Beyond the Walls of the Laboratory: An Analysis of Defence Counsel’s Access to DNA Evidence Within the Canadian Criminal Justice System

by

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B.A. University College of the Fraser Valley, 1996

THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

in the School of Criminology

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SIMON FRASER UNIVERSITY

November 1997

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Abstract

The development of new and controversial techniques such as DNA analysis has turned courtrooms into scientific laboratory forums. Canadian defence counsel, stunned by the sophisticated and technical jargon associated with DNA-related testimony, rarely challenge the expert witnesses. The admission of this scientific evidence has a profound impact on the defendant's right to an adequate defence. It is also a difficult task to find experts who are able to carry out independent examination of the samples. Moreover, access to resources, which could enhance the challenge of the evidence in court, is limited.

The principal aim of this thesis was to evaluate the problems faced by defence lawyers who deal with cases involving DNA evidence. A preliminary survey of forensic scientists, Crown counsel, and other members of the criminal justice system was conducted. This quantitative data showed the differences between Crown and defence counsel in their knowledge and opinions of DNA evidence. Subsequently, 22 interviews were undertaken with defence counsel. The findings suggest that defence counsel find DNA evidence overwhelming, and that they rarely contest the evidence in court. This is partially due to their lack of access to evidence; their inability to understand what evidence is provided; the unavailability of independent experts needed to conduct DNA testing; and the failure of prosecutors to fully disclose their results. As a result, defence lawyers have difficulty in challenging DNA evidence in court.

It is my recommendation that forensic scientists be limited in their interactions with the police, which in turn will decrease the potential for bias in the subjective components of DNA analysis. In addition, I propose that
defence lawyers be granted sufficient time and resources to locate independent experts, who can thoroughly examine DNA evidence and who can testify on behalf of accused persons in the Canadian criminal court system.
Acknowledgements

I wish to extend my sincere gratitude to the following people: Dr. Ron & Catherine Dougan; Deborah Miller and Jay Wynans, and Rosemarie Gilchrist, for editing, listening and guiding me along; Dr. Don and Jan Cook, for loving me as their own; and my boss, Dr. Dean Vause, without whom I would never have believed that I could complete a master's degree. Thank you so much for helping me see the light, and more so for helping me find myself. I thank Dr. Lauren McIntyre & Dr. Bruce Weir, for helping me make sense of DNA and DNA statistics. Heather Cook, Danielle Aubury, and Anna McCormick, thank you for being in my life, David Blakeney, for limitless support and understanding my dream, and Dr. John Winterdyk, for believing in me and for being my mentor. Thanks also to Dr. Darryl Plecas, Doug King, and Martha Dow, who all assisted me in the beginning of my research, and Frédéric Tessier and Rémi Poirier, for helping with printing and endless amount of guidance using my computer to its fullest. My senior supervisor, Joan Brockman, for her ongoing patience, guidance, support, time and invaluable critique. Dr. Robert Menzies, for teaching me so much about qualitative research and for being a member of my committee. Dr. William C. Thompson, for his avid interest in DNA evidence and its impact on the defendant’s rights and for being my external examiner. Dr. Bill Glackman, for helping me with some of the statistical aspects of this thesis. The RCMP Forensic Laboratories, Helix BioTech, and the Calgary Police Service, for their access. Mr. Kenneth Mayberry, the Pennsylvania State Police Crime Lab (DNA Unit), for providing me with invaluable information. And last by not least, to all my participants, who ultimately made this work possible.
To my nephews Alexander and Lucas Støuring Holmgren
# Table of Contents

- Approval  
  - Abstract  
  - Acknowledgements  

## CHAPTER 1
**Introduction and Background**
- 1.1 History of Identification  
- 1.2 DNA: What is it?  
- 1.3 DNA: How Does it Work?  
- 1.4 DNA Fingerprinting  
  - 1.4.1 The Technology: RFLP and PCR-based Techniques  
- 1.5 Overview of Forthcoming Chapters  

## CHAPTER 2
**DNA Evidence: A Dance With Power**
- 2.1 Introduction  
- 2.2 The Scientific Experts: The Knowers  
  - 2.2.1 Experts: A Necessity  
  - 2.2.2 Scientific Experts: The Production of Knowledge  
- 2.3 The State Monopoly: A Look at the Crown, the Experts, and the Police  

## CHAPTER 3
**Method and Data Collection**
- 3.1 Introduction  
- 3.2 Quantitative Data Collection  
- 3.3 Qualitative Data Collection  
- 3.4 Limitations of the Study  

## CHAPTER 4
**Quantitative and Qualitative Findings**
- 4.1 Introduction  
- 4.2 Questionnaire Returns  
- 4.3 Quantitative Findings  
- 4.4 Qualitative Findings: In Their Own Words  
  - 4.4.1 Access to Assessment of the Actual DNA Evidence  
  - 4.4.2 Access to Independent Expert Witnesses  
  - 4.4.3 Access to Full Disclosure of DNA Evidence  
  - 4.4.4 Challenging DNA Evidence in Court  

## CHAPTER 5
**Discussion and Conclusion**
| APPENDIX A | Timeline of DNA Discoveries | 118 |
| APPENDIX B | Glossary | 121 |
| APPENDIX C | Diagram of PCR Technology | 127 |
| APPENDIX D | Diagram of RFLP Technology | 128 |
| APPENDIX E | Forensic DNA Analysis Legislation | 129 |
| APPENDIX F | TWGDAM Quality Assurance Control Guidelines | 135 |
| APPENDIX G | Quantitative Questionnaire | 140 |
| APPENDIX H | RCMP DNA Testimony as of Nov. 2, 1992 | 148 |
| APPENDIX I | Qualitative Questionnaire | 150 |
| APPENDIX J | Fax to Defence Counsel | 154 |
| References | | 155 |
List of Tables

Table 1
Returns of Questionnaires 63

Table 2
Results of Questionnaire Questions: The DNA Process 64

Table 3
Results of Likert Scale Questionnaire Questions 65
CHAPTER ONE

Introduction and Background

Since Britain's Dr. Alec Jeffreys 'discovered' forensic DNA analysis as a means of identification in 1985\(^1\) (Jeffreys et al., 1985), Canadian courts have followed timidly behind the American and British courts in grappling with the acceptance of forensic DNA analysis as admissible and reliable evidence (Chayko et al., 1991; Federico, 1991; National Research Council, 1992; Baird, 1992; Baker, 1993; Balding & Donnelly, 1994; Thompson, 1994).

In April of 1989, the first DNA case, *R. v. McNally*, was presented in the Canadian Criminal Justice System, which involved biological samples (semen stains) obtained from the victim's nightgown and bedspread. The DNA sample was shown, through expert witness testimony, to match that of the accused's blood, which had been voluntarily provided by the accused. The expert witness testified that the type of DNA pattern in this case could be found in less than 1 in 70 billion individuals in the general population. As a result, the accused changed his plea to guilty (*RCMP Forensic Laboratory Services Annual Review, 1989*: 10). DNA evidence cases were soon seen by courts in British Columbia (*R. v. Baptiste*); Alberta (*R. v. Parent*); Saskatchewan (*R. v. Kaysawaysemat*); Manitoba (*R. v. Crane*); New Foundland (*R. v. Young*); New Brunswick (*R. v. Legere*); Nova Scotia (*R. v. Borden*); and the Northwest Territories (*R. v. Lafferty*).\(^2\)

By 1994, the RCMP Forensic Laboratories across Canada had extracted DNA samples in a total of 590 cases, and had given expert testimony in 60

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\(^1\) Although the discovery of the 'DNA fingerprinting' technique is accredited to Dr. Alec Jeffreys, other DNA discoveries deserve credit. See DNA history timeline in Appendix A.

\(^2\) These cases are not necessarily the first cases in the specific provinces to have used DNA evidence. See citations for cases in the references.
cases, including preliminary hearings, voir dires, and trials. Although DNA evidence has been rejected or its admissibility strenuously questioned in Australia, the United Kingdom, and in the United States, it has been successfully attacked in relatively few cases in Canada (Lussier, 1992; Baker, 1993; Brodsky, 1993).

The mastery of modern scientific techniques, such as DNA analysis, is recognized as becoming an increasingly heavy burden for judges, who decide on the admissibility of scientific evidence (Gatowski et al., 1996:86). However, DNA evidence should also be recognized as being especially burdensome for defence counsel who, as this research will show, are the ones with the least scientific ammunition to combat or challenge the use of DNA analysis in deciding (proving) the legal guilt or innocence of an accused (Cohen, 1985:385).

The aim of this thesis is to analyze the problems a defence lawyer may face, both pretrial and at trial, when dealing with a criminal case involving DNA evidence. The following categories signify the difficulties that defence counsel encounter when faced with a DNA case: access to and assessment of the actual DNA evidence; access to independent expert witnesses and independent laboratories; full disclosure of DNA results; and challenging the DNA evidence in court. In order to fully appreciate these difficulties, however, some background on identification, DNA, and DNA fingerprinting is warranted.

1.1 History of Identification

Scientific procedures invented to identify specific individuals have a history of their own. The Bertillon measurement system, developed in France by Alphonse Bertillon in the latter part of the nineteenth century, is recog-
nized as the first truly scientific procedure which sought to establish an individual's identity through, primarily, the measurement of bodily dimensions, and unique features such as scars and other markings, which then resulted in the accused being photographed. The Bertillion system consisted of two essential components: the accurate and consistent measurement of a limited number of different body parts, which were then described and recorded with extensive clarity to ensure that these measurements could be understood in other parts of the world; and, a method of recovery of previous cases to more current cases (Rogers, 1986:14; Mercer, 1995:24).

The Bertillion measurement system was used by police around the world during the latter part of the nineteenth century (Rogers, 1986:13; Mercer, 1995:25). However, matching was a tedious task in that the technician was limited to visual comparisons. Nonetheless, it marked the beginnings of a much more sophisticated identification system.

The Canadian Criminal Identification Bureau was established in Ottawa in 1911 after five years of unsuccessful attempts. By this time, the fingerprinting system and the photograph had been fully adopted and had replaced the Bertillion system (Gibson, 1991:7; Mercer, 1995:25). In 1910, the entire inmate population of the Dominion penitentiaries had been fingerprinted and photographed. This organizational structure provided the advantage of obtaining fingerprints of all federally convicted inmates (Gibson, 1991:8). The Bertillion measurement system and the fingerprinting system marked the early history of Canadian identification techniques. Both of these systems were great technological achievements in their time. However, they have been supplanted by DNA fingerprinting which has become the latest example of how sophisticated instrumental techniques play a significant role in identifying and recognizing specific individuals accused of crime.
1.2 DNA: What is it?

Deoxyribonucleic acid (DNA), first identified in 1869 by Johann Freidrich Miescher, a German chemist, is an organic substance found primarily in the chromosomes that are structured within the nuclei of cells. In 1944, Avery, Macleod, and McCarty demonstrated that the DNA molecule could act as a carrier for genetic material. Previously, DNA had been dismissed as insignificant; it was believed that DNA was a polymer of a simple four-nucleotide repeated unit (McCarty, 1985; Watson & Tooze, 1981; Singer & Berg, 1991:30). It was, however, not until 1953 that two scientists, James Watson and Francis Crick, uncovered the actual structure of DNA, which marked the commencement of modern molecular genetics.

Watson and Crick’s discovery explained for the first time not only how this molecule could encode biological information, but also how the information could be precisely replicated during cell division, which they demonstrated using X-ray diffractions studies and molecular model building (Watson & Tooze, 1981; Robertson et al., 1990; Vernon & Selinger, 1990:4; Singer & Berg, 1991:23; Witkowski, 1991).

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4 Chromosomes are composed of chromatin and carry the genes, which determine the individual characteristics of an organism (i.e. human being) (Oxford Concise Dictionary of Biology, 1996). See also terms in glossary in Appendix B.
5 Molecules are considered the smallest physical unit of an element or compound, consisting of one or more atoms in an element and two or more atoms in a compound (Random House Dictionary, 1990).
6 A polymer is a substance having large molecules consisting of repeated units. See also definition for nucleotides.
Each person's individual characterization is determined by deoxyribonucleic acid (DNA), which is the only basis of genetic differences. DNA, for forensic purposes, is most commonly referred to as “typing,” “profiling,” and “fingerprinting,” which is “an extension of the forensic typing of blood that has been common for more than 50 years; it is actually an extension from the typing of proteins that are coded for by DNA to the typing of DNA itself” (National Research Council, 1992:1). Protein variation is the basis of blood groupings, tissue typing, and serum protein typing, which are all genetically

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8 This image is borrowed and altered from the following website: http://outcast.gene.com/ae/AE/GG/

9 Mitochondrial (mtDNA) DNA is another form of DNA, which has some advantages over nucleated DNA. Mitochondrial DNA is non-nucleated, and is inherited only from the mother (nucleated DNA is inherited from both parents). One of the main advantages of mtDNA is the thousand of copies found of it within the cell. Nucleated DNA is found only in two copies per cell. Current research also shows that mtDNA can be used to determine ethnicity of a person, since it appears that mtDNA is found in some ethnic groups and not others. This is, of course, the reason why mtDNA is of particular interest to forensic scientists (Wilson et al., 1993:68). However, for the purposes of this thesis, nucleated DNA is the area of focus, because mtDNA is just making its entry into the Canadian justice system, and around the world.
determined. However, with the explosive developments in molecular genetics, it is possible to study the individual differences from person-to-person in parts of DNA that are not involved in coding for proteins (National Research Council, 1992). The regions of the DNA molecule, which are not involved in coding for protein and which show the differences between individuals, are the primary loci used for forensic identification.

1.3 DNA: How Does it Work?

The characteristics of a living cell are determined by its genetic makeup; that is, by the instructions contained in a collection of biological messages called genes. Genes are passed on from one generation to the next, so that offspring inherit a range of individual traits from their parents. The complete genetic blueprint of an organism is contained within every cell of that organism. The coding system underlying the blueprint of genetic information of all cells is based on the substance deoxyribonucleic acid (DNA). Two types of cells, somatic cells and gametes, make up the human genome. "The term genome is used to describe the totality of the chromosomes unique to a particular organism (or any cell within the organism), as distinct from genotype, which is the information contained within those chromosomes (or DNA)" (Singer & Berg, 1991:22; Saferstein, 1995). The somatic cells comprise the vast majority of cells in the body. DNA is organized into forty-six complex structures called chromosomes, each of which contains a single DNA molecule.

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10 Loci is the plural word for locus, which relates to the position of a gene on a chromosome. So in this context we are talking about the areas of the genetic makeup that vary from individual to individual. The loci of interest also vary among testing laboratories. Single-locus probes are often used in forensic investigations, but are usually tested in at least five different locations as opposed to just one locus (see Jeffreys in Holland & Kyriacou, 1993:59) (see also glossary in Appendix B).

11 In one gene there are two alleles (alternative forms of a gene) one from each parent. One allele is often dominant to the other (known as the recessive) and determines which aspects of a particular characteristic the organism will display i.e. blonde hair and blue eyes.

12 The somatic cells include all the cells in the body, excluding the reproductive cells (Griffiths et. al., 1996).
The DNA chromosomes within each molecule are composed of two separate polynucleotide strands, each arranged with twenty-three pairs of homologous chromosomes. These comprise 22 pairs of autosomes\textsuperscript{13} and one pair of sex chromosomes\textsuperscript{14} (Chayko et al., 1991), which look like two wires twisted around one another. This structure is referred to as a double helix (Budowle et al., 1988; Vernon & Selinger, 1990:4). An individual inherits one strand from the father and the other from the mother\textsuperscript{15} (Chayko, 1991; Krawczak & Schmidtke, 1994; Saferstein, 1995; Griffiths, 1996).

![Illustration of a double helix](image)

Each DNA strand (half of the double helix) is a complex polymer\textsuperscript{16} consisting of four different, but related, monomer units\textsuperscript{17}. Each monomer unit consists of four nucleotides\textsuperscript{18} (Singer & Berg, 1991:36). The arrangement of these nucleotides (deoxyadenosine monophosphate (A), thymidine monophosphate (T), cytosine monophosphate (C), and guanine monophosphate (G)) forms the double helix.

\textsuperscript{13} Any chromosomes other than the sex chromosomes.
\textsuperscript{14} The sex chromosomes are XX in females and XY in males.
\textsuperscript{15} See supra footnote 11.
\textsuperscript{16} A polymer is a substance having large molecules consisting of repeated units. See also definition for nucleotides.
\textsuperscript{17} Also referred to as “building blocks” (Budowle et al., 1988:8).
phate (T), deoxycytidine monophosphate (C), and deoxyguanosine monophosphate (G)) varies among the hundreds of thousands of nucleotides located in the chromosomal DNA (Jeffreys et al., 1985; Kelly et al., 1987).

While the arrangement of the nucleotides may vary, the pairing, or "base-pairing" (Budowle et al., 1988; Weir & Gaut, 1993), of the two strands is, however, specific: adenine (A) in one strand will only bond with thymine (T) in the other strand, and cytosine (C) in one strand will only bond with guanine (G) in the other strand. Therefore, a double strand of DNA might look something like this:


Therefore the sequence of each individual strand can be known by knowing that of its partner. These four different nucleotides can, however, be attached in any order, which allows for an enormous array of different sequences in a single strand of DNA, that may be hundreds of thousands of nucleotides long (Budowle et al., 1988). This type of complementarity is the key to the information-transmitting capabilities of DNA, as these base-pairs on the DNA strand constitute the genetic code (Antibi & Fishlock, 1986: Thompson, 1993; Griffiths, 1996). The code of a gene can be anywhere from 100 to 5,000 base pairs. Thus, it would be impossible to sequence the entire genome code, which is approximately seven billion units long19 (Vernon & Selinger, 1990:4).

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18 Nucleotides are molecules composed of a nitrogen base, a sugar, and a phosphate group. Nucleotides are the basic building blocks of nucleic acid (Griffiths et al., 1996:871) (see also glossary in Appendix B).

19 However, approximately 90 per cent of the bases do not actually code for proteins (Vernon & Selinger, 1990:10).
Scientists are most interested in the "repetitious DNA" (Hope, 1990:27), which does not appear to sequence for anything in particular. These locations are called hypervariable regions and are typically between 15 to 20 bases long (i.e. GGGGGGAAAAAACCGA), and each region is repeated many times over. While the sequencing of these letters appears to be identical in individuals, there are certain regions that differ in each person (Smith, 1982; Jeffreys et al., 1985; Vernon & Selinger, 1990; Singer & Berg, 1991).

The hypervariable regions are what Alec Jeffreys used in 1984 to develop his probes for DNA fingerprinting.

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20 Sequences of DNA that are different for each individual.
21 Also referred to as "noncoding" regions (see Wyman & White, 1980. A highly polymorphic locus in human DNA. Proc. Natl. Acad. Sci. 77:6754-6758) and "minisatellites" (see Jeffreys in Holland & Kyriacou, 1993:51).
22 These regions differ in every individual with the exception of identical twins (Weir, 1996:5) and individuals who have had a bone marrow transplant. Bone marrow recipients adopt the DNA genotype of the donor; however, the patient maintains the original genotype for all other tissues and body fluids (i.e. semen) (see Knowlton et al., 1986; Ikemoto et al., 1990; Yam et al., 1987). However, it is also noted that DNA in semen is not testible when the individual has had a vasectomy (Gill et al., 1987). Nonetheless, the uniqueness among individuals stems from the variation in the precise chemical sequence of bases along our DNA molecules (i.e. GGGGGGAAAAAACCGA) (Jeffreys in Holland & Kyriacou, 1993:51).
1.4 DNA Fingerprinting

DNA evidence is complicated. The continuous and rapid evolution of DNA typing techniques, for purposes of forensic identification, makes it difficult to come to grips with these complicated testing techniques. Nevertheless, since each technique needs to be tested and evaluated separately, defence lawyers cannot and should not remain aloof from the science. Most typing techniques rely on the same basic principles and vary only in minor ways. In some instances, however, the scientific merits of each DNA typing method may vary; hence, acceptability of techniques must be evaluated accordingly. If, therefore, a substantial controversy exists among reputable scientists on a specific technique, then this technique is presumably not ready for court. Therefore, "judges are not expected to make any judgment on the scientific merits of the controversy, but rather on its existence" (Scheck, 1994).

DNA fingerprinting\textsuperscript{25} is, in essence, a technique which can be used to examine the sequence of the building blocks (the arrangement of CTGA) and, hence, to read the genetic code itself. The code is approximately three billion bases or building blocks long, yet it is possible to detect within this vast array, specific sequences 15 to 20 bases long (Jeffreys, 1988; Jeffreys, 1993; Weir & Gaut, 1995). Some sequences may be repeated many thousands of times; in

\textsuperscript{23} In order to differentiate between individuals (for forensic purposes) using a DNA profile, the only fragments (sequences) of interest are those from the highly polymorphic (variable) area of the DNA. In order to visually locate these fragments, a Probe is used. The probes are short segments of single-stranded DNA with a radioactive tag attached. When the probe encounters a strand of DNA with the complementary sequence of bases, it pairs ('hybridizes') with the target DNA (Kaye, 1993:108).

\textsuperscript{24} Dr. Jeffreys' "DNA fingerprinting" technique is based on the Restriction Fragment Length Polymorphism (RFLP) technique examining the Variable Number Tandem Repeats (VNTR's). VNTR's are sequences, sometimes as small as two different nucleotides (such as C and A), that are repeated in the DNA.

\textsuperscript{25} 'DNA fingerprinting' should not be accepted as one method of testing identity within forensic science. Rather, the term can only be of use in the introductory stages of DNA identification, in the stages in which a particular technique will be chosen as the testing device. Thus, 'DNA typing' is not referring to one specific method, but rather to several different typing methods, each with its own advantages and limitations [i.e. RFLP and PCR (Polymorphic Chain Reaction) are two different DNA typing techniques]. However, DNA profiling usually refers to the RFLP testing techniques (Brodsky, 1993; Thompson, 1993:29).
some of these the same sequence is repeated one after the other, tandemly. For example, the sequence CTGA may be tandemly repeated thusly:

\[
\begin{align*}
\text{CTGA, CTGA} &= 2 \\
\text{CTGA, CTGA, CTGA} &= 3 \\
\text{CTGA, CTGA, CTGA, CTGA} &= 4 \\
\text{CTGA, CTGA, CTGA, CTGA, CTGA} &= 5
\end{align*}
\]

In DNA fingerprinting, the variation revealed is due to the different number of times the specific sequence is repeated. However, the sequences are more complicated than the simple four-base (CTGA) code sequence. The repeated unit is often 15 to 20 bases long and may be tandemly repeated from approximately 200 to 1400 times. However, individuals possess only a relatively small number of these repeats, generally less than 20 (Shutler, 1988; Berry, 1990: 16; Thompson, 1993:25).

1.4.1 The Technology: RFLP and PCR-based Techniques

One method of isolating and examining DNA fragments is through the Restriction Fragment Length Polymorphism (RFLP) technique. This technique allows scientists to split or cut the DNA fragments. If the particular restriction nucleases \(^{28}\) (Vernon & Selinger, 1990:8; Berg & Singer, 1992) are

\(^{26}\) As noted earlier, it is impossible to examine the entire DNA in every cell in the human body (Redmayne, 1995:465); thus, the area of greatest interest to forensic scientists in the study of ‘DNA fingerprinting’ is the area of the DNA molecule, which varies from person to person. These sites of variation in the proteins reflecting DNA are termed polymorphisms; however, the terms variation and polymorphism are at times used interchangeably (National Research Council, 1992).

\(^{27}\) The RFLP technique is also referred to as DNA profiling (Thompson, 1993:29).

\(^{28}\) Also commonly referred to as “chemical scissors” (Budowle et al., 1990:530; Krawczak & Schmidtke, 1994). The important discovery of the restriction endonuclease was that it had the “property of rapidly degrading DNA, unless the DNA came from the same species of bacteria from which the enzyme had been isolated” (Witkowski, 1991:7). Restriction enzymes, particularly the endonuclease enzymes (enzymes of bacterial origin), have the biological function of protecting the bacterial cell from foreign, invasive, viral DNA. However, most important to forensic science is this enzyme’s ability to cut particular DNA sequences at specific locations for that endonuclease (Robertson et al., 1990; Krawczak & Schmidtke, 1994). This cutting of DNA molecules into manageable sizes allows scientists to examine the previously described locations where the sequences of DNA are repeated, which allows them to be examined by electrophoresis (see glossary in Appendix B).
chosen carefully, the repeat region of interest will be intact and a probe based on the repeat region can be used to visualize and size the particular region (McIntyre, 1996).

The probe\textsuperscript{29} used for detection of variation in the sequencing of the DNA should be of a single-locus type. Multi-locus probes are capable of detecting many different fragments in individuals, but for this very reason, they should be avoided as they might detect the fragments with different intensities, thereby increasing the risk of incorrect pattern interpretation. Single-locus probes avoid this problem. Single-locus probes are also advantageous when more than one is used, as the sites are more reliably tested since there is only one intensity to detect (National Research Council, 1992; Curnow, 1995). There are at least two issues of importance with using this technique:\textsuperscript{30} first, the quantity and quality of the DNA sample used for the analysis, and the storage of the sample (Freckelton, 1990; Nicholls & Reed, 1990); and, second, the types of restriction nucleases used in the actual testing (Budowle et al., 1990). Biological samples (ie. blood, semen, skin, hair follicles and fingernail scrapings) obtained and analysed for evidentiary purposes contain highly varying amounts of DNA, depending on the size of the initial sample, the conditions of the surrounding area, and the age of the sample.\textsuperscript{31} Therefore, the typing method used for analysis should be robust in the variation in quantity and the quality of the DNA extracted from the sample.

\textsuperscript{29} See supra footnote 10
\textsuperscript{30} The techniques discussed here, include single-locus probes, but also all other types of DNA techniques.
\textsuperscript{31} For example, a pool of blood discovered some hours after a murder provides much more DNA than a single hair found under the seat of a car one year after the murder. In addition, the sample may be a mixture of DNA from multiple sources and is likely to be contaminated with elements from the scene (i.e. dirt, cloth, cement, leaves). However, this contamination of the sample does not prevent it from being tested.
The Restriction Fragment Length Polymorphism (RFLP) technique requires a relatively larger sample than some of the newer techniques.\textsuperscript{32} These biological samples are often dried blood or semen, which has to be removed from the various surfaces, such as, for example, a piece of clothing. Therefore, it is important to note that RFLP detection is dependent upon the amount of human genomic DNA and its overall quality, once it has been removed from the surface. Both quantity and quality of the genomic DNA can be assessed when isolated by agarose gel electrophoresis \textsuperscript{33} (Chayko et al., 1990).

DNA quality depends upon the length of time between the crime and the extraction of the sample and the molecular weight, or size of the alleles. High molecular weight (HMW) DNA is most desirable for analysis, whereas low molecular weight (LMW) DNA can be an indication of degradation.\textsuperscript{34} Consequently, testing of DNA by RFLP analysis is most reliably achieved if the biological evidence recovered is of high molecular weight (Kanter et al., 1986; Baird, 1991:41; Clayton et al., 1995a:10).\textsuperscript{35}

\textsuperscript{32} RFLP technology requires approximately 50 µL (microliters) of blood, 10 µL (microliters) of semen, and at least 10 hair roots for testing (Freckelton, 1990). Microliters is a measurement used for minuscule amounts of fluid, in this case the amounts of blood would be equal to something like a few pinheads of blood.

\textsuperscript{33} Electrophoresis is the process whereby the DNA fragments are separated using an electric current which passes through an agarose gel matrix. The negatively charged DNA migrates toward the positively charged electrode which is typically situated at the opposite end of the matrix. The speed of migration is determined by the DNA fragment molecular weight: smaller DNA molecules move more quickly and bigger DNA molecules move more slowly (McIntyre, 1996).

\textsuperscript{34} Molecular weight is affected by the quality of the sample. Degradation of samples is accelerated by heat, moisture, light (both sunlight and UV light), chemical and biological contamination (Inman & Rudin, 1997:11). Some samples appear problematic for reasons not particularly known. Samples off concrete and soil are difficult, as are samples from black jeans. In the former two degradation is suspected. In the later it may be the dye in the jeans which shows up as a band rather than the actual DNA. Thus low molecular weight is indicative of some form of degradation, whereas high molecular weight is more indicative of pure DNA, such as for example, whole blood specimens (personal communications, June 17, 1997, geneticists, Dr. Bruce Weir and Dr. John Buckleton). Molecular weight becomes problematic when analyzing DNA samples using an RFLP technique, because “if DNA that has been severely degraded is typed using an RFLP technique, there is a danger that high molecular weight bands for any one locus might be missed. For instance, a 2-banded pattern might erroneously be typed as a 1-banded pattern, or larger bands from a second contributor to the sample might be missed” (Inman & Rudin, 1997:12).
As previously mentioned, the RFLP technique is possible only if there is a sufficient amount of DNA available for testing. Unfortunately, this limitation has created problems, because, in some instances, the samples are denatured to minute portions, rendering DNA analysis impossible. However, with the advancement of gene amplification technology, the polymerase chain reaction (PCR) technique has evolved, giving scientists another powerful analytical tool.

The PCR technique, in contrast to the RFLP technique, is relatively new. It was first used in 1986, but was not widely available until 1990. However, during the current decade the technology has gained a wide acceptance within various scientific disciplines, such as medicine, cellular and molecular biology, and population genetics (Reynolds & Sensabaugh, 1991; Sensabaugh & Von Beroldingen, 1991:63).

The PCR DNA amplification technology is ideally suited for the analysis of forensic DNA samples, in that it is sensitive and rapid and not as limited by the quality of DNA as the RFLP method. While the RFLP method's purpose is to detect restriction fragment length polymorphisms, the PCR method is based on a process that allows millions of copies of a specific sequence of DNA to be made (Reynolds & Sensabaugh, 1991; Inman & Rudin, 1997:45). The PCR method has allowed scientists to rely on an analytical method that requires only a small amount of material for typing forensic samples. Frequently the amount of biological evidentiary material for analysis is quite

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35 For a more extensive description as to how long DNA samples can be exposed to various conditions see Madisen et al., 1987; McNalley et al., 1989; Clayton et al., 1995a; Clayton et al., 1995b.
36 The polymerase chain reaction [hereinafter the PCR technique].
37 Including short regions.
38 The PCR method has distinct advantages over the RFLP method. The amount of DNA needed for PCR analysis can be as little as 1 ng (nanogram) (i.e. the size of a pin head) of DNA, whereas the RFLP technique requires at least between 50 and 500 ng (nanograms) of DNA (i.e. dried blood the size of a dime, and a semen stain the size of a pencil eraser) (Reynolds & Sensabaugh, 1991:7; Walsh, 1992).
small and irreplaceable. The less of a sample that must be consumed in an analysis, the greater opportunities there will be for retesting the sample, creating greater reliability, and, hence, validity.

Consequently, PCR-based DNA typing has been used in identifying remains of individuals who have fallen victim to a mass disaster. PCR-based amplification successfully assisted in the identification of 26 bodies in an advanced state of decay from the aftermath of the fire at the Branch Davidian headquarters, Waco Texas, in 1993 (Clayton et al., 1995a:10). The testing was successful in 26 of the 61 remains. It is important to note, however, that this test was done with whole blood samples, meaning that living family members provided reference blood typing to assist in the identification of deceased members.39

The polymerase chain reaction can process a minuscule amount of DNA and amplify it until enough copies are available for analysis. The process uses two specific sequences ("primers") that flank the area the scientist wants to copy, in a series of heat-controlled denaturing and hybridizing steps in a machine, for any number of cycles, which will yield millions of reproductions (Sensabaugh & Von Beroldingen, 1991:66) (see Appendix C). This type of testing is fast and automated.

The PCR technology does have some pitfalls. Due to the nature of this highly sensitive technique, contamination is an issue. PCR will reproduce copies of the contaminant if the sample is contaminated when placed in the machine. For example, "dandruff, sloughed skin, or hair from the investigators and laboratory personnel might fall into an evidence sample and be

39 The specific PCR technique used in this case was the PCR-based technique of Short Tandem Repeats (STR). PCR amplification of STR loci has an advantage, as STR's are more sensitive to poorly stored or degraded forensic samples than, for example, single or multi-locus VNTR probes (Clayton et al., 1995b; Gill & Evett, 1995) (see Glossary in Appendix B).
amplified" (Sensabaugh & Von Beroldingen, 1991:77).\(^{40}\) This becomes increasingly problematic when a sample containing degraded DNA, or no DNA at all, is accidentally contaminated by the suspect's DNA, thereby yielding a perfect match, or a non-match in instances where a match should have been found.

Another possible contamination problem arises when the sample is contaminated by other PCR products of other amplification reactions. Note the following example:

A PCR reaction mixture can contain \(10^{12}\) copies of PCR product/ml; an aerosol droplet of 0.1 \(\mu\)l volume deriving from this mixture would accordingly contain \(10^8\) copies. Should this aerosol drop find its way into a sample to be amplified that contains only \(10^5\) copies of target DNA, it is the contaminant which will amplify. (Sensaubaugh & Von Beroldingen, 1991:78)

A third possible contamination problem is the mixing of samples during the actual investigation. This is most problematic if the sample is extremely degraded\(^{41}\), or contains no DNA \(^{42}\) (ibid:76).

One type of PCR-based analysis is called DQ-alpha.\(^{43}\) This technique focuses on the locus of a gene for human leucocyte antigen.\(^{44}\) This gene is polymorphic, with 21 different typing possibilities.\(^{45}\) There is a 93% chance of distinguishing between two people chosen at random, using DQ-alpha typing (Fourney, 1994).

Rather than measuring the size of DNA fragments, as in RFLP, the DQ-alpha test detects a specific sequence of genetic bases in the allele. Instead of

\(^{40}\) "Dandruff can be considered as a source of DNA, since in many cases it can yield DNA of sufficient quality and quantity to permit with PCR technology" (presented at the American Academy of Forensic Science Convention, New York City, April, 1997 by Lorente et al.).

\(^{41}\) The fragmentation of DNA into smaller pieces.

\(^{42}\) Or if the DNA sample is too fragmented (Sensabaugh & Von Beroldingen, 1991:76).

\(^{43}\) Other examples of PCR systems are: D1S80, AMP-FLPs (also known as AFLPs or AMFLPs), and polymarker (also known as AmplType PM system). These PCR-based systems are expansions of the HLA DQ-alpha analysis (Inman & Rudin, 1997:45).

\(^{44}\) This is responsible for the rejection of tissue transplants (Fourney, 1994).

\(^{45}\) The most frequently occurring of which is one in five; and the least is 1 in 800 people. For polymorphism see supra footnote 22.
electrophoresis, the test uses a process known as "reverse dot-blot hybridization" (see Appendix D). The genotype of the sample is read by determining which circles on a test strip have developed a colour indicating hybridization with particular probes (Reynolds & Sensabaugh, 1991; Sensabaugh & Von Beroldingen, 1991; Crouse et al., 1994).

Currently, techniques such as Amplified Fragment Length Polymorphisms (AMPFLP), and other tests, such as STR's, and MVR's, are being validated for court use, and hold new promise for use with degraded evidentiary samples. It is of primary importance, however, that this leading discovery of knowledge does not overstep the process of criminal justice, and that lawyers and other players within the courtroom challenge the accuracy of these new techniques.

It is the responsibility of defence counsel to obtain as much expertise and knowledge about the various scientific issues, to ensure that jurors are not swayed by impressive testimony of expert witnesses, which may render the DNA evidence more influential than any other evidence presented at trial. Furthermore, when defence counsel seek more information, and gradually gain more ground in this area, then, and only then, can the scientific community claim that their "procedures are generally accepted by the scientific community" and ready for use in criminal cases (Thompson & Ford, 1993:97). Therefore, it is necessary to examine defence counsel's competency in dealing

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46 Which combines PCR and RFLP analyses.
47 Short Tandem Repeat's (STR's) was the test used in the Milgaard samples. The test is not yet used in Canada; hence a British laboratory conducted the analysis (Makin & Roberts, The Globe & Mail, May 20, 1996: A4) (see Glossary in Appendix B). David Milgaard served almost 23 years in prison for the murder of Gail Miller (a Saskatoon nurse), in 1969. The DNA analysis conducted in July, 1997, showed that Milgaard's DNA did not match the semen found on Miller's clothing (Staff and Canadian Press, The Globe & Mail, August 23, 1997:A4).
48 Minisatellite Variant Repeats (MVRs) is one of the newer (1990) DNA marker systems, also unveiled by Dr. Alec Jeffreys. This technique looks at individualization in just one or two loci. The technique is deemed to be "scientifically elegant," but "intellectually challenging" which may explain why MVRs are used less often in forensic science (Inman & Rudin, 1997:80).
with DNA evidence. Before venturing into the findings of this thesis, however, it is important to look at some aspects of the relationship between science and law, which will be covered in Chapter Two.

1.5 Overview of Forthcoming Chapters

Chapter Two offers a review of perspectives on the professions; namely, the transformation of formal knowledge into professional power. This chapter will also show that, although DNA evidence is used in criminal investigations to help prove a suspect's innocence or guilt, it is the over reliance on scientific inquiry within criminal justice which ought to be cause for concern. Science and law are a difficult mixture. Both institutions are powerful societal structures. Consequently, the balance of these powers, at times, creates conflict. Whilst conflict may be apparent between these institutions, they are also symmetrical in the sense that they work together to establish a field with dominant ideas. This chapter’s main focus, therefore will be the examination of the theoretical literature on expert witnesses and the dialectic interplay between knowledge and power.

Chapter Three provides an overview of the research methods used in gathering the data for this thesis. This chapter is divided into two sections. The first section describes the mail-out questionnaire and the second section discusses the interviews conducted for this thesis. While these sections are separated, it should be noted that they are very much inter-related. A triangulated method was chosen because it allows for verification of questions, which quantification cannot achieve on its own. It is also worth noting that the moving back and forth between an inductive and deductive analysis is what makes theory grounded, because there is a constant interplay between statements of relationships and verification of these statements (Strauss & Corbin,
1990:111). In this chapter, a discussion on various methodological issues will also be examined.

**Chapter Four** theoretically integrates the quantitative and qualitative findings of this thesis. The quantitative findings are presented first. The qualitative findings are presented in four separate sections which demonstrate the difficulties that defence lawyers encounter when faced with a DNA evidence in criminal cases: assessment of the actual DNA evidence, which includes the understanding of the evidence, and the issues surrounding DNA evidence; access to independent expert witnesses, which includes access to funding to obtain an independent expert witness and access to independent DNA analysis; full disclosure of DNA results, such as when DNA samples are analyzed by a government agency (ie. RCMP laboratories, the Centre of Forensic Sciences, the Laboratoire de Police Scientifique); and challenging the DNA evidence in court. These findings are explained and supported with existing literature on DNA evidence, and theories presented in Chapter Three, but from a Canadian criminal justice perspective.

**Chapter Five** concludes this thesis by discussing recommendations for future research, and looks at DNA evidence as a revolutionary topic, which will continue to expand. Therefore, while the issues and concerns with DNA analytical technology will not be resolved within this thesis, it will constitute an important contribution to the scientific and legal issues involved in the “DNA war,” which warrant close examination now and in the future. The current DNA tests discussed herein are the first spinoffs of the molecular rev-

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49 As discussed in the introduction and again in Chapter Three, there is limited literature written on DNA from a Canadian perspective. Therefore, these findings will be compared to existing literature found in Australian, British and American literature.

olution in genetics to reach the Canadian courtroom, but they will not be the last.
CHAPTER TWO

DNA Evidence: A Dance With Power

"Power is not one thing. It is everything."

2.1 Introduction

DNA typing is a powerful comparative identification tool for criminal investigations and justice. Considering that DNA evidence has been accepted in Canadian courts for only eight years, it is rather remarkable that it has been embraced with very little opposition. Although the evidence's acceptability is remarkable, it is important to examine why there has been so little opposition to the scientific principles underlying DNA technology. It is evident that the development of new and controversial techniques, such as DNA analysis, has turned courtrooms into laboratories orchestrated by judges and juries with limited knowledge in challenging the experts, who credit all forms of "life" to the interactions and organizations of atoms and molecules (DNA). It may therefore be useful to examine some of the issues of power that are typically played out within criminal justice in relation to DNA evidence. This chapter will examine the following three topics: The Scientific Experts: The Knowers; The Scientific Experts: The True Inheritors of Power; and The State Monopoly: A Look at the Crown, the Experts, and the Police.

51 This quote is borrowed from the movie "Donnie Brasco," screenwritten by Mike Newell, 1997.
52 "DNA fingerprinting" refers to the technique discovered by Dr. Alec Jeffreys in 1985; however, his technique focused mostly on single-locus probes. Therefore, for the purposes of this thesis, the term "DNA typing" (or analysis) will include all techniques: both single-locus and multi-locus probes (Jeffreys in Holland & Kyriacou, 1993:58).
53 Some countries, such as Britain, have currently accepted DNA evidence for ten years.
2.2 The Scientific Experts: The Knowers

Acceptance of scientific assumptions is not a new phenomenon. Philosophers of science have been examining scientific epistemology for centuries. Some of Plato’s popular works examine the role of knowledge in the formation of theories of justice, principles of government, moral rules, and psychological needs and wants. Plato’s distinction between “image and reality, and the correlate political doctrine of mass and elite, helped to shape modern sociological interpretations of the problem of knowledge” (Horowitz, 1961:14).

In the seventh book of the Republic, Plato introduces the problem of moving from the darkness of ignorance to the light of truth. In this book, Plato outlines the issue of how knowledge is dependent upon one’s social class. In essence, Plato establishes that knowledge is not equally open to all, despite the fact that knowledge is eternally and absolutely fixed. He does, however, distinguish between the conceptual (perceptual) and the factual, which he notes to be dialectic.

Distortions of truth, according to Plato, are the direct result of humanity’s limited ability to make predictions, that what people believe to be truth is falsely made from their present knowledge (ibid:17). However, of most importance to this discussion is the fact that Plato’s philosophy set the stage for more modern philosophies in relation to how “knowledge is a product of man’s (sic) social life” (ibid:18).

It is, however, important to note that the discussion on what actually constitutes knowledge is not an issue easily resolved. It would be a great injustice to the history of philosophy to provide a definitive definition of knowledge. We are today asking the same questions once asked in ancient Greece, but finding different answers, none of which can necessarily be taken as definitive.
Philosophers since antiquity have distinguished between opinion and knowledge. However, most philosophers would agree that an opinion can, typically, be tainted by the often imprecise deliverances of our senses (perception). In fact, this very issue was critical to Plato, who acknowledged that one could have an opinion about something that is true, but not know why it is true (Desjardin, 1990:2). Of great importance here is that 'expert opinion' may be coloured by other factors and, therefore, must not be seen as anything but a 'mere opinion.' Nonetheless, as experts note, even though the technical aspects of DNA techniques are susceptible to error, and the interpretation of results requires appreciation of the principles surrounding the various techniques (objective perception) (Weir, 1992; Koeher, 1993; Kreiling, 1993; Balding & Donnelly, 1994; Kaye, 1995), DNA has become accepted novel scientific evidence with little noise from the bench and other players within the courtroom.

The entire history of the scientific enterprise attests to the fact that very little can be taken as established truth — that is, known for certain. We may claim that we know something even if it is not absolute, and we may even think something to be true which may in fact not be true; but we cannot know for certain whether it is or not (Grove, 1989:5). Knowledge does not, therefore, require absolute certainty. The differences between what we know, or what we think we know, about the world and the concept of reality itself are worth distinguishing. Immanuel Kant argued that we are the ones who impose laws upon an already established nature and not the other way around; we do not draw laws from nature. In essence, what he was saying is that we, in a sense create reality.54 Berger and Luckmann (1966) differentiate between societal

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54 Immanuel Kant also argued that there is a very close relationship between the senses (perception) and the intellectual. In fact, he argued that one cannot prioritize the senses over the intellect as do the empiricists, or the intellect over the senses as do the rationalists (Kant, 1965:61).
objective and subjective realities. Knowledge is dependent upon people's experiences, which are both social and natural (Berger & Luckmann, 1966:41). Thus, for example, according to Berger and Luckmann, one can be knowledgable about a specific area (i.e., DNA), but only have limited knowledge about other specific areas (i.e., cuisine); however, this knowledge is only logical to oneself. In this sense "man (sic) produces himself"55 (ibid:46). Furthermore, "what is granted as knowledge in the society comes to be coextensive with the knowable, or at any rate provides the framework within which anything not yet known will come to be known in the future. This is the knowledge that is learned in the course of socialization and that mediates the internalization within the individual consciousness of the objectivated structures of the social world" (ibid:62).

The reality which scientists try to uncover is identified through a continuous process of trial and error. What is most interesting is the fact that science throughout history was commonly perceived to be an accumulation of absolute, or certain knowledge. This same belief has been carried into the enormous faith in the infallibility of science that is seen in society of today. However, the uncertainty of how things work, or science, is what scientists try to uncover or resolve. But, what is uncovered may or may not be the truth. As well, every solution to a problem will likely generate new problems (or hosts of problems) that will need to be uncovered or resolved. Therefore, it is only fair to say that science is based on socially constructed knowledge and that there is no future completed edifice in store. In fact, as Imre Lakatos (1978) has argued, many of the so-called "hard sciences" are quasi-empirical. Lakatos called the century of mathematics, "the paradigm of certainty and truth." He

55 Berger and Luckmann (1966) argue that social order is a "human product," and can be seen as an "ongoing human production" (49). When people become familiar with certain activities, specific or otherwise, the activities undertaken can then be anticipated (51).
found a lack of consistency in the logic and theoretical aspects of all mathematical truths, which caused some considerable unrest (ibid:30). The paradigm that he discussed, however, can clearly be applied to the advent of DNA fingerprinting. Watson and Crick’s discovery of the double helix has been extremely important in varying scientific fields, but has also brought along a vast new arena of problems, including the ones discussed in this thesis.

DNA evidence should not be embraced as either absolute or certain. DNA evidence is presented and explained by scientists from many different scientific disciplines who present themselves, and are accepted as, experts on DNA (Chayko et al., 1991:305).

The impact of scientific knowledge on the courtroom has increased substantially with the introduction of DNA evidence. “Expert knowledge has become institutionalized as an element of the differentiated culture of modern societies and it is unlikely that this process will be reversed” (Cambrosio et al., 1992:343). Furthermore, expert knowledge is coextensive with the construction of a temporarily stable network. This means that, while knowledge and ‘know-how’ can be said to be embodied in persons, they cannot function as expertise unless they become part of a network. The agents of knowledge (Friedson, 1986:10), can be identified as the crown, the judges, the police, the politicians, and the scientists. It is obvious, therefore, that defence lawyers in Canadian criminal cases find it difficult to gain access to adequate expert assistance in dealing with DNA testimony, since defence counsel are not part of the larger network, or the agents of knowledge, when it comes to the presentation of DNA evidence.


57 Knowledge here pertains to DNA knowledge.
The public is strongly influenced, or rather ‘seduced,’ by the enticing powers of DNA evidence (Cohen, 1985; Chayko et al., 1991; Brodsky, 1993). For example, jurors focusing on the probability statistics of a particular case, as presented by an expert witness, might be induced to discount the possibility of laboratory error\(^{58}\) (Kreiling, 1993). Therefore, it is important that juries are not misled to believe that DNA evidence is infallible, and thereby seduced by probability statistics.

The controversy surrounding the use of probability statistics in criminal cases is beyond the scope of this thesis, but rulings in Canada on the use of DNA statistics are becoming a concern to some judges, as their effects are becoming known. In \textit{R. v. Bourguignon} Judge Keith Flaningan excluded statistical probabilities in a voir dire for this very reason. He made the following comment on the use of probability statistics:

\begin{quote}
This court does not think that the criminal jurisdiction of Canada is yet ready to put such 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.
\end{quote}

Probability population statistics have remained an area of serious controversy since the implementation of DNA typing (Lander, 1991). Concern lies in the potential for human error in the treatment of the sample for data analysis, the interpretation of the patterns of DNA, and, most of all, the criteria used in determining whether two samples match and the population studies used to predict the probability of a potential mismatch (Barinaga, 1989:89; Vernon & Selinger, 1990). Thus, the use of astronomical statistical probabilities, such as a match between two unrelated individuals being less than 1 in 100 million, remains controversial.

\(^{58}\) The Ontario Centre of Forensic Sciences has recently been under attack for a scandal involving the contamination of samples (Makin, \textit{The Globe & Mail}, May, 16, 1997:A7).
Mathematics is not an infallible science. Mathematics, after all, does not consist just of facts and conclusions drawn from facts. It also contains ideas, interpretations of facts, problems created by conflicting interpretations, mistakes, and so forth. It is actually safe to say that science knows no ‘bare facts’ at all, but the facts that enter our knowledge are already viewed in a certain way, and are, therefore, essentially based upon concepts or ideas. This being the case, the history of science is as complex, chaotic, full of mistakes, and as entertaining as the ideas it contains (Feyerabend, 1975). Furthermore, Kitcher (1983:46) explores the relations between traditional mathematics and computer advanced mathematics, and concludes that there is actually no distinction, since the results are still based on human interpretation, while all our mathematical knowledge used to be a priori, there are now parts of mathematics which are not a priori. For there are so many theorems of traditional mathematics whose proofs are so long that they cannot lead us to a priori knowledge. Computer-assisted proofs are merely a new variation on an old theme. From this perspective, the new worries about flaws in computer-assisted proofs are continuous with previous anxieties of an everyday kind: mathematicians commonly complain that, as they look at each step of a long proof, they are certain of its correctness, but that there is still suspect that an error lurks somewhere.

Those who are conducting criminal cases, however, are still trying to find meaning in the ‘truths’ of these numbers (Chayko et al., 1991), which are presented within the courtrooms across the country. Consequently, defence counsel, jurors and laypersons struggle to understand concepts which, in the first place, can be said to hold no absolute truths.

2.2.1 Experts: A Necessity

There is, obviously, a necessity for an expert witness when complex technical evidence such as DNA is introduced (Reynolds & King, 1988; Gianelli, 1993). Such a necessity is not in itself of concern. Of grave concern, how-
ever, is the lack of available independent scientific experts whom defence counsel can consult. This situation brings to the fore one of the greatest limitations of the widespread application of forensic DNA typing within Canadian criminal justice (Brodsy, 1993), and is one of the main reasons defence counsel often advise their clients not to provide a blood sample, bodily tissues or fluid to the police. DNA evidence can potentially be unfavourable to the accused and, if wilfully supplied, can render the evidence at trial extremely difficult for defence counsel to dispute. Proctor (1991) states that “science lies close to the roots of many forms of power: power to create or destroy, to heal or to harm, to feed or let hunger, to enlighten or obscure,” and therefore should be viewed with a critical eye (iv). Defence lawyers should take pains to point out the potential for contamination and cross transfer of evidence that could occur through careless crime scene processing, laboratory practices, and certain police practices (including Charter violations in obtaining evidence).

Only recently, after a widely-published scandal, have Canadian laboratories been forced to face some grim accusations with regard to contamination and bias in the analysis of samples. The release of exhibits for testing at a Boston laboratory showed the discrepancy in the testing of Guy Paul Morin’s DNA. As a result he was released from prison after having served some 11 months for a brutal murder he did not commit. Had his DNA not been tested outside of this country, he may still be serving a life sentence. The gross injustice in this case is a clear example of an undemocratic exercise of power.

59 The Centre of Forensic Sciences has admitted to biased conduct in the Guy Paul Morin case, where they analyzed four microscopic hairs and 12 microscopic textile fibers that purportedly indicated that the victim, Christine Jessop, had been driven to her death in Guy Paul Morin’s car (Makin, May 16, 1997) Forensic centre pit of despair, report says. The Globe & Mail: A5.

60 Mr. Guy Paul Morin was convicted of murdering his nine-year-old neighbour, Christine Jessop, at a retrial in 1992. His conviction and consequent exoneration have become one of the most noted Canadian criminal justice conspiracies. Currently, the CFS, the Durham and York Police, and the Jessop family have all admitted to lying about the various aspects which had initially implicated Mr. Morin (Makin, The Globe & Mail, June 12, 1997: A1-A5; Makin, 1992).
whereby the agents of formal knowledge are left to justify their actions, because lay persons depend on their knowledge as the ultimate truth. Mrs. Jessop, the mother of the murdered girl, deliberately lied at the retrial, because, as she stated: “you believe it. You are told this for so many years so, well, maybe you are wrong. They are the professionals. Anything anybody told you, you would take almost as gospel because you wanted to find an answer....” This testimony supports the contention that lay persons within society see the agents of formal knowledge as the true knowers — to the point of doubting their own ability to know truth from fiction. It is also obvious that the police in this case were aware that they wielded this power over a distraught woman who had lost her child to a murderer, and who would do anything, even lie, to find someone responsible for this crime. Sloppy and overzealous police work is unfortunately not rare.

The previous lack of legislation requiring a suspect to submit a blood sample for analysis was somewhat rectified with the new search and seizure amendments to the Criminal Code in 1993. Although the legislation was fur-

61 Mrs. Jessop “had felt pressured by the police to make a statement that she arrived at home at a certain time (although she had been mistaken) as the police had told her that her original time estimate would provide an unassailable alibi” (Makin, June 11, 1997, The Globe & Mail: A5).

62 Mrs. Jessop had originally stated that she had arrived home at 4:10 p.m. on the date her daughter was abducted and murdered, but when she was told that it would not really fit with the time Mr. Morin was suspected of having taken Christine Jessop, Mrs. Jessop had felt encouraged to state that she was mistaken and that there had been something wrong with her clock (Makin, June 11, 1995, The Globe & Mail: A5).

63 In R. v. Stillman (1997), C.C.C. (3d) 321 (S.C.C.). Judge Cory admonished the RCMP for seizing bodily substances unjustly. Judge Cory called the seizing of Mr. Stillman’s samples, an example of “the abusive exercise of raw physical authority by police.” In this case the RCMP had been instructed by Mr. Stillman’s counsel not to seize any substances from his client. Nonetheless, the RCMP seized hair follicles, dental impressions, and nasal mucus. The nasal mucus, which contained a small amount of blood, was seized for DNA analysis after Mr. Stillman had blown his nose in a tissue when he used the washroom while he was in custody (Makin, March 21, 1997, The Globe & Mail: A1,A5). Also see R. v. Morin [1989] O. J. 508; R. v. Morin (1988), 36 C.C.C. (3d) 50 (Ont. C.A.); R. v. Morin (1988), 44 C.C.C. (3d) 193 (S.C.C.); R. v. Morin (1993), 78 C.C.C. (3d) 559 (Ont. C.A.).

64 Section 487.01 of the Criminal Code outlines the warrant procedure, which if issued by a judge allows a peace officer to use any device, investigative technique, or procedure to obtain materials necessary in a criminal investigation with the exception of any investigative technique which would interfere with the “bodily integrity” of any person. The more recent amendments to this section are found in sections 487.04 to 487.09, which allow for seizure of bodily substances through lawful means for the purposes of forensic DNA analysis (see Appendix E for other aspects of this legislation).
ther amended, effective July 13, 1995, it is still in dire need of further clarification. Prior to the 1993 amendments, the Supreme Court of Canada considered whether there was power to make the seizures for DNA analysis under the common law to search as an incident to arrest. In *R. v. Borden* the police obtained consent from the accused to take a sample of his blood for DNA analysis; however, the accused was under the impression that this analysis was to be used in the case for which he was originally arrested. In fact, the police had wanted the DNA sample to help them solve another crime committed against another victim who was unable to identify the accused. In this case the Supreme Court of Canada ruled that the police should have informed the accused that he was consenting to the use of his DNA in not only one case, but in two. However, because the police did not do so, the court concluded that the admission of the results of the DNA analysis would render the trial unfair and did not allow this evidence to be entered. This specific issue arose again in *R. v. Stillman*, where the Supreme Court of Canada determined that the taking of bodily substances is a violation of one's right to liberty and security of the person, when an accused has been conscripted to give self-incriminating evidence, and when the taking of such evidence is unauthorized. Therefore, the accused's rights under sections 7 and 8 of the *Charter of Rights and Freedoms* were violated. The admission of the evidence could have brought the

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65 See case citations in the references
66 “Evidence will be conscriptive when an accused, in violation of his Charter rights, is compelled to incriminate himself at the behest of the state by means of a statement, the use of body or the production of bodily samples” (*R. v. Stillman* at para. 80).
67 Justice Cory, in *R. v. Stillman*, makes the following statement for the majority: “Traditionally, the common law and Canadian society have recognized the fundamental importance of the innate dignity of the individual. There is little likelihood of maintaining any semblance of dignity where, without consent and in the absence of any statutory authorization, intrusive procedures are employed to take bodily substances. For example, can there be any respect demonstrated for an individual if against their will women and men accused of a crime can be compelled to provide samples of their pubic hair to the police?” (at para. 88).
68 Section 7 of the *Charter of Rights and Freedoms* guarantees that “Everyone has the right to life, liberty and security of the person and the right not to be deprived thereof except in accordance with the principles of fundamental justice.”
administration of justice into disrepute under section 24(2), and as a result the evidence was excluded.69

In R. v. Brighteyes,70 the Alberta Court of Queen’s Bench ruled that the 1995 amendments to the Criminal Code, sections 487.04 to 487.09, violated section 7 of the Charter. However, while the amendments was found to violate Brighteyes’ rights, the violation was “demonstrably justified in a free and democratic society,” under s. 1 of the Charter,71 according to the judiciary. These rulings clearly show the growing pains that this legislation has begun to face.

Ordinary witnesses may give evidence on a “subject about which most people should be able to express an opinion from their day-to-day experience of life” (Salhany, 1991:64). This type of evidence is usually self-evident in the eyes of lay persons (Smith, 1989: 56). However, an expert witness is called to testify on matters that are too complex and technical for the courts (including laypersons) to resolve. These experts are asked to testify in areas which require special skills or knowledge, and, if deemed admissible, to assist the trier of fact72 in reaching their decision in a specific case (Brockman & Rose,

69 The only evidence in this case admitted was the tissue used by Stillman to blow his nose, which contained blood particles. This piece of evidence was admitted on the grounds that “the police did not force, or even request, a mucous sample from the accused. He blew his nose of his own accord. The police acted surreptitiously in this regard for the appellant’s explicit refusal to provide them with bodily samples. However, the violation of the appellant’s Charter rights with respect to the tissue was not seen as serious. The seizure did not interfere with the appellant’s bodily integrity, nor cause him any loss of dignity. In any event, the police could and would have obtained the discarded tissue. They would have had reasonable and probable grounds to believe that the tissue would provide evidence in their investigation and therefore would have sealed the garbage container and obtained a search warrant in order to recover its contents” (at para. 128).

70 This information was found in the following article: Daisley, B. (May 16, 1997). DNA sample seizure constitutional: Alta. Q.B: Impugned law violates s. 7 of the Charter, but saved by s. 1. The Lawyers Weekly, 14-16.

71 Section 1 of the Canadian Charter of Rights and Freedoms “guarantees the rights and freedoms set out in it subject only to such reasonable limits prescribed by law as can be demonstrably justified in a free and democratic society.”

72 Mr. Justice Sopinka made the statement that the test as to whether or not expert evidence would be useful to the court is not a high enough standard, but that the evidence should provide information “which is likely to be outside the experience and knowledge of judge and jury” (In R. v. Mohan (1994), 89 C.C.C. (3d) 402 (S.C.C.).
Therefore, prior to the acceptance of an expert's testimony, a voir dire may be held to determine whether or not the witness will be allowed to give an opinion on the issue before the court (ibid:408).  

Reynolds and King (1988) outline two important functions that experts have in an adversarial hearing. These are:

1. To present the evidence by answering the questions addressed to him/her by counsel. The questions posed are most likely to be based on the expert findings as presented within the report. This will be followed by cross-examination by the defence counsel who will question the expert on issues found with the assistance of defence's own independent expert.

2. To listen to the evidence presented by the opposing side (defence), particularly on those matters within his/her expertise, and to alert the solicitor who is part of his/her client's team to any flaws or problems presented by the opposition's (defence's) evidence. (17)

Reynolds and King's points provide useful information on the expectations of expert witnesses; however, they seem to assume that all adversarial justice systems operate in such a manner. The Canadian criminal justice system is adversarial in name only. This issue is two-fold. Firstly, one of the characteristics of an adversarial system is that each party presents its own case and calls its own witnesses (ibid: 46-47). However, in many instances, and especially in cases involving DNA evidence, Canadian defence counsel (the opposition) are not able to call independent expert witnesses, because most of Canada's experts on DNA evidence work for the Crown and the police. Moreover, few private or independent laboratories within Canada are available to perform DNA testing. Thus, the most often-called expert witnesses asked to testify for the crown on DNA fingerprinting are the RCMP and the Centre of Forensic Sciences (CFS) laboratory scientists. As a result, there is a limited number of

73 The admissibility of the expert evidence is based on the following criteria: relevance of the testimony; the necessity in assisting the trier of fact; the absence of any exclusionary rule; and the qualifications of the expert (Sopinka, J. as quoted in Brockman & Rose, 1996:409).
independent experts available to testify on behalf of the accused. Secondly, while expert witnesses in adversarial systems are subject to examination in chief, cross-examination and reexamination, defence lawyers are often at a loss to know how to examine these experts. These issues have just briefly been touched upon and need a more detailed examination, which will be undertaken shortly.

Independent expert witnesses can be available to testify on behalf of defence counsel, but for a fee. American and British experts have been called to examine DNA evidence in some Canadian cases, but their availability is dependent upon the accused's ability to pay their fees (Olson, 1997). Not only are these scientists influential as enforcers of the law, they are also the most privileged keepers of scientific knowledge (DNA knowledge). Expert witnesses typically present highly specialized knowledge, skill, and experiences that are not familiar to juries or even to counsel and the court (Friedson, 1986:97; Giannelli, 1993:110; Salhany, 1991:64). As a result, their testimony represents some of the most compelling evidence. This is detrimental to the accused. Defence counsel must have an intricate understanding of the controversial issues surrounding DNA evidence in order to ask the "right questions," which can then force specific answers from the expert witness (Robertson & Vignaux, 1995). Such knowledge is a prerequisite for avoiding the potential of a trial by experts, or canons of expertise. A defence counsel, better informed about the controversies surrounding DNA evidence, has an increased chance at ensuring that scientific norms are not substituted for legal ones (Smith, 1989:86).

2.2.2 Scientific Experts: The Production of Knowledge

The Positivistic assumptions appear to be in the forefront of today’s use of science within the criminal justice system. It is important to note, however, that not all epistemological assumptions of the positivist school have been embraced. Scientists themselves engage in endless debates as to what constitutes scientific truth (Feyerabend, 1975; Aronowitz, 1988; Cameron et al., 1992; Evett & Weir, 1992). Increased specialization within each of these sciences has only served to reinforce in the scientists’ minds (and the minds of those relying on their testimonies: the judges and the juries) the idea that these sciences are functionally differentiated, yet joined as one in their search for ‘The Truth.’ Therefore, as previously examined, DNA evidence is also readily accepted as an adequate testing device, because it can, supposedly, identify suspects who may be guilty of crimes and exonerate those who are innocent, based on hard scientific evidence.

DNA evidence is used in criminal investigations to help prove a suspect’s guilt, or to raise doubts about guilt. The matching or mismatching on a DNA fingerprint (autoradiograph) can identify an individual by comparing the sizes of DNA fragments. However, the reliance on scientific inquiry within criminal justice ought to be a cause for concern. There is little doubt that science and law are a difficult mixture. Both of these institutions are powerful societal structures. Consequently, the balance of these powers, at times, creates conflict. While conflict may be apparent between these institutions, they are also symmetrical in the sense that they work together to establish a field with dominant ideas. However, these “fusions of knowledge and power (dominant ideas) have created a new kind of professional-technocrat---men (sic) of narrow specialism and narrower visions” as argued by C. W. Mills (in Johnson,

These terms are also referred to as inclusion and exclusion determinations.
1972:16), who are often represented as the so-called 'experts' within the criminal justice setting, and more specifically within the courtroom. Scientific experts are identifiable 'true' inheritors of power (Johnson, 1972:9), as they, more often than not, leave defence counsel stunned by their sophisticated and technical jargon. As a result, they are rarely challenged.

Scientific experts' opinion evidence is used frequently in criminal proceedings. This specialized opinion evidence, more specifically the use of this evidence and the decision making regarding its use, is not open to the active participation of all. Thus it can be seen as a direct threat to the democratic process (Feyerabend, 1978:77; Friedson, 1986:5). The application of the scientific method to the resolution of social problems can be considered a tool which is employed for the purpose of controlling and dominating our everyday lives (Young, 1991). However, lay members of society may not even be aware of how much they rely on expert opinion as a source of verification for what may otherwise be difficult for them to fathom (Bauman, 1992:98). Science, in essence, is the collective manager of the source of uncertainty and thereby reproduces the classic pattern of power and dependency. Lay persons must be rational, but they cannot be rational without being guided by the verdicts of science and without being offered algorithmic, or at least heuristic prescriptions for action that carry approval of the experts. (Ibid:99)

Once the specific expertise (in this case DNA evidence expertise) has become established within society, it no longer needs legitimization to be active. “Expertise and technology become their own legitimation; their very availability justifies their need and their claims to an increasing share of social resources and growing social esteem” (Bauman, 1992:93). In this sense, expert practices become part of an independently-run system, self-maintained and self-controlled, where others (most typically lay persons) outside of the
specific expertise are kept out of focus and reliant upon the 'know-how' of the experts. Therefore, trials may in fact be conducted by experts, rather than by judges and jurors, which makes the experts the true inheritors of power.

2.3 The State Monopoly: A Look at the Crown, the Experts, and the Police

Particular branches of science, and the formal knowledge required to understand them, are often seen as arcane by lay persons. This elite knowledge, when "used to direct human enterprises can be a tool employed for the purpose of controlling or dominating everyday lives, shaping them to the purposes of the state" (Friedson, 1986:4). Science can be seen as a direct exercise of power, an act of domination over those who view it as prestigious; those who fear it; or those who lack it (ibid:7). As previously discussed, while the experts within the courtroom can be seen as the inheritors of power, it is important to recognize that others within the courtroom, and other criminal justice agents in general, are the carriers of this power into the legal arena (Giannelli, 1993:110). Experts on DNA evidence cannot testify before juries without these other carriers of knowledge - the gate-keepers of this knowledge. While the gate-keepers (the police and the Crown) may not fully understand the DNA evidence technicalities, they do have the access to the experts, if they need them, to help understand the intricacy of the DNA testing process. Typically, the Crown introduces DNA evidence into criminal trials. Therefore, they too are among the agents of formal knowledge.78

76 In the case where the experts work for the crown and the police, the defence lawyers are among those kept out of focus, awaiting the verdict of the expert testimony.

77 Friedson (1989) uses the term formal knowledge to describe the expertise required in the understanding of science. The term also describes knowledge which is not part of everyday knowledge. Therefore, some specialization is needed to engage in formal knowledge (4).
Defence lawyers, on the other hand, are neither agents of formal knowledge nor gate-keepers, except in rare instances when the accused can afford the best of experts. In these instances they may hold the key to the gate, but this is rarely the case because of the limited supply of independent experts who will willingly provide their expertise in order to assist the defence team, unless, of course, as seen in the O. J. Simpson case (they were well paid).

The suggestion in the DNA literature suggesting that lawyers do not need to know the “intricacies” of the DNA testing process (Carlson, 1995) in order to work with it as evidence in court, is dangerous and misleading. While defence counsel don’t need to have the same knowledge and expertise as the experts themselves, it is important to note that an oblivious or naive defence counsel will be unqualified to recognize any discrepancies in the sophisticated techniques presented by the Crown expert witness, unless they possess some basic knowledge on DNA. If defence counsel do not possess some understanding of DNA, obvious, or less obvious, discrepancies may become closed issues and may never reach the jury (Koehler, 1993; Redmayne, 1995:467). Furthermore, seduction of the jury by presentations of “dizzying” heights (Lander, 1991:820) of population genetic calculations is bound to pass unnoticed. However, if the creators of formal knowledge (the scientists) and the gate-keepers (the police and the Crown) combined, appear as the agents of this formal knowledge, then the ‘adversarial’ system is seriously flawed.

Michel Foucault is acknowledged for his critical analysis of the dialectic relationship between power and knowledge. Specifically, he looked at the meaning of technical knowledge — that is, areas in which there are special-

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Friedson (1989) argues that the creators of knowledge are the experts (9). However, these experts cannot engage in the legal process without being invited to do so by the police and/or the Crown (the gate-keepers). Those people who create (scientists) and those who employ (the state) formal knowledge are the “agents” of formal knowledge.
ists, specialized or technical knowledge, and specialized or technical vocabulary. Foucault believed that technical knowledge was the route to power. While he did not look at DNA evidence per se, his writing is singularly applicable, as demonstrated in the following paragraph:

...the idea is that technical specialists always work together to establish their field and its dominant ideas. These technical fields have ever-increasing power over people, and these discourses have profoundly shaped the structure of our society. For instance, the discourse on madness, produced by psychiatrists, psychologists, social workers, and other experts define the roles of craziness, and thus also the roles of normalcy that we all take on. (Fillingham, 1993:67)

The wording in this composition could be changed to encapsulate the meaning of the discourse on science and the meaning of truth. More importantly, however, this writing embodies an intriguing perspective on the nature of power, and how specialized or technical knowledge is the basis of this power. Scientific practices belong to what Foucault has called the realm of "government":

"Government" did not refer only to the political structures or the management of states, . . . the legitimately constituted forms of the political or economic subjection, but also modes of action, more or less considered and calculated, which were destined to act upon the possibilities of action of other people. To govern, in this sense, is to structure the possible field of action of others. (Foucault, 1991:221)

DNA evidence within the Canadian criminal justice system is handled largely by the RCMP; thus, the availability of defence counsel expert witnesses and DNA scientists is a commodification and monopolization of knowledge. Therefore, lawyers — more specifically, defence lawyers — must understand the organization of the human genome, principles of probability population statistics, functions of molecular biology, and genetics of hypervariable loci (Chayko et al., 1991; Alldridge et al., 1995; Robertson & Vignaux, 1995) in order to secure a "just" defence for their clients.
At present, DNA evidence is largely uncontested within the Canadian criminal justice system,\textsuperscript{79} despite the tradition of providing opposing counsel the opportunity to cross examine all witnesses. However, the issue of access to experts is especially important to defence counsel, since they do not usually have access to the personnel of forensic laboratories, nor are the personnel in forensic laboratories likely to be critical of the techniques used by their own lab. As previously noted, the RCMP is responsible for most of the DNA analysis of Canadian criminal cases. However, despite being officially 'impartial,' the RCMP Forensic Laboratories have a “priority case system” which does not allow for defence counsel’s cases unless there are adequate human resources, or unless these are seen to warrant a high priority.\textsuperscript{80} Hence, it is fair to say that these laboratories show a bias against defence cases. Furthermore, the backlog of DNA analyses\textsuperscript{81} easily renders defence cases as “beyond adequate human resources” to warrant priority.

In adversarial proceedings, the prosecution has the upper hand from the start. In Canada, the police conduct the investigation and orchestrate the terms of the investigation from beginning to end. The Crown, in some of the more complex cases (i.e., DNA cases), are appraised of the development of the investigation. By the time the defence is in a position to defend or contest the Crown’s case, it may be very difficult for defence lawyers to get their concerns on the agenda. The incorporation of forensic science evidence into a case only adds to the collaborative and complex process, because this process generally

\textsuperscript{79} Thus, it can be said that DNA evidence has been accepted almost too gracefully. This is also evident in the lack of Canadian literature in this area.

\textsuperscript{80} Letter addressed to All Chief Crown Prosecutors and All Directors and Assistant Directors from the Alberta Attorney General, May 5, 1989: RE: Implementation of DNA Analysis.

\textsuperscript{81} The article “DNA backlog robbing legal arsenal” was written in the Star Phoenix Regina (Zakreski, December, 4, 1996:A1). The article discussed the backlog of some 700 cases and stated that the RCMP lab in Regina “does not have the time to examine all of the samples and that they only examine the crucial ones” [emphasis mine].
involves several powerful institutions working for the Crown, principally the police, the RCMP laboratories, the CFS, which services the provinces of Ontario and Quebec, and the Laboratoire de Police Scientifique, which services mainly the province of Quebec.

It would be a mistake to separate the roles of the police and the scientist, since in some cases involving DNA testing, the roles are one and the same. As scientific experts within their fields, RCMP technical experts testify in areas such as from the pharmacology of alcohol, the matching of any non-biological materials, explosives, data basing of counterfeit documents, legal statuses of firearms, and comparisons of biological fluids, along with many other types of expertise. It is important to note, as well, that the RCMP provide the most extensive DNA training available to police officers across the country (Forensic Laboratories Annual Review, 1992).

Court testimony is a necessity in cases which use DNA evidence, because of the highly technical nature of the evidence. However, if the scientist collects the sample, examines the sample, presents the evidence, and also educates the court regarding the evidence, there is potential for bias. Although this is true for all evidence gathering by the police, it is crucial with regard to the RCMP because they testify in the majority of DNA cases that use expert testimony. Earlier, the statement was made that the scientist and

82 The police may be either municipal, provincial or federal.
83 There are eight laboratories serving all of Canada. In some instances the RCMP may be the police involved as well as the RCMP labs doing the DNA testing.
84 These laboratories are a law enforcement service of the Royal Canadian Mounted Police, hence their name: RCMP Forensic Crime Laboratories. Although the RCMP claim that the labs are impartial, as previously noted, they do show favoritism towards analyzing Crown cases. What I am referring to here is the fact that the RCMP has not testified on behalf of defence counsel. It should also be stressed that the RCMP "priority case system" is structured to assist police investigations and that the memo (previously discussed on pages 38-39) was addressed to Crown counsel, not defence counsel.
85 Laboratory scientists do not collect the samples from the crime scene, but RCMP police officers may be the ones to do so, in which case they are working within the same institution.
86 While RCMP technicians (scientists) are not RCMP officers, they are sworn members.
the police are one and the same. In cases in which the RCMP officers collect the sample, this is true. In such cases the DNA evidence is never examined by anyone outside of the RCMP, which makes it impossible to question their findings. Of concern is the fact that, to date, RCMP expert witnesses have not testified on behalf of the defence, despite their supposed impartiality. This represents an organizational flaw in Canada's Criminal Justice System, because DNA testing is not readily available at any alternate laboratories. That the RCMP scientists adhere to principles of science and claim to be impartial is irrelevant, when there are few alternative methodologies or groups to conduct these types of biological tests in this country. In contrast to the Canadian situation, forensic laboratories in the United States have been forced to open themselves to much needed-scrutiny in the various courtroom debates on DNA evidence (Thompson, 1992).

Due to the possibility of bias in the interpretation of the DNA analysis, which can wrongfully implicate a suspect, defence counsel should try to retain a portion of the DNA sample for subsequent testing. This ought to be common practice, to see if defence counsel's testings achieve the same results (Robertson et al., 1990; Reynolds & Sensabaugh, 1991; Budowle et al., 1991; Lander, 1991; Walsh, 1992). However, this practice is currently not commonplace within the Canadian system of justice. The RCMP laboratories work in close

87 This point raises the entire issue of impartiality. This argument will also become a recurrent theme expressed by defence counsel in the 22 interviews conducted for this thesis. Testimony by DNA experts may not be necessary in cases where the accused is exonerated by DNA evidence, but in many instances defence counsel is in need of an expert to analyze the testing and the meaning of the samples prior to trial. It is this situation which is referred to herein.

88 Helix BioTech, Richmond, British Columbia, is an independent laboratory which services both the Crown and the defence, but their credibility has not, to date, been fully established (see interviews with defence counsel).

89 The RCMP Laboratories "offer a uniform support service because of their national perspective. This also avoids the duplication of effort that would otherwise result if each regional laboratory were to undertake such activities individually" (Forensic Laboratory Services Annual Review, 1989:1). The RCMP works closely with the FBI (the United States Federal Bureau of Investigation), but seem to avoid the accusations that the FBI face from the States in terms of their inherent bias in their testing.
collaboration with the FBI's Forensic Science Centre in Quantico, Virginia; however, it is not altogether clear whether the RCMP adhere to the quality assurance program that the FBI follows. In spite of that, when DNA evidence from a suspect is possibly contaminated, or tampered with, it is of utmost importance that the laboratory conduct be reviewed. What went wrong at the CFS in the Morin case is intolerable. If the personnel had followed procedures and protocols, the errors could have been rectified before the results were disclosed in court. A summary report, along with all original notes, records, and other data pertaining to the test, should have been forwarded to the examiner, analyst, or other appropriate individuals as established by the laboratory policy. The Technical Working Group on DNA Analysis Methods (TWGDAM) recommends that “all DNA laboratories should participate in open proficiency testing programs, conducted by outside institutions or provided by reputable sources, which are appropriately designed for forensic (emphasis added) DNA analysis” (1995:34). This is unattainable in Canada, however, where outside forensic institutions are nonexistent. Who, or what institutions, are then the “objective eye” in evaluating the quality of performance in Canadian laboratories? Maybe no one qualifies to evaluate the RCMP or the CFS, because they are virtually the only laboratories conducting DNA analysis in Canada. This may be the very reason that the Jessop family,
the police and the forensic laboratory were able to carry on the conspiracy against Mr. Morin as long as they did.

For obvious reasons, it is important that defence counsel, and others residing within the courtroom, obtain an intricate understanding of the controversial issues\textsuperscript{92} surrounding DNA evidence in order to ensure that the rights of the accused are not violated. Defence lawyers should also treat requests for post-conviction DNA testing seriously, as claims have been made that there are many more innocent people in prison, based on the handful of exclusions which have occurred to this date (Harmon, 1993). Defence counsel have been successful in cases involving DNA evidence when they were knowledgeable about the particular controversial issues, including issues of possible contamination of samples (Robertson & Vignaux, 1995).

This was the scenario with the Castro case in 1989.\textsuperscript{93} Knowledgeable defence lawyers were able to enlist the aid of independent scientists and mount a thorough and successful challenge to the evidence. Lifecodes, the commercial laboratory used by the prosecution, had violated its own protocols and was charged with outright scientific fraud. When confronted with a unanimity of expert opinion (including experts retained by the prosecution) Lifecodes relented after several changes of opinion, and acknowledged that the firm’s testing did not demonstrate a match. The case was widely covered in legal journals around the world. While this was one of the very first DNA trials to demonstrate the corruption in the use of DNA evidence to obtain a conv-

\textsuperscript{92} These scientific and controversial disputes have been referred to as “the DNA war” (Thompson, 1992, 1993) and “the junk science” debate (Giannelli, 1993:112). Giannelli’s (1993) article focusses mainly on the various types of scientific evidence presented in court. He argues that experts and scientific evidence should be used in criminal cases, but that the legal system ought to protect itself from the misuse of these types of evidence. The term “junk science” is accredited to Peter Huber’s (1991) book titled: \textit{Galileo’s Revenge: Junk Science in the Courtroom}.

\textsuperscript{93} People \textit{v.} Castro, 545 N.Y.S 2d 985 (as cited in Neufeld, 1993:194; Thompson, 1993; Neufeld & Colman, 1990:47).
viction, it is important to note that Canadian criminal justice no longer needs to look south of the border for such examples. Despite the advancement of the technology and supposedly better techniques, Canada can now attest its own corrupted usage of scientific evidence.

Objectivity is needed in determining the status of DNA evidence, for such evidence is at least partly a human product (Cameron et al., 1992:11). To date, little scrutiny has been given to the rate of laboratory error. According to the literature, even less attention has been paid to the potential of subjective interpretation to undermine the value of DNA evidence (Thompson, 1992; Brodsky, 1993). Bayesian statisticians object to the positivistic assumption that science is value-free and infallible. Their objective has been to examine the errors, or the potential errors, with respect to the statistics used in DNA evidence (Evett & Weir, 1992:21). In fact, Bayesian statistics was the focus of human decision making research conducted by a psychologist, Ward Edwards. Edwards was particularly interested in the behavior of the decision maker in terms of how much influence the decision maker (or the DNA analyst) has over what is and what is not in the outcome of certain probabilities (Hammond et al., 1980:10). In essence, Edwards’ focus was on the subjective elements of human decision making. Therefore, it is critical that the honest scientist ought to recognize that he or she is a test instrument, and a fallible one at

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94 Bayesian statisticians calculate probabilities about uncertain events, such as the probability of an accused being the actual perpetrator of a crime. Most simply, Bayesian statisticians break probability statements down into small tractable units which can be easily handled. These probability statements are then manipulated by the analyst to derive probabilities that are important in the solution of the crime (Smith, 1988:86). An important principle in DNA evidence interpretation, using Bayes’ Theorem, is the necessity to consider at least one alternative proposition and then calculate the probability of that proposition. For example, one proposition could be that the suspect left the crime stain, and another could be that someone other than the suspect left the crime stain (information gathered from The 1997 Annual Mid-Atlantic Association of Forensic Scientists, Roanoke, Va. April 29-May 2, 1997, DNA Statistics Course taught by Dr. Bruce Weir). With these two propositions (I would recommend many other propositions, such as someone planted the suspect’s DNA at the scene, meaning that this adds to the two other propositions), one can calculate the probability (likelihood ratio) using the Bayes’ Theorem statistical calculation.
that. Subjectivity inescapably enters into any human endeavour and, there-
fore, should not be denied (Weir & Hill, 1993; Weir, 1995).

DNA testing is rife with subjective elements, no place more so than at
the stage of deciding whether a match exists. On the one hand, non-matching
extraneous bands may sometimes be properly disregarded and patterns that
do not quite meet objective criteria may be appropriately viewed as incrimina-
tory matches. On the other hand, band patterns that do meet objective match-
ing criteria may be treated as exonerative, depending on how they deviate
from perfect matches (Koehler, 1993). Therefore, it is of utmost importance
that the DNA expert not hide behind the cloak of science to deny the role of
human judgment, including the acceptance of a degree of error (Roberts,
1994). Scientific observation, because it involves humans observing through
microscopes and other technological developments, is inherently political,
ideological, and value-laden. Hence, it is also important to note that regula-
tory standards and other monitoring systems become standardized and open
for scrutiny.

When the agents of knowledge have a vested interest in the outcome of
the samples, DNA typing is no more reliable than fingerprinting, palmprint-
ing, voiceprinting, or any other type of technique used for purposes of identifi-
cation, because the potential for bias is too great. The potential bias of
investigators and technicians is not the only factor which can render DNA evi-
dence unreliable. DNA evidence, like other types of evidence, can be planted,
or simply left at a crime scene before the fact. For instance, Blackledge (1995)
comments on a fictional mystery whereby a woman extracts seminal fluid
from her diaphragm, after consensual intercourse, and wipes it in their child's
underwear and then notifies the authorities that her husband is sexually
assaulting their daughter. It sounds awful, but could be a scene in a brutal
custody battle. Blackledge (1995) also discusses the scenario where a woman might have had consensual intercourse with her lover before being murdered by an assailant who uses a condom. The only semen which will show up with DNA analysis is the semen of the lover. What is important here is that DNA evidence tells only part of the crime story, and it is the responsibility of the court and the players within the courtroom to put this evidence into perspective. It is important, therefore, that the Canadian criminal justice system take a serious look at the monopolized handling of DNA evidence within Canada.

Forensic laboratories in the United States have been forced to open themselves to much needed scrutiny in the various courtroom debates on DNA evidence. Canadian courtrooms, however, have remained immensely calm when it comes to challenging DNA evidence almost as if the storm has been raging only outside Canadian borders. This thesis aims to determine whether or not Canadian defence lawyers have reasonable access to DNA evidence within the Canadian criminal justice system, and what the implications are, if any, for defence counsel in terms of their defence of cases involving DNA evidence. Therefore, this writing extends the “DNA War” and the “junk science” debate in analyzing defence counsel’s access to (1) DNA independent expertise, including expert testimony; (2) full disclosure of DNA findings when samples have been analyzed by government laboratories; (3) independent testing of DNA samples; and (4) adequate education on DNA issues.
CHAPTER THREE

Method and Data Collection

3.1 Introduction

An extensive literature review was conducted using various sources, including existing biology, biochemistry, criminal justice, forensic science, genetic, hematology, legal, mathematics, political science, and statistical journals. The RCMP Forensic Laboratories in Edmonton and Vancouver, and Helix BioTech Corporation in Richmond British Columbia were contacted and visited. In addition, the RCMP Forensic Laboratory in Ottawa and LifeCodes Corporation in Stamford Connecticut, were contacted to assist in a complete review of existing literature, both published and unpublished. The Internet was also used for information on various aspects of DNA evidence.

In 1993, I distributed a short questionnaire, using a purposive sampling technique, to professionals in Calgary, including Crown counsel, defence counsel, judges and police, along with members of the general public. The questionnaire fulfilled the requirements for an introductory research methods course. While this exploratory study had many flaws in the content and distribution of the questionnaire, it marked the beginning of this thesis. Some of the findings were published in an Alberta Law Publication, *Law Now*.\(^95\) Taking into consideration the limitations of this earlier study, it nonetheless, in a sense, acted as a pre-test for my thesis research.

The data for this thesis include quantitative data from these earlier questionnaires and qualitative findings from interviews conducted for this thesis. This integrated type of method is necessary because the questionnaire

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results alone do not clarify the reasoning behind the responses. To explore the questions addressed in this thesis, 22 interviews were conducted, which asked for clarification of the quantitative findings, thus making the findings in this thesis more reliable. The quantitative data collection will be described first, with the proposed qualitative data collection following.

3.2 Quantitative Data Collection

In 1993, a questionnaire was distributed to 30 persons from various areas of the criminal justice system, using a purposive sampling method. The questionnaire was constructed, including factual assertions from the RCMP Forensic Laboratory Annual Reviews 1989-1993, the Alberta Attorney General's Memoranda, and the literature. These assertions were followed with a Likert scale which ranged from 'strongly disagree' to 'strongly agree.' The scale was presented in a box-like format to ensure the accuracy of the participants' choices. This sample was used as a pre-test which allowed corrections of any errors found within the questionnaire itself. A few ambiguous questions were found and corrected. The revised questionnaire, consisting of seven demographic questions and 31 assertions on various aspects of DNA evidence, became the tool for the quantitative findings (see Appendix G).

The revised questionnaires, with a cover letter explaining the purpose of the survey and ensuring the anonymity and confidentiality of the respondents, was then sent to the respondents in 1995. A contact telephone number was provided in case the respondents had any questions. The questionnaire provided a check-off box, in which respondents could leave an address if they had an interest in the outcome of the study. Following this check-off box was a space wherein the respondent could attach or write a return address.
The population sampled consisted of members of the criminal justice system who had been or who might be exposed to DNA evidence, including Crown counsel, defence counsel, judges, police/detectives, forensic scientists, and a category titled others.\textsuperscript{96} A non-probability snowballing technique was used to locate those individuals who would have the most involvement with DNA evidence. Criminal cases, involving DNA evidence, were provided by the RCMP (see Appendix H) and offered specific information about who prosecuted the case, who defended the case, who judged the case, and which laboratory provided expert testimony.\textsuperscript{97} This information was used as the beginning reference list for potential respondents, and allowed the targeting of a population which would otherwise have been extremely difficult to locate.

Personnel from the RCMP Forensic Laboratories in Edmonton, Ottawa, and Vancouver; the Calgary Police Service; the Crown’s office in Calgary; defence counsel in Abbotsford, Calgary, Ottawa, and Vancouver; judges in Abbotsford, Calgary, Edmonton, and Ottawa, and laboratory technicians in Calgary, Ottawa, and Vancouver, assisted in the snowball distribution of 250 anonymous questionnaires, which were mailed with a cover letter and postage paid return envelope. By the end of March 1995, 191 out of the 250 (76\%) questionnaires had been returned.

Frequency distributions were examined and crosstabulations of relevant variables by profession were computed. Chi-square statistics were calculated to assess the difference in the response distributions between the Crown and defence lawyers. Probabilities associated with the observed chi-squares were assessed using exact test procedures.\textsuperscript{98}

\textsuperscript{96} Others was a category provided which would accommodate lawyers who were neither crown nor defence counsel (e.g. civil litigators of family law), private investigators who were neither police nor detectives, criminologists, laboratory technicians, and others involved in the criminal justice system.

\textsuperscript{97} All of the DNA samples in these cases were tested by the RCMP.
Several significant findings were obtained which indicated differences between the professions regarding their opinions and evaluations of DNA evidence issues. After consideration of these findings, it became apparent that defence counsel were most lacking in knowledge of the issues, but the questionnaire responses did not include information to show why this might be the case. It was decided, therefore, that interviews with defence counsel would be the most feasible means to obtain further insight. Hence, the enlistment of the qualitative research method described below.

3.3 Qualitative Data Collection

Strauss and Corbin (1990) assert that an important aspect of qualitative data collection is its capacity to contextualize and validate other sources (55). The use of multiple methods, or triangulation, is considered an integral component of sound social research (Denzin & Lincoln, 1994:2). In order to triangulate the thesis research, the quantitative data already obtained were cross-checked with interviews from a sample of defence lawyers who have had some experiences with DNA evidence. These defence counsel either participated in an actual trial with DNA as part of the evidence, or have been involved in other ways such as, for example, defending cases in which the accused pleaded guilty before an actual trial. Since the mail out questionnaire asked specific questions derived from the prevailing literature on DNA evidence, the questions which showed clear discrepancies between the literature and the actual quantitative findings became the focus of the interviews with defence counsel (Strauss & Corbin, 1990:52) (see Appendix I). The question of

50 Probabilities could not be approximated using the usual asymptotic methods because of the relatively small sample size, which contributed to sparse response distributions across cells.

50
whether or not there is a difference in cases which use legal aid defence lawyers as opposed to private defence lawyers was also addressed.

Several other issues evolved in the first few interviews, which were carried into the interviews thereafter. For example, in the province of British Columbia there was, on average, a higher proportion of defence lawyers who had also, at one point or other, worked as ad hoc counsel for the Crown. Therefore, to accommodate jurisdictional differences among provinces, this became the first question asked in the interviews. These differences will be discussed in greater detail in the findings reviewed in Chapter Four. Further, while the interviews consisted of both open-ended (section A) and closed-ended questions (section B), participants were afforded an opportunity to elaborate or improvise. Section C, the last section of the interview, allowed for any comments, observations, and suggestions. In this section, I allowed the participants to choose a fictional name for their own identification purposes, and the time for any additional questions.

This partially inductive approach to research is invaluable, because the otherwise positivistic quantitative approach is limited in certain respects. What actually constitutes scientific research is debatable, as noted by, among others, Johnson, 1972; Harvey, 1990; Strauss & Corbin, 1990; Cameron et al., 1992; Rubin & Rubin, 1992; Silverman, 1993; Thomas, 1993; Denzin & Lincoln, 1994; and O'Connell Davidson & Layder, 1994. However, it has become apparent in this thesis that both a deductive and an inductive approach to this topic are necessary, in order to extend the interpretations of this research. This triangulated evaluative method adds to the overall validity of this study.

99 Ad hoc meaning that defence counsel was appointed for a special purpose to represent the Crown in particular instances or cases (Black's Law Dictionary, 1990:41).
since "deductive as well as inductive thinking are both very much part of the analytic process" (Strauss & Corbin, 1990:148).

It is important to note that the quantitative questionnaire in this study-was distributed to a diverse population (Crown counsel, defence counsel, judges, police/detectives, scientists, and others). These various participants were all affected by pre-existing beliefs at the onset of their answers to the proposed questions. Therefore, their frame of reference undoubtedly swayed their interpretation of the words written, or the meaning of these words. Although the questionnaire was rigorously formulated, it still is a flawed account of the actual meaning of these responses (Thomas, 1993:3; O'Connell Davidson & Layder, 1994:196-202), as it is impossible to know whether all the respondents who gave the same answer in actuality meant the same thing (Cameron et al., 1992:12). Therefore, the qualitative tool is more adequately represented as the observational aspect of an inductive approach.

While the authors of positivistic research typically critique others' research based on its alleged lack of validity, it is important to note that any standard outline for conducting interviews (Silverman, 1985:160) can be a restrictive measure, and may not allow more information than already obtained in the questionnaire (Denzin, 1970:125). Consequently, it was necessary to integrate both open and closed-ended questions to allow for as much explanation and clarification as needed, despite sacrificing the comparability of one interview with another. This triangulated method is a great contribution to science, even if it does subsume some 'unscientific' ingredients (Feyerabend, 1975:305), because this method will allow for the verification of questions, which quantification cannot achieve on its own. It is also important to acknowledge that the moving back and forth between an inductive and deductive analysis is what makes a theory grounded, because there is a con-
stant interplay between statements of relationships and the verification of these statements (Strauss & Corbin, 1990:111).

It is worth repeating that the objective of these interviews was to allow defence counsel to clarify their responses, by explaining and elaborating on the findings from the mail-out questionnaire. However, it was expected that more questions would develop during the interviewing process. As a result, these interviews were conducted in an interactive style (Kirby & McKenna, 1989:68) to allow for as much information sharing as possible. Furthermore, an interactive approach is key in attempting to gather as much insight as possible into any given situation, as argued by Cameron et al. (1992):

> We inevitably bring our biographies and our subjectivities to every stage of the research process, and this influences the questions we ask and the ways in which we try to find answers. Our view is that the subjectivity of the observer should not be seen as a regrettable disturbance but as one element in the human interactions that comprise our object of study. Similarly, research subjects themselves are active and reflexive beings who have insights into their situations and experiences. They cannot be observed as if they were asteroids, inanimate lumps of matter: they have to be interacted with. (5)

The participating defence lawyers also had varying exposure to DNA issues, and all brought these experiences into the interview process. It should also be stressed that as the interviews progressed, I gained more experience which also influenced the responses received. The participants were able to ask questions of me and these questions were, again, an integral part of this research. The constant sharing of ideas brought many innovative questions to the foreground, which would not have been feasible had the interviews been fully closed-ended.

My own "conceptual baggage" has undoubtedly affected the answers of some of these participants. This conceptual baggage relates to my own preconceived beliefs regarding defence counsel and their reactions to my research.
However, I followed Kirby & McKenna's (1989) advice, and kept a notebook on all my thoughts prior to every one of these interviews, as well as after the interviews, to be able to see how much of what I was hearing in the interviews were my own biases (49).

In some of these interviews, defence counsel seemed to become excited by certain questions. An example of this was when I would ask about the assistance provided by Legal Aid services in relation to clients who had DNA evidence pointing to their guilt. The responses were presented in a loud manner, suggesting agitation. I was paying close attention to the body language of the counsel, and was aware of potential sensitive issues (Lee, 1993). I recorded these responses, as well, since I had left some room at the end of the interview questionnaire for such observations (see Appendix I). I should emphasize, however, that I was careful to ask all the same questions in all the interviews to ensure some form of standardization.

The 22 interviews were conducted in the offices of defence counsel, or in places most convenient to them. The interviews were conducted in person, with the exception of the interviews conducted with defence lawyers in Delta, Ottawa, Toronto, Victoria, and Winnipeg, which were done via telecommunication.\textsuperscript{100} It was expected that each interview would be unique; hence there was no restrictive time-limit. Nevertheless, I discussed the matter of time with the participant when contact was first established, to ensure that the interviews would not interfere with the respondent's work. Open, honest and straightforward communication with the participants was an important aspect of these interviews, to ensure that none of the participants left the interview with any doubts about their confidentiality, or concerns about other issues (McKenna & Kirby, 1989:102-104). The participants were provided with my telephone num-

\textsuperscript{100} Nine of the out-of-town participants responded via telephone. These interviews were also taped.
ber along with that of my senior supervisor, should any questions or concerns arise after the interviews.

The initial contact was made through a fax (see Appendix J), which was followed with a telephone call approximately a week later. A total of 22 interviews were conducted with defence counsel (two females and twenty males). Thirteen of the defence counsel (59%) in the sample had, in total, done between 3 and 6 DNA cases. Six defence counsel (27%) had been involved with 6 to 9 DNA cases, and three defence counsel (14%) had defended more than nine. All interviews took place between February 11 and July 10, 1997. In addition, geneticists and statisticians at Duke University and North Carolina State University were consulted regarding the scientific aspects of this thesis.

The cities of Calgary and Vancouver acted as the points of departure for the snowball sample, because defence lawyers in Calgary who have been involved in DNA cases were known to me, and access to Vancouver defence lawyers was made possible by the senior supervisor making the initial contact on my behalf. It is interesting to note that this snowballing effect brought participants forward from all across Canada, which could not have been achieved had I not asked for other possible participants. In most interviews, names of other defence lawyers were provided early in the interviews, which contributed to the identification of additional participants.

It was recognized that the defence lawyers in these interviews might not wish to disclose certain information to other members of the legal profession. Therefore, no names will at any time be disclosed in this thesis, or at any other time, to ensure confidentiality of the spoken words. However, the recording device was necessary to ensure accuracy when reporting (least amount of prejudice and preferred meanings) and to allow the data to speak to the researcher. In all cases, permission to record was discussed prior to the inter-
view with the participants (Kirby & McKenna, 1989:114). The participants were informed that, at any time, they might ask a statement to be “off the record” (Wolcott, 1995:113) if they so wished.

All participants were informed about the actual research objective, the use of their spoken words, and what they could expect from participating in the study (ibid: 111). They were also apprised that there would be no rewards or personal repercussions from this research, apart from the benefit of assisting lawyers and other members of the criminal justice professions in gaining a better understanding of defence counsel’s access to DNA evidence. Any information provided during these interviews which, directly or indirectly, implicates or incriminates other institutions, was closely censored. The content of the interviews, including the information provided on specific cases, was examined to ensure that there was no harm or threat to any institutions or participants.\textsuperscript{101}

If the participant disclosed any information about specific defendants or other individuals, this material was treated with the same confidentiality afforded participants. The participants were assured that any recorded information would be destroyed after transcription. In addition, care was taken in the transcripts to exclude any specific information on individuals.

Given the potential ‘political’ nature of DNA evidence, the research can pose an ‘intrusive threat’ because it deals with areas that can be private and stressful (Lee, 1993:5). However, the sensitive nature of this research was not known until the onset of these interviews, since the meaning of threat varied from one interview to the next. Therefore, I was aware of the possibility that the participants might be reluctant to discuss certain issues. In addition, legal

\textsuperscript{101} Some of the interviews included specific opinions of the defence lawyers on the outcome of some criminal cases. This information was closely censored to maintain the anonymity of the accused and the convicted.
ethnography has ethical boundaries pertaining to the *Code of Professional Conduct*. Lawyers have a duty of secrecy to their clients indefinitely (Beaman-Hall, 1996:66). Consequently, I was careful not to prejudge a lawyer's choice to refrain from becoming specific while answering certain questions by keeping in mind the solicitor-client privilege, which is the basis that lawyers will protect their clients' secrets and all other "communications between the solicitor and the client" (Brockman & Rose, 1996: 364).

The potential for harming or wronging participants is always a concern, because, inter alia, researchers can unintentionally offend participants through inappropriate behaviour, comments, or questions (Kirby & McKenna, 1989:104; Wolcott, 1995:87). It was my responsibility to acknowledge that the questions asked of the participants could have an effect on their lives, and that pushing, manipulating, and nagging the participants to give some wanted response was not acceptable (Kirby & McKenna, 1989:106-107). Therefore, questions during these interviews were posed with courtesy and patience (*ibid*:87), taking into account, as far as possible, these ethical constraints.

### 3.4 Limitations of the Study

While the questionnaire and the interviews clearly guided the themes of this thesis, it is important to note that the categories examined are not mutually exclusive or exhaustive. There are questions which could have been addressed or discussed in greater detail, but due to space limitations, were not.

The quantitative questionnaire was developed to get an overall picture as to who knows what within the Canadian criminal justice system. It was not devised for the sole purpose of questioning defence lawyers. For this reason,
some of the questions were too technical, and some too broad to extract useful information. As a result, many of the questions in the questionnaire were not used in this thesis. Nonetheless, some of the results from these questionnaires were confirmed in the subsequent interviews with defence counsel.

The Likert scale itself was also flawed. I had mistakenly entered the “disagree” category in the box where “disagree slightly” should have been entered. However, both categories appeared in the questionnaire and both categories were checked off by all the participants. The drawback is the possibility that some participants just checked off a box without reading the answers they were giving. Of course, this issue could easily appear in any other type of questionnaire. Still, it is unfortunate that it happened in this instance.

Another limitation of this study is its sample size. The 191 returned questionnaires were not representative of the Canadian Criminal Justice System and the 22 interviews were not representative of defence counsel; however, inferences can still be made from such results. For example, the 22 interviews were conducted with knowledgable defence counsel on the topic of DNA evidence. Using a snowball sampling technique allowed me to reach defence counsel about whom I might otherwise not have heard. The interviews were allowed to snowball until the same persons were mentioned again and again. At that point, it became clear that I had successfully located those defence lawyers who were known to the defence bar for their involvement with DNA cases. The snowball effect allowed me to reach counsel from the Lower Mainland of British Columbia to some eastern cities. This, I believe, was the best method for locating these lawyers; however, again, it cannot be known if I in fact located Canada’s most knowledgeable defence lawyers or those who have successfully challenged DNA evidence. Nevertheless, the information
passed on to me in these interviews is invaluable to understanding how defence lawyers deal with issues relating to such evidence as DNA.
CHAPTER FOUR

Quantitative and Qualitative Findings

Scientific innovation is a pragmatic, matter-of-fact process in which bits and pieces are selected and fitted together in order to achieve an end. As in other practices, the bits and pieces are heterogeneous; chemical materials, instruments, organisms, the skills of technicians, a supply of oxygen, electronic equipment. The object is to juxtapose such objects into an array that generates a product that is somewhat less heterogeneous, somewhat simpler and somewhat more docile than what it grew from. Often this product takes the form of traces: figures, graphs or photographs replace unwieldy bodies or natural forces. They lie, on neat sheets of paper, ready to be summarised, simplified, juxtaposed, and generally rendered even more docile. They are shaped and fitted into a literary array— for the most visible end-product of much scientific work is the scientific article, the patent, or the report. At any rate, it takes the form of a document that will travel beyond the walls of the laboratory and, so it is hoped, convince those who read it. (Law, 1991: 56)

4.1 Introduction

There is little doubt that the last quarter of this century will be regarded as the golden age of human genetics. It is extraordinary to think that while the true number of human chromosomes was determined only in 1956 (Watson, 1981), the present number of cloned human genes and deoxyribonucleic acid (DNA) fragments is now approximately 3105 (Witkowski, 1991: 12). While we are a long way from identifying the entire human genome sequence, we have advanced at an amazing speed. Most recently, the cloning of a sheep\textsuperscript{102} signifies yet another advance within the field of genetics (Wilmut

\textsuperscript{102} Early this year, the journal \textit{Nature} (February, 27, 1997) published an article on the cloning of a sheep. Dolly, the sheep, was derived from the mammary gland of a Finn Dorset ewe and a Scottish Blackface ewe by transferring a single nucleus at a specific stage of development to an enucleated unfertilized egg resulting in the birth of a healthy sheep. This type of cloning was a remarkable development to the genetics field.
et al., 1997). Given these developments, it is not entirely surprising that DNA evidence lies outside the comfort zone of many defence lawyers.

The intrusion of acronyms such as RFLP, PCR, VNTR's, STR's, MLP, HLA-DQ, and DQ-alpha (to name a few) has turned courtrooms into laboratories orchestrated by judges and juries with limited knowledge with which to challenge the experts, who credit all forms of “life” to the interactions and organizations of atoms and molecules (DNA). The mastery of modern scientific techniques, such as DNA analysis, is recognized as becoming an increasingly heavy burden for judges, who are now having to decide on the admissibility of scientific evidence (Gatowski et al., 1996:86). It should also be acknowledged as being especially burdensome for defence counsel who, as this research will show, are the ones with the least scientific ammunition to combat or challenge the use of DNA analysis in proving legal guilt or innocence of an accused (Cohen, 1985:385).

The aim of this research was to analyze the issues and problems which a defence lawyer may face, both pre-trial and at trial, when he or she is dealing with a case involving DNA evidence. A triangulated approach to these issues was used to ensure the soundness of the findings (Denzin & Lincoln, 1994:2).

The quantitative data obtained was cross-checked (triangulated) with interviews from defence counsel who have had varying experiences with DNA evidence. Attorneys were chosen as participants for this thesis if they had defended at least one DNA case, even if the accused pleaded guilty, or if they had co-defended with another counsel. The purpose of this thesis was to gather information on defence counsel’s knowledge, opinions and overall access to DNA evidence within the Canadian criminal justice system.103
The results of this thesis have been separated into quantitative and qualitative findings, although they overlap in many respects. The quantitative data will be analyzed first, with the qualitative findings following. The categories, which evolved from the interviews with defence lawyers and signify the difficulties that defence counsel may encounter when faced with a DNA case, are as follows: assessment of the actual DNA evidence, including being able to obtain the information (education) on how to assess DNA evidence, and the understanding of the evidence; access to independent expert witnesses, including getting access to independent experts to assist defence counsel in evaluation of the actual disclosures and reports provided by the courts; and full disclosure of DNA results and challenging the DNA evidence in court. It should be noted, however, that these categories overlap in many respects.

4.2 Questionnaire Returns

Two deadlines set for incoming questionnaires were the end of February, 1995 and the end of March, 1995. Table 1 shows the data on responses of the participants after round one and round two, and overall.

Table 1 indicates the number of returned questionnaires among the professions after round one (72.4%) and round two (76.4%). It is interesting to note that Crown counsel had the lowest response rates, while the police and the detectives had the highest. The high return rate overall may be an indication that professions within criminal justice had an interest in DNA evidence, which may be the result of the publicity that DNA was accorded during this time period. It is also possible that, due to the lack of legislation, the partic-

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103 Since this thesis was looking at defence counsel's access to DNA evidence, other informants such as Crown counsel and scientists were sought only to assist in the formulation of the questions which may have been an issue for defence counsel in the eyes of a third party.

104 Criminal Code sections 487.04 to 487.09, the DNA Identification Act (Bill C-94), and amendments to the Young Offenders Act had not been enacted at this time.
Participants were eager to have their opinions heard. At the end of March, when 191 questionnaires had been returned, the data were analyzed.

Table 1
Returns of Questionnaires

<table>
<thead>
<tr>
<th>Value Label*</th>
<th>Sent Surveys</th>
<th>Round One Returns</th>
<th>Value Label</th>
<th>Round Two Returns</th>
<th>Response Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crown Counsel</td>
<td>40</td>
<td>20</td>
<td>Crown Counsel</td>
<td>20</td>
<td>50%</td>
</tr>
<tr>
<td>Defence Counsel</td>
<td>40</td>
<td>31</td>
<td>Defence Counsel</td>
<td>31</td>
<td>78%</td>
</tr>
<tr>
<td>Judge</td>
<td>40</td>
<td>30</td>
<td>Judges</td>
<td>35</td>
<td>75%</td>
</tr>
<tr>
<td>Police / Detective</td>
<td>50</td>
<td>44</td>
<td>Police / Detectives</td>
<td>49</td>
<td>88%</td>
</tr>
<tr>
<td>Scientist / Technician</td>
<td>40</td>
<td>33</td>
<td>Scientists / Technicians</td>
<td>33</td>
<td>83%</td>
</tr>
<tr>
<td>Other</td>
<td>40</td>
<td>23</td>
<td>Others</td>
<td>23</td>
<td>58%</td>
</tr>
<tr>
<td>Totals</td>
<td>250</td>
<td>181</td>
<td>Totals</td>
<td>191</td>
<td>76.4%</td>
</tr>
</tbody>
</table>

* Participants who filled out the snowballed questionnaire (see also Appendix G).

4.3 Quantitative Findings

Steventon (1993) investigated how defence counsel, Crown counsel and scientists in Britain viewed DNA evidence. She was particularly interested in how defence lawyers coped with DNA evidence, during pre-trial and at trial. Her study did not, however, focus on the degree to which both defence counsel and Crown counsel understood the DNA evidence. This latter issue was of special concern in the present study. Because there was a dearth of literature on the subject,\textsuperscript{105} I decided to focus mainly on the similarities and differences between defence counsel and Crown counsel with respect to their understanding of DNA evidence and their access to various resources of DNA expertise.

\textsuperscript{105} See supra footnote 49.
Since all of the quantitative data gathered for this research do not appear in this thesis, the unused portion may be analyzed separately at a later date.

When the participants were asked about the process of DNA analysis, 26% of defence lawyers answered that they did understand such a process and 80% of Crown counsel indicated that they understood how DNA analysis was conducted (see Table 2, Question 1).\footnote{See Appendix G, question 7 in the actual questionnaire.}

### Table 2
Results of Questionnaire Questions: The DNA Process

<table>
<thead>
<tr>
<th>Questions</th>
<th>Label</th>
<th>N</th>
<th>Yes %</th>
<th>No %</th>
<th>$\chi^2$</th>
<th>df</th>
<th>Exact p values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1. Do you understand the process of DNA profiling?</td>
<td>Crown</td>
<td>20</td>
<td>80%</td>
<td>20%</td>
<td>14.33</td>
<td>1</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td></td>
<td>Defence</td>
<td>31</td>
<td>26%</td>
<td>74%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q2. Do you understand the differences between the PCR and RFLP techniques?</td>
<td>Crown</td>
<td>20</td>
<td>20%</td>
<td>80%</td>
<td>1.09</td>
<td>1</td>
<td>p = .41</td>
</tr>
<tr>
<td></td>
<td>Defence</td>
<td>31</td>
<td>10%</td>
<td>90%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is difficult to explain what exactly the respondents knew about DNA analysis, based on their answers to this particular question. DNA analysis is a complex process. Therefore, while lawyers may understand that scientists extract DNA from a piece of clothing, they may not know how this procedure is conducted. Furthermore, it is not inconceivable that the defence lawyers actually knew more than the Crown, but that they were less willing to agree that they were knowledgeable. So the next questions sought more detailed information about their understanding of the DNA process, or what they say they know.

A more specific question inquired into their understanding of the polymerase chain reaction (PCR) and the restriction fragment length polymorphism (RFLP) techniques and the differences between them (see Table 2,
Table 3
Results of Likert Scale Questionnaire Questions

<table>
<thead>
<tr>
<th>Likert Scale Questions / Assertions</th>
<th>Label</th>
<th>N</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1. DNA samples can be contaminated</td>
<td>Crown</td>
<td>20</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>Defence</td>
<td>31</td>
<td>0%</td>
<td>0%</td>
<td>16%</td>
<td>0%</td>
<td>0%</td>
<td>77%</td>
<td>7%</td>
</tr>
<tr>
<td>Q2. RCMP labs use sound laboratory techniques</td>
<td>Crown</td>
<td>20</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>20%</td>
<td>45%</td>
<td>35%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Defence</td>
<td>31</td>
<td>0%</td>
<td>0%</td>
<td>10%</td>
<td>77%</td>
<td>7%</td>
<td>7%</td>
<td>0%</td>
</tr>
<tr>
<td>Q3. RCMP has a Priority Case System</td>
<td>Crown</td>
<td>20</td>
<td>0%</td>
<td>0%</td>
<td>5%</td>
<td>15%</td>
<td>30%</td>
<td>50%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Defence</td>
<td>31</td>
<td>0%</td>
<td>3%</td>
<td>0%</td>
<td>68%</td>
<td>3%</td>
<td>19%</td>
<td>7%</td>
</tr>
<tr>
<td>Q4. DNA labs should be privatized</td>
<td>Crown</td>
<td>20</td>
<td>20%</td>
<td>25%</td>
<td>0%</td>
<td>45%</td>
<td>5%</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Defence</td>
<td>31</td>
<td>0%</td>
<td>7%</td>
<td>0%</td>
<td>74%</td>
<td>7%</td>
<td>16%</td>
<td>0%</td>
</tr>
<tr>
<td>Q5. Due to rapid changing technology, a DNA databank should not be established yet</td>
<td>Crown</td>
<td>20</td>
<td>0%</td>
<td>10%</td>
<td>20%</td>
<td>5%</td>
<td>15%</td>
<td>50%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Defence</td>
<td>31</td>
<td>0%</td>
<td>3%</td>
<td>7%</td>
<td>39%</td>
<td>7%</td>
<td>39%</td>
<td>7%</td>
</tr>
</tbody>
</table>
Question 2). Twenty percent of the Crown answered "yes" that they understood the PCR and the RFLP techniques, while only 10% of defence counsel claimed to have this understanding. However, the differences between the groups were not statistically significant. These results indicate that neither the Crown nor defence counsel knew much about the technical aspects (specifically the RFLP and PCR techniques) of DNA analysis.

The technical aspects of lawyers' understanding of DNA evidence were further explained when the participants were asked whether or not they agreed that DNA samples could be contaminated. All of Crown counsel, but only 84% of defence counsel, agreed that DNA samples could be contaminated. However, 16% of defence counsel seemed unsure (see Table 3, Question 1). While the differences between the groups are significant, the overall conclusion is that most lawyers are aware of the possibility of contamination of DNA samples. However, defence lawyers appear to be slightly less sure about this issue. This finding may help account for the fact that defence lawyers seldom challenge DNA evidence in court, or if they do, they typically ask the wrong kinds of questions (Thompson, 1993:62; Sheck, 1994:1962; Robertson & Vignaux, 1995:146).

It may be argued that lawyers cannot know the specifics of forensic science techniques; however, such knowledge is necessary when defending an accused who may stand trial on a serious criminal charge. If defence counsel are not able to understand the evidence, they will not be able to challenge it.

Experts are necessary when presenting DNA evidence (Phillips, 1990:17), and in assisting counsel to scrutinize the work of forensic laboratories (Kaye, 1993:102). In the United States, where both commercial and gov-

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107 See Appendix G, question 6 in the actual questionnaire.
108 See Appendix G, question 10.
ernment laboratories are utilized for DNA analysis, well-credentialized experts are hired by the defence to question laboratory procedures and analyses to prevent conflicting results from seducing juries (*ibid*). In contrast to practices in the United States, in Canadian courts the DNA results presented by the experts are rarely questioned. This might be explained largely by the fact that most of the testing in Canada is done by government agencies such as, for example, the RCMP laboratories and the Centre of Forensic Sciences.

When asked to respond to the assertion that the RCMP laboratories use sound laboratory techniques, 10% of defence counsel disagreed, and 77% neither agreed nor disagreed. Defence counsel who responded that they neither agreed nor disagreed with this assertion demonstrated their lack of knowledge of the soundness of the DNA techniques used at the RCMP laboratories. Crown counsel, on the other hand, seemed more sure about the soundness of the RCMP laboratory techniques, 45% of Crown counsel agreed slightly, 35% agreed, and 20% neither agreed nor disagreed (see Table 3, Question 2).109

This varying response may be largely due to the fact that the Crown are in closer contact with the RCMP laboratories than the defence counsel. However, the result could also be a reflection of the view that the RCMP laboratories are *police-controlled crime laboratories* (Giannelli, 1993:117), which could, potentially, be unfavorable to the defendant.

As noted earlier, the RCMP have a Casework Priority System, which rates cases based on the seriousness of the crime, whether or not the DNA evidence is pivotal to the case, and whether or not a conviction could be obtained without it.110 Therefore, defence counsel see the RCMP laboratories not only

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109 See Appendix G, question 11.
110 This information was obtained in the following document: Letter addressed to All Chief Crown Prosecutors and All Directors and Assistant Directors from the Alberta Attorney General, May 5, 1989: RE: Implementation of DNA Analysis.
as police-controlled laboratories, but also as Crown oriented institutions which are not responsive with respect to defence counsel's needs. Another dilemma may occur when the Crown orders samples to be analyzed at, for example, an RCMP laboratory. Under these circumstances defence counsel typically cannot utilize the RCMP for expert advice or independent testing. However, when defence counsel were asked whether or not they agreed that the RCMP has a Priority Case System, the respondents in most instances neither agreed nor disagreed (see Table 3, Question 3). In contrast, the Crown agreed in 80% of cases. This was expected since a memo had been distributed by the Attorney General to the Crown prosecutors in Canada explaining the Priority Case System implemented by the RCMP.

Although this finding is statistically significant, it is still somewhat puzzling and difficult to explain why defence counsel are neither agreeing nor disagreeing with the assertion. One probable explanation for this finding may be that, if defence counsel do not utilize the RCMP laboratory services, then, for obvious reasons, they may be unfamiliar with the specific protocols and equipment used within these institutions. Furthermore, if defence counsel do not challenge DNA evidence in court because they do not understand the issues, then they may not be familiarizing themselves with the procedures and analyses of the labs and may merely criticize the integrity of the RCMP, CFS, or other private laboratory testing procedures.

It is alarming to think that defence counsel rely on the Crown to seek out the experts who uphold the validity of the tests, the testing procedure and the protocol. "Those experts are only a minority of the scientific community and do not represent the united view nor, in many cases, do they represent the

111 This issue was clarified with the 22 interviews, which will be discussed in the next section.
112 See Appendix G, question 20.
consensus" (Brodsky, 1993:15). It is important that defence counsel challenge DNA evidence by cross-examining Crown witnesses and by calling independent experts. As Brodsky (1993) asserts:

Experimental errors, sample errors, subjective interpretation of the patterns, lack of population studies, lack of uniform criteria to establish pattern concordance are matters counsel must emphasize in presentation of the challenge to the DNA world or be minimized by the Crown in the presentation of the evidence. (15)

Undoubtedly, DNA evidence represents a new and powerful technique; however, recent experiences in Canada\textsuperscript{113} suggest that in common with other scientific evidence, it needs to be treated with some caution and is clearly open to challenge (Kearney, 1990:49). For this very reason, defence counsel should understand the issues surrounding this kind of scientific evidence.

Unless defence counsel become more familiar with DNA evidence, challenging any results seems to be an impossible task. For example, in R. v. Parent, defence counsel did not aggressively dispute the data bank used to derive probability statistics. The matches of the DNA samples were left for the jury to weigh, along with all the other evidence (Brodsky, 1993:17). However, leaving statistical evidence in the hands of juries can be problematic. Thompson (1989) addresses this issue in one of his articles, where he looks at various types of rate statistics. He notes the following:

Although base rate statistics are often highly relevant and informative, their probative value depends on a number of factors. To deal competently with base rate statistics, jurors must take these factors into consideration. However, several poten-

\textsuperscript{113} The fraudulent handling of scientific evidence at the Centre of Forensic Sciences surfaced with the inquiry into the case of R. v. Morin. The nine month re-trial of Guy Paul Morin in 1991 "featured a mammoth battle over the meaning and accuracy of five microscopic fibres found in the Morin home and Morin's car that appeared to match six or seven fibres on Christine's clothing" (Makin, the Globe & Mail, September 16, 1997f.A9A). However, it later turned out that the fibres has somehow become mixed with fibre samples plucked from Morin's car and the clothing found on Christine's body, which made them "dangerously unsound." Nonetheless, this information was withheld from the trial and counsel and only surfaced because someone at the CFS divulged the information.
tial problems with base rate statistics may make these statistics misleading if jurors fail to understand their defects. (15)

Therefore, since DNA evidence can have subjective elements in the declaration of matching bands, defence counsel should be attacking the process in court (Kaye, 1993:112). This is, however, difficult when defence counsel is either unsure or unaware of the DNA techniques.

When the participants were asked their opinions about the privatization of DNA laboratories, the findings were statistically significant (see Table 3 Question 4).¹¹ A greater percentage of Crown (45%) than defence counsel (7%) disagreed with the privatization of DNA laboratories. This was, however, expected since the Crown is well-connected with the RCMP, the CFS, and the Laboratoire de Police Scientifique. While the level of agreement to have DNA laboratories privatized was on average slightly higher among defence counsel (20%) as opposed to Crown attorneys (10%), the variation was expected to be higher because of Canada's limited commercial laboratories for the use of defence counsel (Lussier, 1992:327). Again, the present research supports Lussier's (1992) observation that "in a court of law . . . the process of peer review and information exchange is not available and, unaware of potential flaws in a novel scientific technique, lawyers often fail to challenge it" (331). Therefore, it is becoming apparent that the understanding of DNA evidence is the key to launching any court challenge which could potentially raise reasonable doubt.

Of special interest is the question of establishing a national DNA database, an issue which has become increasingly prominent in the media (Bindman, 1997; Tibbetts, 1997). The purpose of such a facility "is to help law enforcement agencies identify persons alleged to have committed designated offences" (House of Commons of Canada, 1997). However, when the partici-

¹¹ See Appendix G, question 31.
pants were asked to agree or disagree with the implementation of a DNA data bank, because of the rapidly changing technology, the responses from the Crown and the defence were quite similar (see Table 3, Question 5).\textsuperscript{115}

Sixty-five percent of Crown counsel and 52\% of defence counsel agreed that a DNA data bank should not yet be established. In contrast, 30\% of the Crown and 10\% of defence wanted a DNA data bank established regardless of the changing technology. A relatively small percentage (5\%) of the Crown neither agreed nor disagreed, as opposed to 39\% of defence counsel. These pattern further support the recurrent finding that defence counsel are apparently lacking in knowledge about the various DNA issues. Unfortunately, due to the limitations of a questionnaire survey of this type, it is not clear why defence counsel are indifferent or limited in their understanding of DNA related issues. Speculations as to why defence and Crown counsel have responded in this manner have been made, but cannot be verified as the responses were anonymous. However, in an effort to clarify these responses, 22 defence lawyers were subsequently interviewed on various issues relating to DNA evidence in criminal cases. These findings will be examined next.

4.4 Qualitative Findings: In Their Own Words

Twenty two defence lawyers (two females and 20 males) from Calgary, Ottawa, Toronto, Vancouver Lower Mainland, Victoria and Winnipeg were first contacted through facsimile (see sample letter in Appendix J), and then by telephone. Their length of experience as defence counsel ranged from 5 to 27 years with an average of 16.3 years.

The defence counsel, in some cases, contacted me once they had received the fax. On a few occasions, lawyers introduced me to colleagues from

\textsuperscript{115} See Appendix G, question 33.
the same law firm who had had experience with DNA cases. However, in most instances, the snowball effect was initiated in the interviews. These interviews allowed for the contextualization and validation of the quantitative data, which had left so many questions unanswered (Strauss & Corbin, 1990:52). This approach granting the participants to answer the questions presented as they choose; in essence, permitting their voices to be heard (Thomas, 1993:4). Furthermore, this interactive approach, which integrated both open and closed-ended questions, allowed for elaboration, explanation and clarification, which was not possible through the mail out questionnaire (Feyerabend, 1975:305; Kirby & McKenna, 1989:68; Cameron et al., 1992:5).

Ten defence counsel (46%), all from the province of British Columbia, had worked as ad hoc Crown counsel in their career as defence counsel. Their information was invaluable to this research, as they provided insights from both a Crown and defence counsel’s perspective. It should, however, be noted that the objective of these interviews was not to contrast Crown counsel knowledge about DNA evidence with that of defence counsel, but to analyze the issues which defence counsel face when DNA evidence is present in their cases.

4.4.1 Access to Assessment of the Actual DNA Evidence

Throughout the interviews, defence counsel voiced the importance of having a complete independent assessment of the actual DNA evidence in order to understand it and interpret it for their purposes. As a result, there appears to be a close relationship between the assessment and the understanding of that assessment. Thus, if one does not have the competency to understand the evidence, there can be no assessment or evaluation. The resulting vulnerability creates the feeling amongst defence counsel that DNA
evidence is so overwhelming that it is not possible to contest the evidence in court.

Assessment of DNA evidence becomes most problematic for defence counsel when they are unaware of the issues presented. Such problems of scientific assessment are not unique to DNA evidence. Nonetheless, being unable to assess the reliability of the DNA evidence will most likely result in the expert testimony being accepted as ‘truth’ by a jury (Thompson & Ford, 1992; Thompson, 1993). Furthermore, the contesting of DNA evidence is usually dependent upon defence counsel’s ability to produce an expert to challenge the evidence. But again, challenging the evidence can only arise if the defence counsel possesses the means to assess its reliability (Thompson & Ford, 1994).

Some of the most successful challenges to DNA evidence within Canadian courts have been launched by defence counsel who have understood the issues involving, for example, probability statistics. Defence counsel Mr. Stone\textsuperscript{116} was successful in having these highly seductive statistics eliminated from two cases in Ontario. He commented,

\begin{quote}
\text{[t]he last case I saw, the stats are now in the billions. When I worked on the Johnston case, it was something like 1 chance in 320 millions in the male population in Ontario. I looked at the expert and said that there wasn’t 320 million males in Ontario. There haven’t been in the history of the world that many males in Ontario, so that number made no sense to me. So I told the expert not to give a number that makes no sense!}
\end{quote}

Although, his argument is rather weak, it does show that defence counsel who attempt to challenge DNA evidence, are able, in some instances, to debar the court from admitting evidence which could potentially be given too much weight.

\textsuperscript{116} Fictitious names are used to ensure confidentiality of participants. In some instances, the defence counsel chose their own fictitious names.
Matching and non-matching are dependent upon the data bases used to compute the probative values. Hence, it is important to know that the availability of the population structure could undermine the validity of the computational procedures used by forensic laboratories, and that the "evidence of a match is meaningless if one does not know the approximate population frequency of the DNA pattern" (Lander, 1991:821). It was for this very reason that this defence counsel was able to launch a valid argument. Furthermore, his defence team began to challenge all Canada's data bases, because they believed that the numbers were incorrect and misleading:

[we] challenged all the data bases they [RCMP] have. Of course some of them were wrong. Scientists find this very amusing, because when they say that the number is in the millions, then it is the guy [the accused person] according to them. Where we lawyers say, wait a minute, you guys thought that the data base for Caucasians would be different from the data base for native Canadians, and you're right it is, but you thought that the data base would be the same all across the country, and it isn't. The data base for native Canadians from Manitoba is just as different as it is from Vancouver Island as it is for each of the Caucasian ones. Scientists think that we are very picky!

It is essential, therefore, to understand the evidence, if one is to defend or dispute its presentation. This is not, however, such a simple matter, as became increasingly apparent in all of the interviews. When asked what was some of major problems for defence counsel in terms of DNA evidence, Mr. Stone made the following comments:

the biggest problem is knowing how it [DNA] works. Because it isn't like fingerprinting. It is not difficult to explain to the man in the street how fingerprinting works, or how the analysis of glass works, or things like that....or even the analysis of bullets. For one thing you have seen a lot of that on television, so everybody knows how bullets work. Well, but this stuff [DNA], at first blush, appears to be very very complicated...

Juries like experts, everybody likes experts! The jury finds this stuff [DNA] very interesting. I mean they have heard about it in the press, it is cutting edge, and they like it. And it is very persuasive, even without the stats. It is very difficult
for us to challenge the experts and the evidence, but we have
to do it. We have to learn more about it.

The assessment of DNA evidence depends upon the evaluator’s knowl-
edge of how it works. A person from a private laboratory which processes DNA
evidence for both Crown and the defence counsel commented on the limited
knowledge of defence counsel:

A lot of that has to do with funding as well. Defence counsel’s
clients are usually on Legal Aid, so they don’t have a lot of
money. Furthermore defence counsel don’t have a lot of time to
educate themselves. Now, there is an exception to this rule, of
course, but they surely are few and far between.

It appears that defence counsel’s knowledge must encompass the entire
range of biological and chemical sciences. In addition, they must have sub-
stantial experience in the examination and interpretation of evidence. In the
province of Ontario, some defence lawyers are becoming specialized in the
cross-examination of DNA evidence, and, therefore, must become educated in
the hard sciences. This form of specialization is a major shift in the role of
defence counsel and in the criminal trial process, pushing some defence law-
yers into engaging only in criminal cases where DNA evidence is introduced
and leaving other criminal cases to those less experienced with DNA. For the
most part, they co-defend; that is, they are involved in any given trial only
during the testimony of the DNA expert witness and the dealings with this
evidence. In practice, they are employed by other lawyers because of their par-
ticular proficiency or skill. In any case, they have specialized expertise or skill
that sets them apart from amateurs, and establishing them as ‘pros’ or even
experts (Freidson, 1986:25). In three (14%) of the interviews with defence
counsel, this was the case. These defence lawyers had become specialized, and
had been asked to assist other, less knowledgable defence counsel in assessing
the DNA evidence, whether it was to challenge the actual evidence or to assist
in the understanding of the evidence as presented within the courtroom or in a disclosed report from the laboratory, or both. When asked how many DNA cases he had been involved in, defence counsel Mr. Know answered:

Directly myself, I have had about 4 or 5 DNA cases, and I have been involved in about a dozen others, where I have consulted with people. Sometimes they have asked me to help them in the sense of my coming in just to do the cross-examination of the DNA witness, and then I leave. I have nothing else to do with the case. So that totals to about the other dozen, maybe even a bit more.

Defence counsel Mr. Know worked on Canada's first few cases. Having had no prior education on various DNA-related issues, he travelled to the United States to learn about them. His educators, Peter Neufeld and Barry Scheck, were defence lawyers themselves and had successfully challenged the admissibility and validity of DNA evidence in a number of cases. Neufeld (1993) made the following critique in one of his articles:

...not only does DNA evidence often go unchallenged and unregulated...but when a serious challenge is made, some prosecutors and the FBI also have actively and improperly interfered with the scientific debate over the limitations and reliability of DNA evidence. (189)

This type of overt critique of police and scientists is just starting in Canada. Recently, in R. v. Stillman, the Supreme Court of Canada criticized the conduct of the RCMP in obtaining bodily samples from the accused, resulting in the inadmissibility of some of these DNA samples in a new trial (Makin, 1997a:A1). As discussed earlier, the Centre of Forensic Sciences (CFS) is

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117 Neufeld and Scheck were both part of the People v. O.J. Simpson defence. They became world famous for their aggressive cross-examination of Dennis Fong, a prosecution scientist, using his testimony to support claims of evidence-tampering by police.


119 See supra footnote 63 and discussion in Chapter Two.
undergoing a major review for their incompetent and outright fraudulent handling of the Morin case.

DNA evidence is complicated, and requires more than a superficial understanding if one is to cross-examine an expert in this area. As previously noted, an oblivious defence counsel will be unqualified to recognize any discrepancies in the sophisticated techniques presented by the prosecution scientist. As a result, these discrepancies may simply go unchallenged.

When defence counsel were asked if there is a higher propensity for uninformed defence counsel to encourage their client to agree to a plea-bargain, or to plead guilty to the charges before him or her, Mr. Silence\textsuperscript{120} answered:

Yes, I would encourage my client to plea bargain, but only if there was more than just DNA evidence pointing against him [accused]. But I would also be out to lunch in trying to challenge the evidence, as I do not understand it [the DNA evidence].

It is interesting to note that this same defence counsel also stated that he had encouraged one client to plead guilty because he felt that the DNA evidence was indisputable:

[my client was encouraged to plead guilty before we began the trial. I guess we figured that his case was weak to begin with... you know... this DNA evidence is very reliable... and very difficult to challenge. So why waste a bunch of time on trying to figure it out?]

His statement reflects the commonly-held belief that science is expressed as precise sets of objective quantitative relationships, which are

\textsuperscript{120} Mr. Silence noted that he had little experience with DNA cases and also lacked education in this area.
beyond question, especially by those who have limited knowledge about DNA
evidence. Furthermore, as Mr. Serevent\textsuperscript{[12]} noted,

One of the problems with DNA evidence is its mystique. For
example, the jury can be overwhelmed by the science of it, and
I am not sure that it is as scientifically sound as they [scient-
stists] like to portray it to be. The jury can very easily be over-
whelmed by the language and the mystique of the whole thing.
Furthermore, learning the science of it is really problematic.
Lawyers have to learn, at least on a temporary basis, as much
as they can about a particular aspect of science that they may
not be that comfortable with. For someone like me, who did
not take science as an undergraduate student, it is often diffi-
cult to understand how it works and where the weakness in
the evidence is. The underlying assumptions that go with sci-
ence, there is always underlying assumptions, but I do not
know what these assumptions are.

When Mr. Serevent was asked about how he prepares for a case involv-
ing DNA evidence, he commented as follow:

There is no one place for defence counsel in Canada to go and
become educated on DNA evidence. Maybe they teach it in law
school now, but I have practiced law for 20 years, and such
courses weren't available in my time. Now I have to obtain a
private consultant or assistant, and go to the textbooks and
read as much as I possibly can....textbooks...and articles. ... It
is so highly time consuming, and expensive if you're on a time
system. But it is also expensive from a loss point of view if
you're not being paid for all that extra time, which you're usu-
ally not. Usually in these type of cases, I have to hire an assis-
tant, so the two of us can muddle through the evidence, but
that is also expensive.

It is obvious that defence counsel need assistance in assessing DNA evi-
dence; moreover, the rest of such assessments was a recurrent theme in the
interviews. When asked if Legal Aid assisted with the expenses, defence coun-
sel Serevent answered:

Legal Aid might approve for us to have a consultant review the
evidence, but that is it. We have to convince Legal Aid that we
have good reason to obtain independent expertise, but this is
insane when the reason we need independent expertise, in the
first place, is to help us understand what it is we don't know! I

\textsuperscript{12} Mr. Serevent did not understand the basics of DNA technology and found having to learn about these
techniques very difficult.
wouldn’t really know how to convince Legal Aid that I need an expert, because I need the expert to tell me why I need him.

It appears that the assessment dilemma is embedded in many other issues such as, for example, available money and education. Another defence counsel, Mr. Voir Dire, addressed the issue of education in terms of being able to assess DNA evidence:

Well, the biggest difficulty is just obtaining an education. When I started my first DNA case in December of 1990, I knew nothing about DNA and the very little I knew was disillusioned. I ended up going down with the lawyer for Legere, who was being tried at the same time out in New Brunswick. So I called him, actually, first because I thought that maybe he knew something about DNA, but he didn’t know anything about DNA either. So neither of us knew anything about DNA, so we both called Peter Neufeld and Barry Sheck, who ended up doing a significant job on the O.J. Simpson case. And we went down to New York for three days and met with them, and they gave us our first education on DNA, at that time we were using the RFLP technique, but the literature was very thin. DNA evidence was just beginning to explode. And since then it has gone through the various upheavals, or ups and downs with the National Research Council, two reports and so on, and you have gotten into PCR, and now you’re into STRs and some of the other forms, so the most difficult part is just trying to stay abreast. I am a member of the American Forensic Society. I belong as well to the New York State Forensic Society, and I try to stay up to date with the technology. I am a lawyer, not a scientist, so I can only do it in a sort of very generalized way. The other problem of course is that there is no defence organization dealing only with DNA evidence. So the only way you hear about a case is if you happen to do it yourself, or if you are talking to someone...and this is how you try and stay up to date on the law, which relates to DNA. The technology is changing so rapidly, so it is hard to stay on top of it all. For example, I am doing an upcoming case, which uses STRs, so now I have to know about that too.

Not all lawyers can afford the time to become as educated as Mr. Voir Dire. Many attorneys in DNA criminal cases are supported by Legal Aid, and under such circumstances lawyers cannot obtain funding to fly down to the

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122 Mr. Voir Dire was one of the more knowledgeable defence lawyers interviewed. He understood much of the scientific jargon and the variations in the specific techniques.
United States, or anywhere else, for that matter, to get expert advice. Mr. Voir Dire commented,

Most accused don't have the financial resources, especially when you are dealing with a murder case, and they are usually in custody. So you also have a time sort of constraint, because you want to get a trial as soon as possible. We have a very real financial restraint, especially if they are in custody, they are usually poor, they don't have money. And so you don't have the money so that you can go to experts. And the number of independent experts is very limited here in Canada. It is a very discouraging situation.

Mr. Voir Dire also addressed the issue of variation between Crown and defence counsel in terms of education:

You will get two types of educated Crown, you'll get the general type and again, the reason for that is because they go away to Crown school every year. I mean our courts shut down, literally, for three or four days every year, while they all go away to their annual convention. They are paid for it, so they do attend, and they do get themselves educated because the people [scientists and other experts] come up and give them the education, and so that is the luxury, if you want to call it that. So this gives them [Crown] a general education. And then when a specific case comes up, for example, again, in this case that I am doing, I have two Crown attorneys prosecuting, one of them is strictly on the DNA, so he was able to take off many days and weeks to get prepared. As a result the Crown, in this case, are educated and are therefore able to deal with the upcoming issues. This is a legal aid case, so it is not like I am getting paid any kind of real money, but I just felt that it was important, so I have put a lot of extra time into learning about the newer technology.

Another defence counsel, Mr. Stein,123 related the issue of disclosure with the assessment of the evidence,

I tell you that there should be more courses taught on DNA in Canada. Getting full disclosure is the key. From here you have to figure out what all of it means [the DNA analysis]. This is very difficult, because the RCMP work for the Crown and the police and leave us with nothing to turn to. But understanding the actual evidence is the key to a successful challenge.

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123 Mr. Stein was very knowledgable on DNA evidence and has been successful challenging the evidence in a few cases. This participant has defended more than twelve cases involving DNA evidence.
Twelve of the participants (41%), when asked about their understanding of the RFLP and PCR-based techniques, stated that they generally understood the differences, but as one participant, Mr. Right,\textsuperscript{124} noted:

It [RFLP and PCR] has been explained to me before, but I can't separate the two off the top of my head. I don't need to know this until just before the trial. These things go through one ear and out the other. My own experts will explain these concepts to me and show me how to use them during or just before a trial, so that I can cross-examine the witness.

The responses of most of the defence lawyers to this question were similar to Mr. Right's. This is of particular interest because obtaining an independent expert is not easily done in Canada, unless the client is paying for an out of country expert. One would expect that leaving these issues until just prior to trial would put immense pressure on defence counsel to get an understanding of the evidence.

Defence counsel, Ms. Cross,\textsuperscript{125} raised an important issue regarding the educational aspect of DNA evidence. She explained that it is difficult for lawyers, judges, and juries to understand DNA evidence. But she also had another concern — trying to explain to the accused what the DNA evidence means:

A lot of the evidence, in this one trial, went in on voir dire. But the difficulties are not just acquiring a sufficient familiarity with the subject, which is true for many different types of cases, but DNA is a very tough area, because it is not just biology and testing. I mean I didn't major in science in university, so it is difficult to be able to get the concepts and to be able to cross-examine it in such a way so that I can put it before a jury. Being able to explain it to my clients, that's the killer. My clients do not understand DNA. I mean they barely understand primary numbers, so it is not surprising, but it is a difficult situation.

\textsuperscript{124} Mr. Right had defended three DNA cases.

\textsuperscript{125} Ms. Cross has had three DNA cases.
Ms. Cross made this comment about instructing the accused not to submit to biological samples,

I mean we are juggling probability statistics and they [accused], often, do not understand primary numbers. It is a bit different now that we can force the accused to submit samples via warrants, but when I did this one case there was not any method, lawfully, to acquire DNA without consent, but then the issue, and this was an issue... at the trial, the first trial that I did, whether informed consent had in fact been obtained, and the judge found that it HAD NOT been, but he allowed sufficient evidence in anyway. Now, I want the Crown to get the proof and go through the trouble of getting a warrant. I don’t want the police taking samples willy nilly, and of course they will, and the accused give it, because they are frequently traumatized or in shock after being apprehended. The suspect tends to do whatever the police say, especially when they are really vulnerable.

Twenty-two participants agreed that understanding the particular DNA techniques was key in being able to adequately assess the evidence against the accused. It is quite clear, however, that defence lawyers need independent expert witnesses to assist them in the assessment and understanding of this evidence.

4.4.2 Access to Independent Expert Witnesses

Hoeffel (1990) begins her article with the following paragraph:

Courts lost all sense of balance and restraint in the face of this novel scientific evidence, embracing it with little scrutiny of its actual reliability and little concern for its impact on the rights of individuals. Members of the stunned defence bar have only recently come to life to launch a serious attack on the reliability of the evidence. Unfortunately, the rather sophisticated, technical challenge by these defense attorneys may be lost on everyone in the courtroom except the scientists who are testifying. The court and the public must be made aware of the full impact of the damage done and the precedent set as they allow prosecutors, commercial laboratories, and the media to push the currently unreliable and unproven DNA profiling evidence into court (466-467).

While the United States situation is quite different from Canada’s, it is important to acknowledge that DNA evidence has entered the criminal justice
system at an extremely rapid rate in both countries. Some even argue that DNA has been introduced so quickly that protocols (and other controls) to ensure that the testing is done accurately need to be updated (Hoeffel, 1990:479; Scheck, 1994:1962).

The scientific merits of each DNA technique must be evaluated (Scheck, ibid) to ensure that judges and others within the courtroom do not accept all DNA evidence as scientifically reliable. However, if defence counsel are not well rehearsed in the DNA jargon and technical merits, then they may be tempted to reach simplistic conclusions about the evidence and forego any argument. For this reason, independent expert witnesses are a necessity for defence counsel. This issue is, however, complex in Canada. All of the participants agreed that obtaining an independent expert was difficult. They also all agreed that it was especially difficult to obtain an independent expert when the accused was on Legal Aid, because of the limited amount of funding granted by Legal Aid services. As one defence counsel, Mr. Honoure,\(^\text{125}\) put it,

Legal Aid is not helpful. They are helpful to the extent that they are trying to give representation to poor people, but they are being strangled by the government. No, they [legal aid] choke us. We don't have anywhere near the resources that we need. I think that it will become a huge issue in terms of DNA. Obtaining a qualified expert is a huge problem. They [experts] are not terribly excited to do Legal Aid cases, because they run a risk of not getting paid.

Furthermore,

I think that I will have to go through an awful lot of begging and trying to convince Legal Aid that I need what I say I need from them. I decided to keep my Legal Aid cases, I am an [ethnic minority] person myself and think that [ethnic minorities] need a lot of help being represented. Anyhow, I have this client who is native and who I had to go through a bail hearing with. I had to fill out endless pieces of papers and I had to make a claim as to whether or not he was going to be successful upon release. This is ridiculous, I mean how am I suppose to know?

\(^{125}\) Mr. Honoure has defended seven cases involving DNA evidence.
But they [legal aid] won't give us authorization unless I can make such a statement. It really pisses me off that some bureaucrat, some idiot, who knows nothing about the legal system is telling me, who is Queen's Counsel, to state my case. I mean if they were going to be successful, then why would they need me? Gosh, I have a lot of Legal Aid baggage, please don't get me started!

Ms. Cross made this comment on legal aid assistance:

Legal Aid is not helpful. I paid the expert myself in my case, because Legal Aid couldn't find their record of authorizing an expert as a special expense. I am aware that on a couple of previous trials, not my own . . . DNA expenses had been an issue. I think that Legal Aid should have been prepared to pay for the expert in my client's case. I ended up paying $4,000 myself, so no, I didn't find them helpful. I still don't find Legal Aid helpful in terms of providing money for experts. But there aren't any experts there127 and there aren't any practising lawyers there. They have no concept what a courtroom is like on a shoplifting charge, let alone trying to deal with the concept of DNA or running a DNA trial. The other problem, of course, that I had on that case was that I could not find a lab here to run a separate sample. . . .

Of course Legal Aid won't pay for stuff [experts or independent testing of samples] and what it costs to get people to come from Toronto or New York, we can't afford. So people on Legal Aid are not getting the benefit of people with money. But this is the same with any expert, but in most other areas there are independent experts available in Canada, but with DNA there aren't. You know the lab techs all work for the RCMP, and I don't think Helix BioTech128 is able to stand up to cross-examination.

In addition to Mr. Honoures and Ms. Cross' comments, Mr. Smith,129 made the following comment regarding Legal Aid:

The Legal Aid budget is not large, there's not enough money to pay lawyers properly. They are more generous to the experts than they are to the lawyers, I find. But there just isn't enough money. I usually find that in murder cases, which can be high profile, that some experts are willing to financially sacrifice in some respect. I guess there is an honour in working on these type of cases, or just the interest. I am sure it would be an easier task to defend a multimillionaire in a murder case, than it is to defend someone on Legal Aid.

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127 Mr. Honoures reference to “they” and “there” pertains to legal aid services.
128 See supra footnote 88.
129 Mr. Smith has defended six cases involving DNA evidence.
When Mr. Smith was asked where he obtains independent expert witnesses, he responded:

Generally speaking we look to California for independent experts. The problem with that is that in California there is enough crime to keep those experts busy, so they usually have no desire to come to Canada to testify. They also get paid way less up here than in California, but we do occasionally get them from California.

The lawyer's ability to convince Legal Aid that an independent expert was needed in a given trial was, again, dependent on her or his capacity to understand the issues surrounding DNA evidence. Generally speaking, those defence lawyers who felt that they had a fair grasp of DNA evidence were also typically the most successful in getting money from Legal Aid to obtain an expert opinion or testimony. On the other hand, if defence counsel were not very knowledgeable about DNA evidence, then they also typically had more trouble getting independent experts, or money to obtain independent experts.

Mr. Smith made the following statement regarding the lack of independent sources in Canada:

I understand that in some American cases, and maybe in some Canadian cases, people have attacked the technology, or the technological basis for implementing the theory carried out by specific labs. I am aware in a general way about these types of issues, but this would also be an easier thing to do in the States because of the many independent laboratories, and how they work for profit than it is in Canada, where the Crown are mostly using Federal government institutions, as opposed to commercial laboratories. That is not to say that they don't make mistakes, but they are not purposely making mistakes to make more money. If I had a case that successfully challenging the DNA was the key to, my approach would be to examine every possible flaw against what was actually done in the particular case and try to find any hole in the Crown's armour.

When asked whether the Crown's use of the RCMP impeded his own ability to call on the force for DNA testing, he replied:

I would not use the RCMP to give me an independent test. If I had a case where I needed to challenge the DNA, then I would
want my own independent expert, I would turn to the US for that. I don't think that the professionals trust the RCMP as much as the public does. Well, I suppose you may say that this is one reason why I wanted to iron out all the issues with DNA in the preliminary hearing, because I did not want the jury exposed to the actual science. I mean they may be overwhelmed by the science of it and close their ears to the rest of the evidence. I didn't want my man's guilt or innocence to be pending on DNA.

Turning to the United States for independent testing or expert witnesses, as previously discussed, is not available to all. However, it is highly problematic that the RCMP conducts most of the DNA analysis of Canadian criminal cases. Although in theory the RCMP Forensic Laboratories are supposed to do impartial analyses for both the Crown and the defence, in practice this is somewhat of a myth. The Priority Case System, discussed previously, determines what constitutes a high priority case. Typically, defence cases warrant very low priority, according to the criteria. Furthermore, as one defence counsel, Mr. Stone, noted, on the lack of independent laboratories:

Despite what the RCMP lab in [name of city] will tell you...they will tell you that they are an independent agency, and that they do work for both the defence and the Crown. But if you ask them what percentage of their work is Crown work and what percent is defence work, you will discover that 99.9% of the time they do work for the Crown. Like for instance the other day I phoned because I wanted an analysis done by their experts and I was told that it would have to wait six months. This is no good when my case is coming up in two months from now. So it is a lot of bull, the labs belong to them [Crown and Police] and their use...the Crown are a lot better educated on DNA, as well as having all the resources.

On the issue of independent expert witnesses, Mr. Stone stated:

On this one case I was working on, it was one of the first DNA cases in Canada, every single person who did this kind of work in Canada worked for the government [RCMP], so in my case we had to get an expert from Syracuse, because the good experts from New York and California didn't want to come up here to testify.
When asked how he would obtain an American expert, Mr. Stone remarked:

How I would get someone in?...if the client was on Legal Aid it would be impossible, they'd never pay for it. If you can convince Legal Aid that this is the be-all, end-all defence then you might get them to give you the money. For instance in cases such as Guy Paul Morin, you can convince them to get funding. They messed up so badly and the case was so public, they really had no choice.

You see Legal Aid doesn't want to spend money, but if you put them to the wall on it and tell them that this is the guy's defence, and if they don't fund it, the guy is going down, then they are going to have to do it. They absolutely have to. Now, here in [name of province] we are not supposed to have to put pressure on Legal Aid, we are supposed to be able to send things off to the Centre of Forensic Sciences lab and the RCMP and they'd do it for us, but I don't see that happening.

Again, whether or not defence counsel can receive money for an expert is dependent upon the knowledge that they possess. This type of catch-22 situation also came up in relation to the possible implementation of privatized laboratories in Canada, to which defence counsel Mr. Stone asserted:

I can't speak for Legal Aid in the other provinces, [here] there has been tremendous cutbacks, and it totally depends on the case whether Legal Aid is prepared to give you some money. But even the money they do offer is not enough. Most experts want more. We often have to go to an American expert, because Dr. John Waye [a Canadian expert] can't help us as he has already been consulted, or he been retained by the prosecution. Helix BioTech is only useful up to a point, and if you need a real expert to do a proper analysis it means that you are forced to go to the States. If you go to the States, you're talking big bucks, you're talking US dollars versus Canadian dollars, and most of them demand payments up front and it is just very costly.

Most of the Canadian independent labs are paternity and don't get into criminal cases, the reason being that there isn't enough money in it. We haven't got the people who do nothing but forensic DNA, or population geneticists, or people who are prepared to come up here and be critical of the work that is being done here. So, DNA, by itself, as an issue, only arises in certain situations. I am not sure that it necessarily arises in a large enough series of cases that a private, a fully equipped private DNA forensic lab could succeed. If you're not going to succeed, then you are not going to set it up, and if you're not
going to set it up, they are not available. So that is why, I still think, as for example, in the Guy Paul Morin case, they ended up going to the States. Largely because we only have police labs!

With limited resources we have to worry about, what happened at the CFS lab where the witness is at least, subconsciously, fudging in order to get the accused, that is concerning to us. And then there is the question of interpretation. You can suggest to them [scientists] that in fact that there is nothing to show that the bands match, and what they are actually putting the curser on is just an artifact, they will say 'I am sorry, but this is my scientific opinion!' Where are we to go from there? Unless we have an independent scientist to help us, which brings us back again full circle to the problem of money, and the number of experts, then we are out of luck. Getting an experts who is willing to testify in Canada is difficult. They don't like to testify against each other here in Canada.

Even more disturbing, research in other countries has shown that in cases where defence counsel utilized an independent DNA analyst, the results differed from their conclusions drawn by the prosecution analyst. Steventon (1993) obtained information from 34 defence lawyers regarding the findings of their independent analysis. Thirteen respondents (38%) stated that their experts' assessment differed from the prosecution's analysis. Of interest is the fact that 12 of the 34 assessments "were more favourable to the defendant than the opinion drawn by the prosecution expert" (22). In most of these cases, these disparities were due to subjective opinion differences in the matching of the autorad bands; disagreement in the statistical calculations and/or the database used by the prosecution expert; or a combination of these differences (ibid). Steventon's study ought to be a reminder to all members of the criminal justice system that DNA evidence, despite its scientific elements, can be very subjective and must be scrutinized.

When defence counsel have obtained independent expert advice, they have been able to make a more accurate assessment of the evidence, which has helped them advise their clients, and more effectively defend them in court (ibid:24). By now, it should be clear that Canadian defence counsel lack
access to independent expert witnesses, independent laboratories, and funding. However, another concern emerged in the interviews. This issue pertains to full disclosure of the evidence by the Crown, and will be examined next.

4.4.3 Access to Full Disclosure of DNA Evidence

Comprehension of DNA techniques and terminology is the most important deficiency on the part of defence counsel. DNA results mean little to defence counsel if they do not understand how they are obtained and interpreted. DNA experts are needed to assist in the interpretation of DNA results; however, as we have found, this is often a difficult task for defence counsel in Canada, because of limited financial resources. Recently, in British Columbia, the provincial government cut legal aid services by $9.9 million. As a result of this cutback, an estimated 3,000 people will be disqualified from receiving legal aid in 1997 (Pemberton, 1997). These cutbacks to funding affect the disadvantaged members of our society, who comprise the vast majority of those accused of crimes such as murder (Boyd, 1988). How these cutbacks will influence defence lawyers' chances of obtaining independent expert advice or testing of DNA samples is not known, but it is safe to say that the future does not look bright. Without an expert available to review prosecution evidence, defence counsel will have to take their evidence completely on trust.

In some cases, defence counsel are not made aware that the Crown will proceed with DNA analysis until just prior to the trial, which makes it impossible for them to obtain independent expertise, independent testing, or thor-
ough review of the prosecution’s results. As one defence counsel, Mr. Soloman, put it:

In one of my cases, the Crown kept asking for more time because the RCMP had not completed the analysis. When the analysis was done, the Crown was ready to proceed. Well, I had no time to get full disclosure of the results and was left with a summary of the findings. Of course this is a huge advantage for the Crown. They can just keep postponing cases, so that defence will never obtain full disclosure.

Three of the participants (14%) suggested that an independent defence expert should oversee the actual DNA analysis in the laboratory, because in many cases there is not enough DNA available for sample sharing. In this manner the defence can get an independent analysis before the DNA has been replicated, cut, or touched by the government laboratories.

Defence counsel Mr. Cook, and his junior counsel Ms. Carr, made the following comments:

Mr. Cook: I don’t know if it is reliable [DNA], but provided that the playing field is equal, and that the legislation states that they must share the sample, they must not leave any discretion to the authorities, especially not the police. The samples must be made available to both parties so that there is no questions. Furthermore, they must make the funds available for independent testing. But I don’t know how much, for example, of a sample is needed and so on...like if they get to a scene and seize the only sample available and use it all up, then we are out of luck.

Question: So you are speaking to the sharing of the sample then?

Mr. Cook: Yes, the sample must be distributed equally. The legislation should include that when they do DNA testing they should be aware of the fact that wherever possible they must

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130 Mr. Soloman has defended six cases where DNA evidence has been a major piece of the evidence presented.

131 Sample sharing means that samples at a crime scene should be distributed between the Crown and the defence. In cases where there is very little DNA, some defence counsel have suggested that someone independent should be present in the laboratory to ensure that all protocols are followed, and to verify the results.

132 Mr. Cook has had three cases involving DNA evidence.
save some of the sample so that the defence can have it tested independently. The disclosure has to be obligatory.

Ms. Carr: I would also think that in the case where the sample can't be shared that the defence can have a paid expert oversee that the RCMP is doing the testing carefully.

These propositions may be too expensive, but, nonetheless, the point is clear that there should be an increase in the disclosure of the evidence.

Another defence counsel, Ms. Cross, spoke on the difficulty of trying to obtain disclosure:

The protocols are available only under rigorous request by defence counsel, that is the protocol that the RCMP labs follow. And on the case I did, we were dealing with umh...I think the Crown called three people, but the lab tech was the one they relied on the most, who I cross-examined, but it was a very difficult case, especially because of the difficulty in obtaining full disclosure.

Once disclosure of protocols has been obtained, Ms. Cross made this comment:

I always want to talk to whoever runs it [the lab]. If you are familiar with their protocol, they seem to adhere to the protocol, and they do have random testing, but I have to be aware of the protocol. However, the random testing is not as much as I would like, and not as sophisticated as what the FBI employs. The RCMP's stuff is modelled on that [FBI's] rather than the English system, but the FBI system is better. But, again the US has a number of independent labs accessible to both defence counsel and the prosecution. I don't find the RCMP bending over backwards to help defence counsel though, even when you know them.

The whole ballpark is theirs [RCMP], in terms of their expertise, I find them very didactic in their presentation. They don't admit that there are any errors in either their protocol or their adherence to protocol. They don't admit that there are any shortcomings in the way their labs are set up, or in the way their testing is carried out, or the philosophy of their testing. None of them, in my experience, have ever testified for anyone but for the Crown and so, naturally, there is a bias toward the Crown. A true scientist ought to be able to testify for either. But they just don't. And some of their experts are awful little weasels!

Full disclosure is a necessity for defence counsel, so that they can have an independent expert scrutinize, step by step, the procedures used in the
testing to ensure that there is no laboratory "slop." Defence counsel may be given a summary report upon the request for disclosure; however, such a report is not sufficient to closely examine all the results. Mr. Dhillion makes this comment on the importance of obtaining full disclosure:

One of my clients once falsely admitted to first degree murder because the Crown had made a statement that they were going to submit anal and vaginal samples for DNA analysis. The samples came back inconclusive. I asked what this meant. They were really playing a shell game and said that there was no semen. I then called up the pathologist and asked why semen was not present when my client admitted to having raped the victim. Obviously this proved that my client did not ejaculate in her and it proves that he doesn't know what happened, and it also proves that his statement is unreliable, so in that case the DNA evidence helped me, but only because I asked about the disclosure from the inconclusiveness of the report.

They even said to me verbally that it was inconclusive, but when I asked for a report, they said that it wasn't relevant but when I saw that there was no semen in the woman then I realized that it was so important to my case. You can't even rely on the report alone. I want the expert under oath. I want a shot at the expert. Verbally they will get loose or they will say that it got lost in the translation or that they didn't really say this or that. I mean look at the Morin case. They now all say that there was a weak link in the commands. Now the technician says that the Crown put pressure on her to find evidence that was not there.

Steventon (1993) agrees that full disclosure of findings is necessary for evaluation by an independent expert. She also recommends that, if the prosecution intends to rely on DNA evidence, the defence should be invited to instruct an expert who can double check the findings of the police laboratory scientists at the time of the actual testing. As a result, an agreed-upon report can be put to the court in the majority of cases. The cost, Steventon suggests, should be covered by Legal Aid where an alibi warning has been given or some

133 The term laboratory "slop," is a concept borrowed from Thompson and Ford (1989). Slop here does not necessarily pertain to the carelessness of the technicians, but the imperfections and contaminations that can easily occur when handling sensitive materials with complex procedures (ibid).
134 Mr. Dhillion has defended 12 DNA cases.
other form of defence justifying checking DNA sampling has been put forward (1993:27). Contrary to Steventon’s suggestion, it is my opinion that, unless DNA samples can be shared equally between the Crown and the defence, DNA evidence should not be allowed at all. Very few cases rely on DNA evidence alone. Therefore, cases could, in most instances, proceed with other types of evidence, eliminating the DNA evidence altogether. If the Crown and the police know that they are required to fully disclose DNA samples, or at least to preserve additional non-contaminated samples for the defence, then we might start to see more carefully-collected evidence at the crime scene, better preservation, and better storage conditions for these samples.

All 22 participants agreed that the fact that the Crown, in some cases, use all of the available sample, is very problematic for the defence, who already have difficulty in accessing independent experts and laboratories. Defence counsel Mr. Teal\textsuperscript{135} made the following comment on access to independent samples:

I wanted to test my own sample and was told that the whole sample had been consumed by the RCMP. I mean they used up the entire sample for the Crown’s analysis. Why didn’t they replicate it or something to ensure that I could have some? If the sample is already in the hands of the police, then it is virtually already contaminated in my mind. We should have laboratories that are sort of like forensic evidence holding cells, where the police can go and get some evidence and the defence can go and get theirs, some place completely independent!

Mr. Voir Dire was of the opinion that the prospect for full disclosure depends upon the defence counsel’s knowledge about what it actually entails:

You know the disclosure, it is not too bad for me. Because most of the work I do comes out of [name of province withheld] where the Centre of Forensic Science is involved, and they know me and when they know that I am on a case they know that I will ask for it, so they just give it to me. But I know a lot of other lawyers, interestingly, they don’t get the same type of

\textsuperscript{135} Mr. Teal has had five cases involving DNA evidence.
disclosure, so when they come and get consultation I tell them that all they have is a report, which is really useless. I have to see the raw material, the raw data. So that's...and they sometimes have problems getting it. So, I guess you can say that disclosure is the second aspect, and then finally, when you have disclosure, it becomes a question of what is all this?

The issue of full disclosure is an important one indeed. If defence counsel cannot get a handle on the evidence (including their own samples for testing, reports, summaries, and protocols), then they have very little chance of challenging DNA in court. Thus far, this thesis has uncovered the main reasons why DNA evidence is disputed in so few cases in Canada by defence counsel: namely, lack of access to assessment of DNA evidence, to independent expert witnesses and laboratories, and to full disclosure of evidence and testing results. The final section of this chapter addresses the ability to challenge DNA evidence in court, which is, for obvious reasons, difficult to do. Some successful challenges will be discussed, as well as the difficulties defence counsel face.

**4.4.4 Challenging DNA Evidence in Court**

Caught off guard by the storm, and perhaps assuming that there was no way around the damning evidence, defense attorneys were unable to combat the evidence effectively or find scientists to testify against it. (Scheck in Hoeffel, 1990:477)

Barry Scheck's account of the U.S. experience in the late 1980's is an excellent summary of the current Canadian situation in relation to DNA evidence. Scheck and Peter Neufeld, defending Joseph Castro, obtained experts who were willing to testify against the admission of the DNA evi-

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136 The word 'challenge' has been interpreted to include not only cross-examination of the Crown's experts, but also the ability of defence counsel to bring forth their own experts in court and to dispute the evidence in any other way.

137 Hoeffel (1990) cites Barry Scheck in his testimony before Congress in March of 1989, at the beginning of the People v. Castro trial: “there has been little, if any, informed cross examination of private DNA vendors and few qualified expert counsel witnesses testifying in opposition. The defence lawyers in these cases, often court appointed counsel, have been overwhelmed” (477).

138 See supra footnote 93.
dence. The experts were able to unlock serious blunders committed by Life-Codes\textsuperscript{139} in declaring a match between the blood (DNA) found on Castro's watch and that of the victim. As a consequence, the evidence of the match was ruled inadmissible (Hoeffel, 1990:478).

Canadian defence counsel, Mr. Stone, made similar attempts in Bourguignon, Johnston, and Legere.\textsuperscript{140} Mr. Stone explained his involvement and attacks on the DNA evidence in these cases in the following passages:

I have done two trials (Bourguignon and Johnston), and I was involved in Legere's appeal to the Supreme Court of Canada, but he was refused. There is going to be a lot of cases where DNA is a peripheral thing. In Bourguignon it was important, in Johnston it was important, and in Legere it was very, very important. Before, DNA was only being used on big cases, but now as labs are up and rocketing along, you will see it used more and more.

In the Johnston case, for example, the Crown didn't do the DNA testing because they stated that they didn't need it. This is new stuff and the labs have a lot to do and they had an overwhelming amount of identification pointing at Johnston. The reason it was done in Johnston was because of his family. His family decided that this analysis would clear their son, so they went to the defence lawyer. The defence lawyer was not enthusiastic, but they gave him written instruction to go to the Crown to get the testing done. The defence went to the Crown and threatened to make an issue out of this at the trial if they refused to do it. DNA testing is a good exclusionary tool, and therefore this process could potentially prove the accused innocent, which is how we proceed to get the labs to do testing for us! Had they refused to do it, we would have made a real stink about it. They had no choice, so they did it. Unfortunately, it came back overwhelmingly saying that Johnston was the one. So it kind of backfired on the defence. It was at that point that I entered the case, the family hired me then, to attack the DNA.

We attacked the statistics just as we had in Bourguignon. We were successful back in Bourguignon, both at the preliminary hearing and at the trial. And in Johnston, as well, the judge agreed with us. Then as the trial progressed, he kind of watered his ruling down a bit and they did manage to get some of that stuff [DNA analysis results] in, but never the actual numbers. I found that in both of those cases, the Crown

\textsuperscript{139} LifeCodes is an independent laboratory who analyzed samples in the People v. Castro trial.

\textsuperscript{140} See references for case citations.
were furious with me, because they weren't able to get the statistics in. I wasn't worried though, I mean the court allowed the Crown to call upon an excellent expert who we both knew to be a very good witness. The Crown was all upset because the expert couldn't present the numbers in the millions to back himself up. What do they need the numbers for? All the expert has to say is that this is the guy, and that it is highly unlikely to be anyone else. DNA evidence is very persuasive, even without the stats.

Mr. Stone's tactics in challenging the DNA evidence in these cases is not the norm. Most of the participants in this research sample (68%) were unsure about how to challenge the statistics, and about the general techniques. However, as previously stated, in Ontario a few defence counsel are becoming specialized in cross-examining DNA experts for the prosecution, and, as a result, we see more cases in eastern Canada challenged in this fashion. Mr. Voir Dire is another defence counsel who has been successful in challenging DNA evidence. He expressed concern about the lack of uniformity in the testing techniques:

I am struck by the lack of uniformity in the detail work. In the general work they all do it the same. I just don't understand how there can be this lack of uniformity in the detail work and the matching criteria and so on. I think that most of them consciously are trying to be very careful not to mislabel, not to contaminate in any way, not to do anything very obviously wrong. So I think that in that sense the quality of the work is not too bad. If there is a problem, it is usually a problem that arises in the collection gathering or in the scientists. You may send something for a regular serological testing or presumptive testings to an expert, and maybe he will accidentally contaminate the sample. So I think if there is a problem, it will occur before the actual DNA testing. I haven't come across anything where there's been any deliberate tampering with the evidence, although errors do happen. So, the quality is generally good. I think it comes down to the interpretation and the analysis of it, which is where the real subjectivity comes in. This is the area, along with the statistical probabilities, which I usually challenge.

Despite these challenges to DNA evidence, as demonstrated, it is difficult for defence counsel to keep up with the changes in the various techniques. Forensic laboratories are rushing to implement new advances and extensions
to the PCR-based techniques in their protocols and training technicians (Herrera & Tracey, 1992:237). This impetus to get better and quicker techniques to assist in the identification of perpetrators is problematic, not only for the defence of the accused persons, but also in terms of quality assurance within the laboratories. Mr. Voir Dire addressed the lack of uniformity not only in the interpretation of results, but also in the adherence to laboratory standards. The RFLP and the PCR techniques have gained acceptance as scientifically reliable and are now used in a variety of criminal cases. It is important, however, for members of the criminal justice system not to accept all DNA techniques as reliable, there are many subjective elements embedded in DNA analysis. Defence counsel must question how the sample was collected from the crime scene and, more important to the defence, how it was obtained from the accused. We have already seen how samples can potentially be taken from an accused unjustly.\textsuperscript{141} As Ms. Cross observed,

\begin{quote}
My first talk with anybody who is charged with a serious offence is to advise them not to give any samples. This means no saliva, no hair, no pubic hair. I tell them not to give up any physical body parts! It is extremely frustrating when you meet with your client only to find out that they have given a sample of something, because they feel threatened by the police.
\end{quote}

How samples are collected from both the victim and the accused has become the most recent basis of challenges to DNA evidence. Defence counsel, Mr. Dhillon, highlighted the salience of sample continuity when challenging DNA:

\begin{quote}
Continuity of the sample is really important. Who handles and collects the evidence is of utmost important. I think that the Morin case is an illustration of how the police and the scientists can mishandle evidence. The bottom line is that they [the Crown] will try and tell you that everything is perfect, and the police will try and tell you that everything is perfect. I frankly think that there is a little bit of hide and seek that goes on. I
\end{quote}

\textsuperscript{141} supra footnote 67.
don't think that the scientists and the police are as objective as
they would have us believe. DNA isn't perfect.

Mr. Dhillon also commented on police manipulation of DNA evidence:

I am very concerned about how DNA is handled by the police.
My personal view is that the RCMP are very result oriented.
They don't understand their function. They believe that their
function is to get suspects convicted. They don't necessarily
believe that they also have a responsibility to eliminate sus-
pects and to prove people innocent. So, if they target some-
body, when I mean target I mean that they look for evidence
and focus on that evidence. Almost as if they want to believe
that the suspect is guilty. I mean, if you look hard enough for
something, I believe that you will find some results. Just like
the recent mess with the CFS. I have a case right now where I
am dealing with the investigators and they blatantly came out
and said "we believe that it is him!" and I said "why is that?"
and they said "who else could it be?" I had to put down my foot
and say "what kind of an answer is that?" They then said that
they were going to get a warrant for DNA and I said that I
knew that they had already submitted evidence for DNA anal-
ysis. It is like this war out there. When I was asked to have my
client give a sample voluntarily I said "no, because I don't
trust them!" If they are prepared to be dishonest and wrongly
focused, as opposed to be objectively focused, then why should
you trust them?

The mistrust of the police was a common theme throughout these inter-
views, which can largely be explained by the lack of assistance that defence
counsel feel they receive from the police, the scientists, and the Crown.

The scepticism concerning the conduct of forensic laboratories was also
a recurrent theme in the interviews, but seemed not to be directly related to
DNA evidence. The tension may or may not have been there before DNA test-
ing was available. However, it was obvious that the recent uncovering of the
conduct of the Durham and York Police Departments and the CFS in the Guy
Paul Morin case has added to this scepticism. The handling of the evidence in
the O. J. Simpson trial was also touched upon in most of the interviews, and
had clearly added to scepticism regarding the reliability of DNA evidence. Mr.
Voir Dire commented on the probable scenario where DNA evidence could, potentially, have been planted:

Can it happen with DNA? Of course it can happen, if you have a sample of a guy’s semen, hair with a root, saliva, etc. Of course it is a question of continuity. It becomes a question of whether the suspect came to the knowledge of the police before the body was found, that type of thing. Then, of course, it can easily be done. This was the case with the O.J. Simpson case, where it was just classic, although they found the bodies they didn’t find the blood until after O.J. was arrested and then, all of a sudden, blood started to pop up everywhere.

These comments bring us full-circle back to the problem of understanding how DNA works and how the actual testing is done. If defence counsel do not have the minimum ammunition, so to speak, then they are not able to launch any form of serious challenge. Ms. Cross takes us back to this issue with her comments:

Well, I think that there is a significant lack of knowledge on the part of defence counsel. Most defence counsel will not spend the money and time necessary to train themselves in this area, which is the most technical area, I think, that defence lawyers have to deal with. I mean we can all deal with blood splatters. We can all deal with pathologists and forensic pathology. We can all deal with forensic psychiatry and forensic dentists. But this is a completely different area and it is highly technical, and as I say, most defence lawyers just don’t bother getting the grasp of it. There are few defence lawyers who are really good. I have seen some really poor cross-examinations done by defence who clearly do not understand the interpretation. People do not understand the interpretation of the numbers. The numbers are so big, how could you? But there are defence counsel who are wilfully unprepared. I must have spent two weeks, which doesn’t sound like a lot of time when you have got four hundred other files, preparing for the preliminary hearing, and then a lot more time in dividing up the work between my junior and myself preparing for the legal argument and evidence at the trial, and an awful lot of time talking at night trying to figure out if we can explain what it is we want to say.

Time constraint is a serious problem in preparing for a DNA case, especially if counsel have no prior knowledge about DNA. Defence counsel also, in some cases, require a considerable amount of time to locate funding for an
independent test and/or an independent expert to assist in the evaluation of the evidence or to testify on behalf of the defence. In Steventon's (1993) sample 22% of the participating defence counsel felt that there had not been sufficient time for them to obtain an independent assessment of the DNA evidence (17). The preparation of a DNA case can be a strenuous exercise, particularly if defence counsel lack resources. It is important to keep in mind that, while DNA cases constitute a relatively small percentage of the total work done by defence counsel in this sample, they require a disproportionate amount of time for preparation in comparison to many other types of cases.

The Canadian Charter of Rights and Freedoms has been used as a tool to challenge DNA evidence. How samples were seized from the accused has figured prominently in some of the recent challenges, despite the introduction of legislation allowing for a search warrant. Mr. Soloman plans to challenge how evidence was collected from his client, using sections 7 of the Charter as the basis, as he explained in the following excerpt:

It is going to be section 7 and the right to a fair trial based on the fact that I have been put in a position where I cannot verify their results, because they used up all the DNA, and even more than they had to. They extracted enough DNA to do completely separate tests using the RFLP technique, which requires more DNA. So they had enough to do two separate series of tests or more with that technology, and they used up everything they had themselves, thereby depriving me of the opportunity to get an independent test conducted to verify the results. I cross-examined their expert during the preliminary hearing and this was generally the focus of my cross-examination and how I made an attack on it. And so it will be a fairness issue. Is it fair that the DNA evidence, which is as compelling as it is, as a result of the Crown's conduct of its case deprives us of the opportunity to verify the evidence? All I need for this challenge is the source of material that they used to extract DNA. I need the evidence of how much DNA they managed to extract and how much they used for their purposes in excess of what they needed, and that is now in evidence. I expect to be able to argue this on the basis of the

142 See supra footnote 104.
143 Mr. Soloman has been involved in four DNA cases.
transcript from the preliminary hearing. But you see in a way, the attacks that are likely to be made on DNA are going to be made around the periphery of things rather than whether the science is valid. Because I don't think that there is any headway to be made there. Unless someone comes up with some evidence that suggests that this stuff has been dead wrong, but I am not going to hold my breath for that! I think that you can argue dishonesty, continuity and tampering with the evidence, procedure problems or Charter arguments, arguing that the search...the seizure of the DNA comes from a person who was unreasonable and contrary to the Charter in some way. I plan to challenge it, using the argument that I was deprived of part of the sample for independent analysis.

'This argument is indeed a valid one. "Samples should be divided into two or more parts at the earliest practicable time, and the unused parts retained to permit additional tests."144 If, in fact, the RCMP follows the TWGDAM guidelines for quality assurance,145 it is their responsibility to ensure that unused samples are stored to minimize degradation.146 Then, if the defence wishes to get an independent sample analyzed, there is a sufficient amount to have such analyses done. If samples are not provided, due to loose police work or too small a sample, this issue can become a line of attack for defence counsel. As Mr. Soloman stated, if one can argue that the Crown and the police had enough samples to begin with, then there really should be no reason why defence counsel cannot obtain a part of that sample to get a test of their own.

However, without appropriate forensic experts to consult when faced with a case involving DNA evidence, it is difficult for defence lawyers to know whether to try to obtain legal aid funding for an expert and/or have an inde-

144 This point was made at the 1997 Annual Meeting of the Mid-Atlantic Association of Forensic Scientist, Roanoke, VA, April 29-May 2, by Dr. B. Weir at the TWGDAM meeting.
145 The RCMP follow the TWGDAM guidelines for quality assurance (personal communication, Mr. S. Mazzega, forensic specialist (Biology Section), Vancouver RCMP Forensic Laboratory, July 4, 1997) (see Appendix F for TWGDAM guidelines).
146 This issue is outlined in section 7.2 of the RCMP's quality assurance protocol.
pendent sample analyzed. A registry of forensic experts for defence lawyers would be extremely helpful. As defence counsel Mr. Silence noted,

Quite honestly, I am not sure where to turn, should I have to challenge DNA. I would maybe see if Legal Aid would give me some funding to do research on DNA, but I doubt they would do that. Maybe...well, I am not sure where I would begin. I guess I would have to begin from scratch.

Mr. Voir Dire, at the end of the interview, expressed his concern about the lack of resources for defence counsel in dealing with DNA evidence:

I mean as lawyers we are magnificent in our ignorance, because we do different cases every day. Today, I am doing an impaired driving case. I need to talk to toxicology if I decide to do it, and that is part of the difficulty with defence counsel, is their habits and curiosity, or the lack thereof. If you’re not curious about an impaired driving and how the breathalyzer works and maybe my client really didn’t blow over the limit, and what is toxicology all about and how does it work, you are not going to challenge it, or you will challenge it on other grounds, but you are not going to challenge the actual science of it. Once you learn, you see names and you give them a call, to help you make sense out of things. In Canada we need a lot more resources for defence counsel to turn to when time is tight. I have been thinking about specializing in assisting defence counsel, or cross-examining for other defence counsel on DNA-related issues.

It should be noted that in many cases involving DNA evidence, the evidence itself is not an issue and, as a result, defence counsel do not seek independent experts or testings. Still, it is important to keep in mind that if defence counsel need or want such services in particular cases, they can face serious impediments. What should also be remembered is that, with the increased media focus on DNA as an exoneration tool,¹⁴⁷ some grievous miscarriages of justice have arisen from the mishandling of DNA evidence. DNA evidence is only as reliable as the people who interpret the results. For this

¹⁴⁷ See supra footnote 47. David Milgaard was convicted of the sexual assault and murder of a nursing assistant in 1969. He was exonerated for this crime July 18, 1997 by DNA evidence. Milgaard spent almost 23 years in prison for a crime he did not commit (Makin, July 19, 1997, The Globe & Mail:A1).
reason, Mr. Voir Dire expressed alarm regarding the proposed implementation of a DNA data bank (Canadian Press, September 26, 1997:A3):

Again, you just have to come back to all of the more famous miscarriages of justice in Canada: Marshall, Milgaard, and Morin. You concentrate on these type of people and you create a situation where they are going to be convicted. I just think that the data bank is going to lead to witch hunts. I am just more fearful of that. It is not to say that there won’t be some cases where you will have some very good scene samples and you are going to be able to go to five, six or seven loci, and undoubtedly match up, but I don’t think you are going to end up with that many cases. To me, with the little bit of knowledge that I have, most scene samples are degraded; they are not usually very good. You’re usually only at a couple of loci as it is with the suspect and I am not sure...I think it is going to lead to lazy policing and so I have some real reservation about this. The other thing is how long is this data bank going to stay strictly for forensic purposes? I mean, there isn’t anything that the government has ever done that’s stayed for only the one purpose. And the insurance companies are going to want to get at it, and you are going to end up with other social problems.

The prospect of a DNA data bank in Canada is especially problematic in the wake of recent revelations about police and scientific slop in both the Morin and the Milgaard\textsuperscript{148} cases. Mr. Voir Dire’s comments on the possible misuse of the data bank information should be seriously considered. Contemplate living in a society where everything about us could be screened by the government: a society where the state had samples of tissues and fluids on file and a computerized data bank of every individual’s DNA profile (Hoeffel, 1990:533). How would we respond to being under constant threat of governmental intrusion? Guy Paul Morin made a similar point:

People think I am eccentric because I am not normal by their standards. Well, everybody and every family has its difference when you put them under a microscope (Guy Paul Morin in Makin, 1992:321).

\textsuperscript{148} Milgaard has demanded a full inquiry into a possible police and prosecutor cover-up for his alleged conviction (Makin, July 19, 1997, The Globe & Mail: A6).
One can only imagine what types of issues could surface with the government in possession of all genetic information. Let us not forget that the 'criminal' does not inhabit a body full of bumps and other deformities visible to the naked eye. Nor are his or her characteristics to be found in a bar code of genetic information.

The unrestrained use of DNA evidence threatens to shake the foundations of a free society. Criminal defendants are not a different breed of people. They are protected under the same rights as everybody else. However, these rights are jeopardized by difficulties in finding independent experts and laboratories to do DNA testing or verify findings, and in obtaining legal aid approval for these services. All of these impediments make it especially burdensome for defence counsel to challenge DNA evidence in court. In essence, these obstacles can be seen as the emblematic of a true class society — where the wealthy go free and the disadvantaged go to jail.
DNA profiling evidence must not deprive defendants of their constitutional rights to a fair trial. It has become increasingly obvious that an adequate defence in a DNA case requires that defence counsel have access to independent expert services, assessment of the evidence (including retesting of the evidence), and full disclosure. Defence counsel who lack understanding of the complex and technical issues surrounding DNA evidence are often not equipped to challenge the evidence in court.

Such knowledge is perhaps the most crucial component in providing an adequate defence, because defence counsel must explain the need for an independent expert in order to obtain government monetary compensation for such services. However, as one defence counsel noted in the interview, this is often difficult when they are not sure why they need an expert; they need the expert to tell them what they need assistance with. It seems logical that an independent, non-governmental expert should be made available for defence counsel to assist in the examination of experts called by the Crown. In Canada, however, there is a lack of independent laboratories and experts — a situation which hinders defence counsel's effectiveness.

While a government witness, such as an RCMP expert, could suffice in some cases, it is the difficulties faced by defence counsel in obtaining an independent non-governmental expert which are cause for concern. DNA evidence should not be embraced as being generally accepted within the scientific community in the absence of challenges from defence experts. In the United

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149 Non-governmental expert here refers to any expert not affiliated with the RCMP, the CFS, or any other federal or provincial testing laboratory.
States, as in other jurisdictions, defence experts challenge DNA evidence on a regular basis, and in some cases have uncovered horrendous mistakes in the handling of this evidence. These challenges have forced the scientific community to establish standardized protocols, which have been the continuous objective of, for example, TWGDAM (TWGDAM, 1995; Wilson et al., 1993). Koehler (1993) emphasizes that it is the duty of scientists to improve the use of forensic evidence at trial by conducting research into a number of key issues that have been brought to the fore in this thesis (38). “Expert opinion ought not to be available only to the highest bidder” (Giannelli, 1993:106). Such a scenario can easily become the case in Canadian courts, where independent expert witnesses are often obtained across the border for a fee not readily supported by legal aid services. Thus, it can be said that an adequate defence is available only to those who have the monetary means to pay for their own defence. If this is the case, then we ought to be concerned about the potential abuse of this evidence in the courtroom.

Furthermore, if the purpose of expert testimony is to assist the trier of fact to understand scientific and technical evidence, or to determine a fact in issue, then their specific knowledge and skill ought to be available to both Crown and defence counsel.

There may be defence counsel who do not wish to obtain independent assessments of the evidence or expert assistance; however, all defence counsel interviewed for this thesis stated that an independent non-governmental expert would have been useful in all their cases involving DNA evidence. The methods used to locate independent experts varied from one defence counsel to another. Of the 22 defence counsel interviewed only a third (7 defence counsel) had obtained an independent expert for any of their cases. The reasons for

150 See supra footnote 93. See also discussion in Chapter Two.
this varied, with most of the respondents citing multiple factors ranging from a lack of funding to obtain an independent expert to a lack of knowledge regarding how to challenge the evidence in court. It also became increasingly obvious that the defence counsel who had the most experience in handling DNA cases were also those who knew how to secure funding for an independent expert to obtain full disclosure of the evidence, and to challenge the evidence in court.

Still, their lack of understanding how DNA works and how DNA analysis is conducted seemed to be the most distressing aspect for all of the respondents. Without exception they stated that, due to limited non-governmental experts and testing laboratories, they were often left to gain an understanding of the various DNA issues from current literature and/or interaction with other defence counsel who had more experience than themselves. However, since DNA cases accounted for only a relatively small part of defence lawyers’ entire case load, the amount of time needed in preparing for such cases could not always be met. As a result, other counsel (often of junior ranking) were frequently involved in these cases.\footnote{In three interviews defence counsel noted that their junior counsel had a Bachelor degree in the sciences, which was of invaluable assistance to their understanding of DNA evidence.} Exceptions to this pattern were three defence lawyers in Ontario who focussed mainly on defending DNA cases, and as a result were brought into cases only to cross-examine the Crown’s DNA expert witnesses. These defence lawyers were knowledgable of the various DNA issues and had a thorough understanding of how DNA works and how DNA analysis is performed.

In some instances, however, defence counsel felt that they had not been granted sufficient time to locate a suitable expert witness or to have an independent analysis carried out. Locating an expert was further complicated by...
the fact that, in Canada, there is no registry of appropriate defence experts which lawyers can consult when faced with DNA evidence cases. This issue was also discussed in Steventon's (1993:18) British study. It is therefore imperative that DNA evidence be fully disclosed to defence counsel in sufficient time prior to a trial so that they can locate an expert and have an independent analysis conducted. However, this again would depend on a defence counsel's ability to obtain funding and acquire sufficient knowledge about DNA evidence, and to locate an independent expert. Steventon (1993) noted that in some cases defence counsel were able to locate an independent expert, but the expert might not have had experience with certain DNA techniques or was unable to carry out the work because of her or his workload. This meant that the defence lawyer had to attempt to locate another expert (19). Such a situation would be rather disempowering to Canadian defence counsel who are often faced with little access to independent experts within Canada, and are thus further restrained by having to locate an out-of-country expert. The latter would have to be approved by legal aid services, unless the accused could afford to pay for these expenses her/himself.

Of further interest are Steventon's (1993) results obtained from the defence experts in 49 cases. Steventon found that 51% supported the analysis conducted by the prosecution expert in all respects; however, in 21 cases (43%) the defence experts' conclusions differed. The defence experts disagreed with the band matching between the scene of the crime sample and the defendant's sample, the statistical calculations, and the database used. Two analysts disagreed with the procedures utilized to examine the evidence (34). The

152 Using independent DNA experts within Canada also has to be approved by legal aid, but Canadian experts are not as costly to legal aid as experts from another country. The lawyers high profile cases such as those of Guy Paul Morin and David Milgaard were able to use American and British experts, but these are exceptions rather than the rule.

153 The remainder of the cases were excluded for the analysis.
outcome of these results, and their potential effects on the jury, were not explored. However, Steventon's study provides valuable information about how other countries deal with the use of DNA evidence. While this thesis did not directly examine discrepancies between the Crown and defence DNA analyses, the potential existence of such differences ought to become an area of immediate interest to Canadian defence counsel.

Although all the respondents in my interviews expressed the need for an independent non-governmental expert, few of their cases needed an independent analysis of the evidence, because the accused had generally opted to plead guilty to the charges before the trial was finished, or had even begun. In some cases, the accused may plead guilty without being aware that there is DNA evidence pointing to his or her guilt. This issue was not discussed in the interviews. It was also not clear whether any of the respondents' clients had been influenced to plead guilty due to the potentially incriminating nature of DNA evidence, or if any had pled guilty prior to learning about the existence of DNA evidence. However, all respondents agreed that, if an accused had a lawyer with limited knowledge on DNA evidence, there could be a propensity for that counsel to encourage the client to plea-bargain the charge or plead guilty. One respondent admitted that this had been the situation with one of his or her clients. This was attributed largely to the fact that he (or she) had little prior knowledge about DNA analysis and believed that the DNA evidence matching that of his (or her) client was infallible.

None of the respondents in this sample had defended fewer than two DNA cases. It would therefore be interesting to uncover responses from defence counsel who have defended only one case and compare them to

154 Differences between Crown and defence counsel were explored in the quantitative analysis only.
155 Both genders have been included here to assure confidentiality of the respondent.
defence counsel with more experience. However, this was not an objective of this thesis. It should, nonetheless, be noted that 20 of the respondents stated that, if a defence lawyer felt incapable of handling a DNA case, for ethical reasons s/he should not defend the individual but rather pass the case over to someone who is capable.

Until now, little attention has been paid to the psychology of DNA match declaration and the impact of reported DNA matches on decision makers. The standards for declaring a match are variable (Steventon, 1993), and a laboratory analyst’s expectations or goals may influence his or her match determination (Koehler, 1993:38; Thompson & Ford, 1991). Whereas this subjective element of DNA analysis was examined in Chapter Two, it is certainly worth emphasizing again. As Koehler (1993) notes:

> some forensic scientists have testified that the discovery of a match at one locus helps determine whether a close call at another locus increases the analyst’s confidence that the suspect is the source, and the analyst’s expectation of finding a match at another loci increase [sic] as well. This expectation might be used to declare matches in ambiguous situations that otherwise would be declared nonmatches. (38)

Similarly, Thompson & Ford (1991) outline interpretive problems with DNA typing. They found that there are ambiguities in the declaration of a match, and discovered in a number of cases that the analyst’s declaration of a match was in error. They emphasize that these matches have gone unchallenged in court, and may have been traceable to loose standards where the analyst relies upon his or her subjective judgment to distinguish the true variation of the match (97, 141). It thus seems that the more armed with information about a specific crime an analyst is, the more likely he or she is to become consciously or subconscious influenced. The amount of information which is supplied to DNA analysts regarding a specific crime is limitless. Scientists themselves seem to think that all information is important in testing for the
source of the crime.\textsuperscript{156} One scientist expressed the following: “You know some of these crimes are really awful. I had to examine a little girl’s underwear for potential semen. She had been raped and then brutally murdered. I just wanted to find something, anything, which would show guilt that he did it!”\textsuperscript{157}

As I have attempted to demonstrate with this thesis, the subjective element of DNA analysis must not be ignored and it is indeed possible to have errors in the interpretation of the data. Steventon (1993) looked at some of these problems, and Koehler (1993) found “at least three false positive errors out of an estimated 75 match reports”\textsuperscript{158} (25). In Canada, the RCMP claim to participate in the TWGDAM proficiency testing program. However, as previously discussed, it is not known who does the external examination of the RCMP analysts, or how often they are examined. Nonetheless, as with most other laboratories, the RCMP analysts are provided with potentially limitless information by the police regarding the victim and the potential source of the crime prior to their testing. To eliminate possible bias, Thompson \& Ford (1991) propose that “the analyst should never be informed of any facts of the case beyond those necessary to analyze the samples appropriately” (146). All information which links the samples to a suspect should be kept from the ana-

\textsuperscript{156} Mr. S. Mazzega, an RCMP analyst, argues that scientists must be informed of all facts to be able to assess the forensic significance of an exhibit (Personal communication, July 5, 1997, Mr. S. Mazzega, RCMP Biology Section, Forensic Laboratory Vancouver).

\textsuperscript{157} Emphasis mine. This personal communication took place at the Annual Mid-Atlantic Association of Forensic Scientist, Roanoke, Va, April 29-May 2, 1997. The name and the laboratory of this individual have been withheld to assure their confidentiality.

\textsuperscript{158} Koehler (1993) analyzed the results of laboratory proficiency tests conducted by outside agencies. However, the drawback to these tests was the fact that the technicians were aware that they were being tested. There is no way of knowing whether or not these technicians were more diligent and cautious in their performance than when they are not being tested. Moreover, the technicians were provided with all information on the source of the samples and how they were prepared. The proficiency tests conducted of 38 laboratories in the United States (25) are the ones quoted in this thesis. The false positive error pertains to the notion that a match may not necessarily be a true match and could have been derived from possible technical and/or human performance errors (ibid: 24). For more information on false positive errors see Koehler (1993).
lyst and remain confidential until all testing is completed, to decrease the possibility of biased interpretation of samples (ibid: 147).

For these reasons, it is important that defence lawyers question error rates and potential bias in their cross-examination of expert witnesses, since all errors appear to exaggerate the probative strength of DNA and other identification matches (Freckelton, 1990; Hoeffel, 1990; Koehler, 1993; Thompson & Ford, 1991). Consequently, objectivity needs to be an issue of concern for defence lawyers, since bias, and/or a vested interest in the outcome of samples, could possibly affect the interpretation of the match patterns. For this reason, Thompson & Ford (1991) suggest that “there should be no direct communication between the analyst and the party submitting the samples” (146). Since it is not known how often erroneous results are presented, it is of utmost importance that defence counsel become familiar with some of these controversial issues. However, as this thesis has clearly shown, errors do occur.

Scientists argue that false positive matches and contamination of samples will not implicate a suspect, but will result in an inconclusive analysis which will only be beneficial to the accused. However, this claim is not readily resolved by the existing literature. Therefore, defence counsel should ensure that they acquire full disclosure of all records and raise the issue of whether or not there were traces of other sources in the sample, or if the sample could have been contaminated by other samples (Lussier, 1992:347). Furthermore, by failing to obtain full disclosure, defence counsel run a risk of not getting all pertinent information. Securing a report which merely states that the results were inconclusive may not be all that helpful to defence counsel. On the other hand, if they get possession of all reports and documentation which show that

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159 For other issues, such as band shifts, extra bands, missing bands, faint bands, and smeary bands which can cause ambiguity in the interpretation of matches, see Thompson & Ford (1991).
the results were inconclusive, they may be able to analyze the reason for the ambiguous results. This type of information can be used to challenge all other evidence. An inconclusive report means only that the analysis cannot provide any information linking the suspect with the sample. However, it might be argued that this result could be attributed to a mixture of, for example, four different semen stains, in which case the defence can maintain that it cannot be known whether the accused in the dock is the one who murdered the victim. Full disclosure is therefore a necessity in all DNA cases, regardless of all the other evidence. As this thesis, however, has demonstrated, full disclosure is not always easily granted, but seems to be more attainable for those defence counsel with more experience in the handling of DNA cases.

Controversy over DNA evidence still exists to this date (Shapiro & Reifler, 1996; Thompson, 1994). While statistical probabilities, testing methods and forensic laboratory procedures seem to be the most frequently addressed issues in the United States, it appears that the Canadian criminal justice system is still grappling with understanding the basics of this scientific evidence. This is most evident in the lack of Canadian literature on this topic. Almost all of the limited existing literature is written by RCMP analysts (Fourney, 1994; Gaudette, 1990; Shutler, 1988; Waye & Fourney, 1990). While recent amendments to the Criminal Code\textsuperscript{160} can be seen as an attempt to enforce strict guidelines on when and how the police can obtain DNA evidence to support their investigation of specific crimes, there still appears to be controversy regarding what types of biological samples can be collected without violating the rights of the accused. This issue was discussed in Chapter Two, where Charter and constitutional violations were brought to the attention of the

\textsuperscript{160} See discussion in Chapter Two on sections 487.04 to 487.09. See also Appendix E for the actual legislation.
courts in cases such as *R. v. Borden, R. v. Parent, R. v. Stillman*, and *R. v. Brighteyes*. Defence counsel interviewed for this thesis stated that their best line of attack in challenging DNA evidence was to question how the police had obtained a sample from their client, along with the chain of custody of the sample itself.

An essential issue which evolved from these interviews, was defence counsel’s inability to have independent analysis performed because all of the samples had been used by the prosecution laboratory. As one defence counsel noted, this could potentially become a new line of attack for Canadian defence counsel. It should be commonplace that defence counsel are provided with at least a small amount of DNA for independent analysis. If in fact the Crown utilizes all available DNA for analysis, then confirmatory testing cannot be performed. This could be damaging to both parties. If for one reason or another further tests are needed, then some of the DNA ought to be saved for future PCR analysis. There is no reason why forensic DNA testing cannot accommodate such a recommendation, since this is routine practice in medical diagnostics (Thompson & Ford, 1991: 147).

One would hope that forensic DNA experts would ensure that their analysis (which could in some cases put an accused behind bars for at least 25 years or, in the United States, result in the death penalty) would be reliable, and reconfirmed if requested by the accused (ibid:151). It is important to note that, in a related field, pharmaceuticals often undergo years of validation testing before they are released into the hands of medical personnel. Yet, as Thompson & Ford (1991) note, “it appears that DNA testing was placed in routine use before these [validation] steps were completed...and that in an ideal world, the necessary validation research would have been completed by the forensic DNA laboratories before they began accepting casework” (151).
Despite this deficiency, it appears that the Canadian criminal justice system has accepted the use of DNA for forensic identification purposes. As a result, defence lawyers are left to 'muddle through' the injustices which result from the overly-eager utilization of DNA evidence.

The advancement of molecular genetics has moved at an unprecedented speed. There is little doubt that the past 20 years have witnessed a revolution within the field of molecular genetics.\(^{161}\) The development of new DNA analysis techniques has turned courtrooms into scientific laboratory forums. Chapter One outlined the differences between the RFLP and PCR techniques. Moreover, as this thesis is being written, yet another DNA technique has evolved for forensic identification purposes. Mitochondrial DNA (mtDNA), briefly mentioned in Chapter One, is making its entry into some American courts (Van Oorschot & Jones, 1997). While most of the genetic material in the human genome resides in the nucleus of each cell, some bits of material exist in the mitochondrion. Mitochondrial DNA sequences are regarded to be highly variable between unrelated individuals. While the claim that mtDNA is inherited only from the mother;\(^{162}\) there have been a few instances where the mtDNA from the father has made it into the offspring; however, this is said to have little bearing on the outcome of the testing since these amounts will not be detected by standard procedures (Inman & Rudin, 1997:51). Mitochondrial DNA is believed to be beneficial to forensic science in cases where the nucleated DNA is too degraded for RFLP and/or PCR analysis. Before embracing this technique with open arms, however, it is important to note that it is not yet accepted in Canadian courts. Nevertheless, the RCMP is preparing to handle such techniques in the near future — a development which will present

\(^{161}\) See timeline in Appendix A.

\(^{162}\) According to Inman & Rudin (1997), mtDNA "...is said to exhibit maternal inheritance" (51).
yet another challenge to Canadian defence lawyers. Defence counsel, among others, are often mystified by the sophisticated and technical jargon associated with DNA science, whether it be RFLP, PCR, STR's, VNTR's, DQ-alpha, or now mtDNA. The admission of this novel scientific evidence may have a profound impact on the defendant's right to an adequate defence.

The purpose of this thesis has been to analyze defence counsel's access to DNA evidence within the Canadian criminal justice system. The main areas of focus have been their access to evidence with the support of independent non-governmental experts and autonomous analysis of samples; the availability of funding for such analyses or assistance in the interpretation of the Crown's expert submissions; and their ability to challenge the DNA evidence in court. As the main findings suggest, access to anything related to DNA evidence is dependent upon the knowledge base of defence counsel. Defence counsel find it difficult to learn about DNA, because of Canada's lack of independent experts and testing laboratories. Thus, their ability to handle DNA evidence at trial is impeded by a web of inaccessible resources.

It is somewhat paradoxical that our trust in science is as strong as it actually is, considering the fact that scientists routinely try to contradict each other's findings. The O. J. Simpson trial is a graphic illustration of what can happen when science runs amok in the courtroom. The doubts about science surfacing during this trial were limitless. It became very clear that the science in which we so readily trust is not infallible, and, furthermore, is subject to human error.

Nonetheless, society continues to put great trust in the experts of DNA analysis, despite the disagreement among the experts themselves. Most of us have much too high an opinion of the knowledge of scientists, and this will not change in the foreseeable future with respect to DNA or any other scientific
phenomena. More Canadian research is urgently needed in assessing the use and potential misuse of DNA evidence. Of particular salience are the potentially seductive effects which DNA may have on juries, or perhaps judges.

There is no doubt that DNA evidence is a challenge to our current criminal justice system. It is of utmost importance that this body of knowledge not overstep the process of criminal justice, and that lawyers and other players within the courtroom challenge the accuracy of these new techniques. "[S]ubstituting the expert authority of the black robe and the bench for that of the white lab coat" (Jasanoff, 1993: 82) does not serve the process of justice, or for that matter of scientific endeavour.

Convention dictates that a conclusion be found at the end of a thesis or any other paper. However, a topic such as the one presented here does not accord comfortably with such convention. The issues and concerns with DNA analytical technology have not been resolved in these pages, because DNA evidence is a revolutionary topic which will continue to expand. A host of issues and problems have been presented, but new ones are evolving as I write. Nevertheless, the scientific and legal issues involved in the "DNA war" warrant close examination, because they can tell us much about the evaluation of new techniques in forensic science. The current DNA tests are the first spin-offs of the molecular revolution in genetics to reach the courtroom, but they will not be the last.
APPENDIX A

Timeline of DNA Discoveries

1871 Discovery of DNA in the sperm of trout from the Rhine River.

1943 DNA proved to be a genetic molecule capable of altering the heredity of bacteria.

1953 The discovery of the double helical structure of DNA.

1956 Genetic experiments support the hypothesis that the genetic messages of DNA are conveyed by its sequence of base pairs.

1958 Proof that DNA replication involves separating the complementary strands of the double helix.

1958 Isolation of the first enzyme (DNA polymerase I) that makes DNA in a test-tube.

1959 Discovery of an enzyme (RNA polymerase) that makes RNA chains on the surface of single-stranded DNA.

1960 Discovery of messenger RNA and demonstration that it carries the information that orders amino acids in proteins.

1961 Use of the synthetic messenger RNA molecule (poly-U) to work out the first letters of the genetic code.

1965 Appreciation that genes conveying antibiotic resistance in bacteria are often carried on small supernumerary chromosomes called plasmids.

1966 Establishment of the complete genetic code.

1967 Isolation of the enzyme DNA ligase that can join DNA chains together.

1970 Isolation of the first enzyme (the restriction enzyme) that cuts DNA molecules at specific sites.

1972 Use of the joining enzyme DNA ligase to link together DNA fragments created by restriction enzymes.

1 Most of the information in this timeline is borrowed from Watson and Tooze (1981).
1973  Foreign DNA fragments inserted into plasmid DNA to create chimeric plasmids. Finding that they can be functionally reinserted into the bacterium E. coli. Potential now exists for cloning bacteria of any gene.

1973  First public concern that recombinant DNA procedures might generate potentially dangerous, novel microorganisms.

1974  Call for a worldwide moratorium in certain classes of recombinant DNA experiments.

1975  International meeting a Asilomar, California, urges adoption of guidelines regulating recombinant DNA experimentation. Call for the development of safe bacteria and plasmids that cannot escape from the laboratory.

1976  Release of the first guidelines by the National Institutes of Health; prohibition of many categories of recombinant DNA experimentation.

1977  Formation of the first genetic engineering company (genentech), specifically founded to use recombinant DNA methods to make medically important drugs.

1977  Creation of the first recombinant DNA molecules containing mammalian DNA, and the discovery of the split genes.

1977  Development of procedures for the rapid sequencing of long sections of DNA molecules.

1978  The Nobel Prize in Medicine is awarded for the discovery and use of restriction enzymes.

1978  Production of the first human hormone somatostatin by using recombinant DNA.

1979  General relaxation of the NIH guidelines allows viral DNAs to be studied by using recombinant DNA procedures.

1980  The Nobel Prize in Chemistry is awarded dually for the cloning of the first recombinant DNA molecules and the development of powerful methods for sequencing DNA.

1981  Offer to the general public to stock in the first recombinant DNA company (Genentech). Valuation by Wall Street in excess of 200 million dollars.
1984 DNA fingerprinting becomes the first recombinant DNA tool for identification purposes in unsolved crimes. A British double murder case is resolved using DNA fingerprinting.

1989 The first Canadian case to use DNA evidence is presented. The accused, McNally, pleads guilty to sexual assault at the preliminary hearing.

1996 The first time mitochondrial DNA (mtDNA) was allowed as evidence into the courtroom. The accused was charged with sexual assault and murder of a child and the mtDNA from his saliva was found to match that of hair recovered on his victim. The accused was convicted largely on the strength of the mtDNA analysis (Wallace, 1997:44).

1997 Dolly the sheep becomes the first offspring derived from fetal and adult mammalian cells (Wilmut et al., 1997).
APPENDIX B

Glossary

**Adenine:** A purine base; one of the four nitrogen containing molecules present in nucleic acids DNA and RNA; designated by the letter A” (National Research Council, 1992: 167).

**Alleles:** one of the different forms of a gene. Alleles reside at the same locus but differ with respect to DNA sequence (Griffiths et al., 1996:859).

**Allelic association:** tendency of particular alleles of different genes to occur in the same genotype (ibid:859).

**Amino acid:** building blocks of peptide (proteins). Amino acids share the same basic structure but have different side groups (ibid: 859).

**Autosome:** Chromosome other than a sex chromosome (X and Y in humans) Autosomes are present in homologous pairs in practically all nucleated cells (ibid: 860).

**Base Pair:** “Partnership of adenine with thymine or cytosine with guanine in the DNA double helix” (Farley & Harrington, 1991:237).

**Ceiling Principle:** in identification of suspects by DNA fingerprinting, a controversial attempt to deal pragmatically and conservatively with unsound allele frequency estimates and population differences. Instead of an actual frequency estimate, use of either its maximum, taken over a number of different populations, or a fixed value (i.e. 5%) is recommended, depending on which of the two is larger (The 1997 Annual Mid-Atlantic Association of Forensic Scientists Conference, Roanoke, VA: DNA Statistics Course taught by Dr. Bruce Weir).

**Chromatid:** One of the two subunits of a duplicated, but not yet separated, chromosome. Chromatids become visible at certain stages of meiosis and mitosis (Griffiths et al., 1996: 861).

**Chromatin:** Ensemble of DNA, proteins and RNA that constitutes the genetic material of a cell not in the process of division (ibid:861).

**Chromosome:** Packaged DNA; an assembly of linearly grouped genes and extragenic sequences. Chromosomes become microscopically visible as distinct structures during cell division (Oxford Concise Dictionary of Biology, 1990).

**Complementary:** An adjective commonly used in molecular biology to describe the situation when two molecules bind together because they have ‘matching’ structures in some way, e.g. when two DNA sequences are complementary they will bind to each other and form a double helix (ibid).
Cytosine: “A pyrimidine base; one of the four nitrogen-containing molecules in nucleic acids DNA and RNA; designated by the letter C” (National Research Council, 1992: 168).

DNA: deoxyribonucleic acid: The genetic material of higher organisms. An unbranched, linear, heteropolymer of subunits called nucleotides. Each nucleotide consists of a deoxyribose-phosphate and a base, (adenine, thymine, cytosine, or Guamanians each deoxyribose being attached to the next by a phosphate (complex sugar). DNA commonly occurs as a helix of two complementary strands of the linear polymer that are then bound together by hydrogen and hydrophobic bonds. The deoxyribose phosphate is responsible for the molecule’s linear integrity and is non-informational, the informational content, the code, comes from the order of the bases along the molecule (National Research Council, 1992).

DNA Fingerprinting: DNA fingerprinting is a complex process. The first stage is to extract chemically the DNA from suitable sources such as blood (DNA is present in white blood cells), semen, hair roots or mouth swabs; other sources of DNA, such as saliva and urine, generally yield too little DNA for fingerprinting by the RFLP method. However, the technology has increased at a phenomenal rate, and minute samples of DNA can now be examined by newer methods. Next, the extracted DNA is checked to ensure that sufficient good-quality DNA has been recovered for subsequent typing. “It is then cut with a restriction enzyme, a protein that cleaves the DNA strands at specific positions, to produce a complex set of millions of different DNA fragments according to length by passage through a slab of gel in an electric field. The pattern of DNA fragments sorted by size is then transferred from the gel to a sheet of membrane, which is subsequently treated to separate the two strands of the double helix within each DNA fragment without disrupting the pattern on the membrane. Next, the membrane is reacted with a radioactive probe, a segment of stuttered DNA which seeks out and forms a double helix with any minisatellite fragments on the membrane. As a result, the variable minisatellites become radioactive and can be visualized on X-ray film” (Jeffreys, 1993:52).

Electrophoresis: “Any process of using an electric field to move charged molecules through a conductive aqueous (water base) solvent. Commonly in order to separate the moving molecules from each other for the purposes of analysis. In a mixture of molecules, the relatively mobility of each molecule will be principally determined by its charge, its molecular weight and its shape. Thus the technique is very suitable for distinguishing a very wide variety of charged water soluble molecules from each other. Electrophoresis can be carried out on molecules in free solution but this is almost never done. More usually the solution carrying the electric field and its ionic current is immobilized by being held as a wet paper or as a gel. Gels are particularly useful for the separation of very large molecules such as the various size classes of DNA from each other. They are also useful for separating proteins from each other. Gels are
usually created from an inert, uncharged, water absorbent substance that will form a three-dimensional network in an aqueous solvent. Such a network or gel allows the aqueous solution to be handled in a more convenient form as pseudo-solid slabs. The network also contributes strongly to the separation properties of the gel as the average ‘mesh size’ of the molecular work network retards molecules moving through it according to the molecular size of the moving molecules” (National Research Council, 1992).

**Enzyme:** “Protein that speeds up the rate of chemical reactions in the body but is unaltered itself in the reaction” (Farley & Harrington, 1991: 238).

**Gene:** The old usage of this term came from genetics and referred to any inherited determinant of characters i.e. any sequence of DNA. This usage is still valid and often used. The more modern usage of the term is limited to those sections of DNA which are actually transcribed by RNA polymerase. However, increasingly, these other sequences are now being referred to by other names more appropriate to their mode of expression, or are just being referred to by more general terms such as the non-committal ‘allele’ (Griffiths et al., 1996: 866).

**Genetic Code:** The set of correspondences between nucleotide pair triplets in DNA and amino acid in protein. Also referred to as double helix, first discovered by Watson and Crick in 1953 (Watson & Tooze, 1981).

**Genetic Markers:** Genetic markers consist of alleles which are used as probes to keep track of individual cells, tissues, nuclei, chromosomes or genes (Griffiths et al., 1996: 866).

**Genome:** A term for the entire DNA of the organism. These heredity factors are all contained in the chromosomes (Farley & Harrington, 1991: 238).

**Guanine:** “A purine base; one of the four nitrogen-containing molecules present in nucleic acids DNA and RNA; designated by the letter G” (National Research Council, 1992: 169).

**Hybridization:** In the context of molecular genetics this term is used to describe the process of two nucleic acid strands first randomly coming together, then if they have complementary base sequences, the forming of a stable helix together. This is a process of two strands recognizing each other and binding together. Hybridization is generally carried out by placing the two single stranded nucleic acids together such that at least one of the strands is in free solution and mobile and under conditions of temperature and salt concentration such that the double helix that they will form is just only stable. So long as the base sequences are complementary it is then only a matter of time before they match up and form double helices. if the DNA strands are the same ones that they were originally together in a double helix then the process is called ‘renaturation’ rather than hybridization (personal communication, January 2, 1997, Dr. L. McIntyre, Dept. of Genetics, Duke University).
Isozymes: When two or more structurally different enzymes catalyze the same chemical reaction, then these enzymes are isozymes. The various isozymes, within their group, may be derived from entirely different genes to each other and thus have quite different polypeptide chains even though they catalyze the same reaction (ibid, January 2, 1997).

Linkage: A genetic term that refers to the deviations from random assortment of genes or loci that is often found when two genes or loci are physically close together in a chromosome. The shorter the physical distance between the genes or loci, the closer the ‘linkage’ commonly is. However, the degree of statistical linkage of two genes or loci is also affected by factors other than the physical distance apart of the two sites (National Research Council, 1992; Griffiths et al., 1996: 869).

Locus: (loci is the plural form of locus) “Position a gene occupies on a chromosome” (Farly & Harrington, 1991: 238).

Markers: See genetic markers.

Minisatellite DNA: A type of repetitive DNA sequence based on short repeat sequences with a unique common core; used for DNA fingerprinting (personal communication, April 29, 1997, Dr. Bruce Weir).

mtDNA: Mitochondrial DNA is becoming the newer testable DNA. Mitochondrial DNA is non-nucleated and is found in millions of copies within cells that contains no nucleus, this is a great advantage over nucleated cells which only have two copies of DNA (personal communication, June 26, 1997, Kenneth Mayberry, Pennsylvania State Police: DNA Analysis Unit).

Nitrogen Bases: Types of molecules that form important parts of nucleic acids, composed of nitrogen-containing ring structure; hydrogen bonds between bases link the two strands of a DNA double helix (Oxford Concise Dictionary of Biology, 1990).

Nuclease: An enzyme that can degrade DNA by breaking its phosphodiester bonds (ibid).

Nucleoid: A DNA mass within a mitochondrion (ibid).

Nucleotide: A molecule composed of a nitrogen base, a sugar, and a phosphate group; the basis building block of a nucleic acid (ibid).

Nucleotide Pair: A pair of nucleotides (one in each strand of DNA) that are joined by hydrogen bonds (Griffiths et al., 1996: 871).

Origin of Replication: “The point of specific sequence at which DNA replication is initiated” (i.e. in PCR replication) (ibid: 872)
**Probe:** A probe defines “nucleic acid segments that can be used to identify specific DNA molecules bearing the complementary sequence, usually through autoradiography” (ibid: 873).

**Repetitive DNA:** “DNA sequences that are present in many copies per chromosome set” (ibid: 874).

**Restriction Enzyme:** An endonuclease that will recognize specific target nucleotide sequences in DNA and break the DNA chain at those points; a variety of these enzymes are known, and they are extensively used in genetic engineering (ibid: 874).

**RFLP:** “Restriction fragment linnets polymorphism. A method of characterizing any zone of DNA that detects any gross differences, throughout the population, in the zone of sequence concerned. Restriction enzymes and sequence-specific probes are commonly used to break up and observe some particular Oregonian DNA under study and if samples of this DNA region, taken from different individuals, give non-identical (variable) length sets of fragments then a 'polymorphism' exists; that is to say, an RFLP. Although RFLP sometimes arise from minor differences in DNA sequences, even as little as one base difference if it is within a restriction site, the technique is much more applicable to the detection of very large deletions and insertions into the sequences of interest” (Robertson et al., 1990:191).

**RNA:** Ribonucleic acid. A single-stranded nucleic acid, as opposed to DNA, which is double stranded. There are three types of RNA: messenger RNA, which codes for proteins; transfer RNA, an adapter molecule used for protein synthesis; and ribosomal RNA, which contributes to the composition of the ribosome (Farley & Harrington, 1991: 239).

**Sequence:** “In the context of DNA, this refers to the actual order of bases along the nucleic acid molecule” (i.e. AATGC) (ibid: 192).

**Sex chromosome:** a chromosome that plays a role in sex determination (Griffiths et al., 1996: 876).

**Single-locus probe:** “A DNA probe that detects genetic variation at only one site in the genome; an autoradiogram that uses one single-locus probe usually displays one band in homozygotes and two bands in heterozygotes” (National Research Council, 1992:173).

**Somatic cell:** A cell whose genes will not be passed on to future generations; thus it is not heritable (ibid: 876).

**Southern blotting:** “A chromatographic technique for isolating and identifying specific fragments of DNA.” (Oxford concise Dictionary of Biology, 1990). As with the RFLP method, the fragments of DNA is passed through electrophoresis; and are then transferred, or 'blotted,' onto a nitrocellulose filter where they are immobilized in their relative positions (ibid).
**STRs:** Short tandem repeats is another form of repetitive DNA. "These consists of variable length, usually between 100 and 1000 base pairs, that are tandems repeated usually fewer than 100 times at a given site in the genome" (Robertson et al., 1992:38).

**Thymine:** "A pyrimidine base; one of the four nitrogen-containing molecules present in nucleic acids DNA and RNA; designated by the letter T" (National Research Council, 1992: 172).

**VNTRs:** Variable number tandem repeats. This is actually a description of the arrangement of repetitive DNA usually found, but not restricted to, at a single locus (The 1997 Annual Mid-Atlantic Association of Forensic Scientists Conference, Roanoke, VA: DNA Statistics Course taught by Dr. Bruce Weir).
This diagram represents a dot-blot PCR procedure. What makes PCR such a powerful technique is the amplification mechanism of the procedure.

(Kirby, 1990)
This diagram shows how DNA is analyzed using the restriction fragment length polymorphism (RFLP) technique.

(Robertson et al., 1990:76)
DEFINITIONS / "Adult" / "Designated offence" / "DNA" / "Forensic DNA analysis" / "Provincial court judge" / "Young person."

487.04. In this section and sections 487.05 to 487.09, “adult” has the meaning assigned by subsection 2(1) of the *Young Offenders Act*;

“designated offence” means

(a) an offence under any of the following provisions of this Act, namely,

(i) section 75 (piratical acts),
(ii) section 76 (hijacking),
(iii) section 77 (endangering safety of aircraft or airport),
(iv) section 78.1 (seizing control of ship or fixed platform),
(v) paragraph 81(2)(a) (using explosives),
(vi) section 151 (sexual interference),
(vii) section 152 (invitation to sexual touching),
(viii) section 153 (sexual exploitation),
(ix) section 155 (incest),
(x) subsection 212(4) (offence in relation to juvenile prostitution),
(xi) section 220 (causing death by criminal negligence),
(xii) section 221 (causing bodily harm by criminal negligence),
(xiii) section 231 (murder),
(xiv) section 236 (manslaughter),
(xv) section 244 (causing bodily harm with intent),
(xvi) section 252 (failure to stop at a scene of accident),
(xvii) section 266 (assault),
(xviii) section 267 (assault with a weapon or causing bodily harm),
(xix) section 268 (aggravated assault),
(xx) section 269 (unlawfully causing bodily harm),
(xxi) section 269.1 (torture),
(xxii) paragraph 270(1)(a) (assaulting a peace officer),
(xxiii) section 271 (sexual assault),
(xxiv) section 272 (sexual assault with a weapon, threats to a third party or causing bodily harm),
(xxv) section 273 (aggravated sexual assault),
(xxvi) section 279 (kidnapping),
(xxvii) section 279.1 (hostage taking),
(xxviii) section 344 (robbery),

2 Section 487.04 to section 487.09 are replicated from the *Canadian Criminal Code: 1997.*
subsection 348(1) (breaking and entering with intent, committing offence or breaking out),
subsection 430(2) (mischief that causes actual danger to life),
section 433 (arson-disregard for human life), and

(b) an offence under any of the following provisions of the Criminal Code, as they read from time to time before July 1, 1990, namely,
   (i) section 433 (arson), and
   (ii) section 434 (setting fire to other substances),

(c) an offence under the following provisions of the Criminal Code, chapter C-34 of the Revised Statutes of Canada, 1970, as they read from time to time before January 1, 1988, namely, paragraph 153(1)(a) (sexual intercourse with step-daughter, etc.),

(d) an offence under any of the following provisions of the Criminal Code, chapter C-34 of the Revised Statutes of Canada, 1970, as they read from time to time before January 4, 1983, namely,
   (i) section 144 (rape),
   (ii) section 146 (sexual intercourse with a female under fourteen and between fourteen and sixteen), and
   (iii) section 148 (sexual intercourse with feeble-minded, etc.), and

(e) an attempt to commit an offence referred to in any of paragraphs (a) to (d);

"DNA" means deoxyribonucleic acid;
"forensic DNA analysis," in relation to a bodily substance that is obtained in execution of a warrant, means forensic DNA analysis of the bodily substance and the comparison of the results of that analysis with the results of the analysis of the DNA in the bodily substance referred to in paragraph 487.05(1)(b) and includes any incidental tests associated with that analysis;
"provincial court judge," in relation to a young person, includes a youth court judge within the meaning of subsection 2(1) of the Young Offenders Acts;
"young person" has the meaning assigned by subsection 2(1) of the Young Offenders Act. 1995, c. 27, s. 1.

INFORMATION FOR WARRANT TO OBTAIN BODILY SUBSTANCES FOR FORENSIC DNA ANALYSIS/ Criteria.

487.05. (1) A provincial court judge who on ex parte application is satisfied by information on oath that there are reasonable grounds to believe

(a) that a designated offence has been committed,

(b) that a bodily substance has been found
(i) at the place where the offence was committed,
(ii) on or within the body of the victim of the offence,
(iii) on anything worn or carried by the victim at the time the
offence was committed, or
(iv) on or within the body of any person or thing or at the place
associated with the commission of the offence,

(c) that a person was a party to the offence, and
(d) that forensic DNA analysis of a bodily substance from the person will
provide evidence about whether the bodily substance referred to in
paragraph (b) was from that person

and who is satisfied that it is in the best interests of the administration of jus-
tice to do so may issue a warrant in writing authorizing a peace officer to
obtain, or cause to be obtained under the direction of a peace officer, a bodily
substance from that person, by means of an investigative procedure described
in subsection 487.06(1), for the purpose of forensic DNA analysis.

(2) In considering whether to issue the warrant, the provincial court judge
shall have regard to all relevant matters, including

(a) the nature of the designated offence and the circumstances of its com-
mission; and
(b) whether there is

(i) a peace officer who is able, by virtue of training or experience,
to obtain a bodily substance from the person, by means of an
investigative procedure described in subsection 487.06(1), or
(ii) another person who is able, by virtue of training or experience,
to obtain under the direction of a peace officer a bodily sub-
stance from the person, by means of such an investigative pro-
cedure. 1995, c. 27, s. 1.

INVESTIGATIVE PROCEDURES/ Terms and conditions.

487.06. (1) The warrant authorizes a peace officer or another person under the
direction of

(a) the plucking of individual hairs from the person, including the root
sheath;
(b) the taking of buccal swabs by swabbing the lips, tongue and inside
cheeks of the mouth to collect epithelial cells; or
(c) the taking of blood by pricking the skin surface with a sterile lancet.

(2) The warrant shall include any terms and conditions that the provincial
court judge considers advisable to ensure that the seizure of a bodily sub-
EXECUTION OF WARRANT/detection of person under warrant/ respect of privacy/Execution of warrant against young person/ Waiver of rights of young person.

487.97. (1) Before executing a warrant, a peace officer shall inform the person against whom it is to be executed of

(a) the contents of the warrant;

(b) the nature of the investigative procedure by means of which bodily substance is to be obtained from that person;

(c) the purpose of obtaining a bodily substance from that person;

(d) the possibility that the results of forensic DNA analysis may be used in evidence;

(e) the authority of the peace officer and any other person under the direction of the peace officer to use as much force as is necessary for the purpose of executing the warrant; and

(f) in the case of a young person, the rights of the young person under subsection (4).

(2) A person against whom a warrant is executed

(a) may be detained for the purpose of executing the warrant for a period that is reasonable in the circumstances for the purpose of obtaining a bodily substance from the person; and

(b) may be required by the peace officer who executes the warrant to accompany the peace officer.

(3) A peace officer who executes a warrant against a person or a person who obtains a bodily substance from the person under the direction of the peace officer shall ensure that the privacy of that person is respected in a manner that is reasonable in the circumstances.

(4) A young person against whom a warrant is executed has, in addition to any other rights arising from his or her detention under the warrant,

(a) the right to a reasonable opportunity to consult with, and

(b) the right to have the warrant executed in the presence of counsel or a parent or, in the absence of a parent, an adult relative or, in the absence of a parent and an adult relative, any other appropriate adult chosen by the young person.
LIMITATIONS ON USE OF BODILY SUBSTANCES/Limitations on use of results of forensic DNA analysis/Offence.

487.08. (1) No person shall use a bodily substance that is obtained in execution of a warrant except in the course of an investigation of the designated offence for the purpose of forensic DNA analysis.

(2) No person shall use the results of forensic DNA analysis of a bodily substance that is obtained in execution of a warrant except in the course of an investigation of the designated offence or any other designated offence in respect of which a warrant was issued or a bodily substance found in the circumstances described in paragraph 487.05(1)(b) or in any proceeding for such an offence.

(3) Every person who contravenes subsection (1) or (2) is guilty of an offence punishable on summary conviction. 1995, c. 27, s. 1.

DESTRUCTION OF BODILY SUBSTANCES, ETC./Exception.

487.09. (1) A bodily substance that is obtained from a person in execution of a warrant and the results of forensic DNA analysis shall be destroyed forthwith after

(a) the results of that analysis establish that the bodily substance referred to in paragraph 487.05(1)(b) was not from that person;

(b) the person is finally acquitted of the designated offence and any other offence in respect of the same transaction otherwise than by reason of a verdict of not criminally responsible on account of mental disorder; or

(c) the expiration of one year after

(i) the person is discharged after a preliminary inquiry into the designated offence or any other offence in respect of the same transaction,

(ii) the dismissal, for any reason other than acquittal; or the withdrawal of any offence in respect of the same transaction, or

(iii) any proceeding against the person for the offence or any other offence in respect of the same transaction is stayed under section 579 or 795,

unless during that year a new information is laid or an indictment is preferred charging the person with the designated offence or any other offence in respect of the same transaction or the proceeding is recommended.

(2) Notwithstanding subsection (1), a provincial court judge may order that a bodily substance that is obtained from a person and the results of forensic
DNA analysis not be destroyed during any period that the provincial court judge considers appropriate if the provincial court judge is satisfied that the bodily substance or results might reasonably be required in an investigation or prosecution of the person for another designated offence or of another person for the designated offence or any other offence in respect of the same transaction. 1995, c. 27, s. 1.

(Martin's Criminal Code, 1997)
9. Proficiency Testing

Proficiency testing is used periodically to demonstrate the quality performance of the DNA laboratory and serves as a mechanism for critical self-evaluation. This will be accomplished by the analysis and reporting of results from appropriate biological specimens, submitted to the laboratory as open and/or blind case evidence. All specimens submitted as part of an open or blind proficiency test must be analyzed and interpreted according to the DNA analysis protocol approved by the laboratory for use at the time of the proficiency test.

Participation in a proficiency testing program is a critical element of a successful Quality Assurance program and is an essential requirement for any laboratory performing forensic DNA analysis. A forensic laboratory involved in DNA analysis may establish its own proficiency testing program or establish a program in cooperation with another forensic laboratory. The DNA laboratory should participate in proficiency testing programs, conducted by outside institutions or provided by other reputable sources, which are appropriately designed for forensic DNA analysis.

9.1 Open Proficiency Testing

Open proficiency test specimens are presented to the laboratory and its staff as proficiency specimens and are used to demonstrate the reliability of the laboratory's analytical methods as well as the interpretive capability of

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3 I have only included three aspects of the TWGDAM guidelines herein: proficiency testing (including open proficiency testing), corrective action, and audits. No changes have been made to these TWGDAM guidelines to suit the purposes of this thesis.
the examiner/analyst. Participation in an open proficiency test program is the primary means by which the quality performance of the DNA laboratory is judged and is an essential requirement if a DNA laboratory is to perform case work.

9.1.1 Personnel

Open proficiency testing pertains to those laboratory examiners/analysts and technicians actively engaged in DNA testing.

9.1.2 Frequency

Open proficiency tests must be submitted to the DNA testing laboratory such that each examiner/analyst, as well as those technicians involved in performing analytical techniques related to DNA analysis, are tested at least twice a year.

9.1.3 Specimens

Each open proficiency test may consist of dried specimens of blood and/or other physiological fluids, either singley or as a mixture. Each sample to be tested should contain an amount sufficient so that a conclusion can be drawn from the results of the analysis.

For those DNA procedures which use electrophoretic analysis for identification of the DNA polymorphisms, the number of specimens included in the proficiency test should be such that all may be accommodated on a single analytical gel.

For those DNA analysis procedures which use PCR for DNA amplification, coupled with a nonelectrophoretic method for the identification of the DNA polymorphism, an equivalent number of samples should be tested.
Those samples which comprise proficiency tests intended for PCR-based techniques must include the appropriate negative controls as specified in Section 7.5.1.3.

9.5 Corrective Action

The specific policies, procedures, and criteria for any corrective action taken as a result of a discrepancy in a proficiency test should be clearly defined and approved by the appropriate individuals in accordance with established laboratory policies.

9.5.1 Authority and Accountability

It is the responsibility of the Quality Assurance coordinator or designated individual to assure that discrepancies are acknowledged and that any corrective action is documented.

In the event of an unresolved disagreement between the designated Quality Assurance individual and DNA laboratory, the matter should be referred to the laboratory director.

9.5.2 Administrative Error

Any significant discrepancy in a proficiency test determined to be the result of administrative error (e.g., clerical error, sample confusion, improper storage, inaccurate documentation, etc.) will be corrected according to established laboratory policy.

9.5.3 Systemic Error

Any significant discrepancy in a proficiency test determined to be the result of a systematic error (e.g., equipment, materials, environment) may require a review of all relevant case work since the DNA unit's or laboratory's last successfully completed proficiency test. Once the cause of the discrepancy
has been identified and corrective action has been taken, all examiners’ analysis should be made aware of the appropriate action in order to minimize the recurrence of the discrepancy.

9.5.4 Analytical/Interpretative Error

(a) Any significant discrepancy in a blind or open proficiency test result determined to be the consequence of an analytical/interpretative discrepancy should prohibit the individual(s) involved in producing the discrepant result from further examination of case evidence until the cause of the problem is identified and corrected. The Quality Assurance coordinator or designated individual will determine the need to audit prior cases, according to established laboratory policy.

(b) Before resuming analysis or interpretation of case work, an additional set of open proficiency samples must be successfully completed by the individual responsible for the discrepancy.

9.6 Documentation

The results of all proficiency tests will be maintained by the DNA laboratory according to established laboratory policy.

10. Audits

Audits are an important aspect of the Quality Assurance program. They are an independent review conducted to compare the various aspects of the DNA laboratory’s performance with a standard for that performance (Mills 1989; Sayle 1988). The audits are not punitive in nature but are intended to provide management with an evaluation of the laboratory’s performance in meeting its quality policies and objectives.
10.1 Audits or inspections should be conducted at least once every two-years by individuals separate from and independent of the DNA laboratory. It is highly desirable that at least one auditor be from an outside agency.

10.2 Records of each inspection should be maintained and should include the date of the inspection, the area inspected, the name of the person conducting the inspection, findings and problems, remedial actions taken to resolve existing problems, and the schedule of next inspection.
April 5, 1989 was the first time in Canada that DNA (Deoxyribonucleic acid) typing evidence was used in court. This case, which evolved from the sexual assault of an elderly woman, involved serology and hair evidence and had to deal with the admissibility of DNA evidence. After the experts had testified and explained the procedure of extracting semen from the victim’s night gown and blood from the accused, the accused changed his plea to guilty. The accused was sentenced to seven years in prison (RCMP Forensic Laboratory Services Annual Review, 1989).

The admissibility of DNA technology in our criminal justice system is controversial. Some scientists claim that DNA typing can be applied to Egyptian mummies while others disagree. DNA cannot determine guilt or innocence, but it can be a very strong piece of evidence. At present there is on-going debate on the various types of DNA testing. Canada’s RCMP forensic laboratories use the fingerprinting method called restriction fragment length polymorphism (RFLP). However, Canada is working towards adoption of another newer technique, the polymorphic chain reaction (PCR) technique. Each technique presents various strengths and weaknesses.

Due to the lengthy DNA technological process, many cases are backlogged. There are few specialized scientists, and few laboratories, to conduct DNA testing. In Canada most criminal cases are tested by the RCMP. In view of this monopoly over testing procedures, the fairness of access to information on the part of all players of the criminal justice system is questionable. If the police and the Crown, in fact, work so closely together, can this system be rendered a fair and just system? In an attempt to answer this very question this questionnaire has been distributed to 250 different professional people who represent the “exposed to DNA technology” members and players within our criminal justice system.
BACKGROUND INFORMATION

1. Which best describes your profession?
   - Crown Counsel
   - Defense Counsel
   - Judge
   - Police Officer/Detective
   - Forensic Scientist
   - Other

2. How long have you been in this profession?
   _____ years   _____ months   _____ days

3. Have you received any form of instruction/training surrounding DNA evidence?
   - Yes_____   No_____  

4. Are you trained in handling of biological samples for DNA analysis?
   - Yes_____   No_____  

5. Have you been involved in any criminal case which used DNA evidence?
   - Yes_____   No_____  

6. Do you understand the process of developing a DNA fingerprint?
   - Yes_____   No_____
7. Do you understand the difference between the PCR technique and the RFLP technique?

Yes____  No____

**OPINION QUESTIONS**

*After Reading the Statement Please Check Off the Answer You Agree or Disagree With the Most*

8. DNA profiling is mutually exclusive.

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9. DNA testing can eliminate suspects.

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10. DNA samples can be contaminated.

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11. The R.C.M.P laboratories use sound laboratory techniques.

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<th>Neither Agree Nor Disagree</th>
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</table>

12. DNA typing, at the forensic laboratories, is a time consuming procedure.

<table>
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<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
<th>Neither Agree Nor Disagree</th>
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</table>
13. DNA profiling is beneficial, mostly, to cases of sexual assault.

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<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
<th>Neither Agree Nor Disagree</th>
<th>Agree</th>
<th>Agree Slightly</th>
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</table>

14. Homicide cases, which do not involve sexual assault, benefit minimally, if at all, from DNA testing.

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<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
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</tr>
</thead>
</table>

15. One of the most important limitations of DNA typing is the length of time required to obtain a result.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
<th>Neither Agree Nor Disagree</th>
<th>Agree</th>
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</tr>
</thead>
</table>

16. Using DNA evidence in some criminal cases may result in guilty pleas before a possible trial.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
<th>Neither Agree Nor Disagree</th>
<th>Agree</th>
<th>Agree Slightly</th>
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</tr>
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</table>

17. Re-trials will be more common in trials using DNA evidence.

<table>
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<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
<th>Neither Agree Nor Disagree</th>
<th>Agree</th>
<th>Agree Slightly</th>
<th>Strongly Agree</th>
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</thead>
</table>

18. Early exclusion of suspects who have been cleared by forensic DNA evidence will reduce costs to the judicial system.

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<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
<th>Neither Agree Nor Disagree</th>
<th>Agree</th>
<th>Agree Slightly</th>
<th>Strongly Agree</th>
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</thead>
</table>

19. Evaluation of DNA typing/techniques require extensive training.

<table>
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<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
<th>Neither Agree Nor Disagree</th>
<th>Agree</th>
<th>Agree Slightly</th>
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</thead>
</table>
20. The R.C.M.P laboratories have a priority case system. The defendant’s case is ranked as less of a priority than the prosecution’s.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
<th>Neither Agree Nor Disagree</th>
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<th>Agree Slightly</th>
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</table>

21. Juries are persuaded by the high statistical numbers expressed in some cases which use DNA evidence.

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<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
<th>Neither Agree Nor Disagree</th>
<th>Agree</th>
<th>Agree Slightly</th>
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</thead>
</table>

22. The polymerase chain reaction (PCR) is the best technique for minute amounts of DNA.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
<th>Neither Agree Nor Disagree</th>
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<th>Agree Slightly</th>
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</table>

23. Currently, Canada uses mostly the Restriction Fragment Chain Reaction (RFLP) DNA technique for identification of samples.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
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<th>Disagree Slightly</th>
<th>Neither Agree Nor Disagree</th>
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<th>Strongly Agree</th>
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24. There is some confusion as to what fields of study expert witnesses should be drawn to testify at trial.

<table>
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<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
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</table>

25. Population frequency statistics should not be used in DNA cases because it may exaggerate the impact of the evidence.

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<thead>
<tr>
<th>Strongly Disagree</th>
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<th>Disagree Slightly</th>
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26. More than one type of expert may be necessary during a given criminal trial involving DNA evidence.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
<th>Neither Agree Nor Disagree</th>
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<th>Agree Slightly</th>
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</thead>
</table>

144
27. Counsel must obtain a thorough knowledge of DNA typing to ensure that the evidence is presented in an unbiased manner.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
<th>Neither Agree Nor Disagree</th>
<th>Agree</th>
<th>Agree Slightly</th>
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</table>

28. The PCR technique will require new training/understanding for forensic experts including lawyers.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
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<th>Disagree Slightly</th>
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<th>Agree Slightly</th>
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</thead>
</table>

29. The monetary cost of using DNA technology in forensic science will affect the budget for the police, the prosecutors, and the courts.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Disagree Slightly</th>
<th>Neither Agree Nor Disagree</th>
<th>Agree</th>
<th>Agree Slightly</th>
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</thead>
</table>

30. Criminal defendants have a right to have an expert witness paid for by the government.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
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<th>Disagree Slightly</th>
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<th>Agree Slightly</th>
<th>Strongly Agree</th>
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</thead>
</table>

31. DNA laboratories should be privatized.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
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<th>Neither Agree Nor Disagree</th>
<th>Agree</th>
<th>Agree Slightly</th>
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32. DNA data banks should include profiles from the general public and not be limited to convicted criminals.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
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<th>Disagree Slightly</th>
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33. Due to rapidly changing DNA techniques, a DNA data bank should not be established yet.

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<tr>
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</table>
34. Pilot projects, conducted in Canada, on DNA data banks should be established prior to the implementation of such a data system.

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35. DNA technology is an asset to our criminal justice system.

<table>
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<tr>
<th>Strongly Disagree</th>
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<th>Neither Agree Nor Disagree</th>
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<th>Strongly Agree</th>
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</table>

36. DNA is more beneficial than costly to our criminal justice system.

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<tr>
<th>Strongly Disagree</th>
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<th>Neither Agree Nor Disagree</th>
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<th>Agree Slightly</th>
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37. Some criminal cases, which use DNA evidence, could be solved with contemporary methods.

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38. DNA evidence will successfully solve many problems, but will also uncover problems that our current criminal justice system cannot solve.

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<tr>
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</table>

If you wish to have a copy of this questionnaire's results please check here, and leave a return address

Return address:
PLEASE FEEL FREE TO MAKE ANY COMMENTS HERE

Thank You Again For Participating!
APPENDIX H

**RCMP DNA Testimony as of Nov. 2, 1992**

<table>
<thead>
<tr>
<th>Case Reference</th>
<th>Location</th>
<th>Type of Hearing</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. R. v. McNally</td>
<td>Ottawa, ON</td>
<td>voir dire</td>
<td>89 Apr</td>
</tr>
<tr>
<td>3. R. v. Bourguignon</td>
<td>Ottawa, ON</td>
<td>preliminary</td>
<td>90 Dec</td>
</tr>
<tr>
<td>4. R. v. Hunt</td>
<td>Woodstock, ON</td>
<td>preliminary</td>
<td>90 May</td>
</tr>
<tr>
<td>5. R. v. Kaysawaywaysema</td>
<td>Broadview, SK</td>
<td>prelim</td>
<td>90 Oct</td>
</tr>
<tr>
<td>7. R. v. Baptiste</td>
<td>Penticton, BC</td>
<td>voir dire</td>
<td>91 Feb</td>
</tr>
<tr>
<td>8. R. v. Legere</td>
<td>Burton, NB</td>
<td>voir dire</td>
<td>91 May</td>
</tr>
<tr>
<td>9. R. v. McIntyre</td>
<td>Newcastle, NB</td>
<td>Trial</td>
<td>91 Aug</td>
</tr>
<tr>
<td>10. R. v. Crane</td>
<td>Thompson, MN</td>
<td>voir dire</td>
<td>91 Aug</td>
</tr>
<tr>
<td>11. R. v. Bishop</td>
<td>Calgary, AB</td>
<td>Trial</td>
<td>91 Nov</td>
</tr>
<tr>
<td>12. R. v. Robson</td>
<td>Duncan, BC</td>
<td>preliminary</td>
<td>92 Oct</td>
</tr>
<tr>
<td>13. R. v. Williams</td>
<td>Invermere, BC</td>
<td>voir dire</td>
<td>92 Jan</td>
</tr>
<tr>
<td>14. R. v. Young</td>
<td>St. John's, ND</td>
<td>prelim</td>
<td>92 Jan</td>
</tr>
<tr>
<td>15. R. v. Stillman</td>
<td>Oromocto, NB</td>
<td>Transfer hearing</td>
<td>92 Feb</td>
</tr>
<tr>
<td>16. R. v. Atkinson</td>
<td>Edmonton, AB</td>
<td>voir dire</td>
<td>92 Mar</td>
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*All cases were provided at the Alberta Crown Attorney Fall Conference at the Banff Centre, Banff, Alberta, Canada (Sept. 14-16, 1994).*
<table>
<thead>
<tr>
<th>Case</th>
<th>Location</th>
<th>Type</th>
<th>Date</th>
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<tbody>
<tr>
<td>17. R. v. Cruz</td>
<td>Vancouver, BC</td>
<td>prelim</td>
<td>92 Mar</td>
</tr>
<tr>
<td>18. R. v. Borden</td>
<td>New Glasgow, NB</td>
<td>voir dire</td>
<td>92 Apr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trial</td>
<td>92 Apr</td>
</tr>
<tr>
<td>20. R. v. Imhoff</td>
<td>St. Albert, AB</td>
<td>prelim</td>
<td>92 Jul</td>
</tr>
<tr>
<td>22. R. v. Rochon</td>
<td>Flin Flon, MN</td>
<td>prelim</td>
<td>92 Sep</td>
</tr>
<tr>
<td>23. R. v. Napierala</td>
<td>W. Vancouver, BC</td>
<td>prelim</td>
<td>92 Sep</td>
</tr>
<tr>
<td>24. R. v. Royer</td>
<td>Ottawa, ON</td>
<td>Trial</td>
<td>92 Oct</td>
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<td></td>
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<td>Trial</td>
<td>92 Oct</td>
</tr>
</tbody>
</table>
Section A: (open-ended questions)

1. Have you ever worked as crown counsel, litigation, or other? (explain)
   
   YES _______  NO _______  if yes, how long? _______

2. How many DNA cases have you been involved with? (explain)

3. In your opinion, what are the significant issues that you face while handling a DNA case? (If none, explain why)

4. How may the problems that you face in DNA cases be rectified?

5. What influence does Legal Aid Services have upon DNA cases?

6. If you had access to DNA experts would you use them in your attempt to defend your client? (explain)

7. If you had access to DNA private laboratories would you use them in your attempt to defend your client? (explain)

8. Do you understand the differences between the PCR-based and RFLP techniques of DNA testing?

9. What is your opinion on this price chart of various PRIVATE DNA tests? Would you use this service? Why or why not?
10. Have you ever challenged DNA evidence presented in court or prior to court? Why or why not?

Section B: (Comments on quantitative data)

1. Question asked on the questionnaire: Have you received any form of instruction/training surrounding DNA evidence?

   Crown: 90% answered yes, 10% answered no
   Defence: 35% answered yes, 65% answered no

   Can you help me account for this finding?

2. Question asked on the questionnaire: Do you understand the process of developing a DNA profile?

   Crown: 80% answered yes, 20% answered no
   Defence: 26% answered yes, 65% answered no

   Can you help me account for this finding?

3. The majority of defence counsel (76%) agreed that our current CJS is not ready to accept a DNA data bank. What is your comment?

4. Defence counsel (60%) strongly believe that re-trials will become a common theme in the future of DNA trials. What is your comment?

5. Defence counsel (65%) think that the possibility of DNA sample contamination and the entry of these contaminated samples into a DNA databank is problematic. What is your opinion?

6. What do you think about the possible implementation of a DNA data bank?

7. Defence counsel (77%) is concerned that juries are easily influenced by high probability statistical numbers presented by the expert witnesses during the course of a trial. What do you think?
8. Defence counsel (80%) are concerned that DNA evidence may be presented in a biased manner. What do you think about this?

9. Defence counsel (100%) see a relationship between their lack of knowledge/understanding of DNA and their client’s propensity to plead guilty when DNA evidence is presented against the client. What may be the reason for this?

10. The majority of defence counsel (55%) were unsure about the soundness of laboratory techniques used by the RCMP. Furthermore, defence counsel is concerned with the reliability and the validity of DNA testing. Explanation?

11. Defence counsel (73%) believe that a criminal defendant has the right to have a DNA expert paid for by the government. However, they also agree that obtaining a counter-expert is not easily done. How does this impact your ability in defending your client?

12. When you defend a DNA case, do you feel confident? Why or why not? (explain)

13. How do you view the experts on DNA evidence, when they present their findings within the courtroom?

14. What impact, if any, do you think DNA evidence have on the defendant in terms of his/her pleading of guilt or innocence? (explain)

15. Do you have any questions for me?

16. YOC (year of call) ______________

17. How long have you been a defence counsel?
18. Gender of participant: Female _______ Male _______

Section C: (Comments/Observations/Interaction)
Dear Mr./Ms. Lawyer:

I am an Associate Professor in the School of Criminology at Simon Fraser University, and a non-practising member of the Law Societies of British Columbia and Alberta. One of my graduate students, Janne Holmgren, is writing her M.A. thesis on the topic of DNA evidence. Janne is interested in talking to defence counsel who have had experience with DNA evidence in criminal cases, whether it was introduced at trial, resulted in a guilty plea, or is presently being analyzed for a pending prosecution.

If you have had any involvement in such cases, I would very much appreciate your speaking to Janne about your perspectives as defence counsel on the use of DNA evidence.

If you have any questions about this research, please contact me. Janne will be calling you to see if you are interested in assisting her in her research.

Thank you for your consideration.

Sincerely,

Joan Brockman
References


Walsh, J. J. (1992). The population genetics of forensic DNA typing: “Could it have been someone else?” Criminal Law Quarterly, 34, 469-497.


Electronic References


Cases

People v. Castro, 545 N.Y.S 2d 985.


