990s over just this question and there are elements of this scientific controversy in the debates occurring in Canadian courts during this time.

These controversies had been largely resolved by 1998 when *Terceira* reached the Supreme Court of Canada, in part by changes in techniques and also by better and more inclusive data. In *Terceira*, the focus was on the appropriateness of jury instruction by the trial judge as to how to weight the DNA evidence presented to them. Both the Ontario Court of Appeal and the Supreme Court of Canada approved the approach taken at trial, and focused in some detail on the transcript of that jury instruction. This legal controversy itself has produced a scientific interest in those who study jury behavior, again suggesting a strong link between legal and scientific controversy in the DNA environment. Ultimately much of the issue was left to the jury as an issue of weight, and this led to a lengthy jury instruction. Indeed, in the jury instruction in *Terceira*, Campbell J went so far as to compare the problem presented by the probabilistic statements of the DNA experts to the problems faced by nineteenth century juries where miniscule quantities of poison were discussed, emphasizing the historical continuity of the jury function.

One can make a series of observations from the Canadian DNA cases. The first point to draw out is the great complexity and number of actors involved in the various controversies surrounding DNA, including judges, lawyers, scientists, government bodies, and juries. The second major point is the clear prominence of legal needs and legal actors among them. While DNA may have started its existence as a useful laboratory technique for identifying specific genes (the original meaning of the DNA fingerprint) it was adapted and then rapidly applied to a forensic context and it was in this context that formalized match criteria and probabilistic statements of match criteria were required to legally validate the technique. Third, this concern led to a scientific controversy that erupted over the subpopulation problem and played itself out in Canadian courts in the early 1990s. While fundamentally a scientific objection about the accuracy of match statistic estimations, this controversy drew its importance from the legal setting in which it occurred. Fourth, Canadian courts, while concerned with the potential misapprehension of these very match statistics by juries and thus producing some early decisions not to admit match statistics, eventually chose to allow them to be presented to juries but required a relatively complex jury instruction aimed at preventing such misapprehensions. The Canadian solution to DNA evidence has been to find it broadly admissible and to allow opposing testimony as to weight to

be considered by the jury. Taken together, these four factors (the complexity of interaction between legal and other actors, the primacy of legal actors and institutions, the importance of scientific controversy, and the difficult role of the jury) characterize the early Canadian jurisprudence surrounding forensic DNA evidence.

Since *Terceira* there have been two Supreme Court of Canada decisions and one decision of the Ontario Court of Appeal that have significantly advanced Canadian evidence law, and we have seen a movement towards increasing inquiry at the admissibility stage into the scientific reliability of purported scientific evidence. In *R v J-LJ* the Supreme Court emphasized the gatekeeper role of the courts and quoted, favourably, from *Daubert*, the leading American Federal evidence decision.¹⁵³ *Daubert*, in particular, emphasized the scientific reliability of purported scientific evidence and developed a four-part test that relied, in part, on a reading of Karl Popper's philosophy of science.¹⁵⁴ In *R v Trochym*, the Supreme Court extended the novel science approach of *Mohan* and *R v J-LJ* to previously admitted testimony that had come under question and rejected hypnotically aided testimony.¹⁵⁵ In *R v Abbey*, Ontario Court of Appeal Judge Doherty used a two-step approach to implementing the *Mohan* guidelines in the context of non-scientific expert testimony.¹⁵⁶ This approach consisted of a rule-based evaluation of the preconditions to admissibility followed by a discretionary gatekeeper analysis along cost-benefit lines, significantly clarifying the approach to be taken.¹⁵⁷ *Abbey* made it clear that expert testimony based on qualitative expertise remains admissible in Canada and that specific factors can be developed to identify reliable qualitative expertise.¹⁵⁸

The post-*Mohan* cases suggest that a path is available for the re-evaluation of forensic sciences brought into question by the NAS Report, and do so in what seems to be an explicitly scientific context. Three general observations can be made about these three decisions. First, in both *J-LJ* and *Trochym*, there is an explicit distinction made between appropriate standards for the clinical use of a scientific technique and its use in a forensic context. Thus, despite the trend towards a more scientifically rigorous form of analysis by the courts, the standard that will be used is still by necessity at least in part a legal one. Second, *Trochym* was in some sense an easy case since the original expert, whose opinion had been crucial in the development of both the American and Canadian jurisprudence, changed his view to the opinion that "hypnotically induced memories should

¹⁵³ *R v J-LJ*, 2000 SCC 51, [2000] 2 SCR 600 at para 28-34, quoting *Daubert*, *supra* note 53 at 593-94.

¹⁵⁴ *Daubert*, *ibid*. See Karl Popper, *The Logic of Scientific Discovery*, (London: Routledge, 2002).

¹⁵⁵ *R v Trochym*, 2007 SCC 6, [2007] 1 SCR 239.

¹⁵⁶ *R v Abbey*, 2009 ONCA 624 (CanLII), 97 OR (3d) 330.

¹⁵⁷ *Ibid* at para 77.

¹⁵⁸ *Ibid* at para 104-126.

never be permitted to form the basis for testimony by witnesses or victims in a court of law.”¹⁵⁹ As Deschamps J stated:

Since the *Clark* guidelines are derived from Dr. Orne’s testimony in *Hurd*, it would be disturbing for this Court to blind itself to the subsequent developments in the American cases. With the basic reliability of post-hypnosis evidence increasingly in question, judicial approaches to such evidence have tended to shift from an assessment of the weight to be attributed to post-hypnosis testimony to whether it should even be admissible.¹⁶⁰

In essence, there was little scientific controversy for the court to address in *Trochym*, which makes it quite unlike the DNA cases. If this is the standard that has to be met to revisit currently admissible expert testimony, it is a high one indeed, and there is no evidence that trial courts are using *Trochym* to allow widespread attack on conventional forensic techniques.¹⁶¹ Third, while *Abbey* emphasized the gatekeeping role of the courts, it raises the possibility that controversies could develop over whether a forensic technique should be evaluated quantitatively or qualitatively, and, as we have seen, the NAS Report often favours a quantitative over a qualitative approach to determining reliability while forensic practitioners often favour a qualitative one.

While these cases provide a framework on which further jurisprudence may be developed, they do not change the fundamental evidential difficulties faced by trial courts that must evaluate challenges to scientific evidence. This is because the difficulties that have been described in this paper were often not strictly speaking doctrinal but instead are characteristic of the interaction between the courts and the scientific community during the course of a scientific controversy. While the post-*Mohan* decisions have shifted the framework within which that interaction occurs, there is no reason to assume that the underlying difficulties have been solved. The complexity of this evidence remains and legal needs and definitions remain prominent. Scientific controversies will continue to occur; indeed *Abbey* opens the door to a new type of controversy over the proper characterization of a particular technique. Where these decisions have helped is in strengthening the gatekeeping role of the courts, which may significantly protect juries from misleading testimony. However, difficulties over the jury’s interpretation of statistical and other forms of complex scientific evidence are bound to remain.

VII. CONCLUSION

If other forensics disciplines begin to follow the lead of DNA and start to incorporate many of the changes requested by the National Academy’s Report, many of the issues that faced Canadian courts during these early days of the

¹⁵⁹ *Supra* note 155 at para 29.

¹⁶⁰ *Supra* note 155 at para 30.

¹⁶¹ Noting up *Trochym* in Quicklaw show no case where it has been followed in this context.

forensic use of DNA will need to be revisited in new contexts. This can be seen in two ways. First, specific issues with new forensic evidence may turn out to be analogous to those faced by the courts during the DNA cases, but the special nature of DNA evidence may make the existing jurisprudence not helpful with these new forms of evidence. Second, the broader patterns related to the kind of evidence and the challenges raised by it that were seen in the DNA cases may provide some indication of the kind of challenges that the courts will face if there is a more general change in the way forensic evidence is presented.

In the DNA cases, Canadian judges generally admitted DNA evidence and left most questions about the relative importance of such evidence to the trier of fact. The subpopulation problem was generally not seen as an impediment to the admission of DNA evidence, even during the height of the controversy surrounding it. Appropriate jury instruction has been seen as an appropriate solution for any tendency on the part of the jury to overweight DNA evidence. The newer post-*Mohan* jurisprudence provides judges with the discretion to enforce greater limits on expert evidence available to the jury, but certainly does not eliminate the issue of juries having to weigh conflicting scientific testimony.

Forensic DNA has proven to be a remarkably robust technique, as evidenced in the NAS report. This is why, at least in part, the Canadian approach to the subpopulation problem was not problematic. These cases would be much more troubling if it had turned out to be true that DNA techniques were unreliable outside the populations used to validate the original techniques. If the subpopulation problem had turned out to be real, we would probably consider those cases wrongly decided. It might even be said that our DNA jurisprudence works only because DNA has turned out to be a superlatively good identification technique.¹⁶²

It is not clear that other forensic techniques will be as robust as DNA has been when subject to the kind of scientific scrutiny the NAS proposes. Indeed, in the NAS report itself there is evidence of a great deal of distrust in several mainstream forensic techniques. If new approaches to forensic science begin to call traditional forensic techniques into question, and if the NAS report is to be taken seriously, as is likely, then *Mohan* hearings may occur over the admissibility of many forensic techniques that are now routinely admitted in Canadian trials. In this context, leaving questions of validity to the jury, as was the approach in *Terceira*, may prove problematic. *Trochym* provides a possible solution to this problem, but it does not seem to have led to significant re-evaluation of previously admitted scientific evidence thus far.

¹⁶² This does not mean that DNA is without limitations. See Erin Murphy, "The New Forensics: Criminal Justice, False Certainty, and the Second Generation of Scientific Evidence" (2007) 95 Cal L Rev 721 for a discussion of these and see Murphy, *supra* note 14, for a discussion of the dangers of not addressing them.

Following from this example, it might be suggested that DNA evidence did not provide a good test of the ability of Canadian courts to evaluate the complicated issues raised by DNA-like forms of forensic testimony. This does not mean that the DNA cases are without interest, however. It merely suggests that wariness is appropriate before assuming that, because the DNA problem is “solved”, the legal system is adequately prepared for the flood of complicated statistical evidence that a full implementation of the NAS report would generate. The subpopulation cases demonstrate how a scientific concern over adequate data became one about the legal uses of those data, and those concerns were different from those of scientists. Translating scientific techniques in a legal context changes them. Likewise, when DNA-type approaches are applied to traditional forensics, the results will look like neither DNA nor traditional forensics. What might be taken from the DNA cases is the pattern that these cases followed and at the kind of problems that were raised by them. In doing so, members of both the forensic and legal communities could be prepared for the inevitable questions that will be raised by this kind of testimony.

Referring back to the four observations about the Canadian DNA cases, one can imagine how courts might question other forensic techniques when presented in a similar manner. In the case of DNA evidence, there were questions about the admissibility of the results of a new technique. This would not be the case if, for example, fingerprinting was to be questioned. It seems likely that courts will continue to admit conventional forensic results up and until there is a significant scientific controversy over the reliability of those results. Thus, as was the case with DNA evidence, some sort of scientific controversy will emerge before admissibility questions are raised in the courtroom.

From the DNA cases, one notes that there is a period of scientific controversy during which courts can reach decisions that will be seen ultimately to be scientifically unfounded. Appropriate use of scientific actors, in the case of DNA, population geneticists, can be helpful in making sure that decisions taken during the controversy are reasonable, but the only solution is the quick resolution of the scientific controversy. With DNA evidence, the DNA forensic community was responsive to the questions raised in the courts, leading to a fairly speedy resolution of the subpopulation controversy. In the case of traditional forensic techniques, it may be possible to ensure that the scientific controversies that develop are resolved as quickly as possible.

The problem that must be resolved by the forensic scientists is not theirs alone but rather one that will ultimately be decided by legal actors. This means that to the extent a dialogue develops among those working on new ways of doing conventional forensics, it is a dialogue that must include the law in a very fundamental way. If Canadian forensics is to be reshaped, then the law will have a big role to play in that reshaping.