

# TAILORING THE RULES OF ADMISSIBILITY: GENES AND CANADIAN CRIMINAL LAW

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*DNA typing has recently been introduced into the Canadian criminal justice system, both to exculpate and inculpate accused persons. Originally developed and used in the United Kingdom and the United States, DNA typing identifies individuals by comparing DNA fragments isolated from biological material derived from known and unknown sources. Since DNA typing evidence will often result in a conviction, the use of this powerful evidence calls for the development of standards, in Canadian law, for its admissibility.*

*In ruling on the admissibility of DNA typing results, three points must be considered. First, it must be determined whether the technique is ready for use in court. In the United States, the admissibility of novel scientific evidence is often determined on the basis of general acceptance within the scientific community. The application of this standard to DNA typing, however, involves consideration of its acceptance in the forensic context, rather than in respect of research and diagnostic applications, for which the technique was originally developed. Secondly, courts must consider the reliability of specific results. In assessing such reliability, many elements must be considered, involving both the condition of the sample and the actual performance of the test. Finally, the use of probability results in criminal trials, and their effect on the jury's determination of guilt or innocence, must be carefully examined.*

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*L'analyse d'empreintes génétiques fait maintenant partie de l'administration de la justice au Canada et a récemment servi à l'inculpation et la disculpation de suspects. Cette méthode d'analyse génétique, développée en Grande-Bretagne et aux États-Unis, identifie les individus en comparant les fragments d'ADN que contiennent des échantillons provenant de sources connues et inconnues. La présentation de résultats d'empreintes génétiques garantira souvent la condamnation d'un(e) accusée, et le droit canadien doit établir clairement le degré de preuve auquel ces résultats devront être soumis.*

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This article is based on material available as of April 30, 1992. In April 1992, the United States National Academy of Sciences completed its study of DNA typing. Media reports indicate that the Academy's recommendations will significantly affect the admissibility of DNA typing results in Canadian courts. However, at the time of going to press, the author had not read the report, and its findings are therefore not discussed in this article.

*L'admissibilité de résultats d'empreintes génétiques repose sur trois facteurs. Premièrement, il faut établir que la technique elle-même est en mesure de produire des résultats admissibles. Aux États-Unis, l'admissibilité de preuve, issue d'une nouvelle technique scientifique, dépend souvent de l'approbation générale reçue par cette technique au sein de la communauté scientifique. Pour les résultats d'empreintes génétiques, les tribunaux devront considérer l'approbation reçue dans le domaine de la médecine légale, plutôt que dans le contexte de la recherche ou de la médecine prédictive, d'où elle tire ses origines. Deuxièmement, les tribunaux doivent évaluer la fiabilité des résultats qui leur sont présentés, tenant compte de plusieurs éléments, tant au niveau de la qualité de l'échantillon que de l'analyse elle-même. Enfin, le rôle de résultats probabilistes, en droit pénal, et leur impact sur le verdict de culpabilité ou d'innocence rendu par un jury, devront être étudiés de très près.*

The greatest dangers to liberty lurk in insidious encroachment by men of zeal, well-meaning but without understanding.<sup>1</sup>

### *Introduction*

DNA typing technology has recently made its way into Canadian forensic laboratories and the administration of criminal justice in this country. Its impact on criminal investigations and suspect identification has been compared to that of traditional fingerprinting techniques when first introduced in the early 1900s.

Unlike fingerprinting, which identifies individuals on the basis of minute physical characteristics, DNA typing looks for genetic differences which are not expressed externally. Although all individuals, with the exception of identical twins, are unique in their genetic composition, certain regions of DNA show greater variability within the population. DNA typing uses these variations to compare biological material, such as blood or semen, found at the scene of the crime or on the accused or the victim, with that obtained from a suspect. Law-enforcement agencies, Crown prosecutors and defence lawyers see DNA typing as an extremely powerful tool in suspect identification, which can clearly prove or disprove the presence or involvement of a suspect. DNA typing is rapidly being implemented in government laboratories, and evidence derived from the new technique has already been introduced in several Canadian criminal trials, both to exculpate and inculcate accused persons.

The potential of DNA typing technology is unquestionable. But society must question how this potential can best be exploited and understand

<sup>1</sup> Brandeis J., dissenting in *Olmstead v. U.S.*, 277 U.S. 438, at p. 479 (1928), quoted by La Forest J. in *R. v. Dymont*, [1988] 2 S.C.R. 417, at pp. 436-437, (1988), 55 D.L.R. (4th) 503, at p. 520.

its impact on the Canadian criminal justice system. This article will focus on the elements which ought to guide courts in ruling on the admissibility of DNA typing evidence in criminal trials.

The technical aspects of DNA typing, the context in which the technology was developed, and its place in current Canadian criminal practice will first be described. The use of science in the legal process, and the different approaches adopted by courts, and proposed by commentators, with respect to the admissibility of novel scientific evidence will then be presented. In the last two sections, the admissibility of DNA typing results will be discussed. The factors to be considered in determining whether DNA typing is ready for use in court will first be presented. This will be referred to as the technique's general admissibility. Assuming DNA typing technology is admitted in Canadian courts, the article will consider how its results should be challenged in each case. This will include a discussion of the standard of proof applicable to the admissibility of evidence, and the particular points on which DNA typing results should be challenged. This will be referred to as the specific admissibility of the evidence. Finally, the effect on the criminal process of introducing DNA typing results and probability figures, and their impact on the respective roles of the trier of fact and the trier of law, will be discussed.

## I. *Forensic Identification*

### A. *Techniques of Identification*

Situating a particular person at the scene of a crime often goes a long way towards solving an investigation. Eyewitness testimony and line-up identification are obvious ways of doing so, but are not always available and their reliability is open to challenge. Consequently, in linking an offence to its perpetrator, investigators often establish relevant links on the basis of physical trace evidence, detected, analysed and compared by means of various scientific techniques such as fingerprinting, ballistics, bitemark and hair analyses and traditional biochemical tests which analyse specific body fluid proteins. These techniques vary in their intrusiveness and reliability and the technique of choice is usually a factor of the evidence available and the offence investigated.

### B. *DNA Typing<sup>2</sup>*

#### 1. *The Principle and Technique*

DNA typing draws upon complex notions in diverse scientific areas such as forensics, molecular biology, population genetics and statistics. An

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<sup>2</sup> The Working Group on DNA Analysis Methods (TWGDAM) has recognised "DNA typing" to be the correct term to designate the procedure used in North America, a variation of the patented "DNA fingerprinting" system originally developed by Dr. Alec Jeffreys at the University of Leicester, England.

understanding of these notions, and of their complexity, is needed to discuss the admissibility of DNA typing evidence in court.

Deoxyribonucleic acid, or DNA, is the blueprint of an individual. Its structure, discovered in the early 1950s, includes two long chains linked together in the form of a double-stranded helix.<sup>3</sup> It is present in the nuclei of all living cells and can be extracted from any sample containing nucleated cells.<sup>4</sup> All the cells of an individual have the same DNA composition, which composition does not change throughout his or her lifetime. Although the DNA of different individuals varies little,<sup>5</sup> no two people, with the exception of identical twins, have exactly the same DNA composition.

Within the DNA chain, particular base pair sequences are recognised by enzymes, known as restriction enzymes or restriction endonucleases, which cut the DNA strand at a restriction site. Between some of these cutting sites, a series of identical (or almost identical) base pair sequences are present. These base pairs are referred to as VNTRs or "variable number of tandem repeats". The number of base pairs included in these regions varies considerably from person to person and affects the length of the fragments obtained by enzyme activity, giving rise to "restriction fragment length polymorphisms" or RFLPs. DNA typing compares and matches samples based on the size of these restriction fragments.

The first step in DNA typing is to isolate DNA from the collected sample. DNA can be extracted from fresh or dried tissue, blood, semen or saliva samples or from hair roots. Restriction enzymes then cut the DNA into fragments which are sorted by size through electrophoresis. The fragments are put in slots on an agarose gel and an electric current is applied, causing the fragments to migrate across the gel, with large fragments moving more slowly and staying closer to the starting point. DNA markers, of known size, are run on the gel and the size of each fragment is determined by comparison. The fragments are then transferred from the fragile agarose gel and fixed permanently to a nylon membrane, which can withstand subsequent manipulation and chemical treatment. This is known as Southern Blotting. The double-stranded DNA fragments are then split into single strands in preparation for probing.

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<sup>3</sup> Each chain is made up of nucleotides which are, in turn, made up of a sugar, phosphate group and base. The DNA in an average human cell contains approximately 3 billion base pairs.

<sup>4</sup> Hair shafts and fingernails are not made up of nucleated cells, and are therefore unhelpful for DNA typing. Saliva and urine are not made up of nucleated cells either, but contain, respectively, nucleated cells from the wall of the mouth, and urethral cells.

<sup>5</sup> 99.9% of the three billion base pairs in human DNA are identical in all individuals.

The application of DNA technology was made possible by the development of probes which seek out and bind only to polymorphic DNA.<sup>6</sup> A probe is a short, single-stranded DNA sequence whose base pairs are complementary to those of the fragment which it is designed to recognise.<sup>7</sup> The probe finds its complementary single-stranded fragment on the membrane and binds to it, forming a double-stranded fragment.<sup>8</sup> In order to locate the bound probe, a reporter molecule, namely a radioactive phosphorous molecule, is attached to it. An X-ray film is then placed on the membrane and radiation from the probe exposes the film, creating dark bands at the location of the double-stranded fragments. The bound probe is then scrubbed from the blot through a series of chemical washes. The original DNA fragments are maintained on the membrane, which can then be used for subsequent probings.

The process is repeated with a second, third, fourth and sometimes fifth probe. Each probe binds to a specific fragment and produces a different X-ray pattern. If the fragments recognised in the known and unknown samples are at the same location, they are said to match. If, on the other hand, one of the probes does not find a complementary DNA fragment on the membrane, an exclusion is automatically declared. Matches between the samples are then interpreted by population geneticists who determine how often such a match occurs in the general population. A typical DNA fragment might be present in 10% of the general population and it would therefore not be unlikely to find it in two random people. Once three,

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<sup>6</sup> Some reports indicate that these probes were first developed by Alec Jeffreys and his colleagues at the University of Leicester, England. Although Dr. Jeffreys holds the patent for these probes, it appears that a 1980 article by A.R. Wyman and R. White, *A Highly Polymorphic Locus in Human DNA*, *Proc. Natl Acad. Sci. USA* 77:6754, preceded the 1985 Jeffreys publication. It is also important to note that Dr. Jeffreys did not originally develop these probes for forensic use. A 1985 article by J. Chérfas, *Geneticists Develop DNA Fingerprinting*, *New Scientist* 21 (28 March 1985), states that the technique "will provide geneticists with a new tool to study the mechanisms of recombination that occur during cell division, as well as giving them new insight into genetic diseases". This will be discussed further in examining the adaptation of DNA typing to forensics.

<sup>7</sup> Probes can be either single-locus or multi-locus. A single-locus probe locks onto polymorphic DNA sequences which occur only once and gives rise to one or two bands, depending on whether the maternal and paternal alleles recognised are identical. This is the DNA typing method used by the Royal Canadian Mounted Police, the Centre of Forensic Sciences in Toronto and the *Laboratoire de Police scientifique*. The procedure developed by Alec Jeffreys uses multi-locus probes which lock onto "families" of polymorphic DNA segments that occur at many locations, giving rise to about 15 interpretable bands, analogised to a supermarket bar code, and which lead to the expression "DNA fingerprint".

<sup>8</sup> The DNA molecule includes four bases: adenine (A), thymine (T), guanine (G) and cytosine (C). Bases on opposite rungs bind to one another, with A always binding to T and G to C, and the composition of one strand therefore dictates the composition of the other. If, for example, the sequence of one strand is -TGACCT-, the composition of its complementary strand would be -ACTGGA-.

four or five different probes are considered, it becomes increasingly unlikely that two individuals will match for all of them.

In addition to its increased specificity, DNA typing has several advantages over traditional identification techniques. Firstly, contrary to protein marker tests, DNA typing does not rely on the presence or integrity of specific proteins and only requires the integrity of the DNA molecule, known to be highly resistant to environmental effects and particularly stable in dried specimens.<sup>9</sup> Furthermore, the composition of an individual's DNA does not vary from cell to cell; the DNA in a person's blood cells is identical to that in his hair roots, semen, skin and bone marrow. This feature is especially useful for forensic identification since it allows the testing of DNA contained in any trace evidence, regardless of its biological origin. DNA typing also permits the analysis of mixed stains, such as those obtained from victims of sexual assault, containing vaginal and semen secretions, which have traditionally created great difficulties for forensic scientists. With DNA typing, it is possible to determine if a sample contains DNA from more than one individual and the DNA profiles of the various sources can be ascertained and matched to known samples.

Law-enforcement officials consider that an additional advantage is that the DNA profiles of convicted offenders can be stored in databases. For example, legislation has been passed, or is proposed, in several American states, including Colorado and California, compelling convicted sex offenders to submit blood samples for DNA typing before leaving prison, to help solve crimes which they might subsequently commit. The Royal Canadian Mounted Police (RCMP) recently made a submission to the Minister of Justice, calling for legislation authorising the keeping of records and databases, as is presently done for fingerprints. Although the RCMP presently keep any leftover DNA, as well as all probed membranes and autoradiographs, it is not clear whether blood given on consent for the purposes of one investigation could be used to inculcate a suspect in future cases.

One of the limitations of DNA typing is the frequent insufficiency of biological material. This difficulty could be resolved, in the future, by the application of polymerase chain reaction technology, developed about three years ago to amplify specific gene sequences and presently being considered for implementation by the RCMP. Ironically, the main drawback of this new technology lies in its great sensitivity, which can cause it to be affected by the slightest contamination.

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<sup>9</sup> P. Gill *et al.*, Forensic Application of DNA 'Fingerprints' (1985), *Nature* 318:577, report, at p. 578, that the reliability of ordinary forensic testing techniques rapidly decreases with time and sample deterioration and contamination. They specify that DNA of molecular weight sufficient for typing has been extracted from blood or semen samples long after blood grouping or protein marker tests would have been possible.

Possibly the most important limitation of DNA typing is the length of time required to obtain a result.<sup>10</sup> The RCMP report that it takes six to eight weeks to produce a final report but that an exclusion can be declared in about four weeks.<sup>11</sup> The RCMP have implemented a priority system for accepting cases and, in 1988, specified that DNA typing would only be used where "a maximum strength of suspect association" was required.<sup>12</sup> More recently, Barry Gaudette<sup>13</sup> announced that serial crimes would be given high priority, but that sexual assault cases, in which consent is often the central issue, would be treated as low priority cases. Finally, although the RCMP appear willing to accept defence cases, it is unclear where these cases will rank within the system of priority.<sup>14</sup>

## 2. *The Beginning—Europe and the United States*

Although DNA analysis has taken the forensic community by surprise, an amazing amount of progress has been accomplished in a very short period of time.

The case of Colin Pitchfork, involving two sexual assault/murders, committed in 1983 and 1986 in neighbouring villages in Leicestershire, England, was the first criminal case to use DNA typing. Having first used DNA typing results to exonerate one suspect, Pitchfork's DNA was typed and his profile shown to match that of the rapist.<sup>15</sup>

In the United States, DNA typing was first used for human forensic purposes by two commercial laboratories, Lifecodes Corporation of Valhalla, New York and Cellmark Diagnostics of Germantown, Maryland (hereinafter Lifecodes and Cellmark). Although these laboratories have been performing DNA analyses since 1987, and their results have been used in many criminal investigations, defendants usually pleaded guilty after a match was declared and the technique was rarely challenged in court.

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<sup>10</sup> In the *Legere* case, discussed later, the RCMP were criticised for their delay in laying charges against the suspect. Inspector Hutchinson attributed "a large part of the delay" to the DNA testing which was "long, involved and complex", K. Cox, *Legere Charged with Four Murders*, *The Globe and Mail* 1 (Toronto, 21 November 1990).

<sup>11</sup> B.D. Gaudette, *DNA Typing: A New Service to Canadian Police* (1990), 52:4 RCMP Gazette 1.

<sup>12</sup> G.G. Shutler, *A Perspective on "DNA Fingerprinting"* (1988), 50:1 RCMP Gazette 22.

<sup>13</sup> Chief Scientist, Molecular Genetics Section, RCMP Central Forensic Laboratory, Ottawa.

<sup>14</sup> C. Schmitz, *DNA Fingerprinting*, *The Lawyers Weekly* (28 April 1989).

<sup>15</sup> That is, Pitchfork's profile matched the identical profiles obtained from the semen found on the two victims. For a more detailed account of the Pitchfork case, see M.A. Gelowitz, *DNA Fingerprinting: What's Bred in the Blood* (1986), 65 C.R. (3d) 122, at pp. 128-129.

*People v. Castro*<sup>16</sup> was the first to examine thoroughly the methodology and results of DNA tests and, at the pre-trial hearing, held the DNA evidence to be inadmissible.<sup>17</sup> The general theory and procedures of DNA typing were not, however, held to be unreliable; on the contrary, Sheindlin J. "gave a sweeping endorsement of DNA typing as a potentially revolutionary tool in criminal law enforcement".<sup>18</sup> His judgment was limited to a finding that Lifecodes' handling of the material, namely its alleged use of a contaminated probe, rendered the results unreliable in the particular case. The FBI has sought to avoid the negative experience of commercial laboratories and, in implementing the technology, has conducted extensive preliminary research and adopted strict quality control measures.

A recent report of the National Academy of Sciences has, however, raised serious concerns with respect to the use of DNA evidence. Although the Congressional Office of Technology Assessment initially granted its approval to DNA typing,<sup>19</sup> the April 1992 report of the National Academy of Sciences states that courts should not admit DNA evidence until a stronger scientific basis for the technique has been established.<sup>20</sup> The report finds that DNA typing is valid in principle, and carefully avoids commenting on prior DNA cases. It concludes, however, that the technology is too powerful and important for its development and use to be left solely in the hands of prosecutors and law-enforcement officials and recommends that the technology be regulated and controlled by scientists and federal agencies having no stake in its success or failure.

It is encouraging to see the scientific community take positive steps to benefit fully from DNA typing, and avoid negative repercussions on the criminal justice system. However, Neufeld and Colman observe that:<sup>21</sup>

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<sup>16</sup> 545 N.Y.S. 2d 985 (Sup. Ct, 1989). Joseph Castro was charged with two counts of second-degree murder for having allegedly stabbed to death a 20-year-old pregnant woman and her 2-year-old daughter. The police seized Castro's wristwatch, and the blood found on it was subjected to DNA typing. The prosecution sought to introduce the test results which showed, in their opinion, that the blood on Castro's watch was that of the woman victim.

<sup>17</sup> J.G. Petrosinelli, Note, *The Admissibility of DNA Typing: A New Methodology* (1990-91), 79 Georgetown L.J. 313, at p. 325.

<sup>18</sup> *Ibid.*, at p. 326.

<sup>19</sup> U.S. Congress, Office of Technology Assessment, *Genetic Witness: Forensic Uses of DNA Tests*, OTA-BA-438 (Wash., D.C.: U.S. Gvt Printing Office, July 1990). The National Academy of Sciences has also studied the technology, A. Anderson, *DNA Fingerprinting on Trial* (1989), *Nature* 342:844.

<sup>20</sup> In particular, the 12-member panel of scientific and legal experts recommends that DNA laboratories be accredited, and calls for standardized testing methods. It faults the statistical analysis involved in DNA typing, and demands scientific studies of DNA patterns in different population subgroups.

<sup>21</sup> P.J. Neufeld and N. Colman, *When Science Takes the Witness Stand*, *Scientific American* (1990), 262:46, at p. 53.

It is regrettable that these measures were set in motion only after flaws in current DNA typing came to light in the courtroom. We hope the anticipated reforms will enhance the interests of justice in the future, although this may be small solace to defendants who were wrongfully convicted or to crime victims who saw the true culprit set free.

### 3. *The Present—Canada*

#### (a) *Implementation in Canadian Laboratories*

In Canada, quite unlike the situation in the United States, commercial laboratories have not yet had any major involvement in forensic DNA typing.

In 1986, an RCMP serologist, Gary G. Shutler, was assigned to investigate the forensic potential of DNA typing<sup>22</sup> and, in October 1989, the central RCMP laboratory<sup>23</sup> became the first in Canada to offer a national casework service in forensic DNA typing.<sup>24</sup> The RCMP plan to implement DNA typing in their Halifax and Edmonton laboratories by the end of 1992, and in Vancouver and Winnipeg by the end of 1993.<sup>25</sup>

Dr. Barry Gaudette considers that collaboration with other laboratories has greatly accelerated the implementation of DNA typing.<sup>26</sup> The RCMP and the Toronto Centre of Forensic Sciences are both part of the Working Group on DNA Analysis Methods (TWGDAM), a North American group which has been meeting at the FBI Academy in Quantico, Virginia, three times a year since the fall of 1987.<sup>27</sup> Within Canada, the Société canadienne des sciences judiciaires now includes a DNA group, and in Québec, the Laboratoire de Police scientifique has set up a non-permanent interministerial committee, including representatives from the Montréal and Laval police, the Sûreté du Québec, the Association des policiers du Québec, the Québec Attorney General, the Ministère de la Justice and the Ministère de la Sécurité publique.<sup>28</sup>

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<sup>22</sup> Shutler initially collaborated with the National Research Council and molecular geneticists at the Children's Hospital of Eastern Ontario. In 1988, collaboration was extended to the FBI.

<sup>23</sup> The RCMP operate a system of forensic laboratories across the country. The Central Forensic Laboratory in Ottawa carries out regular casework activity and offers research and operational support to its seven regional laboratories, which service all of Canada, except Quebec and Ontario, where forensic work is carried out by the Centre of Forensic Sciences and the Laboratoire de Police scientifique, respectively.

<sup>24</sup> Gaudette, *loc. cit.*, footnote 11, at p. 1.

<sup>25</sup> B.D. Gaudette, *Forensic DNA Analysis in the RCMP*, in J. Ballanytyne, G. Sensabaugh and J. Witkowski (eds.), *Banbury Report 32: DNA Technology and Forensic Science* 229 (1989).

<sup>26</sup> *Ibid.*, at p. 230.

<sup>27</sup> Personal communication, Pamela Newall, Centre of Forensic Sciences, Toronto.

<sup>28</sup> Personal communication, Léo Laverigne, Laboratoire de Police scientifique.

(b) *Canadian Caselaw*

DNA evidence was first introduced in a Canadian court in the 1988 trial of James Parent, before the Alberta Court of Queen's Bench.<sup>29</sup> Parent was charged with eleven counts of sexual assault and breaking and entering. The Crown established identity on the basis of similar fact evidence. During the investigation, many articles of the victims' clothing and samples of the accused's hair and blood were obtained, and the Crown arranged for DNA analysis to be performed by a private laboratory.<sup>30</sup> The test results, obtained halfway through the trial, exculpated Parent in four counts. The Crown introduced the DNA evidence even though it substantially weakened its case; the defence obviously did not object and admissibility issues were not raised.<sup>31</sup>

DNA evidence was next introduced in a Canadian court in the 1989 case of Paul Joseph McNally,<sup>32</sup> charged with sexual assault and identified in a photo line-up. Following a voir-dire, Flanigan Sr D.C.J. admitted the RCMP's DNA typing results, marking the first time in North America that DNA evidence, obtained by a law-enforcement agency, was admitted in court.<sup>33</sup> The two RCMP scientists involved in the analysis testified that there was only a one in seventy billion chance that someone else could have sexually assaulted the victim.<sup>34</sup> Subsequent to their testimony, McNally changed his plea to guilty and is presently serving a seven-year prison sentence.

DNA evidence was next presented in the criminal trial of *R. v. Keenan and Hunt*.<sup>35</sup> As in *McNally*, DNA analysis was performed by the RCMP, a voir-dire was held and the evidence admitted. The defendants did not plead guilty but were convicted at trial.

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<sup>29</sup> *R. v. Parent* (1988), 65 Alta L.R. (2d) 18 (Alta. Q.B.).

<sup>30</sup> Without the cooperation of Parent's lawyer, the Crown used a sample of Parent's blood, obtained in a previous investigation, for DNA typing. Its profile matched that of semen obtained from clothing found at the scene of three of the attacks; H. Levy, *The DNA Debate*, Canadian Lawyer 14 (September 1991).

<sup>31</sup> Roslak J. held that other factors eliminated Parent from three other counts. Having been eliminated from a total of seven of eleven counts, he concluded that reasonable doubt existed as to whether Parent was the assailant in the remaining offences.

<sup>32</sup> *R. v. McNally* (Ruling on voir-dire, 4 April 1989), Ottawa (Flanigan Sr D.C.J., orally) (unreported). The transcripts of the testimony of the Crown experts, G.G. Shutler and Dr. J.S. Wayne, on file with the author, will also be referred to throughout the article.

<sup>33</sup> Gaudette, *loc. cit.*, footnote 11. In *R. v. Parent*, *supra*, footnote 29, a private company performed the DNA analysis and, in the U.S., the FBI had not yet begun performing DNA analysis.

<sup>34</sup> Schmitz, *loc. cit.*, footnote 14.

<sup>35</sup> (Ruling on voir-dire, 11 December 1990), Woodstock (Ont. Ct. Gen. Div., Misener J., orally) (unreported).

RCMP DNA typing results were subsequently used in the trial of Claude Bourguignon, accused of the sodomy and murder of his young nephew in June 1989. DNA typing results allegedly showed that semen from the bed where the boy was assaulted and slain belonged to Claude Bourguignon.<sup>36</sup> Unlike the situation in *McNally* and in *Keenan and Hunt*, an expert testified for the defence at the voir-dire. Judge Keith Flanigan admitted the DNA evidence but held that the scientists could not testify as to the statistical probability of a coincidental match; he believed that Canadian juries were not yet ready for this type of evidence.<sup>37</sup> Claude Bourguignon was nevertheless sentenced to life imprisonment, with no parole eligibility for 25 years.

DNA typing has also been admitted in British Columbia.<sup>38</sup> Although the accused, charged with sexual assault and murder pleaded not guilty, DNA typing results from the RCMP excluded several suspects and identified him as the most likely killer. The jury found him guilty and Hamilton J. of the British Columbia Supreme Court sentenced him to life in prison, with no parole eligibility for 25 years.

DNA typing results were also introduced in the Toronto trial of Carlos Terceira, accused of murdering six-year-old Andrea Atkinson. A voir-dire was held and, on October 23, 1991, Silverman J. held that the match results could be presented to the jury. However, statistical probability results were excluded.<sup>39</sup>

DNA typing evidence was also central to the trial of Allan Legere, charged with four murders in the Miramichi region of Northern New Brunswick.<sup>40</sup> Prior to the trial, the RCMP stated that this would be "a test case for new forensic crime-testing procedures".<sup>41</sup> Although Legere pleaded not guilty to all the killings, and argued mistaken identity,<sup>42</sup> the jury found him guilty of four counts of first-degree murder.

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<sup>36</sup> *R. v. Bourguignon* (Ruling on voir-dire), Ottawa (Flanigan J.) (unreported). Following the voir-dire, held in Ottawa in January 1991, the trial was moved before a jury in Barrie; personal communication, Susan Tereposky, student-at-law, Crown's office, Ottawa. Ms. Tereposky worked with Hilary McCormack, Crown prosecutor in the *McNally* and *Bourguignon* trials.

<sup>37</sup> Flanigan J. held: "This court does not think that the criminal jurisdiction of Canada is yet ready to put such an additional pressure on a jury, by making them overcome such fantastic odds and asking them to weigh it as just one piece of evidence to be considered in the overall picture of the evidence presented."; Levy, *loc. cit.*, footnote 30.

<sup>38</sup> L. Still, *The Vancouver Sun*: Jury Gets Course in Genetic Fingerprinting (Vancouver, 14 March 1991), and DNA Typing Helps Convict Man in Sex Murder (Vancouver, 15 March 1991).

<sup>39</sup> Personal Communication, Carol Anne Matthews, Adler, Schroeder, Toronto.

<sup>40</sup> *Supra*, footnote 10.

<sup>41</sup> Cox, *loc. cit.*, footnote 10.

<sup>42</sup> J. DeMont and R. Allen, *Terror in the Miramichi: Postscript to a Nightmare*, *Macleans*'s 22 (14 October 1991).

Finally, DNA typing evidence is reported to have been used to exonerate at least five suspects in the Scarborough sexual assault investigation.<sup>43</sup>

## II. *Scientific Evidence and Legal Standards of Proof*

### A. *In General*

The development and use of novel scientific techniques has forced courts to deal increasingly with expert evidence. Black states that the "need to evaluate expertise while simultaneously depending on it creates a fundamental tension that permeates and shapes the way in which the courts decide the admissibility of scientific evidence".<sup>44</sup> Mark McCormick adds that the standard of admissibility applied to scientific evidence "functions as the device through which the values of the legal system are imposed on scientific knowledge" and "determines the rapidity and readiness with which scientific information becomes evidence".<sup>45</sup>

In considering the standard of admissibility which ought to apply to scientific evidence, it is important to remember the different objectives pursued by science and by law, as well as among scientists themselves. On this point, Neufeld and Colman warn that "the disjunction between scientific and judicial standards of evidence has allowed novel forensic methods to be used in criminal trials prematurely or without verification".<sup>46</sup>

Law and science differ in their approach to the truth. In law, the final determination of facts, and of the rights of the parties, is crucial and in the presence of uncertainty or ignorance, the party who bears the burden of proof loses. The scientific method, on the other hand, operates under no deadlines; when information is inadequate, the scientific community simply defers decisions. In comparing the scientific and legal approaches, Martin states:<sup>47</sup>

... the legal method sometimes consciously sacrifices its truth-seeking goal to other values, such as efficiency (as seen from procedural rules) and competing social values (as seen in evidentiary privileges, for example), while the scientific method makes no such institutionalized concessions to competing values.

Traditionally, scientists have challenged new theories and findings through peer review. Black states:<sup>48</sup>

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<sup>43</sup> P. Cheney, *Genetic Fingerprinting: Legal Breakthrough or Inexact Science*, *The Star* 1 (Toronto, 5 October 1991).

<sup>44</sup> B. Black, *Evolving Legal Standards for the Admissibility of Scientific Evidence* (1988), *Science* 239:508.

<sup>45</sup> M. McCormick, *Scientific Evidence: Defining A New Approach to Admissibility* (1981-82), 67 *Iowa L. Rev.* 879. Mark McCormick was a Justice of the Supreme Court of Iowa.

<sup>46</sup> *Loc. cit.*, footnote 21, at p. 46.

<sup>47</sup> J.A. Martin, *The Proposed "Science Court"* (1976-77), 75 *Mich. L. Rev.* 1058, at p. 1063.

<sup>48</sup> B. Black, *A Unified Theory of Scientific Evidence* (1987-88), 56 *Fordham L. Rev.* 595 at p. 601.

Contrary to longstanding misperceptions, science does not generate exact knowledge with logical certainty. Instead, it relies on the give and take of criticism, testing, experimentation, and review to determine what is valid. Widespread consensus and acceptance, therefore, is the central test that scientists use to decide the validity of theories and reasoning in any given context. . . .

In a court of law, however, the process of peer review and information exchange is not available and, unaware of potential flaws in a novel technique, lawyers often fail to challenge it. Furthermore, many scientific commentators believe that the peer review process itself should not be seen as "a truth-grinding machine" and, while it may allow scientists to make sense of shared information, Knoll warns that this may not be an appropriate analogy:<sup>49</sup>

Leading scientists and scientific journals often refer to the "community of scientists", in the singular. We would be better off remembering that *in these specialized days there are many communities of scientists*, seeking professional security and personal recognition as well as impersonal truth.

The *Castro* case illustrates both the possibility for, and difficulties raised by scientific collaboration in the legal process. Concerned about certain issues which came to light, the leading witness for the prosecution suggested that a joint scientific meeting of the experts be held to review the evidence. The experts agreed that:<sup>50</sup>

. . . the DNA data in this case are not scientifically reliable enough to support the assertion that the samples . . . do or do not match. If these data were submitted to a peer-reviewed journal in support of a conclusion, they would not be accepted. Further experimentation would be required.

The prosecution initially indicated that it would withdraw the DNA evidence, but the district attorney later decided to press on.<sup>51</sup>

## B. *The Admissibility of Novel Scientific Evidence*

In light of the preceding discussion, it is not surprising that traditional legal standards of proof have been found to be of limited use in ruling on the admissibility of novel scientific evidence. Consequently, alternative tests have been developed which attempt to reconcile scientific and legal approaches to the truth.

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<sup>49</sup> E. Knoll, *The Communities of Scientists and Journal Peer Review* (1990), JAMA 263:1330, at p. 1332. (Emphasis added). The peer review process has been attacked on the basis that it "works best when nothing much is at stake" and that "the more important the claim, the more likely it is that the peer review system and the journals will be shoved aside . . . replaced by the press conference, where publicity about conclusions can be accompanied by considerable vagueness about methods"; *ibid.*

<sup>50</sup> E.S. Lander, *DNA Fingerprinting on Trial* (1989), Nature 339:501.

<sup>51</sup> *Ibid.*

In discussing the admissibility of novel scientific evidence, Charles McCormick states:<sup>52</sup>

Because the admissibility decision is one step towards final adjudication of the legal rights of the parties, the decision becomes final when the litigation ends. Subsequent reconsideration in the light of new information or developments is precluded. This is reason enough for courts to proceed conservatively in admitting novel scientific evidence.

Similarly, Saltzburg considers that:<sup>53</sup>

... a foundation is needed that establishes sufficient reliability for a test to remove fears on the part of the informed scientific community that later developments will suggest that an inaccurate and unjust result was reached at trial because the test was used.

### 1. *The Frye Test of Admissibility*

The need for a special standard for the admissibility of evidence derived from novel scientific techniques was recognised for the first time in *Frye v. U.S.*,<sup>54</sup> a 1923 decision of the Court of Appeals for the District of Columbia. The defendant, Frye, sought to introduce results obtained by way of a precursor of the polygraph. In a brief two-page judgment, Van Orsdel J. delivered a passage which is quoted whenever the admissibility of scientific evidence is at issue:<sup>55</sup>

Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, *the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.*

This statement has become known as the *Frye* standard or the *Frye* test for the admissibility of novel scientific evidence.

The main assumption underlying *Frye* is that general acceptance of a scientific technique or principle, by scientists knowledgeable and experienced in the area to which it relates, is an appropriate measure of its reliability. The test seeks to promote uniformity across cases and avoid constant litigation of a technique. It assumes that judges are more qualified to establish whether scientists consider a technique to be reliable than to assess that reliability themselves. It is said to give scientists a determinative

<sup>52</sup> E.W. Cleary *et al.* (eds.), McCormick on Evidence (3rd ed., 1984).

<sup>53</sup> S.A. Saltzburg, *Frye and Alternatives* (1983), 99 F.R.D. 208, at p. 216, cited in Black, *loc. cit.*, footnote 48, at p. 642, n.255.

<sup>54</sup> 293 F. 1013 (C.A.D.C. Cir., 1923).

<sup>55</sup> *Ibid.*, at p. 1014. (Emphasis added). The Court of Appeals affirmed the lower court's decision to exclude the evidence.

voice in evaluating novel scientific methods and ensure that a sufficient number of experts are available to assist the side opposing the evidence.<sup>56</sup>

## 2. Other Approaches

There is both widespread support for, and criticism of the *Frye* test, especially in the United States.<sup>57</sup> Its critics consider that it is vague and ambiguous on all counts and is therefore difficult to apply. They maintain that it puts too little faith in the trier of fact, namely the jury, that it is unduly restrictive and leads to the exclusion of valuable and reliable evidence. More inclusive approaches are proposed.

### (a) The Relevancy Approach

Proponents of this approach argue that the admissibility of novel scientific evidence is best determined within the traditional framework of relevancy and expert evidence, wherein judges only apply familiar concepts. This, they believe, leads to greater procedural simplicity and uniformity, and avoids the distractions and collateral issues of special rules. At the same time, they believe that the approach can be tailored to meet the characteristics of the scientific technique and the impact of the evidence derived from it. Mark McCormick, a supporter of the relevancy approach, referring to the views of Charles McCormick, states:<sup>58</sup>

“General scientific acceptance” is a proper condition for taking judicial notice of scientific facts, but not a criterion for admissibility of evidence. He [Charles McCormick] favored a rule admitting any relevant conclusions of a qualified expert witness unless reasons for exclusion existed, such as probative value “being overborne by the familiar dangers of prejudicing or misleading the jury, and undue consumption of time.”

Mark McCormick agrees that *Frye* protects the jury from the blinding aura of expert infallibility but also considers that such protection is not always required. He argues that while evidence derived from complex science requires “a proportionately stronger showing of probative value . . . to counter the possibility that the jury will be misled or that unfair prejudice

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<sup>56</sup> Cleary, *op. cit.*, footnote 52, pp. 607-608, states that the *Frye* test “insulates the adversary system from novel evidence until a pool of experts is available to evaluate it in court”. P.K. McWilliams, *Canadian Criminal Evidence* (3rd ed., 1990), p. 9-28, considers that this ties in with an accused’s right to a full defence: “The prosecution should not be able to prove guilt by calling on an expert to give opinion evidence as to a field or topic which is unknown to anyone else or is so restricted in number of experts that the defence cannot find an expert to test the opinion.”

<sup>57</sup> R. Bessner, *The Road Not Taken: The Refusal of the Supreme Court of Canada to Articulate a Test for the Admissibility of Polygraph Evidence* (1988), 60 C.R. (3d) 55, at p. 58, provides a detailed bibliography of American doctrine relative to the *Frye* controversy.

<sup>58</sup> *Loc. cit.*, footnote 45, at p. 886. The passages in quotation marks are from E.W. Cleary (ed.), *McCormick’s Handbook of the Law of Evidence* (2nd ed., 1972), p. 491.

will result",<sup>59</sup> he would agree with Charles McCormick that the traditional approach to admissibility is often to be preferred.<sup>60</sup>

In so treating the yeas and nays of the members of a scientific discipline as but one indication of the validity, accuracy, and reliability of the technique, the traditional balancing method focuses the court's attention where it belongs—on the actual usefulness of the evidence in light of the full record developed on the power of the scientific test.

Mark McCormick considers that a technique's potential rate of error, the nature and scope of the inference adduced, standards governing its use, the availability of experts and possible analogies with previously admitted techniques ought to guide courts in establishing the admissibility of novel scientific evidence.<sup>61</sup> Hence, although the relevancy approach, unlike the *Frye* test, does not focus primarily on the opinion of the scientific community, its use of scientific opinion cannot be overlooked. Accordingly, Bessner's suggestion that "the relevancy approach, unlike the *Frye* test, does not attempt to assure the reliability of the evidence"<sup>62</sup> seems unlikely. For example, in *State v. Free*,<sup>63</sup> the court questioned "whether, in applying the balancing test, it was in reality applying the general acceptance standard in a more explicit fashion".<sup>64</sup>

#### (b) *The Frye-Green Approach*

In *U.S. v. Green*,<sup>65</sup> the Sixth Circuit held that novel scientific evidence was admissible if its proponent established that it conformed to "a generally accepted explanatory theory". In *U.S. v. Yee*,<sup>66</sup> the court sought to reconcile the approaches taken in *Green* and *Frye*,<sup>67</sup> and found that the *Green* general explanatory requirement "abides by the *Frye* standard while concurrently embracing an additional formulation that . . . neither supplants nor serves as a substitute for the basic doctrine of 'general acceptance in the scientific community'".<sup>68</sup> The court viewed the two standards as complementary,

<sup>59</sup> *Ibid.*, at p. 910.

<sup>60</sup> Cleary, *op. cit.*, footnote 52, p. 609.

<sup>61</sup> *Ibid.*, at pp. 911-912. He completes his list with factors intended to measure the prejudicial effect of the evidence such as the clarity and simplicity of the technique and its results, the extent to which data can be verified by the jury and the care with which the technique was employed in the particular case; *ibid.*

<sup>62</sup> R. Bessner, *The Admissibility of Novel Scientific Techniques in Criminal Trials: Voice Spectroscopy* (1988), 30 *Crim. L.Q.* 294, at p. 315.

<sup>63</sup> 493 So. (2d) 781, (La. C.A., 1986).

<sup>64</sup> Black, *loc. cit.*, footnote 48, at p. 643, note 266, referring to *State v. Free*, *ibid.*, at p. 787, note 9.

<sup>65</sup> 548 F.2d 1261, at p. 1268 (C.A. 6th Cir., 1977).

<sup>66</sup> *U.S. v. Yee* (28 November 1990), (U.S. Distr. Ct. Ohio) at p. 59 of U.S. Magistrate J.G. Carr's Report and Recommendation. In *Yee*, DNA typing results were admitted and the Court conducted a very thorough review of the technology.

<sup>67</sup> *Ibid.*, at p. 68.

<sup>68</sup> *Ibid.*, at pp. 53-54.

rather than exclusive, and concluded that the *Green* test "represents an effort, all too rarely attempted, to give some additional, but not inconsistent or competing content, to the vagueness and ambiguity of the term 'general acceptance'".<sup>69</sup> The court concluded that the validity of the underlying scientific principles, and the reliability of the methodology and results, were to be determined by the jury.

### (c) *Proof Beyond a Reasonable Doubt*

As previously mentioned, traditional standards of proof have not been applied to novel scientific evidence and the debate has focused on determining which factors are relevant to the admissibility of the evidence. Some commentators state, however, that such admissibility should simply be controlled by adjusting the standard of proof, in the traditional way.

Giannelli<sup>70</sup> considers that the major flaw of the relevancy approach is its failure to recognise the distinctive reliability problems of novel scientific evidence and its failure to impose a special burden on its admissibility. He argues that "[a]lthough general acceptance by a recognized discipline or profession would be relevant, such acceptance would be neither required nor necessarily sufficient".<sup>71</sup> He concludes that, in criminal cases, the reliability of a novel scientific technique should be proven beyond a reasonable doubt.

### 3. *Canadian Law*

*R. v. Medvedew*,<sup>72</sup> in which spectrographic or "voice print" analysis was used to identify a person accused of making threatening telephone calls, was one of the first Canadian cases to consider the admissibility of novel scientific evidence. The accused allowed the police to record his voice and Sergeant Smrkovski of the Michigan police compared the tape to a recording of one of the calls allegedly made by the accused. The court of first instance held that Sergeant Smrkovski was an expert in the field of voice identification and admitted his testimony. The Manitoba Court of Appeal, by a two to one majority, maintained the admissibility of the evidence. Matas J.A. wrote for himself and Monnin J.A., while O'Sullivan J.A. wrote a dissenting opinion.

Matas J.A. did not look to *Frye* or other related decisions and held that admissibility turned exclusively on whether or not the witness was an expert in the field in which he testified. He concluded that any unreliability

<sup>69</sup> *Ibid.*, at pp. 70-71.

<sup>70</sup> P.C. Giannelli, *The Admissibility of Novel Scientific Evidence: Frye v. U.S.*, a Half-Century Later (1980), 80 Colum. L. Rev. 1196.

<sup>71</sup> *Ibid.*, at p. 1248.

<sup>72</sup> [1978] 6 W.W.R. 208, (1978), 6 C.R. (3d) 185 (Man. C.A.).

in the evidence, even if derived from a novel scientific technique, went to its weight.

Manitoba Legal Aid refused to pay for counsel and Mr. Medvedev argued the appeal for himself, simply stating: "I am innocent of the offence I am charged with."<sup>73</sup> In dissent, O'Sullivan J.A. specified that he would consider what points could have been argued by counsel on the appeal. He stated that he did not know "whether the [*Frye*] test has been adopted in Canadian courts or not", but that "it makes sound sense and expresses a view in accord with the principles of common law".<sup>74</sup> He clearly rejected the relevancy approach, holding that the trial judge erred in qualifying the witness as an expert without first being satisfied that the technique on which he relied was scientifically valid. The scientific validity of voiceprint analysis was not, in his opinion, a matter to be determined by jurors "on the basis of their assessment of the credibility and demeanour of the scientific witnesses".<sup>75</sup>

The admissibility of novel scientific evidence was next considered in *R. v. Doe*,<sup>76</sup> where the District Court of Ontario admitted polygraph test results submitted by the accused. Kurisko D.C.J. noted that there was "a paucity of authority or precedent defining the fundamental procedural and evidentiary guidelines applicable to a *voir dire* in which the accused is tendering novel scientific evidence".<sup>77</sup> Having reviewed American jurisprudence, he opted for "the long established common law test of relevancy and helpfulness applicable to any and all evidence".<sup>78</sup>

A few months after *Doe*, in *R. v. Béland*,<sup>79</sup> the Supreme Court of Canada, by a five to two majority, held polygraph test results to be inadmissible. In the majority, McIntyre J. wrote for himself and Dickson C.J.C., Beetz and Le Dain JJ., while La Forest J. rendered a short separate opinion. In dissent, Wilson J. wrote for herself and Lamer J.

McIntyre J. first explained that the admission of polygraph results would contradict traditional rules of evidence. The test results were not

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<sup>73</sup> *Ibid.*, at pp. 215 (W.W.R.), 193 (C.R.). Mr. Medvedev was represented by counsel at his trial; *ibid.*, at pp. 210 (W.W.R.), 188 (C.R.).

<sup>74</sup> *Ibid.*, at pp. 221 (W.W.R.), 209 (C.R.).

<sup>75</sup> *Ibid.*, at p. 229 (W.W.R.), 209 (C.R.). O'Sullivan J.A. also referred to American caselaw, quoting with approval the *Green* decision, *supra*, footnote 65.

<sup>76</sup> (1986), 31 C.C.C. (3d) 353 (Ont. D.C.).

<sup>77</sup> *Ibid.*, at p. 360.

<sup>78</sup> *Ibid.*, at p. 361.

<sup>79</sup> [1987] 2 S.C.R. 398, (1987), 60 C.R. (3d) 1. Two respondents were charged with conspiracy to rob an armoured truck. The robbery never took place because a third individual informed the police. The respondents denied any participation in the conspiracy and offered to undergo a polygraph test. The trial judge ruled the results to be inadmissible and the respondents were convicted. They were successful on appeal, and the Crown appealed to the Supreme Court.

admissible as expert evidence because the sole issue for which they were adduced, namely witness credibility, was "an issue well within the experience of judges and juries".<sup>80</sup> On the issue of novel scientific evidence, he thought that while the rules of evidence should be modified to allow for improvement, polygraph test results would not lead to greater certainty. His decision was "not based on a fear of the inaccuracies of the polygraph"; and he considered that "even the finding of a significant percentage of error in its results would not by itself be sufficient ground to exclude it as an instrument for use in the courts".<sup>81</sup> He added:<sup>82</sup>

... it must be remembered that however scientific it may be, its use in court depends on the human intervention of the operator... Human fallibility is therefore present as before, but now it may be said to be fortified with the mystique of science.

Hence, while not objecting to the general admissibility of the evidence, McIntyre J. expressed concern with its specific admissibility. La Forest J. agreed with McIntyre J.'s disposition of the case, but based his decision on these last comments, adding that it was inadvisable for the jury to spend time on collateral issues.<sup>83</sup>

In her dissenting opinion, Wilson J. stated that the Crown's argument that polygraph evidence should not be admitted because it is "not reliable to an acceptable standard"<sup>84</sup> was an attempt to introduce the *Frye* test into Canadian law and, quoting Mark McCormick, added:<sup>85</sup>

The courts that have moved away from *Frye* have obviously done so because of a perception that the standard is too rigid, somewhat unclear, and an unnecessary and undesirable barrier to the admissibility of scientific evidence in some situations. The effect of the departure from *Frye* has been a liberalization in the admissibility of scientific evidence. A discernible trend toward an expansive admissibility standard plainly exists.

Wilson J. concluded that the relevancy test retained the values of the *Frye* approach, without its disadvantages.

In conclusion, no clear position has yet been confirmed in Canadian jurisprudence with respect to the admissibility of novel scientific evidence and there has not been much academic debate of this issue.<sup>86</sup> The Law Reform Commission of Canada touched tangentially on scientific reliability

<sup>80</sup> *Ibid.*, at pp. 415 (S.C.R.), 41 (C.R.).

<sup>81</sup> *Ibid.*, at pp. 416 (S.C.R.), 42 (C.R.).

<sup>82</sup> *Ibid.*, at pp. 417-418 (S.C.R.), 42-43 (C.R.).

<sup>83</sup> *Ibid.*, at pp. 434 (S.C.R.), 54 (C.R.).

<sup>84</sup> *Ibid.*, at pp. 432 (S.C.R.), 53 (C.R.).

<sup>85</sup> *Ibid.*, at pp. 433 (S.C.R.), 53 (C.R.), quoting McCormick, *loc. cit.*, footnote 45, at p. 904.

<sup>86</sup> In a comment on the *Béland* decision, Bessner, *loc. cit.*, footnote 57, points to the court's failure to articulate an admissibility standard for novel scientific evidence. Although this perception may be accurate, one must note McIntyre J.'s mention that the parties did not provide sufficient evidence for the court to evaluate polygraph testing.

in its review of investigative procedures,<sup>87</sup> stating that “the procedure must, as a general rule, be likely to produce some evidence that will be of some value and assistance at trial”.<sup>88</sup> Footnoting *Frye*, the Commission wrote:<sup>89</sup>

Although ... potential probative value depends, in large measure, upon the circumstances of each individual case, ... the procedure involved, to be acceptable, must be one the validity of which has gained general recognition in the field to which it belongs.

The Commission thought that “techniques that do not meet the test propounded in the *Frye* case should be regarded with a considerable degree of scepticism”.<sup>90</sup> It nevertheless recognised that this did not facilitate the determination of which tests met the standard.<sup>91</sup>

### C. DNA Typing Evidence

The complexity of the DNA typing process increases its potential for misuse in court. In *R. v. Bourguignon*,<sup>92</sup> Dr. Wayne testified that DNA typing is conceptually and technically a step-by-step procedure which, if adequately explained, can be understood by lawyers and other lay persons. However, Shutler, of the RCMP, writes:<sup>93</sup>

To our legal community, the potential ramifications of this type of analysis mean that more than just superficial media reports are deserved. The sophistication in molecular biology however precludes all but those with a significant biological science background from surveying current scientific literature.

The use of DNA evidence will require judges to rapidly gain sufficient scientific knowledge to evaluate the findings presented to them. In ruling on the admissibility of DNA evidence, Misener J. in *R. v. Keenan and Hunt*<sup>94</sup> stated, orally:

I don't intend to delay the trial by satisfying myself, to a certainty, that I know exactly what I am ruling upon. I intend to simply state what I think I am ruling upon, and rule upon it.

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<sup>87</sup> Law Reform Commission of Canada, Report No. 25: Obtaining Forensic Evidence: Investigative Procedures in Respect of the Person (1985).

<sup>88</sup> *Ibid.*, p. 24.

<sup>89</sup> *Ibid.*

<sup>90</sup> *Ibid.*, p. 25.

<sup>91</sup> *Ibid.* The Commission concluded, p. 26, that: “Even where a given investigative test procedure has gotten over the ‘scientific reliability’ hurdle as regards the admissibility of expert evidence based thereon, the weight that is given to such evidence in practice may well be affected by the existence of an alternative technique that is at least potentially more reliable.”

<sup>92</sup> *Supra*, footnote 36. Dr. Wayne was formerly with the RCMP, and is now Assistant Professor, Department of Pathology, McMaster University.

<sup>93</sup> *Loc. cit.*, footnote 12.

<sup>94</sup> *Supra*, footnote 35.

Later, following a description of DNA typing, he added: "And while I have, as yet, no real understanding of the significance of that, assuming I have an understanding of what I just said . . ." <sup>95</sup>

The capacity of the defence to challenge DNA typing results will also be affected by the complexity of the technique. In Canada, DNA typing for human forensic purposes is presently only performed by government laboratories and there is a strong need for Canadian experts to assist defence counsel in examining and challenging DNA typing results. In *R. v. Bourguignon*,<sup>96</sup> Flanigan J., in ruling on the admissibility of DNA results, stated:

It is unfortunate that in this country, in view of the newness of the technique, few, if any, independent sources can be resorted to by defence counsel to assist them in cross-examining Crown witnesses or in offering an independent view, as occurred in the U.S. in the *Castro* decision.

DNA typing will be used to investigate violent crimes in which the defendants often come from the less affluent sectors of society. Often, Legal Aid lawyers will not have the time to deal with the complexities of the evidence; costs may be prohibitive and defence lawyers, compelled to believe that any challenge against DNA results is futile, may encourage their clients to plead guilty. Federico states: <sup>97</sup>

The "access to justice" issue where an accused cannot afford the cost of rebutting Crown-introduced DNA bar-code analysis requires considerable attention. The additional costs to an accused would include forensic testing, expert witnesses and legal fees.

Finally, the potential of DNA typing to confuse and impress scientifically naive juries must be considered.<sup>98</sup> For example, following a recent trial in Queens, New York, one juror commented: "You can't argue with science."<sup>99</sup> Dr. Wayne considers that an important advantage of DNA typing results is that "[y]ou can actually have the evidence speaking . . . and you are not compelled to base your case on the testimony of a reluctant [witness]."<sup>100</sup> Ironically, a county judge in Albany, New York, pronounced DNA typing to be "the single greatest advance in the 'search for truth' and the goal of convicting the guilty and acquitting the innocent since the advent of cross-examination".<sup>101</sup>

<sup>95</sup> *Ibid.*

<sup>96</sup> *Supra*, footnote 36.

<sup>97</sup> R.G. Frederico, "The Genetic Witness": DNA Evidence and Canada's Criminal Law (1990-91), 33 *Crim. L.Q.* 204, at p. 227.

<sup>98</sup> Following the recent introduction of DNA typing evidence in the B.C. Supreme Court, Still, *loc. cit.*, footnote 38 (14 March 1991) reported: "A jury . . . received a crash course Wednesday in the complex technique of genetic fingerprinting."

<sup>99</sup> Neufeld and Colman, *loc. cit.*, footnote 21, at p. 46.

<sup>100</sup> Schmitz, *loc. cit.*, footnote 14, at p. 15.

<sup>101</sup> Ford S. and W.C. Thompson, A Question of Identity: Some Reasonable Doubts About DNA "Fingerprints" (1990), *The Sciences* 30(1): 37, at p. 42.

### III. *The General Admissibility of DNA Typing Technology*

As discussed in the introduction, general admissibility refers to whether *any* evidence derived from the technique in question should be introduced in court. Once a technique has gained general admissibility, its results can still be ruled inadmissible if they were obtained in an unreliable manner. General admissibility focuses on reliability of the technique while specific admissibility focuses on that of its results.

The general admissibility of DNA typing, namely the technique's capacity to generate results which can be used in court, is based upon two main considerations: (1) the validity of the principle underlying the technique, and (2) the reliability of the technique when applied in the forensic context.

#### A. *The Principle*

DNA typing is based upon the principle that restriction fragment length polymorphisms (RFLPs) are present in human DNA and can distinguish the DNA profiles of different individuals. This theory, which predates DNA typing, is well accepted in the scientific community and Thompson and Ford consider that "it is unlikely even to be raised as an issue in hearings on the admissibility of the new tests".<sup>102</sup>

In *R. v. McNally*,<sup>103</sup> Dr. Wayne explained that genetics had been recognised as a science for over one hundred years, that the inheritance of traits "certainly" had been recognised in the scientific community and that hypervariable regions had been recognised and exploited for many years. In the same case, Gary Shutler of the RCMP was asked, on cross-examination, how scientists know that the DNA of each individual is unique. Defence counsel stated: "So for us to understand . . ., would it be similar to the theory that no two snowflakes are the same?" This type of questioning might be indicative of a misunderstanding of the principle underlying DNA typing and could lead the jury to believe that the profiles generated identify the full genetic code of an individual.

The scientific community appears to generally accept that, theoretically, individuals can be distinguished on the basis of the polymorphisms probed for in DNA typing. However, DNA typing results identify individuals on the basis of a calculated probability of coincidental match between unrelated individuals. Hence, while DNA polymorphisms provide a window into an individual's genetic interior, the light shed on the diversity of individuals is subject to statistical extrapolation. The effect of these calculations on the admissibility of the evidence will be discussed further in Part IV.

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<sup>102</sup> W.C. Thompson and S. Ford, *DNA Typing: Acceptance and Weight of the New Genetic Identification Tests* (1989), 75 Va L. Rev. 45, at p. 60.

<sup>103</sup> *Supra*, footnote 32.

### B. *Adaptation by the Forensic Community*

The basic techniques used in DNA typing were developed for use in population genetics research. Initially applied to the analysis of clean, fresh biological samples, they were subsequently modified to accommodate problems unique to forensic samples, such as unknown age, limited quantities and the presence of unidentified contaminants. Unlike its use in diagnostics, where a number of discrete patterns are known in advance and provide a built-in consistency check, forensic DNA typing compares completely unknown samples.<sup>104</sup> Hence, although the principle underlying DNA typing is generally accepted in the scientific community, and its protocols well referenced in the literature,<sup>105</sup> courts must ensure that the technique's reputation in the context of research and diagnostics does not overshadow potential flaws in its forensic applications. For example, in *R. v. McNally*,<sup>106</sup> Gary Shutler testified that the techniques used are "widely accepted", and that "it is not new technology at all", adding that "it is *just* the application of it to the forensic scenario that is relatively new".

Each of the steps involved in forensic DNA typing should be considered. Firstly, DNA is extracted from forensic samples, and the human DNA extracted is quantified and purified. These steps should be closely examined by the defence in challenging the admissibility of DNA evidence. In cases of sexual assault, for example, vaginal and anal swabs used to collect the semen of the attacker may also absorb vaginal epithelial cells and the effectiveness of the separation procedure is critical to the results obtained. Following purification, restriction enzymes are used to break down the DNA. Although these have been used in research for close to fifteen years,

<sup>104</sup> A. Hall, *DNA Fingerprints—Black Box or Black Hole?* (1990), 140 *New L.J.* 203.

<sup>105</sup> Thompson and Ford, *loc. cit.*, footnote 102, provide an excellent review of the adaptation of DNA diagnostic testing to the forensic context.

<sup>106</sup> *Supra*, footnote 32. (Emphasis added). In cross-examination, the defence noted that this was the first case in which DNA typing evidence produced by the RCMP was used in court and pointed out that Dr. Wayne had been specifically hired to prepare the procedure for use in court. The defence asked Dr. Wayne if there were other applications for DNA typing. He answered that medical applications were "first and foremost", that the variable regions of chromosomes had been used for many years to follow diseases through families and that this application had been accepted in the medical and scientific community for over ten years. Ms. McCormack, for the prosecution, pushed this line of inquiry further.

Q.: And what is the result of that kind of genetic predicting prenatally?

A.: Well in many of the diseases it forms the basis of the parents' decision to continue a pregnancy or obtain a therapeutic abortion.

Q.: So that it has very serious consequences to the fetus?

A.: Oh yes.

The prosecution hence tried to minimize the differences between forensic and diagnostic testing by focusing on the importance of the results in both contexts.

their use requires adherence to a strict protocol, with precise control of the amount of enzyme used and of the completeness of DNA breakdown.

The next steps, Southern Blotting and electrophoresis, are well accepted by scientists, and their use in forensics does not differ from numerous other biological applications.<sup>107</sup> Although fears have been raised that DNA moves from lane to lane on the gel, the RCMP specify that this will not happen if proper procedures are followed. Autoradiography, the final step in DNA typing, has been used for over fifteen years in medical and biological research. Although its use in forensics does not differ significantly,<sup>108</sup> probes used in forensic DNA typing differ from diagnostic probes. In *R. v. McNally*,<sup>109</sup> Dr. Waye explained that the most important factor in probe selection is the variability which it can detect between unrelated individuals and whether it can be used in conjunction with the restriction enzyme chosen by the RCMP.<sup>110</sup>

Although DNA typing procedures seem to have been well adapted to the forensic context, the rapid adoption and intense promotion of the technology by commercial laboratories, especially in the United States, are negative forces which the proponents of the technology must today counter. For example, Thompson and Ford point to misleading press accounts which often "present the commercial hyperbole of companies marketing DNA typing results as if it were a scientific fact",<sup>111</sup> and evaluations of the technology published by employees of these companies, or university researchers with financial ties to them.<sup>112</sup> A related problem is the secrecy with which commercial laboratories have often surrounded their protocols. To protect alleged trade secrets, their procedures were shielded from the scrutiny of the scientific community, forcing the defence to obtain a court order requiring the company to disclose its methods. Thompson and Ford point out that companies hence placed themselves in the contradictory

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<sup>107</sup> Thompson and Ford, *loc. cit.*, footnote 102, at p. 71, state that these two steps are unlikely to be questioned in the admissibility debate.

<sup>108</sup> *Ibid.*, at p. 74.

<sup>109</sup> *Supra*, footnote 32.

<sup>110</sup> The RCMP also take into account the cost of the probe and whether it is available to the entire scientific community.

<sup>111</sup> *Loc. cit.*, footnote 102, at pp. 52-53. Material distributed by commercial laboratories illustrates their approach to the use of DNA typing. The Lifecodes brochure mentions that although DNA typing is a novel technique, "it's already inciting a revolution in American jurisprudence". It lists the company's "pioneering achievements", stating that its results have been accepted in more states than anybody else's. The brochure states that DNA typing increases the likelihood of guilty pleas but, in the case of sexual assault, shifts the burden "from the traumatized victim to where it belongs—to the administration of justice". Finally, Lifecodes appeals to popular fears of increasing crime rates which it contrasts to its own benevolence.

<sup>112</sup> *Ibid.*

position of claiming that their protocols were sufficiently unique to constitute trade secrets, while being generally accepted by the scientific community.

#### IV. *The Specific Admissibility of Test Results*

In the event that DNA typing technology is found capable of generating admissible results, courts will have to consider whether the results before them meet the requisite standards of admissibility. For example, in *People v. Castro*,<sup>113</sup> two separate pre-trial hearings were held, dealing with, respectively, the theory and technique of DNA typing, and performance of the test by the laboratory in question. The court found that the special nature of DNA evidence required a separate hearing to assess the particular application of the procedure.<sup>114</sup>

One of the main difficulties in challenging DNA typing evidence is that the limited size of the sample usually precludes verification tests. Dr. Wayne considers that if he were a defence expert, he would ask to see the Crown's data "first and foremost" and that the most fruitful line of attack is to establish that the technique used deviated in some way from the standard.<sup>115</sup> Hilary McCormack, the Crown prosecutor in *R. v. McNally*<sup>116</sup> and *R. v. Bourguignon*,<sup>117</sup> considers that the validity and reliability of DNA typing is now well accepted by the scientific community, with little room for the defence. She states that "[t]he main line of attack . . . is not with the technique itself, but how somebody actually physically does the sample".<sup>118</sup> Leo Adler, a Toronto lawyer who recently defended a man charged with murder, and against whom DNA evidence was introduced, considers that it is crucial for the defence to obtain a copy of all laboratory protocols, records and results, from beginning to end.<sup>119</sup> He states:<sup>120</sup>

DNA evidence is not unconquerable . . . (it) is only as accurate as A, the people doing the test and B, the machinery.

<sup>113</sup> *Supra*, footnote 16.

<sup>114</sup> Petrosinelli, *loc. cit.*, footnote 17, at p. 327, remarks that "the *Castro* court's requirement that two separate pre-trial hearings be conducted was truly unprecedented".

In this way, DNA typing evidence differs from, for example, traditional fingerprints which are obtained by a generally admitted technique. Since the steps involved in the fingerprinting procedure are relatively straightforward, they are no longer challenged in each case. DNA typing evidence also differs from polygraph results, the specific admissibility of which is not explicitly challenged since, at least in Canada, polygraph testing has failed the general admissibility test due, in part, to its high error rate.

<sup>115</sup> Schmitz, *loc. cit.*, footnote 14.

<sup>116</sup> *Supra*, footnote 32.

<sup>117</sup> *Supra*, footnote 36.

<sup>118</sup> Schmitz, *loc. cit.*, footnote 14.

<sup>119</sup> Levy, *loc. cit.*, footnote 30.

<sup>120</sup> Cheney, *loc. cit.*, footnote 43.

### A. *The Standard of Admissibility*

Evidentiary rules are aimed at ensuring the reliability of evidence produced by the forensic process before it is presented to the trier of fact. The primary goal of the legal process as a whole, however, is to serve the interests of justice; in contrast to science, law does not merely seek to establish truth. Samuel Freedman, formerly Chief Justice of Manitoba, states:<sup>121</sup>

The objective of a criminal trial is justice. Is the quest of justice synonymous with the search for truth? In most cases, yes. Truth and justice will emerge in a happy coincidence. But not always. Nor should it be thought that the judicial process has necessarily failed if justice and truth do not end up in perfect harmony. Such a result may follow from law's deliberate policy. . .

Healy specifies that:<sup>122</sup>

If it is the function of positive rules of evidence to mediate conflicts between the interests of truth and justice, the nub of the political issue is to define the point at which such conflicts arise.

The admissibility standard is based on a determination of the point at which truth, or the disclosure of evidence, conflicts with justice and on an assessment of the respective functions of the trier of law and the trier of fact.<sup>123</sup> Admissibility of evidence is a question of law, collateral to the ultimate determination of guilt or innocence. In ruling on admissibility, the judge must both ensure that the jury is not deprived of information necessary to its determination of guilt or innocence, and is capable of assessing the weight of the evidence presented to it. While guilt or innocence must be established beyond a reasonable doubt, the standard of proof applicable to the admissibility of evidence is not settled in Canadian criminal law.

In cases where conviction hinges on the admissibility of a certain evidentiary element, as will often be the case with DNA typing evidence, the standard of proof takes on critical importance. On this point, it is interesting to consider the admissibility rules developed in respect of confessions.<sup>124</sup> Because a confession is considered to be hearsay when tendered by the prosecution, the prosecution must show that the statement

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<sup>121</sup> S. Freedman, *Admissions and Confessions*, in R. Salhany and R. Carter, (eds), *Studies in Canadian Criminal Evidence* (1972) 95, p. 99, cited in P. Healy, *The Quantum Required for Proof of Voluntariness of Confessions* (1985), 17 *Ott. L. Rev.* 132, at pp. 159-160.

<sup>122</sup> *Ibid.*, at p. 160.

<sup>123</sup> Healy, *ibid.*, at p. 159, writes that "[t]he division of responsibility in criminal cases between trier of law and trier of fact signifies the guiding principle that justice does not always flow from truth".

<sup>124</sup> For the purposes of this article, the term "confession" can be defined as an extra-judicial statement, whether inculpatory or exculpatory, made by the accused to a person in authority, see Healy, *ibid.*, at p. 132, note 1.

is admissible as an exception to the hearsay rule, by proving that it was made voluntarily.<sup>125</sup> Canadian courts have tended to require that the prosecution prove this preliminary fact, namely the voluntary nature of the statement, on the basis of proof beyond a reasonable doubt.<sup>126</sup> It is believed that the higher standard deters law-enforcement officials from eliciting non-voluntary confessions. Furthermore, since a finding of guilt usually follows the presentation of a confession by the prosecution, the same standard should apply to both the confession and the proof of guilt. Otherwise, a person could be convicted on the basis of evidence which had not been proven beyond a reasonable doubt. On this issue, Cross writes:<sup>127</sup>

Where the issue is one which must be decided once and for all by the judge, it would seem proper to hold that, in civil cases, the preliminary fact must be proved to the satisfaction of the judge on a preponderance of probability and that, in criminal cases, when the evidence is tendered by the prosecution, such fact must be proved beyond reasonable doubt.

Since DNA typing results will often lead to guilty pleas or conviction of the accused at trial, it can be argued that their admissibility should depend upon proof beyond a reasonable doubt. Early Canadian cases have not, however, adopted a clear position on the issue of DNA typing admissibility. In *R. v. McNally*,<sup>128</sup> where the admissibility of DNA typing evidence was questioned for the first time in Canada, Flanigan Sr, D.C.J. admitted the evidence and held that it was simply another factor for the jury to weigh in determining guilt or innocence. He recognised that the technology was, at the present time, a high profile topic in forensics, but considered that the evidence generated was “no different from evidence of fingerprints, fibre expertise, blood analysis . . .”, and was on no greater or lesser footing than any other expert testimony presented to the trier of fact.

In *R. v. Keenan and Hunt*,<sup>129</sup> Misener J. held that “[t]he expertise that the witness purports to have must be an expertise that is recognized, generally received in the scientific community”. The real difficulty, in his opinion, lay in determining the degree of proof required to support a finding of general acceptance within the scientific community. He found that if,

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<sup>125</sup> Healy explains, *ibid.*, at p. 161, that “it is assumed that a voluntary statement made by an accused against his own interest is probably true, or at least sufficiently untainted by inducement to allow a jury to rely upon the content of the statement in assessing the guilt of the accused”.

<sup>126</sup> *R. v. Pickett* (1975), 28 C.C.C. (2d) 297 (Ont. C.A.).

<sup>127</sup> R. Cross and C. Tapper, *Cross on Evidence* (7th ed., 1990), p. 172. On this point, Phipson states that there is “. . . surprisingly . . . little authority” on the issue of the standard of proof applicable to the admissibility of evidence in criminal trials; J.H. Buzzard, R. May and M.N. Howard, *Phipson on Evidence* (14th ed., 1990), para. 4-37.

<sup>128</sup> *Supra*, footnote 32.

<sup>129</sup> *Supra*, footnote 35.

in the end, guilt or innocence depended solely on that evidence, the jury had to be satisfied beyond a reasonable doubt of the acceptance of the science. To impose that standard of proof in the qualifying process was, in his opinion, a confusion of the functions of triers of fact and law.

Defence counsel must therefore impress upon the judge, as trier of law, the effect which DNA typing evidence will have on the jury's determination of guilt. With DNA typing results, there appears to be no discrete preliminary fact, comparable to the voluntary nature of a confession, to which a legal standard, such as proof beyond a reasonable doubt, can be applied. Ultimately, defence counsel must argue that the results should not be presented to the jury unless all issues raised by the defence fail to cast any reasonable doubt upon their reliability.

### B. *Points of Challenge*

In *R. v. Bourguignon*,<sup>130</sup> Flanigan J. stated:

It is . . . unfortunate that there are no statutory guidelines, whether incorporated in the *Evidence Act* or the *Criminal Code*, to assist and guide the courts on the admissibility of DNA typing evidence, such as there exists for blood alcohol results, whether through the use of breath samples or blood samples.

The main points which should be examined by the defence in challenging the specific admissibility of DNA typing results include the following.

#### 1. *Chain of Custody and Bias*

When DNA typing was first implemented in the RCMP laboratory, samples were subjected to the same collection and preservation procedures as other biological material.<sup>131</sup> Eric Lander considers that "[i]n view of the infallibility with which many jurors regard DNA fingerprinting . . . stricter sample-handling procedures should be required".<sup>132</sup> In *R. v. McNally*,<sup>133</sup> Gary Shutler admitted that he had no control over what happened to the material prior to its arrival at the RCMP laboratory and admitted that human error could result in a false positive. Although the RCMP may soon implement new sample collection guidelines, the defence should highlight any weaknesses in the chain of custody.

To determine if a match exists between the DNA profiles of different samples, autoradiographs are evaluated both visually and by computer-assisted image analysis, with a computer scanning the DNA image and measuring the individual bands. The RCMP declare a match only if one is found both visually and by computer.<sup>134</sup> While the automation of the

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<sup>130</sup> *Supra*, footnote 36.

<sup>131</sup> Shutler, *loc. cit.*, footnote 12, at p. 6.

<sup>132</sup> *Loc. cit.*, footnote 50, at p. 505.

<sup>133</sup> *Supra*, footnote 32.

<sup>134</sup> Dr. Bilous, personal communication.

match determination process is said to ensure uniform interpretation of results, it is important to note that scientists are informed of the facts of the case and are aware of "traditional" evidence linking a suspect to the crime.<sup>135</sup> Bias, real or apparent, is therefore possible.

Commercial interests can also give rise to bias. Ford and Thompson consider that what is "most troubling of all is the laboratories' collective reluctance to acknowledge reasonable concerns about their objectivity".<sup>136</sup> They argue that commercial laboratories have a "vested interest in a finding of guilt" and that technicians working for them are aware that their companies have been retained by law-enforcement officials who hope that two samples will match.<sup>137</sup> Commercial laboratories, however, also have an important interest in maintaining a strong reputation for reliability, on which the value of their evidence depends.

## 2. Condition of the Sample

Blood or semen, which remains undisturbed for a long time, can mix with the genetic material of microorganisms and chemicals such as clothing dyes. Contaminants can also affect DNA digestion by attaching to the restriction enzyme, causing it to slice the DNA at the wrong place, hence altering the size of the restriction fragments and their rate of migration through the gel. Contaminants can affect probing, either by locking onto the human DNA and preventing the probes from attaching, or by binding to the probes themselves, giving rise to spurious bands on the autoradiograph. The RCMP claim that contaminant interference can usually be detected visually and, more importantly, gives rise to inconclusive, rather than incorrect results. The defence should nevertheless question the scientist as to the age of the sample, the surface from which it was collected, the environment to which it was exposed and the form, whether dry or moist, in which it was kept. The defence should also enquire as to whether samples from more than one source were kept in close proximity to one another, giving rise to possible sample contamination.

## 3. Bandshifting

Bandshifting poses an important challenge to match determinations. It occurs when samples in one lane travel down the gel more quickly or more slowly than samples in other lanes and is usually caused by inconsistencies in electrophoresis conditions such as nonuniformity in the gel or sample contamination.<sup>138</sup> The RCMP control for bandshifting using

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<sup>135</sup> The RCMP argue that scientists must be aware of these facts to assess the forensic significance of an exhibit.

<sup>136</sup> *Loc. cit.*, footnote 102, at p. 42.

<sup>137</sup> *Ibid.*, at p. 43.

<sup>138</sup> P. Knight, *Biosleuthing with DNA Identification* (1990), *Bio/Technology* 8:505, at p. 507.

a monomorphic marker, that is, a probe which binds to a DNA fragment which is the same size in all people. In theory, if such a locus is displaced, bandshifting is said to have occurred. The RCMP have published peer-reviewed studies on this subject and report that bandshifting is rarely seen in their analyses; they have decided to treat bandshifted results as inconclusive, or totally exclusive.<sup>139</sup>

#### 4. *Quality Control and Quality Assurance*

Different controls have been put in place by the RCMP to ensure the reliability of their results. An internal standard, whose profile is known only to Quality Control personnel, is run with each analysis, as a means of testing both the system and the analyst. If the analyst incorrectly determines the DNA profile of the known sample, an inconclusive result is automatically declared. A monomorphic control probe, of known size, and a monomorphic marker for male DNA, are also run with each sample.<sup>140</sup> The RCMP also operate a "buddy system" whereby the scientist who performs the analysis is responsible for the final result, and testifies in court, but can ask for interpretive help from a second scientist with whom he or she is paired. Proficiency tests are also conducted to test the performance of the analyst. In *R. v. McNally*,<sup>141</sup> Dr. Wayne testified that Gary Shutler had performed such a test, with samples sent to him from the RCMP laboratory in Winnipeg. He was given a number of samples and had to match up the samples which came from the same person. Dr. Wayne specified that proficiency testing does not measure how well DNA typing itself works but simply points out whether an analyst is likely to, for example, mix up the tubes. He added: "It's a way to flag the efficiency of the operator of the system, not the system itself."

The New York State Legislature was the first to approve a bill to regulate and license DNA testing laboratories.<sup>142</sup> Permits are issued by the state to laboratories and without such permit, a laboratory cannot submit DNA evidence to a New York court. A scientific review board ensures that the methodology, population databases and probability surveys used by the laboratory are sound. The bill, which applies to both commercial laboratories and the FBI, was supported by Lifecodes, but opposed by

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<sup>139</sup> If any probe gives rise to a non-match between the known and unknown samples, an exclusion is declared, even if subsequent probing shows a slight bandshift. However, if all the probes give rise to a match, and a bandshift is detected, the analysis is held to be inconclusive. The main controversy with respect to bandshifting is the application of correction factors. These are not applied by the RCMP.

<sup>140</sup> D. Deutscher and H. Leonoff, *Identification Evidence* (1991), pp. 169-170, briefly describe the control probes used by the RCMP.

<sup>141</sup> *Supra*, footnote 32.

<sup>142</sup> Bill A.11073 was approved by the New York Assembly on June 29, 1990 and by the State Senate on July 1, 1990.

the New York State District Attorneys' Association which argued that it would make it more difficult to introduce DNA evidence. Although it might be difficult to envisage a similar procedure in Canada, the monopoly of government laboratories remains worrisome, especially in light of the high number of guilty pleas which the evidence generates.

### C. *The Admissibility of Probability Results*

In challenging the admissibility of DNA typing evidence, separate arguments must be directed at the probability figures. Firstly, the accuracy of the probabilities should be challenged. It should then be argued that, regardless of their accuracy, probability results should not be presented to the jury since, especially when the case turns on identification, they usurp its very function.

#### 1. *The Product Rule and Substructure*

The final result of DNA typing is the probability of a random match, that is, the probability that a person picked randomly from the population would have a DNA profile identical to that generated from the forensic sample. The way in which this final result is obtained must not be ignored in challenging DNA typing evidence. For example, in its report on DNA typing, the U.S. Office of Technology Assessment finds evidence derived from the DNA analysis to be "reliable and valid when properly performed and analysed by skilled personnel"<sup>143</sup> but does not consider "the vexing question of the interpretation of DNA test data".<sup>144</sup>

According to the product rule, the frequency of occurrence of independent events can be multiplied to determine the frequency of occurrence of their aggregate. The fundamental requirement of the product rule is that the individual events be independent. In DNA typing, this would mean that the occurrence of genetic events at any one locus would have to be independent of events at other loci, and the alleles identified by the set of probes independent of one another. The product rule could then be used to calculate the probability of a coincidental match, which probability would decrease as the number of matching bands, and the rarity of those bands, increased.

While databases determine the population frequency of the alleles identified by the probes, population geneticists do not agree, however, as to whether the product rule can be applied to DNA typing results. Some argue that certain population subgroups have fewer alleles than found in the population at large, and that within these subgroups some combinations of bands are more common than predicted by applying the product rule to the allele frequencies of the general population. Proponents of the

<sup>143</sup> *Loc. cit.*, footnote 19.

<sup>144</sup> Anderson, *ibid.*, at p. 484. (Emphasis added).

substructure hypothesis<sup>145</sup> argue that allele frequency depends upon the ethnic ancestry of the particular subpopulation and separate databases must be set up "in which members of various racial and ethnic groups, and people from different geographical areas, can be separated and compared".<sup>146</sup> If a correlation exists between two alleles, such that people with allele A are more likely than the general population to have allele B, the product rule underestimates the probability of having alleles A and B. Thompson and Ford state that "[t]o simply assume, without empirical verification, that distinct alleles are independent would allow misleading statistical testimony which greatly underestimates the probability of a coincidental match".<sup>147</sup>

In *R. v. McNally*,<sup>148</sup> Dr. Wayne specified that "the rate limiting step in getting ready to go to Court is to be able to put a significance to your results, the databases themselves". In Canada, the RCMP have two Caucasian data banks. One was put together in Vancouver and includes approximately 360 randomly selected people; the other was put together in Ottawa, with about 500 Armed Forces personnel and dependents living in the Kingston area. The RCMP have also put together a data bank including about 200-300 West Coast Indians,<sup>149</sup> and another including about 200 Native Indians from Northern Ontario.<sup>150</sup> The Laboratoire de Police scientifique has carried out a population study of white French Caucasians in the Montréal area and Léo Lavergne is presently working on samples from the Saguenay and Abitibi regions.

In *R. v. McNally*, Dr. Wayne explained, on cross-examination, that a database had to be regionally representative and, if you are doing work in the Ottawa area, "[y]ou wouldn't make a database on Tibetan monks". He stated that the database used in *McNally* was "a largely Caucasian database", with no breakdown between Francophone and Anglophone Caucasians, even though "there may be slight changes in allele frequencies, either more common or less common".

In *U.S. v. Yee*,<sup>151</sup> Dr. Lewontin, a Harvard population biologist, testified that two factors contributed to substructure within the North American

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<sup>145</sup> Substructure can be defined as "variation in frequencies within a definable segment of a larger heterogenous population"; *U.S. v. Yee*, *supra*, footnote 66, at p. 37.

<sup>146</sup> Thompson and Ford, *loc. cit.*, footnote 102, at p. 86.

<sup>147</sup> *Ibid.*, at p. 82.

<sup>148</sup> *Supra*, footnote 32.

<sup>149</sup> The RCMP are also presently working on another sample of Indians from the West Coast.

<sup>150</sup> This information was in part provided to me through personal communication with George Carmody, a population geneticist at Carleton University, who works as a consultant with the RCMP and the Laboratoire de Police scientifique, and who testified as a Crown witness in the Legere trial.

<sup>151</sup> *Supra*, footnote 66, at pp. 37-38.

Caucasian population: (1) "the relatively recent arrival of the European ancestors of a sizable segment of the American Caucasian population", and (2) his view that inter-ethnic group mating is not as extensive as may be believed ("i.e., most people marry within their own neighbourhood"). In *People v. Castro*,<sup>152</sup> Eric Lander, a mathematician and geneticist at Harvard University, disputed the one in 189 million probability. He argued that a different set of population statistics should have been applied since the suspect and the victim were both Hispanic. He claimed that certain allele combinations could be more common among the Hispanic population than among the population of the United States as a whole, and that the probability could be reduced to as low as one in 24.<sup>153</sup>

In *U.S. v. Yee*, experts for the defence testified that the impact of substructure on the Caucasian database was unknown, that probability estimates derived from it "[were] too speculative to be acceptable scientifically",<sup>154</sup> and that, overall, the method used by the FBI to estimate the probability of a match was not generally accepted in the scientific community.<sup>155</sup> In response to the prosecution's argument that the conservative measures used by the FBI corrected for substructure, the defence responded that these measures had originally been adopted to correct for resolution difficulties and Dr. Lander stated that "you can't . . . penalize yourself on "A" to make up for a problem of "B"; it's apples and oranges".<sup>156</sup> The court nevertheless concluded that even if substructure existed and caused substantial variation in VNTR frequency, there was "no reasonable or troublesome likelihood"<sup>157</sup> that the frequency difference "would be dis-favourable to the defendant or not average out".<sup>158</sup> The court held that:<sup>159</sup>

Limitations on the state of our understanding of the presence and effect of ethnic-dependent variations among VNTRs is . . . a matter relating to certainty, and not a circumstance that causes the FBI's database to produce probability estimates on the basis of speculation.

## 2. Trial by Probability

Especially when a case turns on identification, probability figures can appear conclusive of the guilt of the accused. Tribe explains that although the probability of a coincidental match does not "measure the probability

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<sup>152</sup> *Supra*, footnote 16.

<sup>153</sup> Ford and Thompson, *loc. cit.*, footnote 102, at p. 42.

<sup>154</sup> *Supra*, footnote 66, at p. 20.

<sup>155</sup> *Ibid.*, at p. 41.

<sup>156</sup> *Ibid.*, at p. 42.

<sup>157</sup> *Ibid.*, at p. 51.

<sup>158</sup> *Ibid.*, at p. 117.

<sup>159</sup> *Ibid.*

of the defendant's innocence", many jurors "would be hard-pressed to understand why not".<sup>160</sup>

Confusion between the probability of occurrence of a number of characteristics (in DNA typing, the probability of a coincidental match between two prints) and the probability of a suspect's innocence has been coined "the prosecutor's fallacy". This fallacy, exploited fully by commercial laboratories, also seems to have misled certain commentators. Gelowitz states that:<sup>161</sup>

Even with a single probe, the odds against a chance match are so great that the legal standards of proof, criminal and a fortiori civil, are overwhelmed. The magnitude of these odds means, in practical terms, that DNA fingerprints provide *absolute certainty* in the identification of individuals.

Similarly, Petrosinelli states that "[t]his estimation [of a coincidental match] is crucial to the finder of fact in a criminal trial because it speaks to whether the prosecution has met its burden of proving the defendant's guilt beyond a reasonable doubt".<sup>162</sup>

McCormick states that, especially when there is no other evidence to go on, the presentation of probability evidence "may force a quantification, and thence a degradation, of the burden of persuasion or the presumption of innocence".<sup>163</sup> In *State v. Carlson*,<sup>164</sup> the court held that:

Testimony expressing opinions or conclusions in terms of statistical probabilities can make the uncertain seem all but proven, and suggest, by quantification, satisfaction of the requirement that guilt be established "beyond a reasonable doubt".

Although probability evidence is used in presenting traditional blood testing results, the group within which a suspect is included, on the basis of these tests, is much larger than that proposed with DNA typing. This narrowing, which gives DNA typing its great specificity, can also lead the jury to determine guilt based exclusively on the DNA evidence. Beeler and Wiebe state that because DNA tests are "so accurate and conclusive . . . jurors are less likely to overvalue their weight" and find that "[i]f only one in thirty billion persons possesses the suspect's DNA, jurors rightfully

<sup>160</sup> L.H. Tribe, *Trial by Mathematics: Precision and Ritual in the Legal Process* (1970-71), 84 Harv. L. Rev. 1329. Tribe refers to the oft-quoted case of *People v. Collins*, 438 P.2d 33 (Cal. S.C., 1968), where the police apprehended a couple which fitted eyewitness descriptions. The prosecution proposed six individual frequency figures (for example, the probability of a man with a moustache (1/10), a girl with a ponytail (1/10), an interracial couple in a car (1/1000), etc.) to which a mathematician applied the product rule. The expert found that there was 1 chance in 12 million for any couple to possess these distinctive characteristics and concluded that "the chances of anyone else besides these defendants being there . . . is something like one in a billion"; 438 P.2d 33, at p. 37.

<sup>161</sup> *Loc. cit.*, footnote 15, at p. 127. (Emphasis added).

<sup>162</sup> *Loc. cit.*, footnote 17, at pp. 316-317.

<sup>163</sup> McCormick, *op. cit.*, footnote 52, p. 652.

<sup>164</sup> 267 N.W. 2d 170, at p. 176 (Minn. S.C., 1978).

conclude that the DNA tests are conclusive".<sup>165</sup> They contrast blood tests with DNA tests and conclude that the latter "identify individuals so much more precisely than blood tests, approaching virtual certainty, that arguments of wrongful inclusion are not persuasive".<sup>166</sup>

The judge must seek to ensure that the jury is able to assess the weight of the evidence and combine it with the rest of the evidence presented. For example, the jury could be instructed as to the significance of the probability evidence, in terms such as the following:<sup>167</sup>

... the frequency estimate merely establishes that the defendant is one member of a class of persons who have the incriminating characteristics. The distribution of these characteristics in the population at large simply determines whether this class of persons whom the scientific evidence would identify as a possible offender is large or small.

Alternatively, the judge could limit the scope of admissibility of the DNA evidence. As Phipson states, the reasonable and fair administration of justice will "sometimes lead to the court being content with evidence which, though logically relevant, is not logically conclusive".<sup>168</sup>

In *R. v. Bourguignon*,<sup>169</sup> Flanigan J. rejected the Crown's argument that statistical probabilities went to weight, and not admissibility, and excluded the evidence which, in his words, attained "the astronomical combination of one in 55 million". He held that the prejudicial effect of the evidence outweighed its probative value and that it would, at this time, overwhelm Canadian juries. He concluded that "Dr. Wayne's opinions as they relate to the theory of probabilities [were] inadmissible in law". When asked if two unrelated people could match, Dr. Wayne could only answer that, in his opinion, the likelihood of a chance match was extremely low. Flanigan J. added, however, that if the proven facts were referred to a "probabilist", that is, an expert distinct from the forensic expert, this person could "give an opinion on the application of the theory of probabilities to the matter at hand".

#### D. Consent Requirement

Evidence obtained in violation of the Canadian Charter of Rights and Freedoms<sup>170</sup> can be excluded on the basis of section 24. The manner in which samples used in DNA typing are obtained therefore represents

<sup>165</sup> L. Beeler and W.R. Wiebe, *DNA Identification Tests and the Courts* (1988), 63 Wash. L. Rev. 903, at p. 950.

<sup>166</sup> *Ibid.*

<sup>167</sup> McCormick, *op cit.*, footnote 52, p. 655. McCormick used this as an example of a clarification which could be brought by defence counsel.

<sup>168</sup> Buzzard, May and Howard, *op. cit.*, footnote 127, para. 7-04.

<sup>169</sup> *Supra*, footnote 36.

<sup>170</sup> Constitution Act, 1982, Part I.

an additional ground of challenge. Following the *Parent* decision, a commentator observed:<sup>171</sup>

... even if DNA genotyping is everything and more its proponents claim, it may prove to be of little use if important Charter rights must be violated to obtain samples for testing.

In *R. v. Dymont*,<sup>172</sup> the Supreme Court of Canada ruled on the admissibility of evidence derived from a blood sample obtained from the accused in an impaired driving case, prior to the enactment of specific Criminal Code provisions dealing with this issue. The court held that the taking of a sample, without the consent of the accused, was a seizure within the meaning of section 8 of the Charter<sup>173</sup> and breached the individual's privacy interests in his or her blood. La Forest J., in the majority, writing for himself and Dickson C.J.C., held that "the use of a person's body without his consent to obtain information about him, invades an area of personal privacy essential to the maintenance of his human dignity".<sup>174</sup> He added that section 8 is intended to achieve a balance between claims to privacy and "other societal needs, and in particular law enforcement".<sup>175</sup>

The Law Reform Commission of Canada<sup>176</sup> has considered "the role that an accused person or criminal suspect should be required to play in the gathering of information that may ultimately be used to establish his or her guilt in a criminal case". It found blood sampling to be legal, but specified that it required the consent of the individual.<sup>177</sup> Although the Commission recently modified its approach to procedures in respect of the person, it did not directly modify its position with respect to blood sampling. The Commission reiterated the need for increased statutory regulation of modern investigatory techniques in respect of the person, calling for clarification of the procedures which may be used, how they should be performed, and clear definition of the rights and obligations of prospective subjects.<sup>178</sup>

In *R. v. McNally*,<sup>179</sup> the accused initially refused to volunteer a blood sample but subsequently changed his mind. He maintained his innocence

<sup>171</sup> P.J. Knoll, *Parent: An Auspicious Beginning for DNA Genotyping (Fingerprinting) in Canada* (1988), 65 *Alta L.R.* (2d) 26, at p. 38.

<sup>172</sup> *Supra*, footnote 1.

<sup>173</sup> S. 8 reads: "Everyone has the right to be secure against unreasonable search and seizure."

<sup>174</sup> *Supra*, footnote 1, at pp. 431-432 (S.C.R.), 516 (D.L.R.).

<sup>175</sup> *Ibid.*, at pp. 428 (S.C.R.), 513 (D.L.R.).

<sup>176</sup> *Op. cit.*, footnote 87, p. 3.

<sup>177</sup> *Ibid.*, p. 3.

<sup>178</sup> Law Reform Commission of Canada, Report No. 33: Report on Recodifying Criminal Procedure, Vol. 1: Police Powers, Title 1: Search and Related Matters (1991), pp. 58-59.

<sup>179</sup> *Supra*, footnote 32.

and provided blood, hair and saliva samples. Ian McKechnie, McNally's lawyer, considers that advising a client as to whether to give a sample is very difficult and forces the lawyer to confront his or her client. Although his general approach would be to counsel against it, he states: "I would probably advise the client that it's their choice as to whether they give samples: that if it's not them, the test will exonerate them; and if it is them that the test will convict them. It's almost black and white."<sup>180</sup>

Dr. Wayne considers that "the approach taken by the defence Bar will determine the fate of DNA testing in the short-term".<sup>181</sup> He states that if defence counsel never allow their clients to give a blood sample, they will, in effect, "handcuff the technology".<sup>182</sup> If all lawyers adopt such a position, "the only time we are going to get blood standards is from people before they see their lawyers".<sup>183</sup> The RCMP have submitted a proposal to the Minister of Justice, recommending the adoption of legislation to enable acquisition of two of the following sample types from homicide and sexual assault suspects: blood, hair root sheaths, buccal swabs and saliva.<sup>184</sup> Until such legislation is enacted, the conditions under which DNA typing samples were obtained should be carefully considered by the defence.

### Conclusion

This article has focused on the introduction, in court, of evidence derived from novel DNA typing technology. At the risk of minimising the impact of my work, I submit that the debate should not be occurring at this level. The concerns raised relative to DNA typing and its use in criminal trials must be addressed. But these questions must be part of a larger enquiry, and addressed by society as a whole, namely through its elected representatives.

First, we must decide whether, independently of reliability considerations, DNA typing should become part of the administration of criminal justice in this country. In this regard, an assessment of the potential for abuse of the technology, and its impact on the civil liberties of suspected persons, is needed. Equally, the high financial costs of introducing DNA technology in court must be considered. Whether used to equip and staff government laboratories, carry out population studies or hire Legal Aid experts, funds spent in this area will necessarily be taken away from other criminal law projects. Finally, a system of priority concerning the use of

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<sup>180</sup> Schmitz, *loc. cit.*, footnote 14.

<sup>181</sup> *Ibid.*

<sup>182</sup> *Ibid.*

<sup>183</sup> *Ibid.*

<sup>184</sup> Gaudette, *loc. cit.*, footnote 11.

DNA typing in individual cases must be implemented. This decision, though informed by scientific opinion, should not be left to the case-by-case discretion of law-enforcement agencies and Crown prosecutors.

Secondly, the legislators must examine the effect of DNA typing results on criminal trials in general, and on the role of the trier of fact, namely the jury. Specifically, the standard of proof applicable to DNA typing results, and the use of probabilities in determining guilt or innocence, must be considered. The presentation of DNA typing evidence in Canadian courts highlights the absence of existing guidelines with respect to the admissibility of evidence, in general, and applicable standards of proof, in particular. While this article cannot compensate for the absence of legislative action in this area, it will, it is hoped, provide a background for an examination of the issue.

If the strength of an organisation lies in its ability to cope with change, DNA typing surely presents an important challenge to the Canadian criminal justice system. The law cannot afford to be reactive when the lives of people are being changed forever. The limited objectives and vision of Crown and defence court battles serve the interests of no one. A broader assessment of the benefits and prejudicial effects of DNA typing, on all members of society, is urgently needed. The proper administration of justice, in a free and democratic society, demands no less.