

2013

Forensic Science in Canada

A Report of Multidisciplinary Discussion

May 4 – 5, 2012

Forensic science in Canada is at a critical juncture. Both public and judicial confidence in our practices have been eroded by several high-profile inquiries into the damage wrought by faulty forensic evidence. We have learned that reliable forensic science is a cornerstone of any effective justice system. However, in the past few years, there have been considerable improvements, much to the benefit of the public. In this report, forensic experts from across Canada describe the current state-of-the-art in forensic science and make recommendations to improve services. The unanimous conclusion is that the forensic sciences must grow and develop in Canada to enhance public health, public safety and justice. Continuous and sustainable improvement in all the disciplines of forensic sciences will require the coordinated efforts of academic institutions, government, stakeholders in the justice sector, and forensic scientists.

Edited by

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UNIVERSITY OF TORONTO

Forward

Honourable Justice Marc Rosenberg

Ontario Court of Appeal

Reliable forensic evidence, reported accurately and presented with clarity and honesty in court and with limitations clearly expressed, can be essential for the correct resolution of many criminal and civil cases.

Beginning in the 1990s several developments have affected the use of expert forensic science evidence. In its 1994 decision, *R. v. Mohan*, [1994] 2 S.C.R. 9, the Supreme Court of Canada commented on the risks associated with expert forensic evidence: “There is a danger that expert evidence will be misused and will distort the fact-finding process. Dressed up in scientific language which the jury does not easily understand and submitted through a witness of impressive antecedents, this evidence is apt to be accepted by the jury as being virtually infallible and as having more weight than it deserves.”

In that and other decisions, the courts were assigned a greater role as gatekeepers charged with admitting into evidence only reliable expert evidence necessary for the correct resolution of the case. This development subjected forensic sciences to increased scrutiny by lawyers and judges. Since then, the legal community has struggled to understand what the experts are telling us and to ensure that fact-finding is not distorted by “junk” science, by clinical experience presented as forensic science, or forensic science inaccurately presented.

At the same time, public inquiries began to identify shortcomings in the gathering of forensic evidence and problems with the way it was presented in court. Tentative findings, or those open to many interpretations, were presented in misleading terms suggesting greater certainty than the scientific results could justify. Similar doubts were raised about forensic sciences in other common law countries, especially the United States, with the 2009 publication of: “Strengthening Forensic Science in the United States: A Path Forward.” This report, produced by the National Academy of Sciences, painted a bleak picture of the state of forensic sciences in the United States and cast doubt on the reliability of evidence coming from experts working in long-established forensic sciences.

The multidisciplinary discussion and this report on the state of forensic science in Canada represent important steps in building confidence in Canada's forensic science sector. As Dr. Pollanen has observed, forensic sciences are at a critical juncture. The material included in this report paints a more optimistic picture for Canada than that which exists in the United States, primarily because, unlike in the United States, much of Canada's forensic science is done in a few centres of excellence.

But this report also reveals important areas for improvement, if confidence in forensic sciences is to be restored and maintained. There is an urgent need for greater investment in research, training and graduate education. The demands on scientists, to provide reports and evidence, often leave little time for research and continuing education. In her discussion of forensic entomology, Dr. VanLaerhoven voices a concern that may be generalized to most of the forensic sciences: a chronic lack of funding is a major barrier to developing the discipline and training new experts. The forensic sciences would also benefit from greater integration with the broader scientific community and closer association with universities, as is the case in Ontario for forensic pathology and forensic entomology.

This report also identifies other shortcomings in the forensic sciences in this country. Some important disciplines, like forensic odontology, have no national standards and rely upon training and accreditation from other countries. Important disciplines, such as forensic nursing, suffer from a lack of consistent legislative and regulatory framework and limited opportunities for research.

Thus, while this report contains many positive elements, it also highlights weaknesses and concerns that must be addressed. As the Driskell¹, Morin², and Goudge³ inquiries show, we ignore the state of forensic sciences at our peril.

¹ Commission of Inquiry Into Certain Aspects of the Trial and Conviction of James Driskell, The Honourable Patrick LeSage, Commissioner.

² Commission of Inquiry into Proceedings Involving Guy Paul Morin, The Honourable Fred Kaufman, Commissioner.

³ Inquiry into Pediatric Forensic Pathology in Ontario, Mr. Justice Stephen T. Goudge, Commissioner.

Preface

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The Centre for Forensic Science and Medicine (CFSM) at the University of Toronto is pleased to coordinate and host the first multidisciplinary discussion of forensic science in Canada. This discussion has involved key forensic scientists from across the country who have come together in a collaborative forum to describe the current state of forensic science in Canada. Most importantly, this valuable discussion has identified unifying themes, conclusions and recommendations to strengthen and advance Canada's forensic science sector.

Forensic science in Canada is at a critical juncture. Both public and judicial confidence in our practice have been eroded by several high-profile inquiries into damage wrought by faulty forensic evidence, and must be rebuilt. Furthermore, members of the forensic science community are themselves demanding better scientific practices and an increased emphasis on building academic foundations for forensic work. All of these issues can be addressed by the collaborative efforts of forensic practitioners and academic forensic scientists.

It is our hope that this report will be a catalyst for further activities sponsored by the CFSM and other organizations, including universities, community colleges and institutions. It is now time to develop a national strategic plan for forensic science in Canada.

R. v. Mullins-Johnson, 2007 ONCA 720

“... fresh evidence... together with the other evidence, shows beyond question that the appellant’s conviction was wrong and that he was the subject of a terrible miscarriage of justice.

We conclude these reasons by paraphrasing what the president of the panel said to Mr. Mullins-Johnson at the conclusion of the oral argument after entering the verdict of acquittal: it is profoundly regrettable that as a result of what has been shown to be flawed pathological evidence Mr. Mullins-Johnson was wrongly convicted and has spent such a very long time in jail.

We can only hope that these words, these reasons for judgment and the deep apology expressed by Ms. Fairburn on behalf of the Ministry of the Attorney General will provide solace to Mr. Mullins-Johnson, to his mother and to everyone who has been so terribly injured by these events”.

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Introduction

Forensic science, at its most basic level, is the application of the scientific method to problems in the law. Each of this group of disciplines has originated from a parent core domain of science, but has evolved to encompass a unique body of knowledge and techniques. As an example, forensic pathology has evolved from the largely hospital-based (and surgically oriented) practice of applied human pathology to encompass such exotic questions as “how fast does a human body decompose?” Or “what are the typical anatomic findings of manual strangulation?”

One important aspect of this evolution is the progressive adoption of an integrative paradigm of forensic scientific inquiry. Simply put, the modern forensic scientist understands the results of a test in the circumstantial context of the whole case.

But just as our approach has changed, so does science: new theories, methods and techniques are developed every day, and understanding how these change forensic science presents unique challenges and opportunities. We are mindful that these new developments are as challenging to lawyers and judges as they are to the scientific community.

A number of recent cases, including some wrongful convictions, have inspired interest in the scientific and legal communities about the reliability of forensic science. In response to this challenge, we believe that a survey analysis of the state of forensic science in Canada is required. We have identified three major trends driving change in forensic science in Canada:

- A shift to an evidence-based paradigm in forensic scientific inquiry, paralleling that in medicine.
- The recognition among forensic scientists themselves that there is a need to bridge the gap between expectations and deliverables in expert opinion evidence.
- The seminal publications of the National Academy of Sciences (NAS) in the USA, which have underscored the need for other jurisdictions to reflect upon these trends.

Our goals and objectives in the current report are to provide:

- A description of the current state of forensic science in Canada, spanning the main disciplines of forensic inquiry
- A summary of the major challenges and opportunities facing forensic science in Canada
- Recommendations on how to strengthen and develop forensic science in Canada

We have identified nine main disciplines within the forensic sciences. We understand there are others, but felt this group offered the best place to start a meaningful discussion of the issues. We asked forensic scientists across Canada from both the academic and public sectors to contribute descriptions and analyses of the state of their disciplines. We also asked them to describe their disciplines within the framework of the three main components of healthy intellectual inquiry: service, education and research. We view these as the cornerstones of a sustainable approach to forensic science in Canada. We do not represent this as an exhaustive assessment of these disciplines; rather, we simply wish to catalyze further activity in this area. The conclusions and recommendations emerging from these analyses were derived through a consensus-building workshop held at the University of Toronto in May, 2012.

The nine core forensic disciplines represented in this report and workshop are:

1. Forensic pathology
2. Forensic anthropology
3. Forensic odontology
4. Forensic nursing
5. Forensic entomology
6. Forensic physical evidence
7. Forensic toxicology
8. Forensic biology
9. Forensic psychiatry

We hope the conclusions and recommendations will be of use to the academic and public sectors in defining and funding strategic priorities to strengthen forensic science in Canada. We do not recommend the creation of new agencies, we do not advocate for specific systemic reforms (as the NAS does), and we do not view it as within our expertise to make recommendations as to how coroners, medical examiners, policing agencies and courts (as principle stakeholders and clients of forensic science) should make use of these observations. We wish to engage stakeholders and encourage dialogue, and we are hopeful that the normal instruments of public policy renewal will be inspired to reflect upon the issues raised herein.



Chapter 1: Forensic Pathology

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1. Summary

This paper reviews the current status of forensic pathology in Canada. For many years, forensic pathology was one of the least advanced of medical subspecialties, with no recognition by the Royal College of Physicians and Surgeons of Canada, no domestic postgraduate training programs, unarticulated professional standards and guidelines, no professional or academic societies and a poorly developed research and development infrastructure. This situation is gradually improving due to a new focus on professionalizing the entire field of forensic science. Two important components of this process are formal certification of pathologists in forensic pathology, and new postgraduate training programs at several Canadian universities. Continued and sustainable development of forensic pathology is necessary to standardize high-quality death-investigation services across the country.

2. Overview

Forensic pathology is the application of pathology to legal issues involving deaths that society has an interest in examining for the good of public health. These include sudden or unexpected deaths, deaths from unnatural causes, and deaths where people have been deprived of their liberty. It uses the methods of clinical medicine, anatomical pathology,

including the postmortem examination (autopsy), histology and other ancillary tests, to answer key questions about why and how someone died. It is an integrative discipline in which decision-making and diagnosis is based on observable evidence. However, opinions are ultimately formed by correlating medical data with the history, scene and circumstances of a case, based on the evidence found.

The expert opinions of forensic pathologists are used by a variety of end-users, or clients. These are largely defined as persons or groups with an interest in why or how someone has died. The forensic pathologist's client group can be surprisingly large and diverse, extending beyond the next of kin, coroners and medical examiners to include insurance companies, public health surveillance groups, researchers, automotive engineers and hospital mortality committees. Thus, although forensic pathology's most visible application is providing expert opinions to the criminal justice system, its practitioners also play key leadership roles in the broader medicolegal community, and make significant contributions to death prevention and public safety.

The main work of a forensic pathologist in Canada is to perform autopsies in cases of sudden and unnatural death, and to give expert opinions on the cause of death, the mechanism of death, the time of death and injury, the manner of death and many other related issues. Forensic pathologists deliver a number of work products, including expert reports, consultative advice for police, prosecutors and defense lawyers, and testimony in criminal and civil law courts. Many forensic pathologists also have administrative and academic responsibilities.

3. Service

3.1. Legal Framework

Forensic pathologists work in four types of death investigation systems in Canada, each defined by applicable provincial legislation (Table 1):

System type	Provinces	Role of forensic pathologists
Medical examiner	Alberta Manitoba Nova Scotia Newfoundland	Death investigation, autopsies, and administrative leadership
Lay coroner	British Columbia	Perform autopsies for

	Saskatchewan New Brunswick Nunavut Northwest territories Yukon	coroners only (no forensic pathologists outside of British Columbia and Saskatchewan)
Medical coroner	Ontario PEI	Ontario: perform autopsies only; administer forensic pathology services PEI: no forensic pathologists
Medical - legal coroner	Quebec	Perform autopsies for coroners only

The statutory milieu thus provides for two types of forensic pathology practice: systems where forensic pathologists have the statutory responsibility to order and perform an autopsy, and systems where the statutory responsibility to order the autopsy rests with someone else.

Medical-examiner systems in Canada developed in parallel with those in the United States, a trend that began in Baltimore in 1866, and continues to this day. These systems replaced lay-coroner systems, thereby professionalizing death-investigation services. This trend has been endorsed by the National Academy of Sciences (NAS) in the United States.

The umbrella group for death investigation across Canada is a committee composed of the Chief Coroners and Chief Medical Examiners from each province. This committee is a forum for the exchange of ideas, and does not have a budget or a lawful mandate to recommend reforms or best practice. Nor does it have the ability to promulgate or enforce standards. In any case, only four of the 13 provincial and territorial death-investigation systems are led by forensic pathologists.

There is little coordinated inter-provincial interaction between forensic pathologists. In addition, the structure of forensic pathology services within individual provinces is variable and does not typically encourage or provide for such interaction.

Although there is emerging interest in the qualifications, assessment and competency of forensic pathologists, including certification through the Royal College of Physicians and Surgeons of Canada (RCPSC), essentially no attention has been paid in Canada to a similar evaluation of coroners. This is because being a coroner is a statutory rather than a professional designation. “Coronership” is not associated with any nationally recognized

qualification, certification or training, although Canadian coroners may avail themselves of the credentials provided by the American Board of Medicolegal Death Investigation. The issue of whether or not this is a relevant credential in Canada is open to reasoned debate.

The final work product of any death-investigation system is an opinion on cause and manner of death. Although there are internationally recognized guidelines on this activity, there is no similar agreement in force in Canada. The fact that death-classification patterns of practice are not standardized makes comparisons between jurisdictions difficult, and raises questions about the integrity of mortality statistics in Canada.

In summary, the legal framework for death investigation in Canada provides for different styles of forensic pathology practice. We do not conclude (as the NAS has done) that death-investigation systems must undergo radical change. Rather, we believe that great strides in service can be made at low cost by encouraging meaningful peer review, by monitoring workload, and by encouraging quality-management systems that include and consider the practice of coroners and forensic pathologists together. In short, we hope to engage our coroner colleagues in a collaborative effort at system improvement.

3.2. Facilities

Autopsy, laboratory, body storage and office facilities for forensic pathology activities are highly variable across Canada. Only Alberta, Ontario, Nova Scotia and Quebec have stand-alone governmental facilities to provide forensic pathology services. All other provinces rent or borrow space from hospitals for autopsy, laboratory and body storage. Many coroner and medical examiner systems have office facilities in government or commercial buildings.

Many hospital-based autopsy facilities are not designed for forensic pathology activities and are simply local hospital morgues that serve as *ad hoc* medicolegal autopsy facilities. Some hospitals have developed forensic pathology units to consolidate regional forensic autopsy services. Some of these facilities are financially supported by provincial governments and are staffed by full-time forensic pathologists, but this is not the norm across Canada.

Facilities for ancillary testing (for example, toxicology, microbiology, and DNA analysis) are similarly variable in quality and availability. Although it is broadly recognized that the practice of forensic pathology requires access to appropriate post-autopsy testing, the Canadian reality is a scattered network of federal and provincial government and private laboratories. There is no relevant Canadian standard with respect to the quality or availability of ancillary testing. International accreditation for medicolegal death investigation systems, including an examination of facilities, is available through the National Association of Medical Examiners.

3.3. Professional Standards

There are no generally accepted professional standards or guidelines for forensic pathology in Canada. Standards have been produced in other countries, but may not be appropriate for Canada. The Forensic Pathology Section of the Canadian Association of Pathologist has developed basic autopsy guidelines, but there is no evidence that the guidelines have informed practice. Furthermore, there is no uniform view in the forensic pathology community that professional guidelines are required. In addition, it is unlikely that guidelines or standards can be uniformly adopted across the country until forensic pathology services are better developed.

In any case, professional standards for forensic pathology practice may be of limited usefulness if there is no parallel process defining standards of practice in medicolegal death investigation. The competent execution of an autopsy is important, but the competent integration of the autopsy data into the larger investigative data set is equally important.

3.4. Workforce

There is an increasing recognition that high-quality forensic pathology services require the employment of full-time, qualified forensic pathologists working collaboratively in institutional settings. This is a departure from the historical tendency of governments to use hospital pathologists to perform autopsies on a fee-for-service basis. Because of this recognition, more forensic pathologists are now being hired in Canada, much to the public's benefit.

However, in many provinces a significant proportion (or all) of medicolegal autopsies are still performed by a network of hospital-based, fee-for-service pathologists. These pathologists often work in inadequate facilities, may not be situated in academic pathology settings, and may even function in solo practice. Some provinces do not employ certified forensic pathologists at all, either in salaried government positions or as fee-for-service contractors. Such a system is left in the regrettable position of having plenty of work to do, but because of the distributed nature of the workload, no single place in the network is able to make the economic case for a full-time forensic pathologist.

The problem of having too many pathologists with too little training doing too few cases is exacerbated by the lack of government-based or institutionalized forensic pathology services in many provinces. In provinces with poorly organized forensic pathology services, there is little, if any, professional oversight of the practice, nor is there a clear and consistent integration of forensic pathology into the broader business of death investigation. Medical-examiner systems, where forensic pathologists oversee the entire death investigation process, accomplish this integrative function automatically as a design principle of that system.

There is a critical shortage of forensic pathologists in Canada. In addition, forensic pathologists who *are* in practice are not optimally distributed across the country, and many are burdened with heavy caseloads. On any given day, the number of cases that could benefit from a forensic pathologist's involvement vastly exceeds the capacity of the current roster. In addition, forensic pathologists are subject to increasing demands, such as the increased amount of work to be done in individual autopsies, increased complexity of reports, peer-review commitments, consultation work and heavier burdens for court testimony. This is not even to mention the burden of launching a national organization tasked with meaningful oversight of standards, were such a thing to someday become possible.

Some autopsies on homicide and criminally suspicious cases in Canada continue to be performed by non-forensic pathologists. These pathologists are general or anatomical pathologists who are expert in the study of human disease, but who do not routinely work in a medicolegal context, and may have variable degrees of training and skill in the nuances of medicolegal practice. Although this unacceptable practice is diminishing, it has not been entirely eliminated. In many provinces, large caseloads and the small forensic pathology workforce make it difficult to assign complex medicolegal cases appropriately. Therefore, some of these cases must be managed retrospectively by case reviews and second autopsies, often after exhumation. This situation adds unacceptable cost, complexity, and risk of error to our justice system.

4. Education

4.1. Medical Education

In Canada, entrance to medical school is granted to those who have completed an undergraduate science degree. The Doctor of Medicine degree is then obtained from one of this country's seventeen medical schools. Medical graduates are admitted into postgraduate medical education programs: there are many of these programs, but, broadly speaking, they are either family medicine or one of the various medical or surgical specialties.

Most medical students get little exposure to forensic pathology and related areas in medical school. This is principally because the Doctor of Medicine program must cover a rapidly expanding number of subjects and volume of material in a fixed amount of time. Many subject matter areas therefore achieve diminishing importance in a busy curriculum. Unsurprisingly, if a medical student is exposed to forensic pathology, it is by happy accident rather than by design. For example, a number of medical faculties offer a series of lectures on forensic medicine, but few include courses or a formal curriculum. Elective experience in forensic pathology is available to the interested student in some

institutions some of the time. In any case, most provinces do not actively recruit from the corps of medical students to form the next cohort of forensic pathologists.

4.2. Residency Training and Certification

The Royal College of Physicians and Surgeons of Canada (RCPSC) requires that residents training in anatomical and general pathology complete rotations in forensic pathology. Thus, anatomic and general pathologists in Canada should be able to perform routine medicolegal autopsies. However, there are no standard educational objectives for forensic pathology rotations, no accepted number of autopsies a resident should perform during training, and no formalized assessment of autopsy competency by the RCPSC.

The RCPSC recognized forensic pathology as a medical subspecialty in 2003. In contrast, the certifying bodies in the United States and the United Kingdom have recognized forensic pathology for decades. The RCPSC now accredits one-year residency (fellowship) training programs in forensic pathology after primary certification in anatomical or general pathology. Certification in forensic pathology is based on the successful completion of a one-year training program and a written examination. Currently, the only active program is at the University of Toronto. Since 2008, six forensic pathologists have completed training and are working in Ontario. Other training programs, in Alberta and at McMaster University in Hamilton, have also been accredited by the RCPSC.

Historically, many Canadian pathologists gained forensic pathology certification in the US by undertaking fellowships in institutions accredited by the American College of Graduate Medical Education. In the US, after successfully completing a fellowship, pathologists are eligible for subspecialty certification in forensic pathology from the American Board of Pathology by examination. Some Canadian pathologists have also obtained postgraduate certification in forensic pathology from the UK (e.g., Royal College of Pathologists, the Worshipful Society of Apothecaries of London).

Many of the forensic pathologists who practiced in Canada before the 1990s did not obtain postgraduate training or certification in forensic pathology. These pathologists obtained recognition as forensic pathologists by experience, reputation, academic accomplishments and professional contributions. However, since the 1990s, training and certification have been increasingly emphasized.

4.3. Continuing Professional Development

The Centre for Forensic Science and Medicine (CFSM), established at the University of Toronto in 2008, is an interdisciplinary initiative dedicated to the advancement of teaching and research in the forensic disciplines at the crossroads of medicine, the law and social sciences. The disciplines involved in the CFSM include law, forensic sciences,

forensic pathology, forensic psychiatry and psychology, forensic anthropology, forensic odontology and forensic pediatrics.

The Centre is the sole entity within the country with the mandate and the expertise to provide continuing education for forensic pathologists, forensic medical practitioners and others in the criminal justice system.

The CFMS hosts a monthly seminar series on “Current Controversies in Forensic Science & Medicine: Toward Resolution in the 21st Century,” as well as occasional conferences. These qualify as continuing education credits for the Maintenance of Certification (MOC) program of the RCPSC. The MOC program was designed to encourage specialist physicians to keep their knowledge and skills current by participating in educational activities, such as lectures, seminars and conferences. Participation in the MOC program is required of all specialist physicians in Canada, including forensic pathologists.

Forensic pathologists may also attend annual meetings of organizations such as the Canadian Association of Pathologists, the American Association of Forensic Sciences and the National Association of Medical Examiners for continuing professional development.

5. Research

The importance of continuing research was recognized in the Goudge report. The most active research program in forensic pathology is at the CFMS at the University of Toronto. The research output of Canadian forensic pathologists outside the University of Toronto is sporadic, and consists of the individual efforts of interested individuals who do not enjoy protected time for research, do not have dedicated laboratory space, and do not have access to a research funding institution dedicated to the advancement of the forensic sciences.

A number of major barriers to academic productivity are identified:

- Some forensic pathologists practice outside of an academic context. These pathologists do not hold an academic appointment, and thus have no incentive to do research. In any case, they do not have access to the other research infrastructure that a University provides.
- Many forensic pathologists who work full-time in a death-investigation context are faced with unsustainable workloads.
- Most forensic pathologists in Canada do not teach forensic pathology fellows, thus the country misses out on an activity that encourages and leads naturally to academic inquiry.

- Travel budgets everywhere are under severe pressure, making attendance at national and international meetings less likely.
- Most practice groups (i.e., a group of doctors working in one place for one client institution) of forensic pathologists are small and isolated, making the development of collaborative research networks difficult.

Unlike other disciplines of medicine, forensic pathology does not have a natural research funding champion, like the Natural Sciences and Engineering Research Council of Canada (NSERC). Notably, forensic science is not among the priorities or strategic topics of NSERC, and the Canadian Police Research Council, according to its website, "...funds, plans, conducts, applies and promotes interdisciplinary research and development to address issues of concern to the *first responder community*." [emphasis added] By longstanding tradition, the first responders are understood to include people like police and firefighters, not forensic pathologists and other laboratory scientists.

5.1. Research and Publications

Publications in international peer-reviewed journals are the currency of academic productivity for Canadian forensic pathologists. There is no forensic pathology journal in Canada, although Canadians are regular contributors to international journals, as authors, reviewers and editors. There is no Canadian textbook of forensic pathology *per se*, although Canadians have made notable contributions to forensic texts of other kinds.

5.2. Institutions

The CFMS at the University of Toronto remains the only active forensic pathology research centre in Canada, a situation unlikely to change in the foreseeable future.

6. Professional Organizations and Groups

6.1. Professional societies

The Forensic Pathology Section of the Canadian Association of Pathologists (CAP) promotes and enhances forensic pathology in Canada, fosters inter-provincial communication among forensic pathologists, and facilitates continuing professional development. Not all practicing forensic pathologists in Canada have embraced this group, but the section was only recently founded, and we are optimistic it will develop as time goes by.

6.2. National Committees and Networks

Forensic pathologists in Canada enjoy a mutually supportive, highly collegial (if informal) professional network in Canada. The Conference of Chief Coroners and Chief Medical Examiners of Canada has four members who are forensic pathologists, one of whom is the Chair. The Steering Committee of the Chief Coroners and Medical Examiners Database of Statistics Canada has two members who are forensic pathologists, one of whom is the Chair.

6.3. International Organizations

Canadian forensic pathologists are active in international organizations including committee work and holding officer positions.

7. Conclusions

Forensic pathology as an organized specialty of medicine has made enormous strides in the last decade. The question of who is a forensic pathologist has an agreeably easy answer for forensic pathologists who have recently graduated from training. The training that new forensic pathologists receive was created and is monitored by the Royal College of Physicians and Surgeons of Canada. The end of that training, and the beginning of independent practice, is defined by an examination created and overseen by the acknowledged leaders of our specialty. Forensic pathologists can draw satisfaction from these developments.

Many challenges remain. National standards of practice, especially with respect to the role of peer review, remain elusive. There are too few forensic pathologists doing too much service, and this situation has naturally diminished the academic productivity of Canadian practitioners. Workload is not the sole barrier to academic productivity. The role that the forensic pathologist plays in medicolegal death investigation is dictated by statute, not practice standard, and is variable, making comparisons across jurisdiction difficult.

The authors of this chapter are optimistic that the momentum achieved in our specialty will continue, and that the remaining barriers to a sustainable specialty will be overcome by an increasingly engaged population of practitioners, working in collaboration with our clients and stakeholders.



Chapter 2: Forensic Anthropology

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1. Summary

Forensic anthropology was formally recognized as a discipline in the US in 1973 with the formation of a section in the American Academy of Forensic Sciences. A section of the Canadian Society for Forensic Science was formed in the early 1990s, including anthropology, medical and odontology. To date there are no dedicated training programs or certification in the field offered in Canada.

Although forensic anthropologists were responsible for founding the earliest undergraduate forensic science programs in universities across the country, it remains impossible to obtain a graduate degree in this field in Canada. Universities rarely hire faculty who identify as forensic anthropologists. Instead they hire biological or physical anthropologists who are occasionally used by government death-investigation or policing systems. These faculty members can then provide courses and sometimes practical training to students, but in a limited manner. Graduate programs are non-existent due in part to a lack of recognition of the field by federal funding agencies. There is also an unwillingness on the part of academic anthropology to accept the discipline as a *bona fide* subsection, thereby formalizing it as an academic pursuit. Research in the field is minimal due to the lack of funding.

While Ontario has a fully integrated approach to the use of forensic anthropology in death investigation, other provinces do not. Use of the services available through forensic anthropologists varies widely across the country.

2. Overview

Forensic anthropology is the study of what is generally known as “non-visually identifiable human remains.” Basically this means remains in an advanced state of decomposition; a situation that can arise when remains are skeletonized, buried, decomposed, recovered from water, badly burned, etc.

Forensic anthropologists can be involved in locating and recovering remains in many contexts, both indoors and out. The skeletal analyses they perform may determine if found remains are animal or human, or if they are recent or historical. The work of the forensic anthropologist also involves building biological profiles, pinpointing identifying characteristics, and uncovering events occurring on or around the time of death.

Forensic anthropologists are now recognized as key members of Canada’s death-investigation teams, where they assist by ensuring thorough, methodologically correct and scientific recovery of remains. Having a forensic anthropologist on the scene is a significant help in understanding scene management, building preliminary biological profiles and accurately identifying the postmortem interval. Since forensic anthropologists are trained to make ancillary observations as well, they can often make valuable contributions towards reconstructing crime scenes – as in, for instance, noting tool marks in grave construction.

Forensic anthropologists can also help conserve resources in found-remains investigations. For instance, a forensic anthropologist can determine right away if remains are archaeological, thus ensuring resources are not wasted on unnecessary investigations. Digital technology is now a great help as well, as most forensic anthropologists can easily determine if found bones are human or animal from digital photographs sent via the Internet. This means a scene may be quickly cleared and a recognized authority consulted, no matter where in Canada the find occurs.

In the autopsy room, the forensic anthropologist works with both the forensic pathologist and the medical examiner to clean the remains, build a biological profile, and record and interpret trauma. Forensic anthropologists are regularly called upon to testify in criminal trials as expert witnesses, and they also teach and undertake research projects.

3. Service

3.1. Legal Framework

The services of a forensic anthropologist may be requested at one of two points in an investigation. Requests made at the scene come from either the police agency or the coroner/medical examiner, depending on the province. Requests made after remains

have been removed from a scene may come from the coroner, police, medical examiner or pathologist – again, depending on which provincial system is in play.

Frequently, questions of whether remains are human or animal come from a police agency. Analyses of human remains are most often requested by coroners, medical examiners or forensic pathologists. In some provinces, including British Columbia, Quebec and some of the Atlantic provinces, the police may request these as well, usually with agreement of the pathologist or coroner. In other provinces, the anthropologist will work directly with the pathologist at the postmortem and beyond.

3.2. Facilities

Facilities for the practice of forensic anthropology differ widely from province to province. Most commonly, the work is performed at provincial morgue facilities, in either a hospital or a dedicated forensic unit. Such spaces are routinely shared with pathologists. In addition, some forensic anthropologists have secure laboratory space in their university departments.

Quebec's anthropologists have a fully-equipped, dedicated laboratory, shared with the forensic odontologist. In Ontario, the full-time forensic anthropologist has a dedicated laboratory space in the morgue, although space constraints mean it must often be shared. Ontario's new Forensic Services Complex, slated for completion in 2013, will provide a large dedicated laboratory and an anthropology case storage area, as well as a garage for recovery of burned individuals from vehicles. Southern British Columbia boasts the Centre for Forensic Research, a purpose-built facility affiliated with Simon Fraser University, although it handles only de-fleshed remains.

To summarize, only Quebec, Ontario and southern British Columbia currently provide dedicated space in secure medico-legal facilities for forensic anthropological analyses.

3.3. Professional Standards

There is no national professional body for forensic anthropologists in Canada, and therefore no guiding principles for professional standards.

The forensic anthropologists working out of the Centre for Forensic Research at Simon Fraser University adhere to standardized data-collection and reporting forms.¹ In Ontario, practicing forensic anthropologists recently agreed to use the various protocols published by the Scientific Working Group for Forensic Anthropology in the US as a guide to a minimum standard of practice.⁴ In addition, every forensic anthropology report is reviewed by a forensic pathologist, as part of the peer-review process in place for all

⁴ <http://www.swganth.org/>

forensic pathology case reports. However, a forensic anthropology report is only occasionally reviewed by another forensic *anthropologist* as an independent report. In many provinces forensic anthropologists are sole practitioners and do not have the advantage of discussing cases with colleagues as an informal peer-review system.

The American Board of Forensic Anthropology (ABFA), grants Diplomate status to qualified North American forensic anthropologists who apply for and successfully write an examination. The ABFA then requires a yearly fee to maintain certification and re-certification every three years. Currently there is only one practicing forensic anthropologist in Canada who is a Diplomate of the ABFA⁵.

3.4. Workforce

Forensic anthropology in Canada is largely undertaken by physical or biological anthropologists and/or archaeologists who have full-time positions or are graduate students in academic institutions. There are a few practicing individuals who have full-time employment in other fields, for example in law enforcement. These individuals may have minimal training in forensic anthropology. Except for the one full-time salaried forensic anthropology position in a medicolegal laboratory in Toronto, forensic anthropologists are fee-for-service consultants working for coroners, medical examiners, pathologists and police.

The education and qualification of Canada's practicing anthropologists varies as well. For instance, most forensic anthropologists undertaking casework hold either a Masters or a PhD, but these degrees don't necessarily reflect forensic knowledge, and might be obtained in a related discipline, such as anthropology or archaeology.

Training is similarly varied. Some practicing forensic anthropologists will have extensive hands-on training in local and international forensic casework, while others will have minimal training on this front, but may hold extensive experience with archaeological human skeletal remains. Others may have little practical experience in either, and must learn on the job. Ontario is in the process of formalizing service-level agreements with consulting forensic anthropologists, with a view to standardizing the level of education and experience required to practice in Ontario.

In many parts of Canada, coroners, police and pathologists continue to provide services that are within the forensic anthropologist's scope of practice, at least as it is understood in the US and some Canadian jurisdictions. These services include the determination of animal versus human bones, the proper recording, recovery and interpretation of human remains from outdoor environments and graves, and the determination of whether human remains are of recent forensic interest or are historical. Some jurisdictions continue to employ police for the interpretation of injuries and tool marks on bone.

⁵ <http://www.theabfa.org/index.html>

In summary, some Canadian jurisdictions consult with fully trained PhD-holding forensic anthropologists, or with some combination of PhD graduates and PhD students. At a minimum such jurisdictions would consult with Masters-level forensic anthropologists. However, other jurisdictions rely on individuals trained in other fields. In short, there is no national standard for either education or qualification of Canada's forensic anthropologists, resulting in varied quality of forensic anthropology services across the country.

4. Education

Forensic anthropology is a subfield within the larger discipline of anthropology. Consequently, most practitioners hold degrees in anthropology with specializations in forensic work. Depending upon the structure of the program, forensic anthropology courses and degrees with forensic anthropology specializations may also be obtained through archaeology departments and forensic science programs. The highest and most relevant qualification a Canadian forensic anthropologist can achieve is a PhD with specialization in forensic anthropology, but the route taken to accomplish this goal can vary considerably.

Students applying for a PhD in anthropology with a forensic specialization may obtain a Master of Anthropology (MA or MSc), a Master of Archaeology (MA) or a Master of Applied Science (MSc). In some cases candidates may be admitted directly from an undergraduate degree into a PhD program. Similarly, students may enter a master's program from almost any undergraduate degree, providing they meet the department's requirements. Most commonly, the undergraduate degree will be in anthropology, archaeology, or forensic science.

4.1. Undergraduate Education

Many universities across Canada offer at least one undergraduate course in forensic anthropology through either their anthropology, archaeology, or forensic science programs. It is not necessary to specialize in forensic anthropology at the undergraduate level to become a forensic anthropologist (see above), but it is possible to obtain such a specialization in Canada through any of the following programs:

- Forensic Science Anthropology Specialist (BSc), University of Toronto
- Bachelor of Forensic Science/Bachelor of Arts Forensic, with a focus or major in anthropology, University of Windsor
- Honours BSc in Forensic Science with a concentration in anthropology, Laurentian University
- Forensic Science Diploma Program, St. Mary's University, Halifax

These programs offer a concentration of courses relevant to a forensic anthropologist in training, such as various laboratory courses in analyzing human remains, as well as crime-scene investigation and internship or experiential learning courses.

4.2. Graduate Education

There are no master's programs in forensic science in Canada, but students may specialize in forensic anthropology at the master's level by gaining admission to an anthropology, archaeology, or MSc program in any university with a forensic anthropologist on faculty. Some biological anthropologists do occasional work for the police and can supervise students interested in forensic anthropology, thus providing opportunities for interested students to perform research with a forensic focus. However, such programs are scattered haphazardly across Canada with nothing available in the north or for French-speaking Canadians anywhere.

Similarly, there are no PhD programs in forensic anthropology, but students may obtain a PhD in either anthropology or archaeology with a concentration or specialization in forensic anthropology. The number of Canadian universities equipped with the qualified faculty and the degree program to confer this specialization is quite small, and at present consists of the University of Toronto, the University of Alberta, and Simon Fraser University. PhD students attending these programs can expect to be involved with real-life forensic case work under the guidance of their supervisors.

Aside from these institutions, most Canadian universities do not offer graduate-level courses in forensic anthropology, although students may take independent research or reading courses in the field or one of its topic areas (forensic taphonomy, trauma analysis, etc.) under the supervision of an appropriate faculty member. Additionally, graduate students may take courses relevant to forensic anthropology through other programs, including human osteology, paleopathology, facial reconstruction and human anatomy. At larger institutions they may take relevant courses from outside departments, such as medicine, law, and biomedical communications.

4.3. Professional Certification

There is no professional certification or accreditation process for Canadian forensic anthropologists, although, as noted earlier, we are eligible to take the American Board of Forensic Anthropology examinations. Recently, the relevance of this exam for Canadian practitioners has been called into question. One of the authors of this paper is of the opinion that the exam reflects the American forensic experience, to the exclusion of issues pertinent in Canada. In particular, this author is concerned about the exam's heavy emphasis on black versus white "racial" assessments, and the relatively little attention given to Aboriginal peoples.

4.4. Continuing Professional Development

Continuing professional development is available through research for those engaged at universities. Others attend workshops and present papers at various national conferences, such as those hosted by:

- The American Academy of Forensic Sciences
- The Canadian Society for Forensic Science
- The Canadian Association for Physical Anthropology
- The Canadian Archaeological Association.

Over the last few years, efforts have been made to unify, update, and educate Canadian forensic anthropologists through a symposium and subsequent publication of the state of the art in Canadian forensic anthropology⁶. Most recently Ontario consultant forensic anthropologists met to determine guidelines of best practice and to discuss other issues relevant to case work.

5. Research

5.1. Research and Publications

According to Skinner and colleagues' 2010 review of forensic anthropology activities in Canada, there was a three-fold increase in the number of articles focusing specifically on forensic anthropology published by Canadian practitioners between 1996 and 2006. Another review, looking at the same decade, revealed the average number of forensic anthropology articles published throughout an individual's career was only three, suggesting that, with few exceptions, there are a larger number of individuals practicing forensic anthropology, but rarely publishing⁷. This pattern is reflected in the hiring practices of university departments and the way in which faculty members in anthropology and archaeology departments and forensic science programs self-identify. In recent memory, very few people have been hired by Canadian anthropology or archaeology departments to teach and conduct research solely in forensic anthropology; however, many other faculty members list forensic anthropology as an interest.

A large proportion of Canada's forensic anthropology publications are based on fourth-year undergraduate research in forensic science programs, and master's-level research

⁶Skinner, MF, L. Clegg, A. Katzenberg, R.A. Lazenby, A. Mundorff, T. Peckmann, M. Spence, S. Stratton and K. Waterhouse (2010). Taking the Pulse of Forensic Anthropology in Canada. *Can. Soc. Forensic Sci. J.* 43. No 4: 191–203.

⁷Skinner M. and Bowie K. (2009) Forensic Anthropology: Canadian Content and Contributions. In: Blau S. and Ubelaker D.H. (eds.) *Handbook of Forensic Anthropology and Archaeology*. World Archaeological Congress. California: Left Coast Press; 87–103.

supervised by or in collaboration with forensic anthropology faculty. Publications stemming from faculty research and PhD research are less common, likely due to the lack of funding available for forensic science research from Canada's three major funding agencies

There is in fact no category for "forensic science" in any of these three agencies. Applicants seeking funding from the Social Sciences and Humanities Research Council (SSHRC) typically apply to the section of their home department. For instance, forensic anthropologists apply under "anthropology." Within this broad category are several subsections, but neither biological anthropology nor forensic anthropology is listed as an option. Funding for forensic anthropology projects is therefore sought under the category of "other."

Funding requests for forensic anthropological research (and sometimes biological anthropology research) have been variously denied outright by SSHRC and sent to NSERC (the Natural Sciences and Engineering Research Council of Canada), or denied by NSERC and sent to SSHRC. Skinner and colleagues⁸ conclude that no major funding agency in Canada believes forensic science falls within its mandate.

5.2. Institutions

Forensic anthropology research is typically conducted at universities, although scene-related research and time-since-death research has been undertaken in conjunction with police agencies, such as the RCMP and recently the OPP. Similarly, research involving fire scenes has been conducted with the assistance of the Ontario Office of the Fire Marshal and grants from the Canadian Police Research Centre. However, these grants are small and of short duration compared to those administered by the major funding agencies, and thus not adequate to support either doctoral-level research, or a fully-funded university research program.

Research in forensic anthropology is currently driven by two factors; the first is the need to provide students with a "doable" project that can be completed in a proscribed amount of time in order for the student to fulfill degree requirements. The second is the interest of external parties, such as police agencies, who can often find the resources to undertake research projects. The result of this type of research, while possibly useful in the investigative stage, is often marginal to core issues requiring a more empirical background for rendering opinions in court.

Current research is mainly focused on postmortem interval determination, and investigative techniques helpful in finding buried remains. These are very important at

⁸Skinner, MF, L. Clegg, A. Katzenberg, R.A. Lazenby, A. Mundorff, T. Peckmann, M. Spence, S. Stratton and K. Waterhouse (2010). Taking the Pulse of Forensic Anthropology in Canada. *Can. Soc. Forensic Sci. J.* 43. No 4: 191–203.

the early stages of a medicolegal investigation, but forensic anthropology is lacking in research in the areas of trauma interpretation. The issue of what caused a wound (biomechanics) and when it occurred (wound healing characteristics on bone) are of the utmost importance when someone is in court accused of homicide. Federal granting agencies could assist Canadian forensic anthropologist to be world leaders in this area if they would recognize these as legitimate areas of pursuit. The pursuit of justice depends upon this.

6. Professional Organizations and Groups

6.1. Professional Societies

Forensic anthropologists in Canada may belong to a number of professional organizations. The most common of these are:

- The Canadian Association for Physical Anthropology (CAPA)
- The Canadian Society for Forensic Science (CSFS)
- The American Academy of Forensic Science (AAFS)

Anyone can join CAPA. CSFS and AAFS have sections dedicated to forensic anthropology and some requirements for joining and advancing through membership levels. These requirements include a letter of recommendation. These organizations are a vehicle for presenting scientific papers and meeting with colleagues, and the CSFS and the AAFS both have codes of ethics, which if breached can result in membership being revoked.

There is no national society dedicated solely to forensic anthropology in Canada.

6.2. National Committees and Networks

There are no national committees. The CAPA email list and meetings have been used in the past to contact forensic anthropologists who may be available and have an interest in doing international disaster-victim identification (DVI) work for Canada. An attempt was made to use the CAPA annual meeting in 2009 as a place for all practicing forensic anthropologists to meet and discuss issues similar to these covered at the conference, and a paper was completed and published by the CSFS⁹. However, due to lack of funding, not all interested professional forensic anthropologists in Canada could attend.

⁹Skinner, MF, L. Clegg, A. Katzenberg, R.A. Lazenby, A. Mundorff, T Peckmann, M. Spence, s. Stratton and K. Waterhouse (2010). Taking the Pulse of Forensic Anthropology in Canada. *Can. Soc. Forensic Sci. J.* 43. No 4: 191–203.

7. Conclusions

Forensic anthropology is a well-established discipline of forensic science. In light of this, we present three recommendations. Firstly, it is incumbent upon the federal government to provide research funding to solidify the foundations of our opinions. Secondly, universities should take the discipline seriously, recognizing it as an academic area and hiring appropriately trained faculty. Finally, the provincial government forensic and death-investigation services should use properly trained experts in all cases where forensic anthropology can assist.



Chapter 3: Forensic Odontology

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1. Summary

This chapter sets out the current status of forensic odontology in Canada. Many Canadian dentists, from both private clinical practice and university-based teaching and research roles, have contributed to forensic odontology casework since the early 1970s. Specialization in forensic odontology has been possible in several countries around the world but the Royal College of Dentists of Canada has not recognized this discipline. Consequently, a very small number of forensic dentists in Canada are board certified (by the USA board). These specialists mentor the majority of Canada's forensic odontologists. Two postgraduate training programs exist, with no professional or academic societies to support the discipline. There is a non-funded research and development infrastructure. Gradual improvements have been made over the past 15 years and an exciting renewed interest exists in younger dental practitioners. Continuing to foster and develop this discipline within the overall forensic-science framework in Canada is possible and encouraged.

2. Overview

The terms forensic odontology and forensic dentistry are used synonymously, and their meanings are precisely the same. Bridging the practice of dentistry with that of the law, forensic odontology most often involves the interpretation of dental evidence from crime scenes. In general, forensic dentists are involved in two areas: one, identifying remains through the use of dental records; and two, identifying the cause of bite marks on skin or other surfaces.

Currently in Canada and the USA, forensic odontology is not recognized as an area of specialty practice in dentistry. Rather, general dentists or specialized dentists from other disciplines (e.g. orthodontics, paediatric dentistry, oral surgery) hold themselves out to be forensic dentists on the basis of one- or two-day continuing education or other short courses offered by the American Board of Forensic Odontology (ABFO), the American Society of Forensic Odontology (ASFO) or other similar agencies. The ABFO resides within the odontology section of the American Academy of Forensic Sciences (AAFS), and is the only organization in North America issuing any formal certification in forensic dentistry.

Typically, a dentist who has taken additional training as mentioned above maintains a private dental practice, completing forensic casework after hours. Less commonly, ABFO-certified forensic dentists have completed advanced training in forensic odontology and devote large amounts of time, energy and resources to casework and advancing the discipline and its application in this country.

3. Service

3.1. Legal Framework

The two areas in which forensic dentists work fall under differing legal frameworks. Services related to death investigation (including bite marks in the deceased, in some provinces) fall under the aegis of provincial authorities – either the Chief Coroner or the Chief Medical Examiner. Services related to all other bite-mark identification issues generally fall under the purview of police investigators or child-welfare workers, and are most often part of a criminal or quasi-criminal investigation. When these cases come to trial, the forensic dentist may be called upon to provide expert evidence in court.

3.2. Facilities

Chief Coroners and Chief Medical Examiners, with their access to morgue facilities, most often provide the working environment in which forensic dentists work. Some jurisdictions have well-equipped morgues that may include access to dental and other equipment (such as radiography) required for postmortem assessment procedures. Others have no forensic dentistry equipment, and forensic dentists may find it necessary to perform some or all of the postmortem examination outside the morgue. Occasionally, this means examining human remains in the dentist's own office after normal working hours.

Police investigators working on bite-mark cases cannot provide the necessary facilities for examining deceased victims. Therefore, this work is conducted in the morgue, in

tandem with the forensic-pathology examination. For cases involving living bite-mark victims, examinations might be conducted at a police detachment or hospital. Typically, the dentist brings the required equipment and supplies to these sites, and the police forensic photographers record images of the injuries under the guidance and direction of the forensic dentist. Unfortunately, the few adequately-trained forensic dentists in Canada are unable to attend all bite-mark cases in person.

3.3. Professional Standards

A national standard for forensic dentistry has not evolved in Canada. Several forensic dentists have gained board certification through the USA, and some discussion has taken place about establishing a similar professional standard in Canada.

The Royal College of Dentists of Canada (RCDC) is the body responsible for setting examinations in recognized dental specialties – orthodontics, oral surgery, and so on. To achieve speciality certification, a candidate normally takes an RCDC examination-eligible course offered at a recognized university, followed by both written and oral examinations. The cost for the RCDC to set a series of specialty examinations is approximately \$50,000, and there is currently no appetite for adding forensic odontology to the list.

3.4. Workforce

Three regions in Canada have well-developed and well-trained groups of forensic dentists: British Columbia, Ontario and Quebec. The rest of the country has a small number of forensic dentists who are active in casework to a small degree and, in some instances, trying to consolidate themselves into an organized structure.

British Columbia

British Columbia has a team of approximately 90 dental personnel (50 dentists plus allied dental staff) called the BC Forensic Odontology Response Team (BC-FORT). This team is primarily focused on disaster-victim identification work, identifying large numbers of deceased persons through dental records. Members also work with provincial coroners to identify victims of homicide, suicide, accidental death or undetermined circumstances, and administer a provincial missing-persons dental database on behalf of the RCMP. This database is used to compare found human remains on behalf of the Office of the Chief Coroner.

A core team of six dentists leads BC-FORT. The leader is a university-based forensic dentist with speciality certification in the USA, and a research, teaching and service laboratory. The team maintains a secure, up-to-date website with a multiple-fatality

disaster plan. Prospective casework candidates must complete an understudy program, have advanced training, and be licensed and in good standing with the dental regulatory body.

Three BC dentists complete the human and animal bite-mark cases in the province, including independent verification of results for others. Three other forensic dentists are involved peripherally in these cases. Bite-mark cases are analyzed for both the RCMP plus other police agencies and defence counsel.

Ontario

Ontario has a team of approximately ten forensic dentists called the Province of Ontario Dental Identification Team (PODIT). PODIT maintains a secure private website with an up-to-date multiple-fatality plan. They maintain a contact list of approved forensic dentists with geographic designations of responsibility. Additionally, there exists a recommended but not mandatory independent verification mechanism for any member to peer-review the reports of any other.

Ontario is currently dealing with some instances of police personnel proffering opinions in bite-mark identification cases. Additionally, some individuals who are not approved forensic dentists are undertaking bite-mark investigations, while approved forensic dentists are reluctant to get involved for fear of becoming subject to civil litigation. This is especially true in the case of living victims.

Ontario has made a concerted effort to keep the number of forensic dentists aligned with available casework. Prospective casework candidates are preferred to have clinical or academic appointments at a recognized dental school (University of Toronto or University of Western Ontario), have advanced training, provide evidence of a police background check and be licensed and in good standing with the dental regulatory body.

Members of PODIT have worked with the members of BC-FORT in theatre and there is a loose but good working relationship and network between these two teams.

Quebec

Quebec houses a forensic dentistry laboratory at McGill University, and it offers a well-established forensic dentistry distance-learning course with a primary focus on human bite-mark evidence. The director is an ABFO-certified forensic dentist and has completed a large body of research and casework through this laboratory.

Resiliency considerations and succession planning are encouraged and the future seems bright in Quebec. Until recently, forensic dentists in the rest of Canada have not had a great deal of collaboration with forensic dentists in Quebec. However, following the response to recent international tragedies involving the death of Canadians overseas (e.g.

Haiti earthquake, 2010), there is hope for new networking opportunities between these groups.

Alberta

Four forensic dentists in Alberta work closely with BC-FORT for continuing education, disaster response training and independent verification of bite-mark cases. These dentists respond to requests for involvement by the Office of the Chief Medical Examiner and the RCMP or municipal police agencies depending upon case circumstances, as is the situation in most Canadian jurisdictions.

Manitoba

Manitoba has one university-based forensic dentist who completes identification cases at the request of the Office of the Chief Medical Examiner, and has been involved in a small but growing number of bite-mark cases on behalf of the RCMP.

Maritime Provinces

In the Maritimes, several forensic dentists have been involved in personal-identification cases and disaster responses, and a few with bite-mark cases. Currently there are three forensic dentists in Nova Scotia. In parts of Canada like this, with few or no dedicated forensic dentists, investigators call on the three currently active ABFO-certified forensic odontologists elsewhere in the country as circumstances warrant. This may be an impediment to the professional development of local dentists. This may be especially true in the Maritimes.

Canadian Forces

The Canadian Forces Dental Services is engaging some of its member dentists in forensic dentistry training, specifically in disaster victim identification. Twenty dentists at the rank of Captain, Major and Lieutenant Colonel, plus four dental technicians at the rank of Sergeant, Warrant Officer and Corporal, have completed disaster victim identification (DVI) courses presented by BC-FORT. These courses are offered annually with expansion to other international military agencies anticipated.

Generally speaking, Canadian Forces (CF) has the capacity to respond overseas in unsafe and ultra-challenging local circumstances in which civilian dentists would not be deployed (e.g. Haiti earthquake, 2010). Because CF personnel must be able to identify deceased soldiers and, possibly, civilian casualties of armed conflict, an attempt is now being made to increase their response capacity. It is unclear if other aspects of forensic odontology will be the focus of future courses, but an Ottawa headquarters-based dental officer has been assigned the role of CF forensic odontologist, and charged with

establishing a central command and resource opportunity for CF missions requiring this expertise.

4. Education

4.1. Undergraduate Education

Most regions of Canada require dental-school candidates to have completed a BA, or at least three years of study in a recognized baccalaureate program. These programs are usually in science, biomedical or related disciplines, but it is possible for undergraduates from arts, humanities, social sciences and other disciplines to enter dental school, providing the basic prerequisites (English, math, physics and chemistry) are completed.

Canadian dental schools deliver their curricula using a four-year model, including, on average, two years of basic science (lectures, problem-based learning, coursework) and two years of clinical dental science (lab courses, treating patients). Dental degrees awarded by universities in Canada include the DDS (doctor of dental science) and DMD (doctor of dental medicine) degrees.

Most curricula at Canadian dental schools include subject matter on ethics, jurisprudence, the medico-legal importance of patient records, etc., which are aspects of forensic dentistry. However, forensic dentistry *per se* is not provided any dedicated time in the formal curricula.

4.2. Graduate Education

There are no Canadian graduate programs focusing specifically on forensic odontology. However, the University of British Columbia has graduated four masters-level students with some specialization in forensic practice – two in forensic dentistry (bite-mark evidence) and two in forensic biology (DNA trace evidence from teeth, bones.) These degrees were awarded in oral biology, not forensic dentistry.

At the University of Toronto, graduate and postgraduate students enrolled in a clinical dental specialty may complete their major project in forensics. However, they graduate with degrees in oral pathology or oral radiology. They receive no diploma, certificate, or any other indication they have completed any training in forensic odontology.

No graduate programs in forensic odontology exist in the USA, but several programs in other forensic disciplines include aspects of dental evidence, techniques and methods.

4.3. Professional Certification

Most dental subspecialties follow a traditional training model leading to board exams and specialty certification. Because forensic odontology is not yet recognized as a valid dental specialty, and because no formal graduate programs exist in the discipline, there is no professional certification process for forensic odontologists in Canada.

It is possible for Canadian practitioners to be certified by the ABFO, which resides within the odontology section of the American Academy of Forensic Sciences. The process of ABFO certification includes having candidates complete a career checklist of accomplishments. These include fellowship in the AAFS, working with a recognized medicolegal death-investigation agency, completing a minimum level of casework and research, and providing previous testimony in court. Further considerations include other contributions to the Academy and to the discipline, either in the form of scientific presentations or chairing sessions.

The ABFO is organized with a typical board of directors and committee structure, including a certification and examination committee responsible for setting the online examination and staging practical aspects of the certification exam. The ABFO holds an annual meeting in conjunction with the annual AAFS scientific sessions, and also offers workshops in identification, civil litigation, age determination and bite-mark analysis. These workshops are meant to help prospective forensic practitioners move towards board-eligible status.

There are approximately 100 ABFO-certified forensic odontologists practicing in North America. Five of these are in Canada, four of whom are currently active. Each must seek re-certification every five years by successfully challenging an online multiple-choice-question proficiency examination.

4.4. Continuing Professional Development

As noted above, the annual AAFS meeting provides one forum for continuing professional development, in the form of research and/or case studies presented in both oral and poster form. Continuing education is also available through the one- and two-day courses offered in conjunction with this meeting by the American Board of Forensic Odontology.

A different organization—the American Society of Forensic Odontology—open to all persons interested in forensic dentistry, whether they are dentists or not – presents a one-day continuing education meeting with presentations and case reports. This is also held in conjunction with the AAFS meeting.

International meetings occur infrequently but have been well attended by Canadian forensic dentists. The International Organization of Forensic Odonto-Stomatology holds

meetings every few years, usually in Europe. National societies of forensic dentistry in countries such as Australia, New Zealand and Scandinavia are also open to visiting forensic odontologists.

As may be seen, continuing professional development for Canadian forensic dentists requires prohibitively expensive international travel. This is a significant barrier to maintaining an adequate level of training.

Lack of funding also makes it difficult to bring Canadian forensic dentists together for collaboration and professional development on a more domestic level. Such working collaborations could be essential, especially in multiple-fatality training.

5. Research

5.1. Research and Publications

Three centres in Canada have produced the vast majority of peer-reviewed research in Canadian forensic odontology: Vancouver, Toronto and Montreal. These centres lead the way with respect to recognized forensic odontology researchers and research results, and are widely regarded for their objective approach to data interpretation and quality of published manuscripts.

5.2. Institutions

The BOLD Laboratory at The University of British Columbia, the Centre for Forensic Science and Medicine at the University of Toronto and the Forensic Dentistry Program at McGill University are established and recognized forensic dentistry institutions in Canada. The forensic odontology programs at these institutions struggle with annual funding, resiliency considerations and succession planning.

6. Professional Organizations and Groups

6.1. Royal College of Dentists in Canada

Dentists in Canada must be licensed to practice according to standards set out by each provincial dental regulatory body. It is unclear if each jurisdiction's definition of *practice of dentistry* includes dental techniques used in forensic casework. But, as a general rule, it can be said that dentists must be licensed to practice dentistry, and

typically this licence should be for the local jurisdiction for the dentist to be involved in forensic dentistry casework.¹⁰

The jurisdictional lines involving dentists from other provinces that travel for forensic casework are blurred. It is unclear if a dentist licensed to practice dentistry in one province could practice forensic dentistry in another. One can imagine concessions might be made in the case of a humanitarian crisis, allowing forensic dentists from one province to practice forensic dentistry in another in response to a mass disaster.

The issue of licensure in the context of cases involving bite-mark evidence or other kinds of casework is, at this time, not understood. For instance, an Ontario dentist working outside his area of licensure – for example, in Alberta – could conceivably be subject to legal sanctions for “practicing without a license,” if a complaint were brought against him by any member of the public.

The issue of professional and personal liability has not been addressed to any extent in any region as yet. This is a particular impediment to the provision of opinions on bite-marks.

6.2. National Committees and Networks

As yet there are no national committees or organizations for forensic dentists in this country. The Canadian forensic-dentist community has not embraced The Canadian Society of Forensic Science, and many members have gravitated instead toward meetings of the odontology section of the American Academy of Forensic Sciences.

Many of today’s Canadian forensic-dentistry leaders are actively encouraging others to become trained and skilled at casework. The majority of certified specialists are past career mid-point, and are looking to pass the baton. Cooperation and collaboration on a national vision and standards for the profession have been difficult to establish for a variety of reasons. We are optimistic that agreements in response to recent disasters have shown the potential for closer working relationships between various practice groups in Canada.

Death investigation in Canada is a provincial jurisdiction, so forensic dentistry has always been approached in a provincially focused way. The forensic dental community continues to come to terms (through the recent guidance of the RCMP, the Fatality Management Working Group of the Chief Coroners and Chief Medical Examiners of Canada, and DFAIT) with the need to cooperate, as well as the need to increase our capacity to respond to national and even international disasters. It is clear the time is right for the formation of a national network of forensic odontologists.

¹⁰ We’ve just learned here in BC that one does not have to hold an active licence to complete forensic odontology casework. We believe this can and should be challenged, but the regulatory body has offered this opinion with in the past few weeks. (January, 2013)

7. Conclusions

1. The number and calibre of forensic dentists in Canada has grown over the past 45 years to establish a critical mass of expertise that longs for support and encouragement.
2. No national agency, society or other organizations exist to provide needed infrastructure to enhance the established discipline and practitioners.
3. No funding or funding agencies exist to promote, foster or encourage current or continuing research in forensic odontology in Canada.
4. Forensic dentists in Canada have voluntarily trained and funded their own development and continue to make themselves available to provide identification services to Canadians and others as needed.



Chapter 4: Forensic Nursing

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1. Summary

Forensic nursing is an emerging nursing field in Canada. While Lynch and Duval¹¹ describe it as a discipline unto itself, others consider forensic nursing to be a sub-specialty within the larger field of nursing. However defined, forensic nursing is the integration of forensic-science knowledge and principles with nursing knowledge in the clinical investigation of trauma and the recovery of medical evidence. It also provides direct service to victims, suspects, perpetrators, and those who witness violence. The forensic nurse scientist identifies, assesses, intervenes, and evaluates trauma, disease and death while documenting findings. She or he also preserves and secures evidence to determine legal outcomes and improve patient care (Lynch & Duval, 2011). In Canada, forensic nurses practice in a wide variety of roles, including death investigators, sexual assault and domestic violence nurse examiners, child physical abuse and neglect nurse examiners, legal nurse consultants and forensic psychiatry and correctional nurses.

The legislative and regulatory milieu varies by activity and location, where these roles are described at all. Education and research programs are scattered across Canada. There is little in the way of formal recognition or regulation of forensic nurses, outside the International Association of Forensic Nurses. Although there are outlets for research in forensic nursing, this research happens sporadically in Canada.

¹¹Lynch, V. A., & Barber Duval, J. (Eds.). (2011). *Forensic Nursing Science* (2nd ed.) St. Louis, MO: Elsevier, Mosby

2. Overview

Forensic nursing in Canada is very much in its infancy. Nurses all across the country are united in acknowledging the need to have a scientific basis for practice and to apply the knowledge and methods of nursing to problems in the law. Forensic nurses may work in a variety of contexts, including:

2.1. Medicolegal Death Investigation

Medicolegal death investigators assist a medical examiner in the investigation of deaths falling under relevant local legislation. Registered nurses first began working as death investigators under the leadership of Dr. John Butt in Calgary, Alberta, in 1975 with the Office of the Chief Medical Examiner. Nurses have also filled various investigative roles within coroner systems, at ranks up to and including Chief Coroner. There are no recognized national standards with respect to this activity, and indeed no consensus that this role ought to be filled by nurses exclusively.

2.2. Sexual Assault Nurse Examiner (SANE) Programs

The sexual assault nurse examiner (SANE) is a registered nurse with specialized training in examining and evaluating sexual trauma in the living patient, while collecting biological and physical evidence. The SANE nurse must strike a delicate balance between serving the needs of the justice system and minimizing the patient's physical and emotional trauma, while also facilitating recovery. The SANE program was initiated in Canada in 1993, and there are now 46 programs across the country.¹²

2.3. Legal Nurse Consultant (LNC) Roles

The legal nurse consultant (LNC) performs a critical analysis of clinical and administrative nursing practice, healthcare facts and issues, and their outcomes. Such analyses are performed for the legal and healthcare professions, consumers of healthcare and legal services, and others as appropriate. The legal nurse consultant is qualified to assess adherence to standards and guidelines of healthcare practice as applied to the nursing and healthcare professions.

¹² Lynch, p. 619

2.4. Forensic Psychiatry

Forensic psychiatric nurses work in collaborative practice with forensic psychiatrists and other mental health professionals. The clients of this service are persons with mental health issues who are also clients of the criminal justice system.

2.5. Corrections

Correctional nurses care for patients who are inmates in the correctional system. Correctional nursing integrates the principles of nursing, forensics, psychiatry, primary care and public health.

3. Service

3.1. Legal Framework

Because of the diversity of roles and regulation of nursing in Canada, a forensic nurse in Canada may work under a variety of legislative or regulatory mandates.

To begin with, regulation of the nursing profession is administered by provincial bodies:

- College of Registered Nurses of Nova Scotia
- Nurses Association of New Brunswick
- The Association of Registered Nurses of Prince Edward Island
- College of Registered Nurses of British Columbia
- Saskatchewan Registered Nurses' Association
- College and Association of Registered Nurses of Alberta
- College of Registered Nurses of Manitoba
- College of Nurses of Ontario
- Ordre des infirmières et infirmiers du Québec
- Association of Registered Nurses of Newfoundland and Labrador
- Yukon Registered Nurses Association
- Registered Nurses Association of the Northwest Territories and Nunavut

Any Canadian nurse must hold a valid license to practice nursing. Canadian nurses must also hold membership in a provincial or territorial nursing association in order to belong to the Canadian Nurses Association (CNA) and the International Council of Nurses. Further, all Canadian provincial and territorial nursing associations, with the exception of those in Ontario and Quebec, are members of the CNA. Ontario Nurses wishing to belong to CNA will normally join the Registered Nurses Association of Ontario. Those

in Quebec will join the Yukon Registered Nurses Association or become associate members of the Nurses Association of New Brunswick.

The Canadian Nurses' Association (CNA) has recognized forensic nursing as an emerging specialty and began collaborating with forensic nurses through the Forensic Nurses Society of Canada (FNSC) in 2007. This collaboration has the potential to develop certification and standardization for forensic nurses across Canada.

The American Nurses Association has recently recognized Legal Nurse Consulting as a subspecialty of nursing, and the Legal Nurse Consultants Association of Canada¹³ is working towards similar recognition. There is progress being made. In 2011 the CNA awarded the LNCAC with "Emerging Group" status – an important step as Legal Nurse Consulting progresses in Canada.

3.2. Facilities

Forensic nurses work in a variety of environments with respect to death investigation. For instance, the Office of the Chief Medical Examiner in Alberta has two stand-alone medicolegal death investigation facilities; one in Calgary and the other in Edmonton. The Nova Scotia Medical Examiner Service is housed in the Dr. William D. Finn Centre for Forensic Medicine in Halifax. The Office of the Chief Medical Examiner in Manitoba is administered out of rented office space and a hospital mortuary service in Winnipeg.

In Canada, correctional nurses practice under provincial or federal jurisdiction and may work in jails, prisons, penitentiaries and other correctional facilities such as detention centres and holding cells. Forensic mental-health nurses or forensic psychiatric nurses work in forensic psychiatric institutions or forensic psychiatric units within general hospitals.

In Ontario, the Ontario Network of Sexual Assault/Domestic Violence Treatment Centres (SADVTC) is the umbrella organization for the 35 hospital-based SADVTCs in the province. These Centres are located in both rural and urban areas.¹⁴ Nurses working in any of these centres are offered the SANE training program, which runs twice each year in Toronto. In most provinces, the SANE program is funded provincially and is based out of hospital emergency departments.

In order to meet emerging needs, the Ontario SANE and other programs have expanded their mandates to include domestic violence. Others have broadened their mandates to include child physical abuse and elder abuse. In British Columbia, two programs now called Forensic Nursing Services also include human trafficking.

¹³ www.LNCAC.ca

¹⁴ SADVAC locations can be found at www.sadvreatmentcentres.net.

3.3. Professional Standards

All registered nurses, regardless of the province in which they practice, have standards for nursing practice. These are for all areas of nursing and are not unique or specific to forensic nursing. As forensic nursing is not formally recognized as a specialty group by the Canadian Nurses Association, many Canadian forensic nurses, especially SANEs, are using the Standards and Practices as described by the International Association of Forensic Nurses. Professional standards in other areas are less well defined, although nurse death investigators may avail themselves of the credentials of the American Board of Medicolegal Death Investigators (ABMDI).

A unique exception is the Canadian Federation of Mental Health Nurses, an associate group of the Canadian Nurses Association that represents the national voice of psychiatric and mental health nursing in Canada. Since 1995, registered nurses who specialize in psychiatric and mental health nursing have been able to achieve national credentialing by writing a certification exam. The 3rd edition of the Canadian Federation of Mental Health Nurses Standards for Practice, published in 2006, is currently in use, and the 4th edition will be published in 2013. Although these standards are not specific to forensic mental health nursing or forensic psychiatric nursing, they are designed to provide guidance to nurses working in psychiatric and mental health nursing in diverse settings.

Psychiatric nursing is regulated as a distinct profession by the provinces of Alberta, British Columbia, Manitoba and Saskatchewan, and by the Yukon Territory. Registered Psychiatric Nurses of Canada (RPNC), made of the provincial/territorial regulatory authorities, provides a unified provincial, national, and international voice for registered psychiatric nurses (RPNs) in Canada.

3.4. Workforce

The workforce of forensic nurses in Canada is difficult to determine, partly because there are many nurses who work within forensic areas but do not identify as forensic nurses, and also because of the absence of educational standards and certification within the specialty. However, there are a number of leaders in Canadian forensic nursing.

In psychiatric and correctional nursing, Dr. Arlene Kent-Wilkinson and Professor Cindy Peternelj-Taylor at the University of Saskatchewan, and Dr. Dave Holmes at the University of Ottawa have all established research and/or education programs at the university level. Dr Dave Holmes currently holds a University Research Chair in Forensic Nursing (2009-2014). SANE leaders include Dr. Cathy Carter Snell in Alberta, Sheila Early in British Columbia and Sheila Macdonald in Ontario. Tanya Smith, NP provides leadership across the country in paediatric sexual assault care.

Entry level to practice as a Nurse Death Investigator is a valid Canadian license as a registered nurse. Provinces other than Ontario, Newfoundland, Prince Edward Island and Quebec use nurses in death investigator roles, in both medical examiner services and coroners offices. However, the experience registered nurses must have to be Nurse Death Investigators varies across the country. Some jurisdictions require emergency room and/or intensive care experience. This is the case in Nova Scotia. Scattered Nurse Death Investigators across the country have or are pursuing certification with the American Board of Medicolegal Death Investigators. British Columbia, Nova Scotia, Manitoba, and Alberta have Nurse Death Investigators certified with the American Board of Medical Death Investigators (ABMDI). Some jurisdictions support their Nurse Death Investigators in becoming certified after they are employed for a period of time.

Please see Appendices B “Registered Nurses as Medical Examiners and Coroner Officers, by Province” and C “Forensic Nursing for the Living: A Provincial and Territorial Breakdown” for some insight into how Canada’s forensic nurses are distributed in death investigation agencies.

4. Education

4.1. Undergraduate Education

The Bachelor of Science in Nursing (BScN) and Bachelor of Nursing (BN) degrees are widely available at a number of institutions. Entry to practice as an RN in Ontario is limited to those with an undergraduate degree as of 2005. Since 2000, a baccalaureate degree in nursing has been required for entry to practice in Saskatchewan. These undergraduate programs do not uniformly provide information on forensic nursing, although some concepts are included (e.g. child abuse screening in family nursing courses). An undergraduate degree is not a requirement of the SANE role, and most SANE training programs are not university-affiliated. In British Columbia, the British Columbia Institute of Technology (BCIT) offers 3-credit 45 hour educational courses in Forensic Health Sciences. Calgary’s Mount Royal University offers master’s-level online courses for nurses and other professionals, but allows senior-level undergraduate nursing students to take the courses as senior options. Students can choose single 3-credit (48 hour) courses, or they may obtain a certificate in forensic studies if they take six of the courses (18 credits).

In addition, Mount Royal University has just initiated an undergraduate minor in Forensic Studies, which is available to nurses as well as other disciplines, such as criminal justice, science and psychology. This will allow undergraduates to obtain additional coursework and preparation in forensic concepts pertinent to their discipline.

4.2. Graduate Education

Most master's-level degree programs in Canada are generic and do not offer specific forensic nursing degrees. The most notable example is housed at the University of Saskatchewan, which administers a Master of Nursing with Forensic Specialty through its College of Nursing. Also offered is a course in advanced forensic nursing, which examines issues and challenges related to advanced forensic mental-health nursing as a way of bridging the mental-healthcare and criminal justice systems.

Mount Royal University offers multidisciplinary courses in forensic studies online. These courses are designed for professionals (mostly nurses) to use as options towards obtaining master's degrees at other universities. Many nurses also choose to complete the Forensic Studies Certificate program (6 courses) as a specialization to supplement their bachelor's or master's degree.

A number of other programs are available post-baccalaureate (e.g. Seneca College) but not all contribute to graduate-level studies or are aimed at a graduate level.

4.3. Practice-Specific Education

There is no minimum experience to qualify as a legal nurse consultant (LNC), although three to five years of general nursing experience followed by three to five years in a clinical specialty area is recommended. There is a LNC non-credit course that can be taken.

Either a diploma or bachelor's degree in psychiatric nursing is currently the entry-to-practice requirement for a registered psychiatric nurse (RPN) in Canada. There are also regulations that permit internationally trained RPNs to enter practice in Canada.

Registered nurses working in forensic mental health/psychiatric nursing and correctional nursing require, at a minimum, a diploma in nursing. In many provinces in Canada, a baccalaureate degree in nursing is currently the entry-to-practice requirement.

The majority of SANE education programs are not university-based; rather, they are clinically-based and taught by clinicians with expertise in the specialty area. In Ontario, the SANE training consists of 16 online learning modules completed by the nurse trainee prior to attending a 30 hour in-class session. The in-class session is provided by a variety of faculty members, such as forensic biologists, forensic toxicologists, crown attorneys, police members, sexual assault nurse examiners, and counsellors. These instructors provide case-based discussions that build on knowledge learned through the online modules.

Other SANE education programs typically consist of 40 hours of in-class learning, taught by various experts in their fields, in a way that is broadly similar to practice in Ontario. In

British Columbia and Alberta, three credits are provided for the 45-hour course. The Mount Royal course is also designed to be consistent with the IAFN SANE-A theory requirements, in order to prepare students to write the certification examination if desired.

Training programs for Forensic Nurse Death Investigators are variable, but are most frequently administered within the medical examiner service or coroner's office. Each provincial jurisdiction works with its own legislation. This impacts the scope of practice for registered nurses in that role. The IAFN publishes guidelines for Forensic Nurse Death Investigator education that can be applied to this practicing group.

4.4. Professional Certification

Much of a forensic nurse's education is achieved through direct on-the-job experience, or – as in the case of SANEs – within specific healthcare institutions. In the absence of certification in the discipline through the Canadian Nurses Association, many nurses are attaining SANE-A (adult), and SANE-P (paediatric) certification through the International Association of Forensic Nurses. BCIT offers a two year part-time study for an Advanced Specialty Certificate in Forensic Health Sciences. As well, Mount Royal University offers an online Forensic Studies Certificate. Medicolegal death investigators may pursue certification with the American Board of Medicolegal Death Investigators. This is a multi-disciplinary and layperson certification.

4.5. Continuing Professional Development

Nurses have many opportunities for continuing professional development through various college and university certification programs, continuing education forums such as international or national conferences, online educational forums, and in-house training sessions.

Since 1989, the Custody & Caring Biennial International Conference on the nurse's role in the criminal justice system has become known globally as a conference "icon" for forensic psychiatric/mental health and correctional nurses¹⁵. Held almost exclusively in Saskatoon, Saskatchewan, the conference is hosted by the College of Nursing at the University of Saskatchewan and the Regional Psychiatric Centre, Correctional Service of Canada.

¹⁵<http://www.usask.ca/nursing/custodycaring/>

5. Research

5.1. Research and Publications

In Ontario, within the Network of Sexual Assault/Domestic Violence Treatment Centres, there have been numerous publications regarding the role of the Sexual Assault Nurse, as well as research related to specific clinical issues. The scholarly output of academic forensic nurses may find a home in peer-reviewed journals such as the *Journal of Forensic Nursing* (JFN), *Journal of Interpersonal Violence*, *Canadian Journal of Nursing Research* (CJNR) and the *Journal of Correctional Healthcare*.

Mount Royal University has a Forensic Research Network (FRN)¹⁶ formed as a partnership between various community agencies with specific research needs and researchers from various institutions in Canada and the USA with expertise in forensic areas. Agencies propose specific questions and the FRN identifies key research to conduct the projects and seek funding.

In 2011, the Centre for Forensic Behavioural Sciences and Justice Studies¹⁷ was established at the University of Saskatchewan. The “Forensic Centre,” as it is known, fosters a variety of interdisciplinary research, education and engagement activities. These activities are aimed at understanding critical issues of crime and justice, and examining the criminal justice and corrections systems in Canada and elsewhere in relation to the offender populations, victims and public they are intended to serve. Nursing membership is well represented at the Centre by nursing faculty with a forensic psychiatric mental health focus. In addition, these (forensic) nursing faculty are members of the Forensic Interdisciplinary Research: Saskatchewan Team (FIRST) and have been in leadership roles as Principle Investigator (PI) on recent province-wide studies, and on the Executive Advisory team at the Forensic Centre.

5.2. Institutions

A number of institutions host active research programs. They include:

- University of Saskatchewan, Saskatoon
- University of Ottawa, Ottawa
- University of Toronto, Toronto
- Women’s College Research Institute, Toronto
- Trent University, Peterborough
- Mount Royal University, Calgary

¹⁶ www.mtroyal.ca/forensicresearch

¹⁷ <http://www.artsandscience.usask.ca/fbsjs/>

6. Professional Organizations and Groups

6.1. Professional Societies

A number of professional societies are stakeholders in the development of forensic nursing as a discipline:

- Canadian Nurses Association (CNA)
- Canadian Federation of Nurses Unions
- Forensic Nurses Society of Canada
- Legal Nurse Consultants of Canada
- International Association of Forensic Nurses
- Saskatchewan Registered Nurses Association Forensic Nursing Professional Practice Group
- Registered Nurse Association of Ontario – Correctional Nurses Interest Group

These and other related organizations have issued a number of important and recent documents:

- Joint Position Statement Scopes of Practice (2006)
- Advanced Nursing Practice: A National Framework (2008)
- Canadian Nurses Association's Framework for the Practice of Registered Nurses in Canada (2007)

6.2. Networks

- Ontario Network of Sexual Assault/Domestic Violence Treatment Centres

7. Conclusions

This overview of forensic nursing in Canada may not present a complete picture of forensic nursing practice, as there is no central repository that collects all activities and work currently underway. However, based on what is known by the contributors to this document, we conclude there is a need for forensic nursing to become further established and recognized in Canada. Achieving status and certification through the Canadian Nurses Association will advance this specialty area.

Research and education are two other areas important to the advancement of the scientific foundation of forensic nursing. In Canada, there are several excellent forensic nursing

researchers who have greatly contributed in this effort on both the national and global fronts.

- Professor Cindy Peternelj Taylor and Dr. Arlene Kent Wilkinson in Saskatchewan have both published extensively on psychiatric/correctional nursing.
- Dr. Cathy Carter Snell in Alberta has completed significant work on injuries and physical findings following sexual assault, dating-violence prevention and mental health effects of intimate forms of violence.
- In Ontario, Dr. Janice Du Mont has provided research expertise to the Ontario Network of SADVTC's in examining relevant clinical issues such as drug facilitated sexual assault, HIV Post Exposure Prophylaxis care and client evaluation of sexual assault services.

Despite these accomplishments, the collective research agenda is uncoordinated and fragmented. Establishing a national strategy on forensic nursing research is essential to providing the scientific basis required for this specialty area. National and international partnerships for research (as well as funding opportunities) could be included in the strategy.

On the education front, we must address the credentialing of forensic nursing education programs including most SANE and death-investigator education programs. While several certification programs exist across the country, we need more forensic nursing education at the undergraduate and graduate levels. Examples are the specialty forensic nursing courses in psychiatric/correctional nursing offered at the Universities of Saskatchewan and Ottawa.

As forensic nursing grows and evolves in Canada with the development of educational standards, practice standards and credentialing, the potential for undergraduate and graduate degrees in forensic nursing moves closer to reality.



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For further information on Canada's forensic nurses, please see Appendix D: "Forensic Nurses in Canada: Profiles of those mentioned in this paper who have leadership roles in education, research, administration and practice."

Chapter 5: Forensic Entomology

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1. Summary

Forensic entomology did not exist as a practical scientific discipline in Canada before 1992. Although police services occasionally contacted university- or museum-based entomologists for help in analyzing insect evidence for specific cases, there were no actual forensic entomologists in the country.

As would be expected, there were also no professional standards or guidelines, no domestic opportunities for education or training, and no dedicated academic or professional societies to further knowledge of the field. Neither was there any domestic infrastructure for research or development, or any general awareness or recognition – even within the broader discipline of entomology – of the forensic subspecialty.

The profession has improved considerably since that time. Forensic entomologists may now be certified in North America, there is some domestic research capability, and new opportunities exist for undergraduate, graduate and postgraduate training. There are university positions for forensic entomologists, and a professional association – the North American Forensic Entomology Association – has been formed.

However, the full potential utility of insect evidence has not yet been realized in Canada. Considerable progress is required to develop forensic entomology resources to the sustainable levels needed to provide quality standardized death-investigation services throughout the country

2. Overview

Forensic entomology is the study of insects within a legal context, and may include investigation of contaminated products, food, insect bites, abuse and death. Medicolegal entomology, a subset of forensic entomology, is more narrowly defined as the study and use of insect evidence in abuse and death investigation. For the purposes of this report, we will use the terms forensic entomology and medicolegal entomology interchangeably.

Forensic entomology uses knowledge of the ecology, behaviour and development of insects to provide answers to investigative questions. Such questions may involve both the timing and location of critical events such as abuse, wounding, death, dismemberment and transport of bodies. A forensic entomological analysis includes a detailed set of observations, including which insect species are present, what developmental stages are present, and where the insects are located within the scene. These data are interpreted within the scene's environmental conditions and circumstances, as well as the overall context of the case. As such, forensic entomologists attend scenes and autopsies in order to collect the insect evidence later analyzed in the laboratory.

Clients requesting analysis of insect evidence are primarily those involved in death investigation (i.e. police, coroner, medical examiner, pathologist, next of kin), and the most common situation calling for entomological expertise is homicide investigation. Forensic entomology expert opinion may also be used for unattended deaths, particularly to provide a timeline to help identify the deceased. Forensic entomologists provide consultative advice and expert reports for police, coroners, medical examiners, pathologists, crown and defence attorneys. They also provide expert testimony in court. In order to increase understanding of the full utility of insect evidence, forensic entomologists also provide training workshops and seminars for police, coroners, medical examiners, pathologists and lawyers. In addition, forensic entomologists hold academic positions with administrative, teaching and research responsibilities.

3. Service

3.1. Legal Framework

Forensic entomologists in Canada are university professors who are contracted on a fee-for-service basis by outside clients requesting analysis of insect evidence. As such, they may be called into a death investigation at any stage by police, coroners/medical examiners, pathologists or attorneys. Unfortunately, this frequently results in a forensic entomologist being called into a case long after the scene examination and autopsy are over. This, in turn, results in incomplete collection of the insect evidence and requests for analysis of partial evidence or photographic evidence of the insects present.

3.2. Facilities

Because forensic entomologists work out of universities, the facilities available to them can vary widely in quality. They must also rely on university co-operation to secure use of these facilities for forensic work.

The minimum standards for such facilities include dedicated high-security evidence (insect) rearing, processing and storage areas, office space and research laboratory space. Ideally, these spaces have been designed and renovated specifically with forensic entomology requirements in mind, using grants obtained from government and university funds. At present, only two such facilities exist in Canada: one at British Columbia's Simon Fraser University and one at Ontario's University of Windsor.

3.3. Professional Standards and Certification

The accepted professional standard for North American forensic entomologists is certification by the American Board of Forensic Entomology (ABFE). Diplomate status is the highest certification available and re-certification is required every five years. Initial certification is at the member level. To achieve member certification, an individual must have earned a thesis-based master's degree in entomology or related biological discipline and have one additional year of experience in forensic entomology. Alternatively, candidates may be accepted if they are at least three years into a PhD in entomology or related discipline. Candidates are required to submit three case reports for approval by the ABFE and must pass both written and practical exams covering the theoretical basis of the discipline, case-evidence analysis, identification of insects and professional ethics.

To achieve Diplomate certification, an individual must hold a PhD in entomology or related biological discipline, meet all criteria for member level and have demonstrated experience in forensic entomology for five years after receiving member certification. This five year period must include a minimum of three presentations and two peer-reviewed publications. Candidates must also submit two additional case reports for approval by the ABFE.

At present, the ABFE has not developed specified best practices for the collection of evidence, case analysis or report content. However, certification requires that methods used by forensic entomologists be supported by research and accepted by the majority of the ABFE. Forensic entomologists widely accept the best practices suggested by the European Association of Forensic Entomology, published in Amendt et al. 2007 "Best Practice in Forensic Entomology – standards and guidelines," *International Journal of Legal Medicine* 121: 90-104.

3.4. Workforce

There is increasing recognition within the forensic entomology community that all practitioners should be ABFE-certified if the discipline is to provide accurate and high-quality collection and analysis of insect evidence for death investigations. Ideally, practitioners should also be active members of the North American Forensic Entomology Association (NAFEA). Additionally, the role of the university- or museum-based entomologist with little formal forensic training is diminishing. These individuals lack in-depth understanding of the rapidly changing discipline's current research, developments and practices.

That said, there is a critical shortage of certified forensic entomologists in Canada, along with a critical lack of understanding about how insect evidence may be used for death investigation. These two factors, together with the fee-for-service callout structure, are the most important barriers to advancing high-quality forensic entomology service for death investigation across Canada.

There are currently only two ABFE Diplomate-level (D-ABFE) forensic entomologists in Canada; one in Ontario and the other in British Columbia. Necessarily, this means non-forensic entomologists are still performing a large share of the collection and analysis of insect evidence. This troubling practice has diminished somewhat in Ontario and British Columbia, but even here the qualified D-ABFE forensic entomologists are still only called in on a fee-for-service basis, and fiscal restraints have prevented their full participation in many cases. Ontario has taken steps to address this issue with a trilateral agreement between the Ontario Forensic Pathology Service, the Office of the Chief Coroner and the University of Windsor. These bodies will work together to specify which case types will result in automatic call-out of the forensic entomologist.

The full utility of insect evidence is still poorly understood, even within Canada's death-investigation community. For instance, the forensic entomologist is often not contacted until after other methods of establishing circumstances and timelines in an investigation have failed. This results in the sub-optimal practices of collecting insect evidence at autopsy, or analyzing such evidence from photographs. It is important to remember the forensic entomologist is not just looking for the simple presence or absence of insects. We are also searching for any remnants of insect development or behavior, both of which can provide vital information about the remains. These kinds of data are available only in the very earliest stages of an investigation; thus, much valuable evidence is lost when the forensic entomologist is called in too late. This, in turn, can lead to underestimating the postmortem timeline – a practice unacceptable in providing high-quality death-investigation services.

Although not ideal, forensic entomologists have been training both police and forensic pathologists in insect-evidence collection techniques. It is not feasible to provide enough training for these individuals to recognize all possible species, to recognize and locate all insect developmental stages, or to identify associated evidence left behind once various species have left the remains.

As has been demonstrated with actual case examples, even the absence of insect evidence can be informative in recreating the scenario and establishing a timeline around death. As such, a forensic entomologist should be included as part of the investigative team attending the scene for all suspicious cases where the suspected time of death is 48 hours or more prior to the time of discovery. Forensic entomologists should also be involved in those non-suspicious death investigations where providing the postmortem timeline assists in identifying the remains.

In short, if every region of Canada is to enjoy access to standardized, high-quality death-investigation services, D-ABFE forensic entomologists must be available across the country.

4. Education

4.1. Undergraduate Education

The traditional training for forensic entomologists is a generalized undergraduate degree in biology. Now, with several Canadian universities offering undergraduate programs in forensic sciences focusing on biology, students can acquire their foundation skills in both these disciplines. In this way they better understand the evidentiary aspects of the field. Additionally, these degrees provide opportunities for research training, a core skill for anyone seeking a career in forensic entomology, and one that is critical for advancing the discipline. Insect evidence is now a required course for all students taking undergraduate forensic degrees at the University of Windsor. At other universities, coursework in entomology or forensic entomology may be offered as electives.

4.2. Graduate Education

There are three major limitations to graduate training in forensic entomology in Canada: lack of funds for forensic research, lack of graduate-level forensic programs with specialized courses, and lack of tenured forensic entomologists at universities. There has been some improvement in opportunities for tenure-track forensic entomology positions at Canadian universities over the past decade, due to the development of the undergraduate forensic-science programs mentioned above. However, success in these positions requires research productivity, and Canada's lack of research funding for forensic science limits our universities' ability to recruit and retain high-quality faculty. As forensic programs grow in other countries, competition for PhD-level forensic scientists becomes more intense. Canada is losing out.

Canada's two D-ABFE forensic entomologists certainly take on dedicated graduate students, as research funds permit. In addition, several non-forensic entomologists have occasionally supervised graduate students doing thesis work in forensics. Thus Canada has some limited capacity for developing qualified forensic entomologists in-house. Additionally, our D-ABFE forensic entomologists have been mentoring other entomologists wishing to pursue certification with ABFE, a practice that will further increase Canada's capacity to provide forensic entomology services.

4.3. Continuing Professional Development

Canada's forensic entomologists continue their professional development by maintaining active research programs, presenting talks and workshops, and attending scientific conferences and collaborations with colleagues. Each year, the North American Forensic Entomology Association hosts a workshop to develop skills in forensic entomology, bringing in outside experts with techniques or procedures that are of use to forensic entomology.

5. Research

In the sciences, both research and graduate-student stipends are funded by research grants. Thus, recruitment and training of graduate students cannot occur without dedicated grant funds to support them. Advancement of the discipline would increase dramatically, as would the availability of trained certified forensic entomologists, by an infusion of funds for research. This lack of funding is a major barrier to both the development of the discipline and the training of certified professionals in Canada.

Unfortunately, although forensic entomology encompasses some aspects of ecology, its broader interdisciplinary nature prevents it from fitting the funding guidelines for the ecology-evaluation group within NSERC's Discovery Grants program. Nor does it fit within any other evaluation group. This is a common problem for all the forensic sciences, as, somewhat like engineering, it integrates principles from many scientific areas into a unique discipline with its own fundamental questions. The NSERC Discovery Grants program is the major source of government funding for primary research for university scientists across Canada. All other grant programs offered by NSERC require industry partners. Unsurprisingly, there is no industry associated with forensic entomology.

The Canadian Police Research Centre, administered by Defense Research and Development Canada, is the only government agency providing any forensic-entomology research funding. These grants are substantially smaller than those offered through the NSERC Discovery Grants program, and each requires a police partner. Such grants are

not available every year, and obtaining the minimum four-year commitment required to recruit and train a PhD student is not possible.

5.1. Publications

As in other forensic sciences, forensic entomology is moving away from anecdotal observation and assumption in favour of carefully designed experiments testing critical hypotheses in the field. This shift is reflected in recent peer-reviewed publications with recommendations for mechanism-based research to bring greater predictive power to forensic entomology,¹⁸ and publication of the first blind validation study within the discipline¹⁹.

6. Professional Organizations and Groups

6.1. Professional societies

The North American Forensic Entomology Association (NAFEA) held its first meeting in 2003 and has held annual meetings since that time. Two of these meetings were hosted in Canada, and both Canadian D-ABFE forensic entomologists have served terms as NAFEA president. The sole aim of this association is to bring together those interested in the advancement of forensic entomology to exchange ideas and present current research.

Additionally, most forensic entomologists attend the American Academy of Forensic Science, the International Congress of Entomology and the Entomological Society of America, where regular symposia and talks on forensic entomology are presented. Both our D-ABFE forensic entomologists regularly attend these meetings, as do their graduate-student trainees.

7. Conclusions

Forensic Entomology is a rapidly evolving scientific discipline in Canada with professional Diplomate certification through the American Board of Forensic Entomology (D-ABFE), and a professional association (the North American Forensic

¹⁸Tomberlin JK, Mohr R, Benbow E, Tarone A, VanLaerhoven SL 2011 "A roadmap for bridging basic and applied research in forensic entomology" *Annual Review of Entomology* 56: 401-421; VanLaerhoven SL 2009 "Ecological theory and its application in forensic entomology" IN Byrd JH, Castner JL Eds. *Forensic entomology – the utility of arthropods in legal investigations*, 2nd Edition, CRC Press, Boca Raton

¹⁹VanLaerhoven SL 2008 "Blind validation of postmortem interval estimates using developmental rates of blow flies" *Forensic Sciences International* 180: 76-80.

Entomology Association – NAFEA) formed for the exchange of research and case analyses.

Clients requesting insect evidence analysis are primarily involved in death investigation, and forensic entomologists are most commonly asked to provide timelines in homicide investigations. That said, many other uses of expert forensic entomology analysis exist.

Unfortunately, forensic entomologists are rarely used to their full capacity in Canada. This is due largely to the current fee-for-service structure within which forensic entomologists are called into cases, as well as the lack of client knowledge of the full utility of insect evidence. These two situations most often result in forensic entomologists being called into cases too late, or not at all.

Furthermore, Canadian D-ABFE forensic entomologists are university professors, and development of university positions requires the ability to establish research programs. A critical lack of research funding for forensic science in Canada results in limited domestic opportunities for undergraduate, graduate and postgraduate training, and difficulty in retaining qualified practitioners for academic positions.

Together, these barriers are impeding development of forensic entomology resources to sustainable levels required to provide quality death-investigation services throughout Canada.



Chapter 6: Forensic Physical Sciences

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1. Summary

This paper tries to combine the disparate fields of forensic identification, firearms identification and BPA analysis. Although these different disciplines have some common characteristics, they are distinct enough to warrant their own subsections throughout the following discussion.

Forensic Identification (FI) personnel are responsible for the analysis, comparison, and evaluation of certain pattern-based evidence such as friction-ridge, footwear, and tire-track impressions. This work provides support for front line investigators. The most well-known of these, friction ridge analysis, has a long and storied history as a technique used successfully in criminal investigations. FI personnel are also responsible for locating, collecting, documenting, and preserving and packaging forensic physical evidence for further analysis by scientists in the forensic laboratory.

Firearms identification work was first established in Canada in 1914 under the direction of Montreal's Dr. Wilfred Derome at North America's first forensic laboratory (now the LSJML). Firearms identification work is now performed by the RCMP, the Ontario provincial government, the Vancouver City Police and – most recently – the Calgary Police. The main type of examination carried out by firearm and toolmark examiners is the analysis of marks or striations created by a harder object on a softer object. This includes the impressed or striated marks on a cartridge case made by a firearm, or the marks made by a screwdriver at the point of entry of a break and enter.

Bloodstain pattern analysis (BPA) has a much shorter history in North America as a technique used in criminal investigations. However, it has proven its worth in many high-profile bloodletting cases. By examining the patterns of blood at a crime scene, the analyst is often able to deduce the series of events that may have occurred.

2. Overview

2.1. Forensic Identification

FI personnel attend crime scenes where they document the scene and look for evidence. This can include fingerprints, tire tracks, footwear impressions and bloodstains. As well, FI officers are responsible for locating, collecting, documenting, preserving, and packaging forensic physical evidence for further analysis by other experts in the forensic laboratory. These might include biological samples for DNA analysis, trace materials such as explosive and gunshot residues, alcohol or drugs in biological samples, counterfeit documents, and firearms and ballistics evidence. FI personnel provide expert testimony to the courts on crime scene documentation as well as comparisons of physical evidence they may have completed.

2.2. Firearms Identification

Firearms Identification is a discipline of Forensic Science whose main concern is the identification of fired bullets, cartridge cases or other ammunition components fired from a specific firearm. The process of identification is a microscopic comparison based on pattern matching. The discipline of firearm and toolmark identification involves a number of different examination types beyond the identification of fired ammunition components. Such examinations may include toolmark identification, classification, serial number restoration, bullet impact recognition, bullet path analysis, range determination and physical matching. Examinations are typically conducted within a laboratory setting; however, reconstructing a shooting scene typically requires off-site analysis at crime scenes. Practitioners are frequently required to provide expert testimony in all levels of court throughout Canada.

2.3. Bloodstain Pattern Analysis (BPA)

BPA analysts are FI members who have received specific training in the interpretation of bloodstain patterns found at a bloodletting crime scene. This knowledge can be used to examine critical physical evidence at the scene, and to attempt reconstructing a series of events that may have occurred. The analyst provides the Canadian courts with reliable scientific evidence that will help the trier of fact to reach a conclusion.

3. Service

3.1. Legal Framework

Canadian experts in physical forensic sciences work under differing legislation and jurisdictions. Those experts employed by police services are bound by internal regulations and policies in addition to provincial or federal statutes, such as a Police Services Act. Firearm examiners employed in government forensic laboratories and municipal police agencies will operate according to the Standard Operating Procedures (SOP) of the accredited laboratory. Government laboratories employing firearm and toolmark examiners are ISO accredited and bound by their accrediting bodies. ISO accreditation through bodies such as the Standards Council of Canada (SCC) and the Association of Crime Laboratory Directors (ASCLD) International ensure reliable testing for forensic laboratories and assist in ensuring acceptable and valid scientific practices throughout the country. BPA analysts are typically available to assist all police agencies across Canada. However, regardless of jurisdiction, all these experts are bound by federal legislation such as the Criminal Code of Canada and the Canada Evidence Act.

3.2. Facilities

Facilities for this work depend upon who employs the analyst, so facilities vary widely across Canada. Canada has three federal, two provincial, and two municipal laboratories equipped to conduct firearm and toolmark investigations. Such equipment includes:

- Bullet recovery tanks (for the capture of test-fired projectiles)
- Bullet traps (for the safe discharge of firearms)
- Dedicated ventilation systems (to capture airborne lead associated with firearm discharge)
- Biohazard examination rooms (to examine target surfaces while protecting the analyst from exposure to bloodstained and other bio-hazardous materials)
- Comparison microscopes (the principal tool for the identification and comparison of fired ammunition components)
- Typically, FI sections contain a laboratory for chemical processing of exhibits, an area for examination and photography using forensic light sources, and an area for secure exhibit storage.

As a result of occupational health and safety concerns, there has been increased awareness about the quality of these facilities, with some improvement over the past decade. Although there is no legislated standard, standards exist within various policing agencies for new and renovated FI sections. Costs for FI facilities are significant, which frequently delays or prevents renovations and new construction. The Ontario Provincial Police (OPP) has recently completed the construction of 13 new FI sections across the province.

FI sections whose membership includes BPA analysts will usually include an area where experiments can be conducted and patterns recreated. In Quebec and in the RCMP, these analysts are located within the forensic laboratories.

3.3. Professional Standards

There are no universal or national standards governing all forensic physical sciences experts. Rather, they are guided by agency-specific policy and guidelines. The following external organizations set out recommendations and guidelines that are non-binding, but considered industry best practice:

- Canadian Friction Ridge Working Group (CanFRWG)
- Scientific Working Group on Bloodstain Pattern Analysis (SWGSTAIN)
- Scientific Working Group for Shoeprint and Tire Tread Evidence (SWGTTREAD)
- Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST)
- Scientific Working Group for Imaging Technology (SWGIT)
- Scientific Working Group for Firearms and Toolmarks (SWGgun)
- Canadian Scientific Working Group for Firearms and Toolmarks (CanSWGgun)
- Canadian Identification Society (CIS)
- The International Association for Identification (IAI)
- Association of Firearm and Toolmark Examiners (AFTE)
- International Association of Bloodstain Pattern Analysts (IABPA)

Analysts are encouraged to, and typically will, follow the guidelines set out by their relevant groups and associations.

FI sections are not yet accredited, but most FI personnel maintain some form of certification. The RCMP requires its members to attend an Advanced Forensic

Identification Training Course (AFITC) every two years, which includes some type of certification testing. In Ontario, the provincial government has mandated compulsory testing every three years.

Firearms and toolmark experts housed within laboratories with ISO accreditation are subject to standardization and quality-assurance requirements set by the accrediting body involved – usually the Standards Council of Canada (SCC) or the American Society of Crime Laboratory Directors - Laboratory Accreditation Board (ASCLD/LAB). Recently, these groups formed CanSWGUN, a working group comprised of firearm and toolmark examiners tasked with establishing and disseminating consensus guidelines for the firearm and toolmark discipline. It is expected this activity will move this discipline closer to national standardization.

Standards followed by BPA analysts are dependent on their particular agency. However, most will follow guidelines set out by relevant recognized organizations such as SWGSTAIN and IABPA. Most analysts undergo some form of certification testing at the end of their initial understudy period, but regular re-certification is lacking.

3.4. Workforce

FI personnel are most often police officers who have received extra forensic training after several years of general policing experience. At a minimum, all FI officers are experts in friction-ridge comparison. FI officers are also trained in areas such as footwear and tire-track comparisons, but this type of evidence may arise less frequently. While there are only approximately 15 FI members certified as footwear examiners, all FI members should have some knowledge of this area of examination.

The ratio of FI personnel to sworn police officer population varies considerably across Canada (see Appendix E). Over the past decade many police services have seen little-to-no growth in their FI workforce. At the same time, they have also witnessed a dramatic increase in technical, scientific, forensic, and legal requirements. The result has been a difficult struggle for the FI discipline to keep up with a growing volume of client needs. For example, between 1996 and 2006 the RCMP increased its number of regular members by 25%, yet increased its FI positions by only 10%.

The Scenes of Crime Officer (SOCO) program has provided some relief, as it relies on general duty police officers with a few weeks of rudimentary training to handle less-serious property crimes. Many police services have SOCO programs ranging in size from 400 members (OPP) to 24 members (Ottawa Police Service). In addition, civilian employees occupy a variety of FI roles, ranging from scene and document support to expert crime scene analysis. Both the OPP and the RCMP routinely dispatch trained civilian members to crime scenes in support of their forensic units, and this trend towards civilianization may rise.

Firearm and toolmark examiners throughout Canada are employed as civilian scientists. There are currently 35 specialists employed by only five agencies. Technologists are also employed within government facilities to assist with specific types of analysis.

BPA analysts are for the most part police officers with extra training in this specialty. Approximately 35 analysts across the country work for the RCMP, the OPP, and various municipal agencies. In Quebec, two civilian analysts are located at Montreal's LSJML. While some analysts have bloodstains as their primary function, others are expected to carry out regular FI duties.

One of the challenges of training forensic physical science analysts is that in policing agencies, sworn officers are sometimes transferred from unit to unit, based on the agency's operational needs. As such, the expertise acquired may be lost to the unit when the officer is reassigned to other duties. Such policies were developed at a time when FI duties were much less complex. As the forensic physical sciences have evolved, the complexity of FI duties has increased significantly, as have the expectations of the judicial system and society in general. Firearm and toolmark examiners, on the other hand, tend to remain in the same field throughout their careers.

4. Education

4.1. Undergraduate Education

Unfortunately, there are currently no undergraduate programs in Canada specifically related to the physical forensic sciences described here. There are, however, several general forensic science programs now in place at several universities (e.g. University of Toronto, University of Windsor). Some classes in these programs may cover certain aspects of forensic identification, and final thesis research may be conducted in areas of physical forensic science. Additionally, some of these program graduates go on to become police officers and, potentially, FI specialists, or find employment in the forensic laboratory.

Without formal academic education specific to physical forensic sciences, training for experts has gone two routes:

- Generalized science or forensic science undergraduate degrees
- In-house police training, through either the Canadian Police College (CPC) or Ontario Police College (OPC)

The minimum educational requirement for employment as a firearm and toolmark examiner is typically a four-year BSc (or Quebec equivalent) from a recognized Canadian university in one of the natural sciences such as physics or chemistry. Some practitioners hold a four-year Bachelor of Engineering, or equivalent from a post-secondary facility.

Friction ridge, footwear, tire track, or BPA experts employed as FI specialists must hold the educational requirement specified by their employing law-enforcement agency. For instance, many officers enter the RCMP with a high-school diploma and receive in-house training.

4.2. Non-university (in-house) training

FI candidates typically go through a structured assessment and screening process to determine if FI is the right career choice. Any aversions to challenging or disturbing crime scenes, physical limitations or allergies to the various chemicals employed in forensic identification can become apparent during this assessment.

If accepted as FI candidates, police officers receive an eight-week basic FI course at the Canadian Police College (CPC), or a nine-week course at the Ontario Police College (OPC). Most agencies have a structured understudy or mentorship program (up to 3 years) which candidates must successfully complete to continue in the discipline. RCMP FI members must pass a Qualification Board after a 12-18 month qualification period.

For further training in footwear or tire track analysis, FI officers may receive training at either the OPC or the CPC. The RCMP also has an internal impression evidence course for their members which includes a strong footwear component. In 2011, the OPP introduced a one-year understudy program in footwear and tire track impression evidence. This program encompasses all aspects of tread evidence and the candidates are required to complete a research paper and pass a moot court trial.

Before being promoted to a court-qualified firearms and toolmarks specialist position, an incumbent typically undergoes a two-year understudy training period. The RCMP has introduced an external training curriculum that is a modified version of the training guidelines issued by the Association of Firearm and Toolmark Examiners (AFTE), which it offers to recognized forensic employers. In this way, some measure of standardization has been introduced to the post-employment training process.

BPA analysts in Canada are trained by either CPC or OPC. A qualified analyst follows through a structured understudy program of approximately one year in length under the direction of a mentor, an experienced BPA analyst. Typically this involves study specific to the theory and principles of BPA analysis, literature reviews, case analysis, practical experimentation, actual scene work, blind testing, and successful completion of a final board examination.

4.3. Graduate Education

No formal graduate programs exist in Canada for the forensic physical evidence disciplines, although several relevant MSc student projects have been managed under

related scientific departments such as chemistry and microbiology (see comments under section 5 Research). On a few rare occasions, members of law enforcement agencies have managed to complete the research required for a graduate degree.

4.4. Professional Certification

In 2009, Ontario was the first province to demand provincial certification for all FI personnel. A Forensic Identification Officer (FIO) must be familiar with the location, documentation, collection, and preservation of evidence, as well as the Centre of Forensic Sciences and the Forensic Pathology Services. A certified officer (certification granted by the Ministry of Community Safety) must re-certify every three years by written exam and practical testing.

RCMP Forensic Identification trainees enter a 12- to 18-month period of intense study and work involving practical exercises, research, moot trials and hands-on participation in case investigations at the end of which is a Qualification Board. They then participate in a moot trial where they present expert testimony, after which they are recognized as Forensic Identification Technicians. After a further 22 months of study and training, successful candidates will become certified Forensic Identification Specialists. Re-certification occurs every two years at the AFITC. The RCMP certification program began in 1981.

Within specific forensic physical sciences, the Canadian Identification Society (CIS) has been offering footwear certification since 2003 and launched a friction ridge certification program at the 35th CIS Educational Conference in September 2012. FI members can also be certified by the International Association for Identification (IAI).

Forensic firearm specialists are certified by their respective employment agencies. The Association of Firearm and Toolmark Examiners (AFTE) is an external body that also offers certification.

Currently within Canada, certification for BPA analysts will be completed by the RCMP for their own members, by the Ontario Police College for any police service meeting their entry criteria, and by some municipal services which have their own certification process. Regardless of the certifying board, all programs within Canada have similar understudy program structures and requirements. This Canadian model has been recognized internationally, and the program has been completed by analysts from the United States and The Netherlands, and duplicated by agencies in Australia and New Zealand. The RCMP BPA program is currently exploring accreditation under ISO 17025.

4.5. Continuing Professional Development

Typically recertification is required every two to five years for FI members, depending on the agency or the governing body. Most agencies mandate personnel to attend advanced courses to increase competency and skill levels. Training conferences and workshops, such as those hosted by sub-specialty associations such as IABPA, IAI, CIS, CSFS and AFTE, provide additional learning opportunities, as well as opportunities to present research and to teach.

5. Research

Laboratory-based scientists routinely conduct validation studies and research projects to improve techniques or methodologies. This kind of research is required of all Firearm and Toolmark specialists and occurs subsequent to both university and in-house training programs. Some graduate research, for example in surface contour measurement, is being carried out within the firearm and toolmark discipline. Other applicable research, of graduate degree quality, is as a result of forensic, industry, and academic partnerships.

The majority of research within the FI and BPA disciplines occurs at an undergraduate level through the mentoring of fourth-year science students. In addition, FI and BPA personnel may conduct research themselves related to courses or equipment used in the discipline, or research related to case-specific issues.

A major barrier to research in the FI area and the advancement of this discipline in Canada is that practitioners are only able to conduct research when caseloads permit. They have no inherent research mandate, nor will they necessarily have much experience conducting research. The only exception might be the RCMP which has two full-time research scientists working in forensic identification.

On a few occasions, law enforcement agency members have been able to complete the research necessary for a graduate degree. This may sometimes require taking time off from regular duties (leave without pay), or carrying out research after hours. Neither is an ideal or encouraging method for carrying out relevant research related to the forensic physical sciences.

A few students have been able to obtain MSc degrees carrying out research related to the forensic physical sciences. There are currently no Canadian graduate programs specifically in these areas, so students are generally forced to find a sympathetic faculty member in a related field to supervise their research. Often this means there is little or no funding for this work, so outside agencies or law enforcement agencies must be asked for support. Some university researchers have recently developed an interest in forensic science, but there is always the danger that their research may lack relevance without the collaboration and advice of forensic practitioners.

5.1. Research Funding

Most current forensic physical sciences research projects are internally funded within the police service or laboratory. There are potential funding opportunities for this research available through the Canadian Police Research Centre (CPRC) and the CBRNE Research & Technology Initiative (CRTI), both managed by the Canadian Safety & Security Program (CSSP) at Defense Research & Development Canada. Research funding is also available through provincial grants and partnerships formed with various academic institutions. However, these grants are not available every year and they are rarely sufficient for the graduate-level training necessary for research program partnerships with academic institutions.

Some firearm and toolmark-related research is industry-driven, so funding would be provided by the private sector.

5.2. Publications

Peer-reviewed publications are the scientific standard for advancement of disciplines. Research in the forensic physical sciences is published in journals such as:

- *Identification Canada*
- *Association of Firearm and Tool Mark Examiners Journal*
- *American Journal of Forensic Medicine and Pathology*
- *Journal of Forensic Sciences*
- *Forensic Science International*
- *Canadian Society of Forensic Science Journal*
- *Journal of Forensic Identification*
- *Journal of Bloodstain Pattern Analysis*

6. Professional Organizations and Groups

For FI specialists, the Canadian Identification Society (CIS) was founded in 1978 with the intent of providing annual educational conferences, quarterly publication of its journal (*Identification Canada*) and certification of fingerprint examiners for the Canadian FI community. There are many other professional organizations and associations offering international membership for FI personnel. These include the International Association for Identification (IAI) and the Fingerprint Society.

Firearm and toolmark examiners are eligible for membership in many of the above organizations as well as the Association of Firearm and Toolmark Examiners (AFTE).

Besides the CIS, BPA analysts may also belong to international organizations such as the International Association of Bloodstain Pattern Analysts (IAPBA) and the IAI.

7. Conclusions

The forensic physical sciences differ somewhat from many of the other disciplines described in this report in that they are full-time pursuits of law enforcement agency employees. They also differ in that they are not related to university “hard science” subjects (as are forensic biology or toxicology), but instead may best be described as “applied sciences” using a variety of natural and physical science principles with application to police field experience. As such, this creates unique challenges in court, and underlines the need for even more supporting research and validation.



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Chapter 7: Forensic Toxicology

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1. Summary

This section reviews the current status of forensic toxicology in Canada as applied to criminal and death investigations. Forensic toxicology has evolved from its analytical chemistry roots a century ago. It has incorporated pharmacology and physiology into its own specialization, focusing on the effects of drugs or toxins on the human body, including the toxicity and impairment attributed to these substances. There are no federal standards to which forensic toxicology adheres; however, the major forensic toxicology services in Canada are accredited to ISO/IEC 17025:2005 standards. The discipline has experienced a significant increase in the scrutiny of its practices and the qualifications of its experts. While there are no recognized forensic toxicology degree programs in Canada, the country does contain a wealth of highly qualified and experienced experts in the field. Forensic toxicology in Canada may be greatly improved and better received under this new level of scrutiny in the courts with a greater focus on national collaboration on policies and practices, and greater financial support for training, research, and standards

2. Overview

Toxicology, the study of the adverse effects of drugs, is a specialization of pharmacology. Forensic toxicology is the application of this field within a legal context. Thus a forensic toxicologist uses knowledge of pharmacology, physiology, medicine, and chemistry, combined with an assessment of ancillary evidence (e.g. case history, evidence of the scene), to interpret the effect of substances introduced to the human body.

A legal investigation may require that both biological and non-biological evidence be analyzed for the presence of drugs, alcohol and poisons. These findings are then used by forensic pathologists, coroners and medical examiners to help determine a cause of death.

They are also used by law-enforcement agencies as investigational aids, are presented to the courts in support of the justice system, and may be used to determine guilt or innocence in criminal proceedings. Findings may be presented in written form, as a report or letter of opinion, or as spoken evidence (*viva voce*).

Currently there are three major forensic toxicology laboratories supporting Canada's justice system. They are:

- Laboratoire de sciences judiciaires et de médecine légale (LSJML), Montréal
- Centre of Forensic Sciences, main operations in Toronto (CFS) and satellite laboratory in Sault Ste Marie (NRL)
- Forensic Science and Identification Services of the Royal Canadian Mounted Police (RCMP), with toxicology laboratories located in Vancouver, Winnipeg and Halifax.

The RCMP laboratories are operated as part of Canada's federal policing service, whereas the CFS and the LSJML operate under their respective provincial governments. In addition, there are several forensic toxicology laboratories that assist the various provincial Coronial systems in Canada, including the CFS, LSJML, and toxicology testing services associated with various Chief Medical Examiner offices (e.g., Edmonton) and Public Health offices (e.g., Regina).

3. Service

3.1. Legal Framework

Forensic Toxicology: Criminal

Toxicologists from these organizations are routinely called upon to provide evidence at all levels of criminal court. For example, toxicological evidence may include opinions about impairment as a factor in motor-vehicle collisions involving drugs or alcohol, or drug-facilitated sexual assault and homicides.

Evidence presented by forensic toxicologists is generally accepted on its merit by the justice system; however, when contested, such evidence is highly scrutinized, often by multiple individuals, including contradicting experts and the judiciary. Today, forensic toxicologists are being scrutinized more often by the courts. These examinations can include challenges to the forensic toxicologist's qualifications and/or degree of expertise.

These organizations also provide assistance to the criminal courts by supporting the drug-evaluation and classification and breath-alcohol programs of Canada's various police services. Toxicologists from these laboratories are often called upon to help test

biological samples, provide opinion evidence, evaluate new instruments or testing protocols, and provide teaching or other intellectual support to these programs.

Forensic Toxicology: Coronial

Forensic toxicologists also support Canada's coronial system, working with the country's medical examiners, coroners and pathologists. Medical examiners both employ forensic toxicologists and contract this work out to private or government-run laboratories. In both cases, toxicological test results are used as ancillary information in determining cause and manner of death in routine (i.e., non-suspicious) death investigations.

There are no requirements, either federally or provincially, for forensic toxicologists assisting either the criminal court or the coronial system to belong to any professional organization, or to practice in an accredited laboratory. Despite this lack of regulation, most forensic toxicology laboratories operate under the auspices of accreditation (e.g., ISO/IEC 17025).

3.2. Facilities

The facilities used for toxicological testing vary highly across Canada. Government laboratories are staffed by over 100 technologists and forensic specialists and scientists, and are accredited by either the Standards Council of Canada (SCC) or The American Society of Crime Laboratory Directors Laboratory Accreditation Board (ASCLD/LAB). Both these organizations adhere to ISO/IEC 17025:2005 standards. These stand-alone government facilities provide a wide range of forensic scientific support across the country.

Toxicological testing involves myriad techniques, ranging from simple colorimetric tests to powerful analytical procedures such as exact-mass mass-spectrometry. At present, there are no provincial or government standards regulating the type of sample used or the technology employed in performing toxicological testing nor is there consistency in testing between laboratories

3.3. Professional Standards

There are no professional standards or organizations to which forensic toxicologists must belong, and no recognized professional standards to which laboratories or analytical testing are held accountable in Canada. Although accredited testing facilities must adhere to the quality standards mandated by ISO/IEC 17025:2005, there is an overall lack of consistency in quality systems and testing models in Canada's toxicology-related services. As a result of this variability in screening and capabilities, the quality and completeness of testing from any one laboratory may not, and likely would not, match

those tests from a different laboratory. A national-level oversight may be required to ensure the same high quality and completeness in testing from all laboratories in a given case, or to at least ensure transparency and a fulsome accounting of limitations where these tests may differ or be limited.

3.4. Workforce

Forensic toxicology experts working in Canada's justice system hold varying degrees of education and expertise. At the same time, the demand for high-quality forensic-toxicology expertise is rising, as is the court's scrutiny of the background and training of individuals providing this expertise.

All of this has led to a shortage of "trusted" forensic-toxicology experts available to the courts. This leaves courts dependent on written reports or letters of opinion from those trusted few, or on testimony provided by individuals without specific training or expertise in the field. This lack of quality can lead to miscarriages of justice and/or threats to public safety.

4. Education

There is no formal training in forensic toxicology available in Canada, and few programs available internationally. Currently, those practicing in Canada may hold anything from a college diploma to a graduate degree, although specialists at the RCMP, the CFS or LSJML must hold at least an undergraduate degree, and many experts in this field hold advanced degrees. Because of this lack of formal training and lack of mandated training requirements in some laboratories, individuals working in the field may have backgrounds in a wide variety of disciplines, including chemistry, pharmacology, physiology or toxicology.

Several undergraduate programs in forensic science are now available in Canada, but none is highly specialized. These programs tend to provide only a broad overview of the forensic sciences; thus, education in a core scientific discipline is often a better background for forensic-science laboratory work.

There is also no formal requirement for continuing education or professional development in the forensic-toxicology field, despite the fact that ongoing training increases the courts' ability to deem one an expert. Those few existing professional-development opportunities (international conferences, membership in international organizations, annual meetings, independent research), and the financial burden they incur, must be undertaken by the individual alone. There is a significant lack of financial support available for such activities. Additional funding is required to rectify this situation.

5. Research

Most Canadian forensic-toxicology research takes place in the major federal or provincial laboratories. Such research tends to focus on method development, validating new technologies, and/or analysis of data collected by the laboratories in question. There is little opportunity or funding for toxicologists employed in these facilities to pursue the type of independent academic research needed to advance the discipline, nor do they enjoy the research infrastructure available at a university.

There is no forensic toxicology journal in Canada and there are few journals specializing in the field internationally. The small body of work published in the field in Canada is carried in either the *Canadian Society of Forensic Science Journal*, a journal neither recognized nor reviewed regularly internationally, or published in international journals such as the *Journal of Forensic Science* or *Forensic Science International*.

Other limitations hindering growth in the field include:

- Over-burdened forensic toxicologists who must focus on operational pressures such as managing large caseloads and preparing to provide *viva voce* testimony
- Limited forensic-toxicology faculty positions at recognized universities
- Lack of budgetary support for additional training and education in the form of travel to national or international conferences, workshops and meetings
- Government restrictions on seeking research funding from outside agencies, and permissions to travel to national or international conferences, workshops and meetings

6. Professional Organizations and Groups

There are no professional societies to which forensic toxicologists are mandated to belong. Some organizations that offer continuing-education workshops, seminars or annual meetings include:

- American Academy of Forensic Science (AAFS)
- Society of Forensic Toxicologists (SOFT)
- International Association of Forensic Toxicologists (TIAFT)
- International Association of Chemical Testing (IACT)
- American Board of Forensic Toxicology (ABFT)
- Canadian Society of Forensic Science (CSFS).

6.1. National Committees and Networks

There are only three national committees dedicated to forensic toxicology in Canada. They are:

- The Scientific Working Group in Toxicology (SWGT); a biannual meeting between CFS, RCMP and LSIMJ toxicology management
- The Alcohol Test Committee (ATC), operated by the Canadian Society of Forensic Science (CSFS)
- The Drugs and Driving Committee, also operated by CSFS

Scientific Working Group in Toxicology (SWGT)

The SWGT brings together management representatives from Canada's three largest toxicology facilities to explore national goals and foster cooperation and collaboration. These meetings provide an opportunity to share information about methodology, research, programs, staff training and more.

At present, SWGT is an opportunity for intellectual sharing of ideas regarding laboratory management, research and validation of new methodologies and testing protocols. There is no funding or support provided from any level of government other than the cost of travel associated with attending these meetings by a few members. With the correct national support system and a mandate to do so, the SWGT could be a means by which these three national laboratories can take steps to align toxicological testing and provide recommendations for such testing to all laboratories nationally.

Alcohol Test Committee (ATC)

The ATC, a committee formed to provide scientific support to Canada's blood-alcohol breath-testing programs, has been in effect since 1967. This committee has been instrumental in developing the recommendations needed to produce high-quality breath-testing programs across the country, and has published formal standards by which new breath testing instrumentation must be tested before being deemed acceptable for use by law-enforcement agencies.

While the ATC maintains and updates these recommendations, it does not provide any direct oversight to Canada's breath-testing programs. At present, various government agencies and policing agencies mandate and facilitate their own breath-testing programs with support from the three large national forensic toxicology laboratories.

Drugs and Driving Committee (DDC)

The Drugs and Driving Committee (DDC) is another committee operated under the CSFS. Similar to the ATC, the DDC was formed to discuss drugs-and-driving related issues in Canada. The DDC provides support to the Department of Justice regarding these issues, sponsors workshops on drug-impaired driving, and maintains a drug-impaired-driving computer database.

The DDC has not produced recommendations to be followed nationally with respect to drug impairment related to driving. With the proper support and commitment of all parties nationally, this committee could provide the type of support needed in this highly contested area of forensic toxicology. The ATC could be used as a model for this endeavour.

Particular areas requiring attention include:

- A comprehensive evaluation of the Drug Evaluation and Classification (DEC) program, along with recommendations for its use by police services to attain high-level and consistent quality
- Evaluation of road-side testing kits, and a program by which these devices can be evaluated and then recommended for use to the DOJ
- Review and recommendations regarding testing of alternate biological samples (e.g., saliva) in suspected impaired drivers.

7. Conclusions

Forensic toxicology is not unique in that these services are provided primarily by publicly funded government laboratories. The discipline faces a critical lack of national funding, which reduces its ability to respond appropriately to changes in the field, such as new technologies, new drugs and drug trends, and state-of-the-art training and research and development. The industry is also facing staffing shortages due to these same funding issues. This ongoing lack of funding has also resulted in uneven quality in both the types of toxicological testing available and the levels of service provided across the country.

At a time when the field is struggling to keep up with rapidly changing technology, its customers and accrediting bodies are becoming more demanding. Greater transparency and traceability of analytical testing and opinion evidence is required. This has placed a greater weight on qualifications and a correspondingly greater scrutiny of those qualifications.

It is recommended that a national body, such as the Scientific Working Group in Toxicology, strive to make national-level recommendations about forensic toxicology

testing, and be provided the funding to do so. Such a national group can be called upon to make recommendations about the types of tests and the training and education required to standardize this testing across Canada.

In addition, there is currently a lack of collaboration between the public laboratories performing most of Canada's forensic toxicology work, and academia. Greater collaboration between these two bodies may address the lack of specialized training for new staff, and provide research and development opportunities not now well-funded in Canada's publicly run forensic toxicology laboratories.



Chapter 8: Forensic Biology

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1. Summary

This paper reviews the current status of forensic biology in Canada as applied to criminal and death investigations. The discipline is well-established, having evolved from small laboratories in academic institutions to large public-sector laboratories. Today the primary service providers are the provincial government laboratories in Ontario and Quebec, the RCMP for the rest of Canada, and a few small private laboratories. The discipline has experienced rapid progress since the development of forensic DNA analysis methods in the late 1980s. Over the last 20 years the development and implementation of guidelines and standards have played a central role in advancing the field and in establishing the integrity of DNA evidence in the justice system. Although there is no legislation describing mandatory standards for laboratories and individual scientists, we believe the Canadian system delivers high-quality forensic biology services in support of official investigations.

2. Overview

The primary function of forensic biology is to establish associations between biological samples submitted as evidence, such as body fluids found at a scene, and the individuals from whom they could have originated. Analysts seek to identify substances such as blood, saliva and semen, and to classify them based on their biological, chemical and physical characteristics.

For the past two decades, forensic biologists have used techniques derived from molecular genetics to detect highly variable regions of human DNA. Specifically, biological samples are tested to determine the pattern of repeated sequences present in the nuclear DNA taken from a given sample. Such a pattern is called a “profile.” Canadian laboratories apply validated protocols, often using similar procedures and instrumentation to perform such forensic DNA analyses. The relevance of a match between forensic DNA profiles is derived through well-established scientific population genetics principles. The outcome is an estimate of the significance of observing a particular “DNA profile”.

2.1. History of Forensic DNA

On the morning of Monday, September 10, 1984, Alec Jeffreys pulled an x-ray film from the developing tank in a laboratory at Leicester University.

“Within seconds it was obvious that we had stumbled upon a DNA-based method not only for biological identification, but also for sorting out family relationships. It really was an extraordinary moment.”²⁰

With this discovery it was obvious that DNA analysis was destined to become a “forensic science.”

The potential forensic application of this discovery was first discussed in the journal *Nature* in 1985. In their paper titled “Forensic application of DNA ‘fingerprints,’ authors Alec Jeffreys, Peter Gill and David Werrett (the latter two were research scientists working for the Home Office Forensic Science Service in the UK) concluded, “It is envisaged that DNA fingerprinting will revolutionize forensic biology, particularly with regard to the identification of rape suspects.”

Forensic DNA analysis in Canada developed rapidly. It evolved from using a process referred to as RFLP (restriction fragment length polymorphism) analysis in the late ‘80s to PCR (polymerase chain reaction) analysis by the mid-1990s. This change dramatically improved the speed and sensitivity of DNA analysis. The analysis of Short Tandem Repeats (STR) using PCR is the current “gold standard” used in forensic science laboratories around the world.

²⁰DNA pioneer’s “eureka” moment <http://news.bbc.co.uk/2/hi/programmes/newsnight/8245312.stm>

In the late 1980s and early 1990s forensic scientists and academics from Canada and the US were invited by the Federal Bureau of Investigation to develop guidelines and best practices for the use of forensic DNA analysis. This group became known as the Scientific Working Group on DNA Analysis Methods (SWGAM). In the mid-to-late 1990s, by drawing on the results of research conducted by academic, medical, and forensic science laboratories, SWGAM established a standard set of 13 DNA STR markers (known as the “core loci”) for forensic DNA analysis. This was formally announced to the forensic science community in North America in 1998 and resulted in manufacturers developing commercially-available kits for all 13 loci. These kits were validated for forensic science using standards that included the requirement to publish results in peer-reviewed journals.

Forensic DNA databases assist investigators by providing information that helps identify and eliminate suspects and determine when a serial offender is involved. An individual’s privacy, the security of the DNA profiles and the sharing of information is strictly controlled by the National DNA Data Bank. The Canadian public-sector laboratory systems work together as a fully integrated National DNA Data Bank.

Cooperation between the laboratories and adherence to common guidelines and standards ensure there are no provincial barriers to the use of DNA technology in crime investigation. Also, the use of common DNA technology allows Canada to conduct DNA comparisons in support of police investigations that cross international borders. These comparisons are controlled by the National DNA Data Bank and are conducted through an international sharing agreement with Interpol.

Although STR analysis is considered the gold standard and is the routine methodology, there are other DNA-based analysis systems in use or in development. For instance, mitochondrial DNA is primarily used in the examination of bones and hairs where the amount of nuclear DNA can be extremely small. Research by academic, medical and forensic science laboratories continues to advance the use of new DNA technologies. In the near future, analysis of single nucleotide polymorphisms (SNPs) using large automated detection arrays has the potential to provide information about geographic ancestry, eye colour, hair colour, facial features, and stature. The application of this new DNA technology has been referred to as the “genetic eyewitness.”

3. Service

3.1. Legal Framework

The use of DNA analysis methods in support of police investigations was quickly followed by the introduction of the results as evidence in criminal trials. As a novel science the evidence was subjected to legal scrutiny. It was introduced by the

prosecution, challenged by the defence and evaluated by the judiciary. In almost all cases, courts ruled the evidence was admissible. As a result, DNA evidence became generally accepted.

The first-known use of DNA evidence in a Canadian case was *R. v. Parent* (1989), 46 C.C.C (3d) 414 (Alta, Q.B.) where PCR-based evidence, using a modified DQ alpha test developed by a private laboratory, was entered at trial with the Crown's consent. This evidence excluded the accused.

The first case in Canada in which DNA evidence was entered to implicate an accused was in a sexual assault trial in Ottawa on April 10, 1989: *R. v. McNally*, [1989] O.J. No. 2630 (Ont. Ct. Gen Div.). In *McNally*, the trial judge ruled that the DNA evidence should not be treated differently from other expert evidence. The accused pled guilty after the DNA evidence was heard and the RCMP became the first police organization in North America to have DNA evidence developed by its own laboratory accepted into evidence by a court of law.

The first DNA case to be considered by the Supreme Court of Canada, was *R. v. Terciera*, [1999] 3. S.C.R. 866 (aff'ing (1998), 123 C.C.C. (3d) 1 (Ont. C.A.)). The evidence in this case was developed by the Centre of Forensic Sciences. The ruling paved the way for the development of legislation incorporating DNA analysis into the *Criminal Code* of Canada.

In 1995 Parliament enacted amendments to the *Criminal Code*. Under these amendments a provincial court judge could issue a warrant authorizing a police officer to obtain a biological sample (hair, blood or saliva) from a suspect for the purposes of forensic DNA analysis in the investigation of certain designated *Criminal Code* offences. This legislation came into force on July 15, 1995²¹. In 2003, the Supreme Court of Canada unanimously upheld the constitutionality of the DNA warrant in *R. v. S.A.B.*, [2003] 2 S.C.R. 678.

Parliament enacted the *DNA Identification Act*²² in 1998. The Act created a new statute governing the establishment and administration of a national DNA data bank to be maintained by the Commissioner of the RCMP. It also amended the *Criminal Code* to permit a judge to make a post-conviction DNA data bank order authorizing the taking of bodily substances from a person found guilty of designated *Criminal Code* offences. This amendment allowed for inclusion of DNA profiles from offenders in the National DNA Data Bank. As well, the legislation authorized courts to order that a person convicted of certain very grave offences prior to the legislation coming into force must provide a bodily substance for analysis (retroactive sampling).

²¹S.C. 1995, c. 27, formerly Bill C-104, An Act to amend the Criminal Code and the Young Offenders Act (Forensic DNA analysis).

²²S.C. 1998, c. 37, formerly Bill C-3, An Act respecting DNA identification and to make consequential amendments to the Criminal Code and other Acts (short title: the DNA Identification Act)

On June 30, 2000, the legislation came into force and the National DNA Data Bank (NDDB) opened. The data bank consists of two collections of DNA profiles:

- The CSI (crime scene index), containing DNA profiles derived from bodily substances found at a crime scene
- The COI (convicted offenders' index), containing DNA profiles derived from bodily substances taken from offenders against whom post-conviction DNA databank orders have been made

Several appeal courts unanimously upheld the constitutionality of the DNA databank provisions²³. The privacy protections of the DNA databank scheme have been commented on favourably by the courts²⁴. The Supreme Court of Canada held that having regard to the interests at stake and the procedural safeguards afforded by the legislative scheme, the *ex parte* nature of the retroactive sampling proceedings meets the dictates of procedural fairness afforded under section 7 of the Charter²⁵. Charron J.'s comments in *R. v. Rodgers* provide an apt summary of the judiciary's current view of forensic DNA analysis:

*There is no question that DNA evidence has revolutionized the way many crimes are investigated and prosecuted. The use of this new technology has not only led to the successful identification and prosecution of many dangerous criminals, it has served to exonerate many persons who were wrongfully suspected or convicted. The importance of this forensic development to the administration of justice can hardly be overstated.*²⁶ (para. 4)

3.2. Facilities

Almost all human forensic DNA testing in Canada is conducted by one of three public-sector laboratories:

- Laboratoire de sciences judiciaires et de médecine légale (LSJML), provides forensic biology services for the province of Quebec and operates one laboratory facility in Montréal.

²³R. v. Briggs (2001), 45 C.R. (5th) 99 (Ont. C.A.), R. v. Murrins (2002), 162 C.C.C. (3d) 412 (N.S.C.A.); R. v. Ku (2002), 169 C.C.C. (3d) 535 (B.C.C.A.) and R. c. J.H., [2004] J.Q. no. 5820 (Que. C.A.)

²⁴See: R. v. Jordan (2002), 162 C.C.C. (3d) 385 (N.S.C.A.) at para. 30 per Cromwell J.A.; R. v. S.A.B., [2003] 2 S.C.R. 678 at para. 47 per Arbour J.; R. v. Briggs (2001), 157 C.C.C. (3d) 38 (Ont. C.A.) at para. 36-39 per Weiler J.A.

²⁵R. v. Rodgers, [2006] 1 S.C.R. 554

²⁶R. v. Rodgers, supra., at para. 4.

- The Centre of Forensic Sciences (CFS) does the same for the province of Ontario and has two laboratories, the main site in Toronto and a satellite laboratory in Sault Ste Marie.
- All other provinces and territories are served by the Royal Canadian Mounted Police Forensic Science Service. The RCMP laboratories in Vancouver, Edmonton, Regina, Ottawa and Halifax conduct DNA casework analysis. The RCMP National DNA Data Bank laboratory in Ottawa analyzes samples taken from persons on conviction from all jurisdictions in Canada.

Forensic biology services are also available from a few small private laboratories with more limited capacities. Maxxam Analytics and Wyndham Forensics are located in Guelph, Ontario, and Gamma-DynaCare/WarnexProDNA is located in Thunder Bay, Ontario. The latter offers some forensic DNA testing services not currently performed by the public-sector laboratories (e.g. mitochondrial DNA and SNP-Phenotype).

3.3. Professional Standards

There are no mandatory legislated professional standards for forensic biology laboratories in Canada. However, there are well-defined and consistent guidelines and standards creating the stringent checks and balances under which forensic biology laboratories operate.

Since it was established in 1989, SWGDAM has published guidelines used by operational laboratories across North America as best-practice references. The guidelines cover subjects such as validation, training and data interpretation. In 1996 a landmark report was published by the US National Research Council (NRC) titled “The Evaluation of Forensic DNA Evidence.” This report established the framework for the application of population genetics and statistics in the field of forensic DNA analysis, and established broad consensus among forensic scientists and academics. The NRC report also recommended that laboratories performing DNA work be accredited.

By the late 1990s many of the SWGDAM guidelines and NRC recommendations were incorporated as standards into accreditation schemes such as those employed by the Standards Council of Canada (SCC) and the American Society of Crime Laboratory Directors-Laboratory Accrediting Board (ASCLD-LAB). These forensic biology-specific standards are additional requirements to the ISO17025 standard “General Requirements for the Competence of Testing and Calibration Laboratories.”

Standards relate to laboratory setup, ways in which tests are conducted and reported, ways in which new test methods must be validated prior to use in forensic casework, academic qualifications and training of staff, and ongoing performance monitoring of scientists involved in casework. In addition, accredited laboratories must have and follow written guidelines for the interpretation of analytical data.

The three public-sector laboratories and the three private-sector laboratories performing forensic biology examinations and testing are all accredited to the ISO17025 standards. Maintenance of accreditation involves auditing of laboratory operations at least once every two years. Adherence to standards and guidelines ensures a uniform approach to forensic biology across Canada.

3.4. Workforce

Most of the scientists employed in accredited forensic-biology laboratories fall into one of two categories²⁷:

DNA analyst: an employee who has successfully completed the laboratory's training requirements for casework-sample analysis, passed a competency test, and entered a proficiency testing program. This individual conducts and/or directs the analysis of forensic samples, interprets data and reaches conclusions.

DNA technician: an employee who performs analytical techniques on forensic samples under the supervision of a qualified analyst. DNA technicians do not interpret data, reach conclusions on typing results, or prepare final reports.

In addition, each laboratory must have a Technical Leader with enhanced academic qualifications and experience. This person has accountability for the quality system and oversight of the implementation of new technologies.

The scientists who interpret data, write reports, and testify in court must at a minimum hold a Baccalaureate degree in biology or a related field, and have completed undergraduate coursework in biochemistry, molecular biology and genetics, and taken courses in population genetics/statistics. The Technical Leader must have a postgraduate degree and postgraduate coursework in the same subjects.

In addition to these academic qualifications, biannual proficiency testing is mandatory for all scientific staff, and those who testify are subject to annual court monitoring. Scientific staff involved in DNA analysis must also complete eight hours of continuing education each year.

Governments in Canada have recognized the important role that forensic biologists fulfill in the justice system, and that DNA analysis is a critical tool used by investigators to identify and apprehend violent criminals. Government laboratories have been able to recruit people who are well-educated and who have studied the theoretical principles that underpin the application of science in the field of forensic biology and DNA analysis. As

²⁷Guidelines for the Accreditation of Forensic Testing Laboratories CAN-P-1578 May 2009

a result, the capacity for forensic biology and DNA analysis in Canada has increased significantly over the last 20 years.

4. Education

Since the early 1990s there has been an increase in popularity and public awareness of forensic science, including forensic biology and DNA. TV shows such as “CSI” have established forensic science as a career interest for young people.

Applicants to the three forensic laboratories in Canada are encouraged to hold four-year university degrees with course credits in molecular biology, genetics, biochemistry and statistics.

Scientists working in the field of forensic biology are almost all graduates from BSc courses in biology or related fields. Some scientists have gone on to postgraduate study, including MSc, PhD and postdoctoral research in biology and related fields. Many Canadian, American and other recognized universities offer undergraduate and postgraduate courses that include the required theoretical knowledge applied in the field of forensic biology.

Traditional undergraduate degrees such as biochemistry and genetics deliver the in-depth study required, but may not attract students who have decided on a career in forensic science. As a result a few universities have begun offering “forensic science” degrees. These degrees include course work that covers a range of disciplines, including chemistry, biology, anthropology and psychology. The challenge for the university is to satisfy the vocational interest in forensic science while offering students the opportunity to study the core subjects of molecular biology, biochemistry, genetics and population genetics/statistics. This is not always possible and some students find they are “missing” some of these core subjects when seeking employment after graduating.

When newly-graduated scientists realize that the minimum academic requirements for a testifying scientist include specific coursework, some decide to complete additional courses after graduating. There are no “forensic science” postgraduate degrees offered by Canadian universities. This may partly explain the scarcity of postgraduate academic research in forensic biology in Canada.

Outside of Canada there are many more opportunities for training in the forensic sciences, at both undergraduate and postgraduate levels. These include over 70 university institutions in the US, and a number of respected European universities, such as Kings College London and the University of Strathclyde in Glasgow. It is perhaps no surprise that many prospective Canadian forensic science students continue to choose undergraduate and graduate training outside of Canada.

4.1. Professional Certification

There is no Canadian professional certification mechanism for forensic biologists. The individual competency framework required by the ISO 17025 standards is preferred to a formal certification “scheme.” This framework, requiring laboratories and staff to operate within a defined quality system, is considered by many to be the best mechanism for ensuring adherence to professional standards.

4.2. Continuing Professional Development

Continuing education is a key element of maintaining expertise. Access to opportunities for continuing education for Canadian forensic biologists is a challenge. The field is small, and there are only a few annual conferences in North America where research is presented and scientists can engage in direct knowledge-transfer with other practitioners. At present there is only one technical conference in Canada specific to forensic biology and DNA analysis; this is held annually in Toronto as a result of collaboration between the CFS and Promega Corporation.

A robust continuing education program must also assist lawyers and judges in applying their critical reasoning to evaluate the admissibility and significance of forensic DNA evidence. Unless the ultimate consumers of forensic DNA are able to understand its strengths and weaknesses, the efforts and improvements made by the scientific community may come to nothing.

There is no mechanism in Canada to fund academic institutions specifically to develop and deliver continuing education for forensic biology. In comparison, the National Institute of Justice (NIJ) in the US funds in-person and online continuing-education courses for forensic scientists and for justice system participants. Courses are delivered by universities, and costs are recovered by the university through NIJ grant funding.

It is important to note that Canada became a leader in the use of DNA analysis because the technology originating in the UK was adopted in Canada through professional contacts, laboratory visits, and data and knowledge sharing that crossed international boundaries. It is essential that scientists, legal practitioners and police be aware of the next technology wave so the justice system is able to derive full benefit from scientific advancements. Without a well-developed infrastructure that includes a program of continuing education, Canada risks falling behind.

5. Research

5.1. Research and Publications

Although options can be explored through the usual Canadian federal programs (NSERC and MRC, Genome Canada), research funding for forensic science is limited. In contrast, the US NIH provides specific funding for forensic, legal and law-enforcement research in the interest of justice. Most research in Canada is small scale, and originates through work undertaken by one of the three public-sector laboratories, or by students enrolled in undergraduate forensic science courses.

Advancements in forensic biology in Canada are largely dependent on research completed in other countries. The United States government has dedicated significant funds to support forensic biology. American universities and state and local forensic laboratories have been involved in the research and development of new technologies, including the application of SNPs, and instrumentation, including micro-devices. Additionally, the US-based National Institute of Standards of Technology has a research group dedicated to the advancement of forensic DNA technology. This group has been instrumental in developing the new DNA markers later developed and commercialized by Life Technologies Corporation (Applied Biosystems) and Promega Corporation.

Much of the research in forensic biology is published in journals such as the *Journal of Forensic Science* and *Forensic Science International - Genetics*. That said, there is a paucity of published research originating from Canadian laboratories.

6. Professional Organizations and Groups

The Canadian Society of Forensic Science (CSFS) is a non-profit professional organization incorporated to maintain professional standards and to promote the study and enhance the stature of forensic science. Membership in the society is voluntary and members pledge to follow a code of ethics.

The society organizes a conference, including workshops and seminars, usually held in a different province or territory every year. However, due to the size of the membership it is not always possible to organize workshops specific to forensic biology and DNA.

Forensic biologists in Canada may also choose to apply for membership in other societies, such as the American Academy of Forensic Sciences and the Forensic Science Society in the UK.

6.1. National Committees and Networks

Collaboration between the CFS, the LSJML and the RCMP occurs through their participation in a national working group on DNA analysis methods. Representatives from all three organizations meet once or twice a year to share research and information about the new systems and technologies implemented in their respective operations.

The National DNA Data Bank Advisory Committee is mandated to report to and advise the Commissioner of the RCMP on all matters related to the effective and efficient operation of the National DNA Data Bank, and to assist in preventing potential misuse of DNA information. Members of this committee represent the interests of the public, the police, the law and science.

Representatives from the CFS and the RCMP were founding members of the US SWGDAM, and continue to participate in the development of North American guidelines and standards for forensic biology and DNA laboratories. Representatives from the LSJML participate in the French working group of the International Society of Forensic Genetics. This group has membership from more than 20 laboratories located in France, Belgium, Switzerland, Lebanon and Morocco. The working group conducts collaborative exercises and discusses operations and accreditation.

The National DNA Data Bank is also a member of an international working group sponsored by Interpol that deals with issues related to the sharing of DNA information across international borders.

7. Conclusions

The application of DNA analysis in forensic science has its origins in academic research and a firm foundation in scientific theory. The scrutiny to which the science has been exposed by leading scientists and in courts of law has resulted in robust scientific methodologies. Today, forensic DNA methods can be applied to the analysis of the most challenging samples with a high degree of confidence. When combined with a firm underpinning of quality assurance, results are reliable and have a high probative power.

The foundation of a valid and reliable science applied to the most challenging of samples should never be taken for granted. It is essential that Canada contribute to the continuing development of forensic DNA analysis. This can only be realized through a strong infrastructure designed to deliver the science to those who depend on it, and by building and maintaining a system that produces scientists and research of the highest quality.



Chapter 9: Forensic Psychiatry

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1. Summary

This paper offers a review of forensic psychiatry in Canada. Forensic psychiatry may be broadly defined as the practice of psychiatry as it relates to the legal system, both criminal and civil. The discipline has evolved considerably in recent years, and today Canada has an adequate number of trained forensic psychiatrists. This is due, in part, to the many new opportunities for formal training that have arisen in the past 30 years. Despite this growth, there remain challenges in the area of clinical-practice guidelines or professional standards for forensic psychiatry. Happily, there are now also a number of professional organizations working with the forensic psychiatry community to address these issues.

2. Overview

The practice of forensic psychiatry takes place in two distinct arenas, both of which require specialized psychiatric knowledge, as well as an understanding of legal or quasi-judicial circumstances and statutory or common law.

First, a forensic psychiatrist is called upon to apply principles and knowledge about general psychiatry (schizophrenia, mood disorders, treatment, prognosis, etc.) to persons referred by the court. However, there are additional domains of expertise unique to forensic psychiatry, and in which other psychiatrists are not typically trained or comfortable.

The work of a forensic psychiatrist may be further divided into assessment and treatment. Assessment involves using a variety of techniques to analyze the behaviour precipitating the referral. Such analysis may include diagnosis, as well as an investigation of possible root causes or cycles of thought and behaviour in the patient (or “service user.”)

Treatment (or rehabilitation), takes place in a variety of contexts, but is perhaps most frequently seen when the service user is subject to a Warrant of the Ontario Review Board. The forensic psychiatrist will then use the assessment results, along with

standardized psychological and physiological interventions, to support the patient's recovery.

As may be evident to the reader, the work of forensic psychiatrists is quite diverse, ranging from assessment techniques to in-depth knowledge of criminal law. In fact, skilled forensic psychiatrists must hold expertise in the following areas:

- bio-psychosocial basis of criminal behaviour
- relevant legislation and case law
- clinical sexology
- risk assessment and management

Most forensic psychiatrists in Canada will spend the bulk of their time dealing with assessment and rehabilitation in the context of criminal-court matters. In such circumstances, the forensic psychiatrist is expected to present opinions on the presence or absence of mental disorder, and on the individual's fitness to stand trial. He or she is also expected to perform an assessment of criminal responsibility, and to present risk-mitigation strategies.

The work of forensic psychiatrists will almost always find its initial expression in a written report. The relatively well-accepted guidelines for producing such reports stipulate that each must:

- be addressed to the individual/party posing the question
- articulate the nature of the question(s)
- articulate sources of information used in arriving at one's conclusions
- indicate that consent for the evaluation was given, and was informed
- set out in detail the information used to reach the conclusion(s)
- contain conclusions, and caveats/statements of limitation as regards both general issues (e.g., confidence intervals regarding risk assessment), and issues specific to the matter at hand (e.g., lack of good collateral information about an assessment.)

3. Service

3.1. Legal Framework

The legal framework for forensic psychiatric involvement is fairly uniform across Canada. Most frequently, forensic psychiatrists work in a criminal-code and/or review-board context. The criminal code is, of course, standard across the country. There are small differences in how provincial review boards administer warrants of persons found unfit or not criminally responsible due to mental disorder, and some provinces have more unified systems than others. Nevertheless, the review-board process across the country is more similar than different.

There are, of course, interprovincial differences regarding other statutes, and province-specific case law that might apply. Examples of this variation might include case law dealing with labour arbitration, child-welfare matters, mental health acts, etc.

Forensic psychiatry has its origins in case law from the United Kingdom, in particular the cases of M'Naughton and Hadfield. These cases gave rise to the notion of being found “not guilty by reason of insanity” (the precursor to being found “not criminally responsible due to mental disorder”). They also inspired the creation of specialized facilities for mentally-ill offenders (*Criminal Lunatics Act* of 1800) for the protection of the community, and established the idea of rehabilitation.

Throughout much of the last century, the evolution of forensic psychiatry was gradual, not particularly well-supported empirically, and very much a system of apprenticeship. All of this gave rise to considerable variation in practice. More recently a movement to produce greater standardization of work and greater accountability has resulted in the formation of professional organizations in the United States and Canada, with accompanying journals and some practice standards, these latter largely related to process.

The area in which assessment practice varies the most, both within and between provinces, is that of clinical sexological issues (paraphilias), including the psycho-physiological assessment of such situations. Specialized knowledge in this area is not well-distributed, and psycho-physiological assessment methods, such as phallometric testing²⁸, and viewing-time measures, are not consistently available across the country. Further, there is no “host” or governing body setting standards for this type of assessment, which means there is considerable variation in the rigour with which it is practiced. Phallometric laboratories have emerged “organically,” and the sensitivity and specificity of their stimulus sets are often unknown.

The growth of professional societies comprised of and supporting forensic psychiatrists has led to less interprovincial variation in work performed in academic settings, but there remains considerable variation elsewhere. In particular, the nature and quality of work in our urban areas varies widely. Like many other areas of medicine, knowledge transfer remains an elusive goal.

3.2. Facilities

Forensic psychiatry is most commonly practiced in hospital settings, typically with an academic affiliation. In each province, the relevant Ministry designates certain hospitals to receive forensic-service users for assessment, treatment, or both. The availability of specific investigative processes, such as brain imaging, neuropsychological testing, or

²⁸Phallometric testing measures blood-flow to the penis, and is used in sexual offence cases to measure a patient's sexual response to various stimuli.

psycho-physiological testing of sexual preference, varies considerably, with less well-resourced settings having to outsource them. The availability of qualified medical specialists is also inconsistent across the country.

3.3. Professional Standards

Clinical-practice guidelines do exist directing medical practitioners in the treatment of many common conditions seen by the forensic psychiatrist, such as schizophrenia or bipolar disorder. However, there are no such standards for many of the key tasks performed specifically in forensic work, including assessment of fitness to stand trial, assessment of criminal responsibility, or risk assessment and management. Risk management, in particular, is bedevilled by the fact that it is not possible, for ethical reasons, to conduct randomized controlled trials of risk-mitigating interventions.

Thus other methodologies (meta-analyses, less sound investigative methods) typically have to be employed as guidelines to these strategies. One of the defining changes in our field over the past twenty years has been the emergence of statistical or structured risk appraisal, replacing clinical judgment. This change has reduced both Type 1 and Type 2 error significantly, and has brought a new transparency to the risk-assessment process.

Generally speaking, forensic psychiatrists have been eager and willing to apply structured risk-appraisal techniques to their practice. The next “wave” in risk assessment will comprise a strength- and vulnerability-based assessment of both risk and opportunity. Such assessment will be consistent with the Recovery framework in mental-health services.

Happily, there is a sense in the forensic-psychiatric community that practice guidelines are required, and the Forensic Directors Group, comprised of the medical and administrative directors of the designated facilities in the province of Ontario, have embarked upon just such a project. This is, however, an extremely ambitious project, involving integration of both specialized forensic knowledge and practice guidelines as they pertain to common mental-health conditions. The group is not particularly well-resourced, and the process has been slow.

3.4. Workforce

Forensic psychiatrists may work in inpatient, outpatient or correctional settings. Inpatient settings are those in which the service user is admitted to hospital, while outpatient work does not require hospital admission and may take place outside the hospital setting. In inpatient settings, the work typically involves an inter-professional team, comprised not only of the forensic psychiatrist, but of forensic psychologists, recreation and occupational therapists, social workers, nurses, pharmacy experts and others.

Increasingly such teams favour the “Recovery” method, which empowers clients to set and achieve goals and take principal responsibility for their course.

In outpatient settings, forensic psychiatrists are more likely to work alone or in small groups. Correctional settings are lagging in their acceptance of the Recovery framework, and of the sophistication of forensic work in general. This is an area that needs better integration with hospital facilities, and better application of standards, particularly in relation to remand facilities, as opposed to federal institutions.

These are interesting times; there is recognition of the value that well-trained forensic psychiatrists bring to the forensic process, and thus there is demand for forensic psychiatrists in their traditional domains. However, forensic psychiatry expertise is not always deployed in several other areas in which it could also yield good results. Many civil patients could benefit from the forensic psychiatrist’s expertise in clinical sexological issues and understanding of risk-assessment and mitigation practices. This reluctance to tap into Canada’s forensic-psychological expertise is likely due to provincial fee structures not supporting the file-review process necessary to do this work properly.

At the same time, there is increasing recognition that service models may soon change in order to best capitalize on the skills brought by each member to an inter-professional team. Such changes will also reduce costs. The service model of the future may involve a smaller number of forensic psychiatrists, and a larger number of other practitioners working with them, and assuming more significant day-to-day roles in both the risk-assessment, and, perhaps more significantly, risk-management, process.

The fact that general psychiatrists are regularly called upon to provide risk assessments in civil patients, when they typically have training only in short-term risk assessment, may contribute to the perceived “weakness” of the civil system in managing persisting risk in mentally-disordered offenders who are not subject to *Criminal Code* sanctions. This may in part contribute to one of the most significant issues in forensic practice in Canada: the steady increase in persons subject to warrants of provincial review boards. This increase leads in turn to significant process delays, and costly resource reallocations.

4. Education

4.1. Medical Education

Most medical students get little exposure to forensic psychiatry, unless they specifically request an elective in this area. Further, forensic and general psychiatry, despite dealing with the same individuals (persons with psychotic or mood disorders) are siloed, and there is poor cross-pollination of expertise. General psychiatrists tend to lack knowledge of structured risk-assessment processes and empirically supported risk-management

interventions for crime-producing variables. Forensic psychiatrists tend to lack expertise in sophisticated psychopharmacological interventions. That being said, it is arguable whether this should be addressed at the medical-school level.

4.2. Residency Training and Certification

The Royal College of Physicians and Surgeons has clear standards for specialist certifications in psychiatry, and has recently approved a training program for sub-specialization in forensic psychiatry. Forensic psychiatry lectures are part of the core curriculum for psychiatry residents in training programs across the country, albeit exposure to forensic psychiatry is limited, and again there tends to be little integration between the training provided in forensic psychiatry and its application to general psychiatry.

The first Postgraduate Year-6 (PGY-6) residents in forensic psychiatry will begin training in July, 2012. The only Canadian university currently recognized by the RCPSC to provide such training is the University of Toronto. It seems probable, given that U of T is a major training centre and has been “first off the mark,” that only a limited number of other academic programs will apply for such recognition. This in turn will likely lead to many Canadian residents travelling to a small number of accredited programs for their training. This is likely to contribute to an uneven distribution of specialized forensic knowledge. That being said, both British Columbia and Quebec will likely establish training programs in the future, for regional, linguistic, and statutory reasons. The University of Ottawa will also likely become a training centre.

Forensic psychiatrists who have practiced 20 hours or more will be permitted to sit a qualifying exam in 2013. Beyond this, individuals entitled to describe themselves as subspecialists in forensic psychiatry will have to complete the one-year training program in PGY-6 at a recognized institution. Historically, residents wishing further forensic training have typically taken two-year fellowships, often with a research component. Reducing the subspecialist training period to one year may affect residents’ abilities to complete research during training – a predictor of future research output.

As an overview, the content areas to be covered in PGY-6 training include the following:

- outpatient and inpatient mental-health assessments of fitness and criminal responsibility
- longitudinal care, rehabilitation, and risk-mitigation of the forensic client
- child and adolescent forensic psychiatry
- correctional psychiatry
- assessment of civil matters (typically disability or sequelae of trauma)
- assessment of sexual behaviours (both clinically and psycho-physiologically)
- complex long-term violence risk assessments (e.g., dangerous offender or long-term offender proceedings)
- forensic research methodology

- forensic report preparation
- expert testimony
- the Recovery framework, as applied to forensic care
- culturally competent forensic assessment
- forensic clinical content across the lifespan
- administration of forensic facilities

4.3. Continuing Professional Development

While the Centre for Forensic Science and Medicine could in some respects be considered a natural “home” for the continuing education of forensic psychiatrists, there is little common ground between topics typically covered at CFSM and the clinical or academic practice of forensic psychiatry.

Accordingly, most forensic psychiatrists will engage in continuing professional development on a somewhat ad hoc basis, supplemented by attendance at annual meetings of professional societies serving forensic psychiatrists (see below).

In the spirit of knowledge transfer, The University of Toronto will make the core training program for PGY-6 residents available to all academic staff.

5. Research

Research in forensic psychiatry is typically collaborative, involving both forensic psychiatrists and forensic psychologists. Active areas of research include risk assessment, and, in particular, risk management/mitigation, along with clinical sexology.

Most of our forensic research takes place in Ontario (in particular at the University of Toronto, at the University of Ottawa, through Correctional Services Canada, and at Queen’s University), and in British Columbia (through the Forensic Services Commission, affiliated with the University of British Columbia).

Major barriers to research (and perhaps more importantly to knowledge transfer) include:

- The diversity in forensic practice means that applicable research is disseminated through a host of different journals, and channelled through a host of different professional bodies
- Forensic practice tends to be segregated from other practices, leading to work in silos. Better outcomes could result from collaboration

- Many forensic psychiatrists are seduced by the income gradient that exists between academic and clinical practice, leading to low research output
- Demand for clinical work is high
- Ethical issues impact research methodology, compromising the quality of risk mitigation research
- Many funding bodies do not consider forensic research part of their “mainstream” mandate

5.1. Research and Publications

There is no forensic psychiatry journal in Canada, save the newsletter of the Canadian Academy of Psychiatry and the Law (CAPL) – the national body representing forensic psychiatrists in Canada. This newsletter is geared more to information-sharing than publication of original research.

The Journal of the American Academy of Psychiatry and the Law tends to contain more original research, but generally speaking original research is spread across a host of journals published in the UK, Australia and New Zealand, the United States, Canada, and elsewhere.

The relatively recent formation of the International Association of Forensic Mental Health Services, and their quarterly journal, will be of benefit in terms of standardization, knowledge transfer, and convergence of research interests.

6. Professional Organizations and Groups

Among the groups representing the interests of Canada’s forensic psychiatry community are:

- The Canadian Academy of Psychiatry and the Law (CAPL)
- The International Association of Forensic Mental Health Services (IAFMHS) (whose 2014 annual meeting will be held in Toronto)
- The National Working Group (NWG), bringing together management representatives from Canada’s three largest forensic facilities

In recent years, there has been renewed interest in participating in the Canadian Academy of Psychiatry and the Law, likely as a result of the upcoming 2013 subspecialist

examinations and the PGY-6 program. This should improve interprovincial communication and standardization of practice.

There is also a law and mental health section of the Mental Health Commission of Canada. It is hoped this body may help with national data gathering, stigma issues (which continue to present a major challenge for the field), and field-wide collaboration. It may also help reign in the inexorable growth of Canada's forensic systems, and the high degree of variability between forensic systems and services (length of stay, application of statutory and case law tests, risk assessment and management procedures, etc.)

7. Conclusions

Forensic psychiatry as an organized specialty of medicine has developed an extensive medicolegal contribution to the justice sector. The advent of residency training by the Royal College of Physicians and Surgeons of Canada is an important step in the recent history of forensic psychiatry. Although the academic mandate is developing, there is great room for growth and developments.



Conclusion and Recommendation

1. Principles

This document is intended as an introduction to a much larger and inclusive discussion, and is not intended to cover every discipline in Canadian forensic science. We begin our conclusions with first principles that emerged from our discussions:

1. Forensic science is an integrative activity. Cases are complex, and are analyzed by many experts whose competencies straddle different fields. Elucidating the ‘truth’ of a case means uncovering verifiable facts and then offering a defensible, evidence-based opinion of the meaning of those facts. The practical consequence of this integrative approach is a multidisciplinary service-delivery model. This means solutions to mutual problems require a multidisciplinary approach.
2. The expert-knows-best paradigm of expert witness testimony is obsolete, and thankfully has been replaced by a system where experts are accountable to the public for explaining why they hold the views they do, and defending those views with reference to current scientific evidence.
3. Forensic science has evolved from parent core-scientific disciplines, but the overarching principles of those core disciplines still apply: That is, a healthy intellectual climate means embracing the virtuous cycle of **service, teaching and research**. Although there is no shortage of service to be done in Canada, there are many scientific discoveries to be made and generations of young minds to nurture. We should give as much attention to teaching and research as we do to service, because they are every bit as important.

2. Conclusions

A number of common themes emerge from the forgoing chapters. It is clear the forensic science system – the system that is supposed to deliver this service to Canadians – is a patchwork of contributions across different public institutions. We respectfully offer these conclusions:

1. Forensic science wants for a lack of a national granting agency. Forensic science generates novel questions and issues quite distinct from the common run of mainstream scientific problems, which means it does not fit well into the mandate of existing agencies, such as CIHR, NSERC, SSHRC, and CPRC. We respect the fact that these agencies have an envelope of funding that is fixed and under increasing pressure, but we do see forensic science falling between the cracks of Canada's network of granting agencies.
2. There is no culture of research in Canada's forensic science community. This trend may be driven in part by workload and in part by lack of funding, both of which have been discussed above. This lack of research culture directly and negatively impacts Canada's capacity to train the next generation of forensic scientists and practitioners.
3. The low number and geographically scattered nature of Canada's population finds its echo in the low number and geographically scattered number of forensic scientists in Canada. Creating a critical mass of scientists and practitioners in any one place is difficult, and effectively networking the various components of the forensic community is even more so. In particular, there appears to be a dissonance between the community of academic forensic scientists and public-sector forensic-science practitioners.
4. Forensic science has suffered from the patchwork of provincial and federal agencies, responsibilities and paymasters. A unified strategy on any aspect of public policy is made more complex when an activity spans the grey zone between municipal, provincial and federal mandates, and forensic science is no exception.
5. Training in the forensic sciences happens in a number of universities, institutions, and agencies, and under a patchwork of legislative mandates. These entities do not coordinate their efforts, with respect to either content or recruitment. There is no agreement on the content and standards of training for most disciplines on a national level, with a few laudable exceptions. (e.g., forensic pathology and forensic psychiatry.) Unsurprisingly, there is no national forensic science human resources strategy.
6. One of the most basic questions in forensic science is, who is an expert? Credentialing of forensic scientists in Canada is absent for some disciplines, fragmentary in others, not universally accepted as necessary or desirable by some, and in any case not lawfully mandated for most disciplines in Canada.

3. Recommendations

3.1. Research

1. A research culture should be fostered in Canada.
2. National tri-council granting agencies should recognize the forensic sciences, including forensic pathology and forensic psychiatry, as a distinct area of interest, and funding should be specifically targeted in this group of disciplines.
3. Universities should develop strategic and sustainable forensic research programs.
4. Collaborative research programs should be developed between scientists at universities and practitioners at forensic science institutions.
5. Canadian universities should establish research chairs in the various disciplines of forensic science, forensic pathology and forensic psychiatry.
6. Researchers should be encouraged to publish their findings in peer-reviewed journals.
7. Statistical, probabilistic approaches to problems in the forensic sciences should be developed.
8. Research methodologies in the forensic sciences should be objective and evidence-based.
9. Research that addresses cultural dimensions of the practice of forensic science should be encouraged.

3.2. Education and Training

1. Multidisciplinary cross-training should be encouraged between scientists, police, lawyers and judges.
2. Scientists should obtain training and continuing education in best practices in writing reports and giving expert witness testimony.
3. Internet-based training modules for forensic-identification officers and scientists should be developed.
4. Master's and doctoral-level, research-focused degrees within the various forensic sciences should be developed in Canadian universities.

5. Graduate and postgraduate training programs in forensic pathology, forensic psychiatry and forensic nursing should continue to be supported.
6. Secondment programs for established forensic practitioners should be developed and financially supported.
7. Judges should receive continuing education in forensic science, forensic pathology and forensic psychiatry, including basic training in ‘scientific literacy’.

3.3. Best Practices

1. International guidelines and standards (for example, the publications of scientific working groups – SWGs) could be adopted for use in Canada. Canada’s forensic scientists should participate in the formulation of these where possible, and then the appropriate organization should collate and distribute them.
2. Standards and best practices should be developed by applying proven methods for the formulation of these documents, for example, using the Alcohol Test Committee of the Canadian Society of Forensic Science as a template.
3. Practitioners should develop and participate in professional certification.
4. Organizations that provide forensic science services should develop accreditation standards and participate in accreditation programs.
5. Practitioners should embrace professionalism and adopt strong codes of ethical practice.
6. Recognizing the harmful effects of bias, a culture of scientific neutrality in all practitioners is required and should be encouraged. This applies equally to all experts, irrespective of their paymaster.
7. A systemic response to error is needed when it occurs. After each adverse event, an analysis and recommendations should be developed to insure a relevant and sustainable approach. We note with regret that, at present, the public inquiry is the primary mechanism for remediation after a miscarriage of justice occurs, if the error is detected at all.

3.4. Administration and Regulation

1. Memoranda of understanding (MOU) or similar instruments should be developed between fee-for-service forensic scientists and service end-users.

2. Funding models that emphasize full-time personnel over fee-for-service providers should be developed within existing budget frameworks. In particular, forensic nursing and forensic pathology would benefit from this reform.
3. The policies and procedures of medicolegal death investigation systems should be brought into alignment with current thinking on the best practices in forensic pathology.
4. Standards should be developed in each of the forensic disciplines with respect to workload.
5. Peer review and other quality management systems should be developed in each of the forensic disciplines. Collaboration across provincial boundaries should be encouraged in this respect.
6. Career paths for forensic-identification officers should be developed, allowing long-term professional commitment to this important activity. This will help develop expertise and specialization.

4. Concluding Remarks

The science that serves as the underpinning of so many court cases in Canada requires scrutiny. The volunteerism, good intentions, and *ad hoc* organizational efforts of Canada's forensic scientists are no substitute for a thoughtfully designed system of service delivery. Other jurisdictions, including the United States, have begun the process of critically evaluating these systems, and Canada cannot afford to lag behind her peers in this respect. Why is this so important? Because we Canadians hold that peace, order and good government are our most fundamental values. Establishing and maintaining a just peace is thus *the* core mission of government, and a just peace cannot rest on a foundation of bad science.



APPENDIX A

Declaration of Conflict of Interest for participants

I have no conflict of interest to declare:

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The views expressed in this report do not necessarily reflect the policy position of my employer:

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APPENDIX B

Registered Nurses as Medical Examiners and Coroner Officers, by Province

Medical Examiner Office/Coroner Office	Nursing Status
Prince Edward Island	Nurses not involved in death investigation.
New Brunswick	Nurses may function as fee-for-service coroners A coroner may have a law, nursing or general medical background
Ontario	Nurses not involved in death investigation.
Manitoba	Nurses are active as medicolegal death investigators in Manitoba.
Saskatchewan	The Chief Coroner is a nurse. Approximately 3 nurses have current appointments as coroners. Coroners must have a law or medical background.
Alberta	Most but not all death investigators are nurses.
British Columbia	Some coroners are nurses
Nunavut	The Chief Coroner is a nurse.
NWT	The Chief Coroner is a nurse. Other coroners come from a variety of backgrounds.
Yukon	Some coroners are nurses. RCMP and volunteer coroners (32 total) do all investigative work
Newfoundland	Nurses are not involved in death investigation. Police officers do all medicolegal death investigation in Newfoundland and Labrador.

APPENDIX C

Forensic Nursing for the Living: A Provincial and Territorial Breakdown

Newfoundland	One program in St. John's.
Nova Scotia	The SANE Program is funded by the Nova Scotia Department of Health, and coordinated by the Antigonish Women's Resource Centre in partnership with Guysborough Antigonish Strait Health Authority (GASHA) and St. Francis Xavier University (STFX).
Prince Edward Island	The SANE program has been proposed but is not yet in place.
New Brunswick	The SANE program is based out of Saint John Regional Hospital, and there is a SANE coordinator in Moncton, NB.
Quebec	Information not currently available
Ontario	35 Sexual Assault/Domestic Violence Treatment Centres that use SANEMs who have been trained through centralized provincial training. Approximately 40-50 nurses trained annually. Scope of practice is determined locally but many programs use Medical Directives for the provision of health care.
Manitoba	The SANE program is located at the Health Sciences Centre, Winnipeg
Saskatchewan	Only one certified sexual assault nurse examiner (SANE) in Saskatchewan; this person is also the co-ordinator of the program in the Regina Qu'appelle health region.
Alberta	Edmonton and Calgary have SANE programs.
British Columbia	Approximately seven SANE programs exist in British Columbia.
Yukon	Unknown
Nunavut	Unknown

APPENDIX D

Forensic Nurses in Canada: Profiles of those mentioned in this paper who have leadership roles in education, research, administration and practice

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APPENDIX E

Forensic Identification Personnel Within Canada's Police Workforce²⁹

	SQ	RCMP	Toronto	OPP	Ottawa	Winnipeg	Saskatoon	St. John
Sworn Police Officers	4,519	18,833	5,376	4,521	1,161	1,295	409	170
FIS	48	296	90	110	29	36	13	7
FIS: Police	1:94	1:68	1:59	1:41	1:40	1:36	1:31	1:24
Civilians	5	27	40	30	6	16	1	2

²⁹Yaacoub TY, Dionne PM, Fraser N, Haring P, Oattes B, Stewart C, Weatherall M. *Examining the Evidence: A Clear Call for Change, Forensic Science & Identification Services*, RCMP, Ottawa, 2008. ISBN 978-0-662-05487-0

APPENDIX F

Major Scientific Controversies by Forensic Discipline

Discipline	Major Scientific Controversies	Policy/Systems Issues
Forensic Anthropology	Use of race; use of data from limited skeletal collections that doesn't reflect variability in population of question	Case referral system/stakeholder understanding is barrier to effect use; inconsistency across the country
Forensic Biology	Low template DNA amplification; use of DNA databanks for investigative aid information	Missing persons DNA index; evaluation, approval & use of point of collection analytical devices
Forensic Entomology	Lack of funding limits research in some areas, limiting some analyses	Case referral system/lack of stakeholder understanding is barrier to effect use of workforce
Forensic Nursing	Utilization of forensic evidence in sexual assault/domestic violence	Stabilization of workforce; recognition by CAN; standards; minimum education; credentialing
Forensic Odontology	Error rates in bitemark analysis; development of scientifically sound language & terms in bite-mark analysis	Certification of specialists; coordination and homogenization of standards of case; definitive approach to malpractice/liability assurance
Forensic Pathology	Time since death; post-mortem artifact; shaken/abused infants; 'negative' autopsies; death in police custody	Structure of death investigations systems
Forensic Physical Sciences: Bloodstain Pattern; Friction Ridge; Footwear & Tire track Analysis	Bias; threshold for identification; error rates; limitations of methodology; establishment of objective, quantifiable measures for identification; similar bloodstain patterns with opposite opinions & scientific basis of both	Blind verification; case audit & review of SOPs; standard report writing; certification of examiners; accreditation of units; review existing areas of overlapping service delivery
Forensic Physical Sciences: Firearms	Establishment of objective, quantifiable measures for identification	Review of existing areas of overlapping service delivery
Forensic Psychiatry	Cannot ethically do RCTs for interventions; heterogeneity of content areas; work in silos	Exponential service growth

Forensic	Alcohol or drug-induced	Lack of new instruments/facilities, low
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Discipline	Major Scientific Controversies	Policy/Systems Issues
Toxicology	automatism; research to improve science and statistical/quantitative methods on population-level studies required, especially for impaired driving to reduce miscarriage of justice	workforce & hiring freeze results in longer turn-around time, fewer analyses, and less credible science in court due to use of inappropriate individuals used as experts

Service, Education and Research by Forensic Discipline

Discipline	Service	Education	Research
Forensic Anthropology	Generally good quality; limited capacity	3 PhD programs with specialized FA opportunities	Considerable research but lacks strategic approach; lack of funding
Forensic Biology	Good quality; insufficient capacity as demand continues to increase; laboratories accredited	Undergraduate programs available; no graduate programs; limited continuing education for practitioners	Limited capacity due to workload, lack of graduate programs & linkages with university research programs
Forensic Entomology	Good quality; small workforce; underutilized	No formal programs; limited graduate-level opportunities with few appropriate mentors; Board Certification available	Lack of funding inhibits development of research programs, graduate training and hiring of university faculty
Forensic Nursing	Good quality but highly variable across country due to lack of awareness; variable workforce/capacity	No formal university programs; no certification or accredited programs	Limited; no systemic approach
Forensic Odontology	Good quality but highly variable across country and workforce aging; lack of uniformity due to lack of national strategy and funding	No formal programs; limited undergrad coursework available; some graduate training available as part of clinical specialty	No systematic approach; lack of funding limits research & development of programs at universities
Forensic Pathology	Good quality; severely limited capacity; additional forensic pathologists needed	Only one active residency training program	No strategic approach or research capacity; largely case-report based
Forensic Physical Sciences: Bloodstain Pattern;	Good quality; limited & insufficient capacity as job complexity increases	No academic programs; in-house technical training uniform through 2 organizations (OPC/CPC); 1 year understudy &	Limited capacity due to lack of funding, lack of academic degree or research training, workload; case-based

Discipline	Service	Education	Research
Friction Ridge; Footwear & Tire track Analysis		certification programs available; development of University based-BSc's linking with OPC/CPC training required	and not strategic
Forensic Physical Sciences: Firearms	Good quality; Quality assurance programs; small but adequate workforce	No discipline-specific academic programs available; BSc minimum requirement	Limited capacity due to lack of academic institution affiliations; workload; largely reactionary
Forensic Psychiatry	Generally good quality; generally sufficient workforce	RCPSC PGY-6 in place; 1 formal program, otherwise on-the-job training	Limited capacity due to workload, lack of funding, lack of PhDs
Forensic Toxicology	Good quality – limited capacity due to low workforce, lack of new instruments/testing facilities; laboratories accredited	No discipline-specific academic programs available, no graduate programs, lack of funding/support for continuing education/professional development	No strategic approach; little capacity due to workload, lack of funding, lack of research training or graduate programs, lack of linkages with university research programs

