REPORT

ON

FORENSIC SCIENCE MATTERS

TO THE

COMMISSION OF INQUIRY

RE: JAMES DRISKELL

DOUGLAS M. LUCAS MSc, DSc (Hon)

August 17, 2006

CONTENTS

I. INTRODUCTION

James Driskell was convicted at Winnipeg, Manitoba in June, 1991 of the murder of Perry Harder. Following a review of the conviction by the Minister of Justice for Canada, a new trial was ordered in March, 2005, however, Crown Counsel directed a stay of proceedings. On December 07, 2005, The Honourable Patrick LeSage, QC was appointed a Commissioner to inquire into certain aspects of the trial including "*the role of the RCMP Laboratory in the prosecution of James Driskell, and to review any systemic issues that may arise out of its role*."[1]

On May 01, 2006, I was retained by the Commission Counsel, Michael Code, to review and prepare a report on the forensic science aspects of the Commission's mandate.[2] This is my report.

A. Context

Mr. Harder disappeared from the Winnipeg area on June 16, 1990. His body, in an advanced state of decay, was discovered on September 30, 1990 in a shallow grave. There was evidence of disturbance of the body by animals. At the autopsy it was determined that Mr. Harder had been shot in the chest with a .22 cal. firearm. Constable CW Pearson of the Winnipeg Police Department Identification Section submitted items of physical evidence to the RCMP Forensic Laboratory Services (FLS) Laboratory in Winnipeg on several dates including October 12, 1990 when the ones of interest to this review were submitted.[3] The submission document stated that

> "*There are suspects in this case, but no arrests at this time. A van has been seized that is believed to have been used to transport the body to the grave site.*"

Most of the items were received by Mr. Tod Christianson, a Hair and Fibre Section Specialist in the Laboratory. They included purported known hairs of Mr. Harder from the grave site and items from a van that had been owned by Mr. Driskell including a carpet and vacuumed debris from its cargo area. Mr. Christianson was requested to examine a hair, the vacuumed debris and the cargo area carpet from the van for any hairs similar to those believed to be Mr. Harder's. He was also asked to examine some fabric and debris from the grave site and articles of clothing believed to be Mr. Harder's for any fibres similar to those used in the construction of the cargo area carpet from the van.

---

[1] Order in Council re: Driskell Inquiry, December 07, 2005

[2] Letter of Retainer, M Code to D Lucas, May 01, 2006. (A copy of my CV is on file with the Commission.)

[3] "*Request For Analysis/Examination of Exhibits*" form prepared by Constable CW Pearson dated 90-10-12

Following his examinations, Mr. Christianson reported to Cst. Pearson that one hair from the vacuumed debris and two from the van carpet were consistent with those believed to be Mr. Harder's but no fibres similar to those of the carpet were found on any of the exhibits examined.

Mr. Christianson testified about his examinations and findings at the trial of Mr. Driskell in June, 1991. He explained what he meant by "*consistent with*":

> *"So if the hair is consistent, that means it either came from the same person as that known sample or from somebody else who has hair exactly like that."* [4]

On June 06, 2002, microscope slides (presumably as prepared by Mr. Christianson) containing the known (K) hairs and the three questioned (Q) hairs which Mr. Christianson had found to be consistent with the Ks were submitted to the UK Forensic Science Service (FSS) Laboratory in Birmingham, England. There, the hairs were analyzed for mitochondrial DNA (mtDNA) by Mr. John Edward Bark, an experienced DNA analyst. He concluded that his findings:

> *"----provide extremely strong support for the proposition that the hairs from the van originated from three individuals, none of whom was Perry Harder."*[5]

B. Process

This review has involved reading (or re-reading) a number of technical research papers and other documents dealing with forensic hair comparisons, reviewing relevant FLS policies and procedures, and examining relevant documents from Mr. Christianson's personnel file.[6] A meeting was attended in Toronto on June 08, 2006 with Dr. John Bowen, FLS Chief Scientific Officer, Jon Dawe (Assistant Commission Counsel) and David Gates QC (RCMP FLS Counsel). Dr. Bowen subsequently provided a number of documents and facilitated my visit to FLS Winnipeg June 26-28, 2006. A second meeting with Mr. Dawe in Toronto occurred on July 28, 2006.

In Winnipeg, the FLS Winnipeg Hair and Fibre (H&F) Section laboratory file (90-1296) was examined in detail with Mr. Christianson on June 27, 2006. He also provided a tour and description of the areas in the Laboratory in which he had performed his examinations. During this visit, Mr. Wayne Greenlay (the current General Manager of FLS Winnipeg and FLS Regina), and Mr. James Cadieux (currently the FLS National Case Manager but in 1990/91 the FLS Winnipeg H&F Section Head) were also interviewed and provided very helpful insights into the

---

[4] Transcript of Testimony of Tod Christianson in R. v Driskell pp. 148/149

[5] FSS Statement of John Edward Bark re: James Driskell, 02 December, 2002, p. 5

[6] A list of all the papers, files and documents reviewed is provided at the end of this report.

Laboratory operations, both as they were in 1990/91 and as they are today.

As with any review such as this, it has been important to attempt to assess the work that was done in the context of what was generally accepted practice in forensic science in the 1990/91 time period. This was a time of considerable change in forensic science due in part to the impact of the then rapidly developing discipline of DNA profiling and, perhaps even more significantly, the growing influence of accreditation requirements on laboratory management and operations. Some comparisons with the way things are generally done in forensic science laboratories in 2006 are provided throughout this report.

II. FORENSIC HAIR COMPARISON[7]

A. Background

Although there are a few references in the early twentieth century scientific literature to papers dealing with the microscopic comparison of hairs for forensic science purposes, this type of examination did not become common until around the middle of the century. As an increasing number of forensic scientists developed experience and expertise with these examinations and created a larger body of scientific literature, such comparisons became well established as one of the common types of trace evidence examinations (paint, glass, soil, fibres etc.) A recent review of the subject lists one hundred literature references about hair examinations.[8]

Until the introduction of DNA profiling in the late 1980s, the generally accepted method for comparison of hairs was microscopic examination. Even after DNA analysis became more common, it was not widely used on hair because hair does not lend itself to nuclear DNA (nDNA) analysis unless there is tissue attached to the hair root. In addition, the early technique for DNA analysis - Restriction Fragment Length Polymorphism (RFLP) - was not very sensitive and success rates with hair were low. After the mid-1990s, when much more sensitive PCR (Polymerase Chain Reaction) techniques became the norm, application of DNA analysis to hair became more common in forensic science.

Another type of DNA, mitochondrial DNA (mtDNA) which can be applied to the hair shaft, was introduced to forensic science in 1994 by the FSS in the UK and in 1996 by the FBI in North America. Because it is a complex and expensive process, mtDNA is not widely used (as

---

[7] It is important for the reader to know that I have never performed hair and fibre examinations. My knowledge of the subject is general only and is derived from my experience as a forensic laboratory director, as an accreditation inspector, and as a consultant.

[8] Houck, MM and RE Bisbing; *"Forensic Human Hair Examination and Comparison in the 21st Century"*; Forens. Sci. Review, Vol. 17, 51-66 (2005). This is a very useful source of general information on this subject for anyone who wishes to learn more about it.

compared with nDNA) and only a relatively few laboratories have the capability to perform this type of analysis. (For example, the number of laboratories reporting nDNA results in a large international forensic proficiency testing program is about 125 whereas the number reporting mtDNA is only about ten.[9]) Neither FLS nor the Quebec or Ontario forensic laboratories analyze mtDNA.

B. Microscopic Examination of Hair

Examination of hair in forensic science is used to determine if an item is a hair (as opposed to a synthetic fibre), whether it is human or animal, the part of the body from which it originated (e.g., scalp, pubic, facial, other body part), and race (e.g., Caucasian, Oriental, Negroid.) Comparison of hairs for the purpose of possible association or elimination of a common source, is based on comparison of macroscopically and microscopically visible characteristics. The two charts on the following page[10] illustrate the types of characteristics normally examined. These have been shown by research and experience to be useful for the discrimination of hairs
between individuals.

Because there is a degree of variability in the (for example) scalp hairs of an individual, in practice a good "*known*" sample of hair must be representative of the range of variation across the various regions of the individual's scalp. This requires that a large number of hairs (up to one hundred) be collected from the scalp by both combing and pulling. The K hairs are then examined macroscopically and by low power microscopy to select a smaller number (6 - 10) that are representative of the range. These are then mounted on microscope slides and the Q hairs are compared with them using a comparison microscope at about 200x to 400x magnification. Significant differences in characteristics result in eliminations. Q hairs which a skilled examiner determines to have the same arrangement, distribution, and appearance of microscopic characteristics as one or more of the K hairs along their entire length, are deemed to be microscopically similar.[11]

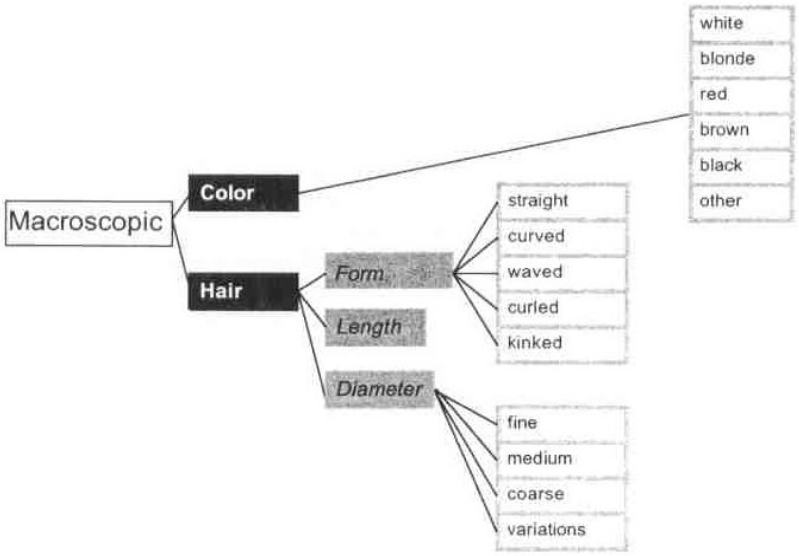
Since the comparisons are strictly visual, the validity of the results is very much dependent on the training, experience and judgement of the examiner, as well as on the quality of the samples. It is generally accepted, however, that well trained and experienced hair examiners can effectively determine that a Q hair did not originate from the same source as a K sample or, assuming a valid sample, that they are microscopically similar and could have originated from the same source (or another source with the same characteristics.) Since it is known that two

---

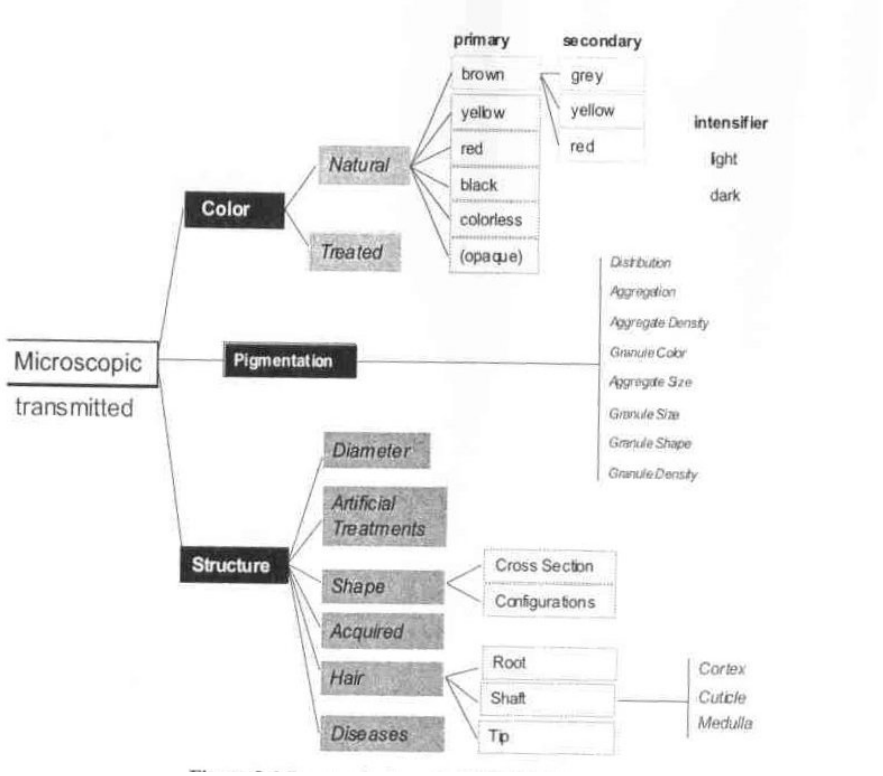
[9] Personal communication, Collaborative Testing Services Inc., Sterling, Virginia

[10] From the above Houck and Bisbing review pp. 56/57

[11] Deedrick, DW; "*Hair, Fibres, Crime, and Evidence*"; Forens. Sci. Communications, Vol. 2 Number 3 (2000)



Macroscopic Hair Characteristics



Microscopic Hair Characteristics

individuals can have hairs that are microscopically indistinguishable, coincidental "*matches*" can occur. Thus, regardless of the examiner's expertise, it can never be stated on the basis of microscopic comparison that two hairs did come from the same individual.

The significance of a conclusion of microscopic similarity cannot be expressed in any numerical fashion as, for example, with DNA profiles or with conventional blood groups. There are no equivalent databases of microscopic hair characteristics to permit population distribution statistics to be determined. Because the observable characteristics vary within the hair from an individual and because they change with age and treatment, such databases would be neither practical nor useful.

The above description represents the general view of microscopic hair comparison in forensic science in 2006 and as it was in 1990/91. The only change has been a reduction in the number of cases to which it is applied, e.g., those in which nDNA analysis is not possible or is not successful, and in the number of examiners performing microscopic hair examinations. The FLS Laboratories, for example, stopped performing microscopic hair comparisons in 2001/2002.[12] Some hair examiners may also now express their conclusions more conservatively than they did in earlier times.

C. DNA Analysis of Hair

As noted above, human hairs can be analyzed for mtDNA and, if there is any tissue attached, for nDNA. The latter is much more discriminating than the former however, because the hairs typically encountered in forensic casework are more likely to be telogen (dormant or degenerative growth phase) rather than anagen (active growth phase)[13], they may have little or no nucleated material and therefore be less amenable to successful nDNA analysis.

Mitochondrial DNA varies less between individuals than does nDNA and is therefore much less discriminating. Also, unlike nDNA which is inherited from both parents, mtDNA is inherited only from the maternal side. As a result, siblings and relatives linked on the maternal side have the same mtDNA profile and cannot be differentiated by mtDNA. In addition, it is possible (although not common) for an individual to have two different mt DNA sequences.[14]

III. HAIR AND FIBRE EXAMINATIONS IN THE HARDER CASE

---

[12] Dr. John Bowen, personal communication

[13] Houck, MM and RE Bisbing; "*Forensic Human Hair Examination and Comparison in the 21st Century*"; Forens. Sci. Review, Vol. 17, 51-66 (2005), p. 61

[14] FSS Statement of John Edward Bark re: James Driskell, 02 December, 2002, p. 10

A. Mr. Christianson's Qualifications

Tod Christianson graduated from the University of Manitoba with a four year BSc degree in chemistry in 1984. During his undergraduate years, he spent two summers as an intern in the H&F Section of FLS Winnipeg. Following graduation in 1984, he joined the RCMP as a civilian member and was assigned to the H&F Section of FLS Winnipeg. He then began a formal understudy training program in the Laboratory with two experienced examiners, D Ogilvie and D Doll, serving as his mentors.[15]

In 1984 (and in 1990/91), FLS was a large forensic laboratory system consisting of six operational laboratories in Vancouver, Edmonton, Regina, Winnipeg, Ottawa and Halifax. It had a strong central scientific and administrative support staff at its headquarters in Ottawa. Each discipline had a Chief Scientist responsible for ensuring appropriate common standards within the discipline across the entire system. Training was one of the functions for which the Chief Scientist had oversight responsibility. In the H&F discipline in the mid-1980s, the Chief Scientist was Barry Gaudette, an internationally respected hair and fibre specialist.

Although training in hair and fibre examination was done on an understudy basis in most forensic science laboratories, FLS was atypical (for a non-accredited lab[16]) in that its training program was formal and structured. In addition to a Methods Manual, the discipline had a written Training Manual[17] which included a separate Instructor's Guide.

The training program had an expected average duration of fifteen months and was divided into four phases:

Phase 1	Introduction, Microscopy and Hair Identification - approx. 2 ½ months.
Phase 2	Hair comparison - approx. 4 months
Phase 3	Fibre Identification and Comparison, Textile Examination, Physical Matching and Physical Comparison - approx. 6 months
Phase 4	Further Study, Research Project and Preparation for Court Testimony -approx 2 ½ months.

[15] Statement of Tod Christianson to Commission Counsel, 17 May, 2006

[16] Accreditation of North American forensic laboratories began in 1982 but by 1990 the number of accredited labs was still relatively small. In Canada, the Ontario Centre of Forensic Sciences was the first to be accredited in 1993 by ASCLD/LAB. FLS labs began preparation for accreditation in the mid- to late 1990s and the first lab to be accredited by the Standards Council of Canada was FLS Edmonton in 2000. FLS Winnipeg was accredited in September, 2001.

[17] Hair and Fibre Section Training Manual (including Instructor's Guide); Revised version February, 1985 with subsequent revisions in 1987, 1988 and 1989. A similar version would have been in place in 1984.

Each phase included reading assignments, practical exercises, twenty-one practical examinations and four written examinations in addition to instruction in, and practice of, basic skills. Practical test # 21 (the final test) required comparison of one hundred Q hairs with one K sample. This test was considered to be a major challenge for all understudies. It was prepared and graded by the Chief Scientist. Mr. Christianson received a grade of 41 out of a possible 50 on it.

For the time (and indeed even today), this was an impressive training program.

Mr. Christianson received above passing grades (the passing grade was 70%) on all of his written and practical examinations and was therefore certified by Mr. Gaudette as having completed the training program in October, 1985. As a result he was recommended by his Section Head and Lab Manager at FLS Winnipeg for promotion from Forensic Science Laboratory Specialist (FSLS) 1 to FSLS 2.[18] This was the journeyman level (i.e., fully functional but non-supervisory) within FLS.

Mr. Christianson's annual Performance Evaluations prepared by his Section Head were reviewed for the years 1985 through1992. They indicate a progression from "*satisfactory progress*" through "*fully satisfactory*" and "*valued member of the System*" to "*performed consistently above the level of his peers.*" By 1989, he was considered as qualified for promotion to FSLS 3 if an opening arose.

Although they are post 1991, there are records in Mr. Christianson's personnel file of two hair proficiency tests which he took. Both were prepared and graded by the Chief Scientist in Ottawa. The 1994 test consisted of ten Q scalp hairs and two Ks. Mr. Christianson reported no Type II errors (incorrect associations) and two Type I errors (incorrect eliminations.) In the 1996 test (five Qs and two Ks), he reported no errors. Records for both of these tests were reviewed. He also remembers a third test in which he had no Type II errors and one Type I error. During an interview, Mr. Christianson explained the Type I errors as being attributable to his conservative approach to his H&F work.

After completing his H&F training, Mr. Christianson took a Fibre Microscopy Course from McCrone Associates in 1989 and a Forensic Infrared Spectroscopy Course at Queen's University in 1990.

I am satisfied that Mr. Christianson was fully qualified to perform the H&F examinations in the Harder case.[19]

---

[18] Tod Christianson Personnel File

[19] In 1992, FLS merged the H&F Sections in all its laboratories with the Serology Sections thus creating new Biology Sections. Mr. Christianson began cross training in DNA analysis but continued performing H&F examinations until 1999. When FLS was reorganized in 2002 and the Biology Section in Winnipeg was closed, he became the Case Manager of the Case Receipt Unit in Winnipeg, the position he currently occupies.

B. Hair and Fibres Section Methods Manual

As with its training procedure, FLS was also atypical for a non-accredited lab in that it had a formal written Methods Manual.[20] In addition, general standard operating procedures (SOPs) for practices such as exhibit handling, note keeping, report reviews etc., existed in written form in the Laboratory Services Manual (LSM).[21] Although accredited labs are now required to have such documents, it was still quite common in 1990/91 for forensic labs to have less formal SOPs, either unwritten and transmitted by word of mouth, or often in the form of individual collections of written procedures, memos or copies of literature papers.

The section on hair examinations in the Methods Manual consists of about thirty pages covering such topics as, contamination prevention, exhibit searching, macroscopic examination, microscopic examination, cosmetic treatments of hair, sample conclusions, testimony and an extensive bibliography. The methods described are well-written, thorough and are, for the most part, in keeping with what was the general practice of microscopic hair comparison at the time.

Minor departures from what was then general practice include the following:

1. Magnification - The Methods Manual states that:

> *"100x and 125x are the magnifications most commonly used. Higher magnifications are used when more detail is required. Lower magnifications are used when a wider field of view is required.*"[22]

This magnification is lower than many hair examiners would use. Various literature references recommend magnifications of 40x - 400x [23,24], 40x - 250x[25], and 300x[26]. On the other hand, much

---

[20] Hair and Fibre Section Methods Manual (1983 with revisions in 1984 and 1986)

[21] Laboratory Services Manual (28 April, 1993): Chapter 2 *"Laboratory Operations - General"*. This version is identified as an "*Update and Revision"* of an earlier version.

[22] H&F Methods Manual, III.C.4.b

[23] Houck, MM and RE Bisbing; *"Forensic Human Hair Examination and Comparison in the 21st Century"*; Forens. Sci. Review, Vol. 17, 51-66 (2005), p. 58

[24] Deedrick, DW; "*Hair, Fibres, Crime, and Evidence*"; Forens. Sci. Communications, Vol. 2 Number 3 (2000)

[25] Houck, MM and B Budowle; "*Correlation of Microscopic and Mitochondrial Hair Comparisons*"; J. Forens. Sci., Vol. 47, 1-4, (2002), p.2

[26] The Centre of Forensic Sciences; "*Hair Information Sheet*" (ca 2004)

of the research by Barry Gaudette (the principal author of the Manual) was performed with a magnification of 100x, e.g.,[27] which had proven satisfactory.

2. Contamination Prevention - in the section on "*Contamination Prevention*"[28], there is no reference to wearing gloves during examinations. There are, however, requirements that "*Lab coats are always worn when handling exhibits*" and "*A different clean lab coat is used for examining clothing from the suspect(s) than is used for examining clothing from the victim(s)*". Prior to the late 1980s, it was not common practice for forensic scientists to wear protective gloves when examining exhibits. It is therefore not surprising that they were not mandated in a manual prepared in the early to mid-1980s. The practice became more common in the late 80s/early 90s and is now virtually universal.

3. Verification - There is no reference in the Manual to a verification procedure for "*positive*" comparisons. It was common practice in some forensic science disciplines, e.g., firearms/toolmarks, latent prints, for such comparisons to be observed and verified by a second qualified examiner. In some laboratories in which there was more than one qualified hair examiner, this was also the practice for hair/fibre examinations e.g.,[29]. It was not, however, universal practice in 1990/91.

4. Conclusions - In the section on "*Sample Conclusions From Hair Comparison.*"[30] five possible conclusions are described: "*Strong Positive; Positive; Negative; Strong Negative";* and "*Inconclusive.*" The latter three are quite straight forward. The suggested wordings for "*Strong Positive*" and "*Positive*" conclusions are, however, identical:

> "*The human scalp hairs removed from exhibit O are consistent with having originated from the same person as the hairs in exhibit K (reportedly from the accused.*)"

No criteria are provided in the Manual for distinguishing between "*Strong Positive*" and "*Positive*" conclusions. The only difference appears to be that the following "*Remarks*" could be included with a "*Strong Positive*" conclusion:

> *"At present, hair is not a positive means of personal identification. However, in*

---

[27] Gaudette, BD and ED Keeping; "*An Attempt at Determining Probabilities in Human Scalp Hair Comparison*"; J. Forens. Sci., Vol. 19, 599-606 (1974), p. 603

[28] H&F Methods Manual, II.C

[29] Houck, MM and B Budowle; "*Correlation of Microscopic and Mitochondrial Hair Comparisons*"; J. Forens. Sci., Vol. 47, 1-4, (2002), p.1

[30] H&F Methods Manual, Appendix III-1

this case, because of the large number of hairs in agreement between the questioned hair and the known sample (and/or because of the unusual characteristics possessed by both the questioned hair and the known sample), the possibility that the hairs removed from exhibit O originated from anyone other than the accused would be extremely remote."

While all forensic hair examiners would agree with the first sentence, not all would agree with the final expression. Because of the lack of population distribution data for microscopic hair characteristics, there was no unanimity among hair examiners in the 1990/91 period about ways to express the significance of a "*positive*" hair comparison. Some would go no further than "*could have come*" while others (particularly those who specialized exclusively in hair and fibre comparisons) would use phrases such as "*remote possibility*."

Currently, it is more common to see conclusions in such cases expressed along the lines:

"Hair comparisons are not a basis for absolute personal identification. It should be noted, however, that because it is unusual to find hairs from two different individuals that exhibit the same microscopic characteristics, a microscopic association or match is the basis for a strong association."[31]

or:

"*The Q hairs are microscopically similar to the K hairs and could have come from that source or another source with similar hairs."* [32]

5. Testimony Guidelines - In the section on "*Guidelines Concerning Testimony*"[33], the advice provided is that "*conclusions should be stated in the same way they are written in the laboratory report.*" It goes on:

"When asked to elaborate on these conclusions or when directly or indirectly asked questions as to the significance of hair comparison evidence, a response such as the following should be given:

"When careful examination by a qualified examiner indicates that a questioned hair is consistent with a known hair, there are two possibilities. Either the hair actually originated from that source, or there was a coincidental match. Since it

---

[31] Deedrick, DW; "*Hair, Fibres, Crime, and Evidence*"; Forens. Sci. Communications, Vol. 2 Number 3 (2000)

[32] The Centre of Forensic Sciences; "*Hair Information Sheet*" (ca 2004)

[33] H&F Methods Manual, Appendix III-5

is possible for two different people to have hairs which are indistinguishable by present methods, it is known that coincidental matches can occur in forensic hair comparison. However, based on my knowledge and experience as a hair examiner, I am of the opinion that such coincidental matches are a relatively rare event. The explanation that the questioned hair actually originated from the known source is generally the more likely of the two."

As with the wording of conclusions discussed above, not all examiners would have agreed with the last two sentences.

C. Mr. Christianson's Examinations[34]

Mr. Christianson received the exhibits from Cst. Pearson of the Winnipeg Police Department on October 12, 1990, probably in Room 250[35] in the Laboratory. During this transfer process, there would have been discussion about the case and the nature of the examinations to be performed. There would also have been some "*triage*" of the items to select those most likely to provide useful information. Most of the exhibits were then stored in the walk-in freezer of the Laboratory (Room 243) until removed for examination.

There are no dates on Mr. Christianson's work notes indicating when the examinations were performed[36] but he remembers working on the case between Christmas and New Years and believes he probably performed most of the hair examinations in early January, 1991.[37]

There are a number of changes or corrections (overwrites or scratch outs) in the handwritten notes. These were acceptable in 1990/91 but would not meet the accreditation requirements of today; changes may only be made with single, initialled strikeouts.

Two apparent inconsistencies in his work notes were discussed with Mr. Christianson. The "*Exhibit Work Sheet*" for exhibit 36 (fabric from the grave site) is checked as "*negative*" for fibres but the "*Fibre Data Work Sheet*" for this exhibit indicates three fibres that were not consistent with the van carpet. The "*Exhibit Work Sheet*" for exhibit 141 (the van carpet) indicates 24 scalp hairs but the hair comparison work sheet lists 25 hairs of which two are

---

[34] Most of this information is derived from a review of Mr. Christianson's laboratory case file and personal discussion with him on June 27, 2006.

[35] Copies of the floor plans of FLS Winnipeg are included as an Appendix to this report.

[36] Such dates were not required by the H&F Methods Manual nor by the LSM. It was not common in non-accredited labs for such dates to be included in the work notes. They are now required by accreditation programs and by the FLS Quality Manual Section 8.2.2

[37] Personal Statement of Tod Christianson to Commission Counsel, 17 May, 2006

animal. Mr. Christianson was unable to offer any explanation for these minor inconsistencies. They may, however, provide an indication of the thoroughness of the case file review process described below.

The procedures used were essentially those which Mr. Christianson had been trained to use and which are outlined in the Methods Manual. The K hairs would have been laid out on a white enamel tray on a table in Room 212. Mr. Christianson remembers being somewhat surprised that the K hairs in exhibit 42 from the grave site were in quite good condition considering their origin and opined that they constituted a good sample. He would have macroscopically selected from the mass in exhibit 42 six hairs covering the range of macroscopic characteristics e.g., length and colour, and mounted these individually on 25 mm x 100 mm microscope slides marked "*A*" to "*F*". Fifteen to twenty of the remaining hairs would then have been mounted on a 75 mm x 100 mm microscope slide (the "*bulk mount*"). Each slide would have been marked with the file and exhibit numbers, the number of hairs, their lengths and his initials as required by the Methods Manual.[38]

The carpet from the cargo area of the van (exhibit 141) was examined in Room 211 using a low power mobile microscope. The twenty-five hairs observed were removed with bare fingers or forceps. Although Mr. Christianson explained that he does not know any details about the van (e.g., make, model, year) or its usage, based on his previous experience with carpets from the trunks of vehicles, he was surprised at the number of hairs recovered from this type of exhibit. These Q hairs were mounted individually on 25 mm x 100 mm microscope slides and labelled.

Most of the other exhibits were examined in Room 210 using a stereo microscope. Nine hairs were recovered from exhibit 134 (vacuumed debris from the van), one of which turned out to be animal. These also were mounted and labelled individually. Twenty-one Q fibres were found on seven of the exhibits (36, 60, 76, 78, 93, 115, and 134) but, although they required a significant amount of microscopic comparison work, none were subsequently found to be consistent with the fibres of the van carpet. Mr. Harder's clothing, exhibits 115 (a jean jacket) and 116 (a sweat shirt), were in such poor condition that Mr. Christianson did not bring them into the H&F Section area but chose to examine them in Room 130, a storage area in the basement. Nothing of interest was found on them. There would have been little value in looking for fibres from Mr. Harder's clothing on the exhibits from the van because the sweat shirt was not an outer garment and the jean jacket would have been of blue denim fibres which are ubiquitous and of little evidential value.

One hair (exhibit 140) recovered from the van by the police was submitted in a separate vial and was mounted as the other Q hairs.

The microscopic comparisons of the mounted Q hairs with the mounted K hairs would have been made at a magnification of 100x–125x using a comparison microscope in Room 214.

[38] H&F Methods Manual, III.C.2.a.iv

The process is described in the Methods Manual.[39] This detailed work would have been done over the course of several days because it is quite intensive and visual fatigue can limit effectiveness. Comparisons which were not clear-cut would have been revisited, sometimes several times. Eventually, Mr. Christianson concluded that hair Q5 from exhibit 134 was consistent with K hair A from exhibit 42, hair Q13 from exhibit 141 with a hair on the bulk mount (this hair would have been marked on the slide with a pen), and hair Q29 from exhibit 141 with another hair on the bulk mount. These comparisons would have been 1:1 along the entire length of the hairs. Although hair Q29 was described in his notes as "*broken*", Mr. Christianson believed that the break must have been just above the root allowing an almost complete 1:1 comparison or he would have not called it "*consistent*". These examinations and conclusions were as described in the Section Manual:

> *"If the questioned hair fits within the range of characteristics of the known sample and also is similar in all major characteristics to at least one hair with the known sample, its characteristics varying in a similar manner along the length of the shaft and across the diameter (cross-section), then the questioned hair is said to be consistent with having originated from the same person as the known sample."*[40]

All of the other Q hairs were sufficiently different from the Ks to be marked as "*not consistent*" with the Ks. The Section Manual states:

> *"If the dissimilarities between the questioned hair and the known sample are not quite so marked as in III.C.4.f.i, but are still sufficient for elimination purposes, it is stated that the questioned hair is not consistent with the known sample."*[41]

There is minimal detail about the observations on the Q hairs in Mr. Christianson's work notes. He advised that this was normal practice in the H&F Section (and in many other forensic laboratories) at the time. The Methods Manual states:

> "*Questioned hairs are described only to the extent that they are dissimilar to a standard sample*" and "*If a questioned hair is similar to one or more hairs from a known sample, this is noted and only the length of the hair, the condition of the root, and any unusual features are described.*"[42]

---

[39] Ibid, III.C.4

[40] Ibid, III.C.4.f.iv

[41] Ibid, III.C.4.f.ii

[42] Ibid, III.C.4.d

Mr. Christianson believed that this policy was changed sometime later, possibly in the mid-1990s, and the same "*Hair Data Worksheet*" form used to describe K hairs was then used to describe Q hairs as well. (This was confirmed through review of the two proficiency tests performed by Mr. Christianson described above; the one done in 1994 has the brief descriptions of the Q hairs seen in his notes in the Harder case but the later test in 1996 has the Q hairs described in more detail on the same form as the Ks (but in somewhat less detail than the Ks.)

The current LSM states that:

> *"Case Notes will record in detail all examinations, testing and analyses done in the case, and include the interpretation of data obtained. Notes are made at the time of observation and are incorporated in the Working File in their original format."* [43]

No photographs were taken of the "*consistent*" hairs. Mr. Christianson stated that it was not H&F Section practice to photograph positive comparisons (and it was not required by the Methods Manual) because such photos had "*the potential to be misleading*." While such photographs were sometimes taken in other forensic laboratories during this period, they were not common practice.

Mr. Christianson also advised that no one else in the Section looked at the hairs he examined. As discussed above, this was not required by any policy in effect at the time. He believes that sometime in the mid- to late 1990s, probably after the Kaufmann report[44], it did become normal practice for another H&F examiner to look at forensically significant comparisons under the microscope.

Several of the exhibits received (122-127) were not examined; these had been taken from Mr. Harder's truck. Mr. Christianson had been informed that Mr. Driskell was known to have been in this truck and so believed there would be no evidential value in finding hairs or fibres attributable to Mr. Driskell on these exhibits. The absence of such fibres also would be of no value since "*absence of evidence is not evidence of absence*."

No K hairs were received from any suspects or other potential sources of hair in the case. While it would be normal practice to request such samples, and Mr. Christianson believes such a request would have been made, such samples are not always provided.

There is only one notation in the work notes about a discussion with an investigator. It deals with a discussion about Mr. Christianson's reasons for not performing some examinations that had been requested. It was not then normal practice to record conversations or discussions

---

[43] Laboratory Policies and Procedures Manual (June 17, 1998 with subsequent revisions): Chapter 2 "*Laboratory Operations - General*", I.1.d

[44] Kaufmann, The Honourable Fred; "*The Commission on Proceedings Involving Guy Paul Morin*", 1998

with investigators in the work notes. This practice changed following the Kaufmann Report.

D. Mr. Christianson's Report

Mr. Christianson's Forensic Laboratory Report dated 91.01.09 is in the standard, structured format described in the LSM which suggested sections headed "*GENERAL*", "*PURPOSE*", " *METHODS*", "*RESULTS*", "*CONCLUSION*", "*REMARKS*", and "*DISPOSITION OF EXHIBITS*"[45], except that it does not contain sections labelled "*METHOD*S", "*RESULTS*", or "*DISPOSITION OF EXHIBITS*". The disposition of the exhibits is included in the "*REMARKS*" section of Mr. Christianson's report, and his results are incorporated into the "*CONCLUSION*" section.

The "*PURPOSE*" of the examinations is stated in the Report to be:

> "*To examine Exhibits 134, 140, and 141 for the presence of any scalp hairs consistent with having originated from the same individual as the known scalp hair samples, Exhibits 42 and 48, purportedly from the deceased.*" and "*To examine Exhibits 20, 36, 44, 47, 60, 76, 78, 93, 94, 95, 115 and 116 for the presence of any textile fibres consistent with those employed in the construction of Exhibit 141.*"

It was not common practice in most forensic laboratories in 1990/91 to include such an explicit statement of purpose in their reports. Since most labs direct their reports to the investigator, the purpose would be considered implicit rather than being explicitly stated. The "*PURPOSE*" stated reflects the examinations requested by the investigator.

The wording of Mr. Christianson's conclusions follows the guidelines provided in the Methods Manual as discussed above.

> *"a. Scalp hairs consistent with having originated from the same person as the known scalp hair samples, Exhibits 42 and 48*[46] *purportedly from the deceased, were found as follows:*
>
> *Exhibit 134: one (1) scalp hair*
> *Exhibit 141: two (2) scalp hairs*
>
> *b. No textile fibres consistent with those employed in the construction of Exhibit 141 were found on any of Exhibits 20, 36, 44, 47, 60, 76, 78, 93,*

[45] Laboratory Services Manual (28 April, 1993): Chapter 2 "*Laboratory Operations - General*", J.2

[46] According to his work notes, Mr. Christianson did not use the known hairs in Exhibit 48 for his comparisons.

94, 95, 115 or 116."

There was nothing particularly distinctive about the K hairs; they were described in his notes as *"blonde"* to "*medium warm brown*", 75 to 105 mm in length, the pigment was small and uniform, the texture was smooth, etc. Mr. Christianson advised that he considered the comparisons to be "*Positive*" but not "*Strong Positive*" as described in the Manual. He explained that his interpretation of "*consistent with*" was that *"the chances are not very high that the hairs originated from different sources*.[47] Based on the microscopic characteristics described, many hair and fibre examiners would have agreed with this explanation although most would have added that the basis for this conclusion was that the hairs were "*microscopically similar*", or some such description.

The two page Forensic Laboratory Report is briefer than what would have been the general practice in such a case in many forensic labs in the 1990/91 period. Mr. Christianson stated that it was normal practice in the FLS to not include mention in the Report of, for example, non-matching scalp hairs such as the seven in exhibit 34, the one in exhibit 140, and the twenty-two on exhibit 141. The policy about reports in effect in 1991 included the following guidelines[48]:

> *"RESULTS – states briefly the results obtained from the analysis of physical evidence or hypothetical data."*
>
> *"CONCLUSION – fully addresses the PURPOSE of the analysis and states the forensic significance that the analyst was able to deduce from the results obtained."*

It was more general practice in forensic labs in this period to include in their reports information about all their findings, such as the number of hairs found on an item, even those which were not consistent with the knowns. Such information may or may not be of any value to anyone in a particular case, something which is often unknown to the forensic scientist.

The current FLS Policy Manual describes a similar format for reports except that the word "*briefly*" has been deleted from the description of "*Results*", and the "*Conclusion*" is to describe:

> *"The forensic significance that the examiner was able to deduce from the results obtained in answering the purpose of the analysis or examination of the exhibit material. When applicable, significance is discussed in terms of associations*

---

[47] Personal discussion with Mr. Christianson, June 27, 2006

[48] Laboratory Services Manual (28 April, 1993): Chapter 2 "*Laboratory Operations – General*" J.2.a.4 and 5

which can or cannot be drawn between:

1. parties involved in the occurrence which led to the request for analysis,

2. locations of the occurrence which led to the request for analysis and/or

3. objects involved in the occurrence which led to the request for analysis."[49]

E. Supervisory Review of the Case File

It is normal practice now in forensic laboratories for laboratory reports to be subjected to an "*administrative review*" (for editorial correctness and consistency with laboratory policy) and a "*technical*" or "*peer review*" (a review of the notes, data and other documents which form the basis for a scientific conclusion.[50]) A technical review can only be adequately performed by someone with the relevant technical qualifications; an administrative reviewer does not require such qualifications.

In 1990/91, the LSM required what were essentially administrative reviews by both the Section Head and the Assistant Laboratory Manager of all reports issued by their staff.[51] Both of these reviews were for "*congruence between PURPOSE and CONCLUSION*", "*correct spelling and grammar*" and, in the case of the Assistant Laboratory Manager, for "*readability from the recipients perspective.*" The review of the report by the Section Head also included "*scientific validity*" in its requirements. It is not clear how scientific validity could be assessed from a review of only the Laboratory Report.

The Section Head was also required to:

"Review and initial the work notes of at least 10% of the requests for analysis received by each specialist and technologist in your section on a bi-monthly basis."[52]

This would constitute a technical review. James Cadieux, Mr. Christianson's Section Head at the time of the Harder case, advised that he performed technical reviews on most of the H&F Section

---

[49] Laboratory Policies and Procedures Manual (June 17, 1998 with subsequent revisions): Chapter 2 "*Laboratory Operations - General*", J.2.a.4/5

[50] Glossary in the ASCLD/LAB Accreditation Manual (2003)

[51] Laboratory Services Manual (28 April, 1993): Chapter 2 "*Laboratory Operations – General*" J.4.&5

[52] Ibid, section I.4.a

case files and would have done so in the Harder case. This review would not, however, have required him to examine the evidence hairs (his initials would have appeared on the relevant case notes if he had). Because this review was limited to a paper review, both Mr. Christianson and Mr. Cadieux agreed that it would not have been capable of validating Mr. Christianson's conclusions because of the minimal descriptions in the work notes of the Q hairs.

In the Harder case file, these reviews were documented with the initials of the Assistant Lab Manager and the date 91-01-09 on the main file copy of Mr. Christianson's Laboratory Report and those of the Section Head dated 91-01-11 on the H&F Section file folder. The master case file folder (containing the case files prepared by each of the Sections involved in the case) bears the initials of the Assistant Lab Manager and the date 90-10-03 (the date the master file was opened) and the initials of the FLS Winnipeg Lab Manager dated 91-10-11. The former indicated confirmation that the case met the requirements for acceptance i.e., it originated with an authorized user agency and dealt with a criminal matter, while the latter indicated a review of the Laboratory Report made during a scheduled Quality Review by the Lab Manager.

The current Policy Manual requires four different reviews to be conducted before a final report is released.[53] Three of these are essentially administrative reviews and the fourth is technical. The technical review is described as:

> *"A complete reinterpretation of the data and observations that have been collected in the Working File. This review assesses the validity and adequacy of the tests applied in the case, the reliability of the data collected, the soundness of the interpretation of that data and the degree to which conclusions answered the original question."* Also, *"the reviewer must have appropriate scientific or technical knowledge and experience."*[54]

F. Mr. Christianson's Testimony

Based on the transcript of Mr. Christianson's testimony at the trial of Mr. Driskell[55], his testimony was, for the most part, quite straight forward and in accordance with what most other hair and fibre examiners with the same observations would have given at the time.

In direct examination, he accurately described his qualifications and there was no challenge to them. He described the items he examined as they were listed in his report (including exhibit 48 which, as noted above, he did not examine), and the examinations he made

---

[53] Laboratory Policies and Procedures Manual (June 17, 1998 with subsequent revisions): Chapter 2 "*Laboratory Operations - General*", I.1.i.2

[54] Ibid, section B.6 "*D-Review*"

[55] Transcript of Testimony of Tod Christianson in R. V. Driskell (Date unknown)

of them. His description of the Q hairs he compared with the K hairs and his conclusions about them ("*consistent with*") were also in accordance with his report.

In response to a question from Crown counsel about what he meant by "*consistent*" he responded:

> *"And when I say that a hair is consistent, as I have in this case, that means that the hairs have all of the features that the known samples have, within normal biological variation, and there's nothing, nothing that you would – – that you can't account for. So that if there was some feature, for example an abnormal colour or something like that, that would cause that hair to be eliminated. So, it falls exactly within the range of the variation of the known sample with no unaccounted for differences whatsoever."*[56]

As sometimes happens in oral testimony, what was said in the above paragraph and what was intended do not quite gibe. During our interview, Mr. Christianson agreed that what was intended was that all of the characteristics observed in the Q hairs could be found within the K sample rather than the reverse.

He then went on to testify:

> *"And the point about this type of analysis is that it's not a positive identification, all right, because the only way you could do that is to look at all the hairs from all the person's head* (sic) *that exist, and that's an impossibility. But I can tell you, based upon my experience, that the chances of just accidentally picking up a hair and having it match to a known sample are very small. So if the hair is consistent, that means it either came from the same person as that known sample or from somebody else who has hair exactly like that."*[57]

This statement is in accordance with his training and would be agreed with by virtually all hair examiners, with the exception of the mention of the chances of a random match being "*very small*", which some might not agree with .

In cross-examination, Mr. Christianson quite properly responded in the affirmative to a suggestion that "*you can't make a positive examination but you could narrow it down considerably?*"[58] He then went on, in response to questions about population distribution of hairs, to say that he didn't know what the numbers would be and that:

---

[56] Ibid p. 148

[57] Ibid pp. 148/149

[58] Ibid p. 151

"In fact, I specifically address only the questioned hairs and the known sample that I'm dealing with, and I conduct my comparison only on those, and I don't consider the possibilities of other people, only the standards that I am looking at."

This is an important point and one that is often not recognized by some hair examiners or by persons reading or hearing their conclusions. Hair examiners can generally quite accurately distinguish between hairs with differing microscopic characteristics. That is what they do in the laboratory. This is quite a different thing, however, from distinguishing between hairs from different people, particularly if the population of potential sources is large or unknown.

During cross-examination, Mr. Christianson also acknowledged that he could not determine how or when the hairs got onto the van carpet, and that he did not receive known hairs from any other source. He also explained why he did not look for hairs similar to Mr. Driskell's in items from the grave site or in Mr. Harder's vehicle.[59] These explanations were quite reasonable.

There is one example of unfortunate wording that might be interpreted as indicating a possibility of bias on Mr. Christianson's part. In outlining a discussion with the investigator he testified:

"And so the idea was to try and establish some association between the deceased and the accused's vehicle, which I believe was a van."[60]

It is not clear whether this is a description of the investigator's "*idea*" or Mr. Christianson's. If the latter, it would have been more appropriate to say that his objective was to look for hairs on the van carpet and compare them with hairs from the grave site. If the former, it reasonably describes what the investigator was looking for.

In an attempt to assist the court in understanding the significance of his "*consistent with*" conclusion, Mr. Christianson provided a presumably well-meaning but not particularly relevant analogy:

"And in order to give you a sort of a guideline or a rule of thumb to determine how much weight to put on that, you can look around the room and just see how many people even have similar hair styles. If you look at one hair and you examine those 20 features, it's got even more information than you can see by looking at different lengths of hair and different colours and different hair styles. That's not to say that you can't accidentally meet somebody or two people on the

[59] Ibid p. 155

[60] Ibid p. 155

street that have exactly the same kind of hair, just like sometimes you accidentally mistake one person for another, but the chances are not very high. So that's basically what hair comparison is like."[61]

The relevance of hair styles to microscopic hair comparison is not particularly apparent.

G. The FSS mtDNA Report

As noted in the Introduction, microscope slides containing the K hairs and the three Q hairs which Mr. Christianson had found to be consistent with the Ks were submitted to the UK Forensic Science Service (FSS) Laboratory in Birmingham, England in June, 2002. There, the hairs were analyzed for mtDNA by Mr. John Bark. In his report, Mr. Bark stated that:[62]

"The techniques employed are extremely sensitive. Wherever possible a sample is tested twice. Obtaining the same result from two independent tests provides confidence that the sequence obtained relates to the item under test and has not arisen from contamination during the analysis."

Further:

"Where a mitochondrial DNA sequence differs at one or more positions the results indicate that the hair and the reference sample are from different individuals. The strength of this conclusion increases with the number of differences." [63]

He reported that hair Q5 (from the vacuumed debris) had four differences from the K hairs, Q 13 (from the carpet) had nine differences from the Ks, and Q 29 (from the carpet) had five differences from the Ks. Each of the Qs also had multiple differences from each other.[64] As a result, Mr. Bark concluded that: [65]

"The mitochondrial DNA findings do <u>not</u> support the proposition that the hairs found in the van originated from Perry Harder." (Emphasis in the original)

"The findings provide extremely strong support for the proposition that the hairs

---

[61] Ibid p. 149

[62] FSS Statement of John Edward Bark re: James Driskell, December 02, 2002, p. 3

[63] Ibid, p. 4

[64] Ibid, p. 6

[65] Ibid, p. 5

from the van originated from three individuals, none of whom was Perry Harder."

It should be noted that "*extremely strong*" is the highest of seven rankings of support used by the FSS to explain the value of a "*match or non-match*."

Since microscopic hair comparison and mtDNA analysis are based on totally different parameters, it is not surprising that the latter sometimes provides a different conclusion from the former. Hair examiners, including Mr. Christianson, acknowledge that more than one person can have hairs that are microscopically similar. What is surprising is that the mtDNA results in this case indicate that the Q hairs likely came from three different persons, all of them different from the source of the K hairs.

During our discussion on June 27, 2006, Mr. Christianson stated that he was very surprised by Mr. Bark's findings. Despite the considerable thought he has given to the mtDNA conclusions, he is unable to explain the differences.

The only possible explanations for the different conclusions[66] (assuming that the hairs examined by Mr. Christianson and Mr. Bark were the same hairs) are:

1. Mr. Christianson's findings of similar microscopic characteristics for the hairs were incorrect, or
2. Mr. Bark's analyses were not correct, or
3. The microscopic similarities of the hairs was a chance occurrence.

As discussed above, so far as is known, no one other than Mr. Christianson has actually looked at the hairs under a microscope and his work notes are not sufficiently detailed to permit an assessment of the validity of his observations. The only way to confirm his observations would be for another qualified examiner to examine the hairs microscopically. Given their history and the fact that at least some portion of them has been removed for the mtDNA analysis, a second microscopic examination may not be feasible or even helpful.

While the FSS work notes have not been examined, the quality assurance procedures of the FSS are well known to be very thorough. The differences between the hairs as reported by Mr. Bark are quite clear and are based upon "*two independent tests*".

[66] Although the possibility of the hairs being contaminated, before or during their original collection, during Mr. Christianson's examination of them, or during their removal from the slides for the mtDNA analysis, is real, it would be expected that such contamination would be limited to the surface of the hairs. I would assume that the FSS protocol for their mtDNA analysis would ensure that any such contamination is removed. Even if it was not removed, it would seem unlikely that such contamination would be from three different persons. I have not therefore considered contamination as a possible explanation.

The possibility of the conclusions being a chance occurrence seems remote but must be considered.

IV. POTENTIAL SYSTEMIC ISSUES

As noted in the Introduction to this report, one of the mandates of the Commission is:

> *"to consider the role of the RCMP Laboratory in the prosecution of James Driskell, and to review any systemic issues that may arise out of its role.*"

To assist in this regard, I was asked to "*report on any systemic concerns that arise from your review.*"[67] Although I have described in the body of the report a few practices or procedures which I believe were not generally accepted in the forensic science community in 1990/91 (and certainly not in 2006), none of them, in my opinion, rise to the level of being considered "*systemic issues.*"

There are, however, a few matters which the Commission may wish to discuss as potential systemic issues and, possibly, to make recommendations about. These will be discussed here.

A. The Value of Microscopic Hair Comparison

Insofar as the RCMP FLS is concerned, this topic is no longer relevant. In April 2001, FLS decided to phase out microscopic hair comparison and the last case was reported in April, 2002.[68] Also in 2002, FLS went though a major restructuring as a result of which FLS Winnipeg ceased operations in all forensic science disciplines except Toxicology.

Hair examinations in FLS are now restricted to determining whether they are of human or animal origin; if human whether they possess a root sheath suitable for DNA analysis; and, if suitable, the body area of origin.[69] These examinations are made in the Evidence Recovery Units (ERUs) which are located in FLS Vancouver and Ottawa. (An example of changes in procedures between 1990/91 and 2006 is provided by the fact that, although microscopic hair comparisons are no longer made, ERU examiners, who determine only the suitability of a hair for nDNA analysis and the body area of origin, are required to "*submit the hair(s) and work notes to*

---

[67] Letter of Retainer, M Code to D Lucas, May 01, 2006

[68] FLS Memo from the Acting Program Manager Evidence Recovery and Biology Services, "*Summary of Policy Changes re: Forensic Hair Examinations*" (July 16, 2003)

[69] Evidence Recovery Unit Methods Guide (May 01, 2003 with subsequent revisions)

another Search Technologist/Search Coordinator for peer review."[70])

While some other forensic labs may have adopted a policy similar to that of FLS with respect to hair comparisons, such comparisons continue to be performed in many labs. The basis for this is articulated in the 2005 Review by Houck and Bisbing:[71]

> *"Despite the clamoring of a few legal experts for the wholesale demise of forensic hair examinations [89,90][72] , a considered microscopical analysis of hairs by a qualified forensic hair examiner can add immeasurable value to both the investigative and judicial phases of a case. The literature of hair microscopy and genetics is rich and full; multiple sciences, including anthropology, biology, chemistry, histology, and molecular biology, contribute to this peer-reviewed literature. Forensic hair examiners would be wise to immerse themselves in it."*

They went on:

"Mitochondrial DNA has galvanized the use of hair as evidence and, when combined with microscopical examination, has enhanced its significance. Microscopy is not a 'screening' test and mtDNA analysis is not a 'confirmatory' test – Either method can provide probative information to an investigator. One approach is not superior to another as both analyze different characteristics."

Another paper by different authors from a mtDNA laboratory states[73]**:**

> *"We have observed cases where the microscopic evaluation was discordant with respect to mtDNA analysis, however, we have observed many cases in which the microscopic evaluation was concordant with respect to the mtDNA analysis. In these cases, a microscopic evaluation performed by an experienced examiner was extremely useful in limiting the number of hairs which were then recommended for DNA testing. Therefore, we advocate hair microscopy as an adjunct to DNA testing, if the examiner is experienced and understands the*

---

[70] Ibid, section IV.2.F.1.e

[71] Houck, MM and RE Bisbing; "*Forensic Human Hair Examination and Comparison in the 21st Century*"; Forens. Sci. Review, Vol. 17, 51-66 (2005), p. 63

[72] Citation 89 in the original is: Starrs J, "*From bad to worse: Hair today — Scorned tomorrow*"; Scientific Sleuthing Review 21:1; 1997. Citation 90 is: Strauss MAT, "*Forensic characterization of human hair I*"; Microscope 31:15; 1983

[73] Melton, T, G Dimick, B Higgins, L Lindstrom and K Nelson; "*Forensic Mitichondrial DNA Analysis of 691 Casework Hairs*"; J. Forens. Sci., Vol. 50, 73-80 (2005), p. 80

limitations of this largely descriptive science. Because of the high cost of mtDNA analysis, it is likely that hair microscopy will long be a useful tool for screening of large numbers of hairs prior to submission and we urge the continued training and availability of hair examiners to aid the DNA testing community."

Although these two sets of authors have somewhat different takes on the usefulness of microscopic hair comparison, they agree that it still has a place in forensic science. Another laboratory states an intermediate view of the value of such comparisons[74]:

"Forensic hair microscopy is good for exclusionary purposes. Within limits of the factors that affect the significance, it <u>can</u> be good for inclusionary purposes (though it <u>never</u> individualizes)." (Emphasis in the original)

Cases in which results are required quickly, appropriate samples are available, and the possible number of sources is known and limited, are the types of cases where microscopic hair comparison can be useful.

As discussed above, experienced hair examiners are very good at discriminating between hairs with different characteristics. For example, in his seminal research on the topic, Barry Gaudette[75] reported that 366,630 comparisons were made between 861 hairs from 100 different individuals and only nine pairs were found to be indistinguishable.

However, the usual question in forensic science is not "*Are these two hairs indistinguishable?*", rather it is "*Are these two hairs from the same person?*" - quite a different challenge. Mr. Gaudette recognized this difference in a later paper when he stated:

"In my research, the population considered was not a population of people, but rather a population of hair comparisons." [76]

This distinction has not always been understood by some hair examiners and recipients of their results.

For example, in his original paper, Mr. Gaudette concluded that:

"----if one human scalp hair found at the scene of a crime is indistinguishable

---

[74] The Centre of Forensic Sciences; "*Hair Information Sheet*" (ca 2004)

[75] Gaudette, BD and ED Keeping; "*An Attempt at Determining Probabilities in Human Scalp Hair Comparison*"; J. Forens. Sci., Vol. 19, 599-606 (1974)

[76] Gaudette, BD; "*A Supplementary Discussion of Probabilities and Human Hair Comparison*"; J. Forens. Sci., Vol. 27, 279-290, (1982)

from at least one of a group of about nine dissimilar hairs from a given source, the probability that it could have originated from another source is very small, about 1 in 4500."

This statement has been frequently cited, generally misunderstood, and never widely accepted in forensic science e.g.,[77]. In Gaudette's paper, however, he reported that there were nine pairs of hairs from thirteen of the 100 persons in the study that could not be discriminated. One of the sources had at least one hair similar to three of the other sources and two sources had hairs similar to at least two other sources.

Houck and Budowle compared the results of cases in the FBI Laboratory between 1996 and 2000 in which both microscopic comparisons and mtDNA analyses of hairs were performed[78]. There were 170 microscopic hair comparisons which were analyzed for mtDNA. Of the 80 hairs which were microscopically associated, nine were excluded by mtDNA (about 11%). None of the 19 microscopic exclusions were associated by mtDNA.

During our discussion on June 27, 2006, Mr. Christianson stated that he believed that the chances of two "*consistent*" hairs being from two different persons are somewhere between 1 in 100 and 1 in 1,000. His basis for this belief is his experience and the 100 hair test he and all other FLS understudies were required to take. The apparent difference between the studies cited and Mr. Christianson's experience may be due to the fact that in most hair cases examined in a forensic laboratory, the hairs are not from a random population, and the number of potential sources is usually limited.

Current views in forensic science about the significance of microscopic hair comparison have been summarized by Deedrick[79]:

" The range of opinions concerning hair examinations includes:

Nothing about hair is comparable to the specificity of fingerprints, and at best, the probability of establishing identification from hair is no greater than the probability of determining identification using the ABO blood group system;

Research studies have shown that hairs from two individuals are

---

[77] Barnett, PD and RR Ogle; "*Probabilities and Human Hair Comparison*"; J. Forens. Sc., Vol. 27, 272-278 (1982)

[78] Houck, MM and B Budowle; "*Correlation of Microscopic and Mitochondrial Hair Comparisons*"; J. Forens. Sci., Vol. 47, 1-4, (2002)

[79] Deedrick, DW; "*Hair, Fibres, Crime, and Evidence*"; Forens. Sci. Communications, Vol. 2 Number 3(2000)

distinguishable; that no accidental or coincidental matches occurred; and that such accidental or coincidental matches would, in actual casework, be a relatively rare event; and

The significance of a hair match is a median point between the above statements."

In his report on the Morin Inquiry, Judge Kaufmann explored the issue of the use of microscopic hair comparisons quite extensively.[80] His formal recommendation was that:

"Trial judges should undertake a more critical analysis of the admissibility of hair comparison evidence as circumstantial evidence of guilt. Evidence that shows only that an accused cannot be excluded as the donor of an unknown hair (or only that an accused may or may not have been the donor) is unlikely to have sufficient probative value to justify its reception at a criminal trial as circumstantial evidence of guilt."

In his discussion of the recommendation he added:

"Nothing that I have said is intended to inhibit the ***informed*** *use by investigators of hair comparison evidence* ***for investigative purposes.*** *Similarly, nothing that I have said is intended to inhibit the use of this evidence for exclusionary purposes or to discriminate from within a finite group of persons who could have contributed an unknown hair."* (Emphasis in the original)

B. Impartiality in Forensic Science Laboratories

As discussed above, the forensic science work in the Harder case was performed, at the request of the Winnipeg PD**,** in the Winnipeg Forensic Laboratory of the Forensic Laboratory Services component of the RCMP. The H&F Section Head reported to the Manager of FLS Winnipeg who reported to the Assistant Commissioner FLS in Ottawa who in turn reported to the Deputy Commissioner National Police Services.

The FLS mission in 1990/91 was, and today is[81]:

"----supports the mission of the RCMP by continuously providing scientific and technical assistance to the Canadian criminal justice system through the delivery of a quality forensic service in a timely manner."

---

[80] Kaufmann, The Honourable Fred; *"The Commission on Proceedings Involving Guy Paul Morin"* (1998), pp. 311 - 324

[81] Laboratory Services Manual: Chapter 2 *"Laboratory Operations - General"* (28 April, 1993)

"The primary users of this service are Canadian law enforcement agencies involved in criminal investigations. Other users include government agencies whose mandate includes a law enforcement function."

"The ultimate users of this service are the criminal courts."

There is nothing apparent in any of the material that I have reviewed related to the Harder case that suggests in any way that the examinations, conclusions or testimony were somehow influenced by the fact that FLS Winnipeg was a component of a police agency. It is a fact, however, that, although there are many excellent forensic laboratories within law enforcement agencies, there have been instances of problems with some others e.g., the FBI Laboratory[82] and the Houston PD Laboratory[83]**.** There have also been problems in forensic laboratories that were not part of law enforcement agencies. Examples of these are described in the Kaufmann Report.[84]

In addition to law enforcement agencies, forensic labs are also administratively situated within prosecutor's offices, coroner/medical examiner's offices, health or other government departments, universities and colleges. Some lab systems are themselves a separate department of government or even a semi-autonomous government agency. There are also some private forensic labs. Most are funded directly by some level of government; others operate on a cost recovery basis or on a contractual arrangement with their clients. Regardless of organizational structure or method of funding, the vast majority of their work is for law enforcement agencies and the funding is therefore from government, whether directly or indirectly.

In most of the cases where there have been problems in forensic labs, the structure or administrative location of the laboratory had little or nothing to do with the cause. In the case of the Houston PD, for example, the problems were due in part to inadequate funding and partly to an almost total lack of scientific leadership. In the FBI Laboratory, one of the problems was the inability of some of the examiners, who were also sworn Special Agents with field investigation backgrounds, to distinguish between the standards of the field investigator and those of the laboratory examiner. In other labs, problems have related more to the competence or specific performance of individual examiners rather than to the structure of the laboratory.

In the Harder case, the work was performed by a qualified examiner using procedures that were well established and accepted. The staff and management of FLS are all civilians and

---

[82] Bromwich, Michael R; "*The FBI Laboratory: An Investigation into Laboratory Practices and Alleged Misconduct in Explosives-Related and Other Cases*", (April 1997)

[83] Bromwich, Michael R; "*Fifth Report of the Independent Investigator for the Houston Police Department Crime Laboratory and Property Room*", (May 11, 2006)

[84] Kaufmann, The Honourable Fred; "*The Commission on Proceedings Involving Guy Paul Morin*" (1998), pp. 256-291

there is strong scientific leadership. FLS Winnipeg is in a separate building, remote from any other police building.

If there is any issue associated with a competent forensic laboratory being within a law enforcement agency, it is primarily one of a perception of a lack of impartiality. After thoroughly considering this topic, Judge Kaufmann did not make any recommendation about the administrative location of a forensic laboratory. He did say, however:

> *"Since I am not convinced that removal of the Centre from its placement within the Ministry would have appreciable effect on its impartiality, the real issue is the **appearance** of impartiality. Dr. Tilstone framed the issue well: independence does not guarantee impartiality; but it can assist in removing an entrenched and deeply rooted perception of bias or level of distrust which exists."* (Emphasis in the original)

There is no question about the importance of objectivity and impartiality on the part of forensic scientists. They are virtues that may be elusive but which must be continuously strived for and for which forensic scientists and their supervisors must be constantly alert. Whether, a forensic scientist is within a law enforcement agency or some other more independent entity, makes little or no difference. Their principal clients will be law enforcement officers and the primary function, in the first instance at least, will be to assist investigations. As noted by William Rodger, the former Director of the Strathclyde Police Laboratory in Glasgow[85]:

> *"The function of the forensic scientist is to assist with the investigation of crime, which is carried out primarily by police officers. The forensic scientist, therefore, assists the police officers. To state that is in no way to state that the integrity of the forensic scientist is suspect.*"

There may be some management/logistical advantages to the laboratory being within a law enforcement agency; there undoubtedly are some to being outside of law enforcement. History, tradition, local politics, personnel, personalities and "*depth of pockets*" are examples of factors that impact on the location of a laboratory. Objectivity and impartiality are not among these factors; they are a given regardless of the organization.

C. Communication of Forensic Science Information

One of the challenges faced by all forensic scientists is how to effectively articulate the results and the significance of their examinations. This is particularly difficult for types of evidence for which definitive results or population statistics are not available. Most trace evidence types, including hair comparisons, are of this type.

[85] Rodger, WJ; "*Does Forensic Science Have a Future?*"; J. Forens. Sci. Soc., Vol 24 #4, (1984)

As noted above, Mr. Christianson's Report in the Harder case was very brief and contained only his conclusions with no indication of how they were arrived at. It was, however, in accordance with FLS policy at the time. His testimony also was generally similar to what most other hair and fibre examiners with the same observations would have given at the time.[86]

In his report on the Morin Inquiry, Judge Kaufmann made several recommendations about the wording of reports and testimony. He suggested that they should use language "*which is not potentially misleading*", and should not use terms such as "*match*" and "*consistent with*" in the context of hair and fibre comparisons. He specifically recommended that:[87]

> *"Certain language enhances understanding and more clearly reflects the limitations upon scientific findings. For example, some scientists state that an item 'may or may not' have originated from a particular person or object. This language is preferable to a statement that an item 'could have' originated from that person or object not only because the limitations are clearer, but also because the same conclusion is expressed in more neutral terms."*

I , and I suspect many other forensic scientists, are not among those who would use "*may or may not*" in a report. It is an absolutely meaningless expression that could be said by anyone without even making any examinations. Having said that, I do not have any perfect suggestion to make for expressing the significance of a hair comparison. The most commonly accepted one currently is along the lines of:

> *"The Q and K hairs are microscopically similar and could have originated from the same person or from another person possessing hair with the same microscopic characteristics. Microscopic hair comparison is not a means of personal identification."*

The basis for and limitations of hair comparison should be included in all reports and testimony.

---

[86] I have also been provided with partial transcripts of testimony by Mr. Christianson and Mr. Cadieux in three other cases. In a 1995 case (R. v. Starr), Mr. Christianson's testimony was very similar to that in the Harder case. During cross examination in response to a specific question he did go a bit further in explaining what chances being very small meant when he said "*Based on my experience it would be less than .1 percent.*"

In a 1992 case (R. v. Unger and Houlahan), Mr. Cadieux's testimony was similar to Mr. Christianson's in the Harder case. In cross examination, when asked to give a probability, he carefully referred to a published study without saying whether he agreed with it or not and quoted the Gaudette figure of one in forty-five hundred. In a 1997 case (R. v. Sanderson), Mr. Cadieux described hairs as being "*microscopically consistent*" He also referred to the preference for DNA analysis where possible and was not asked about probabilities. Otherwise his testimony is similar to the earlier cases.

[87] Kaufmann, The Honourable Fred; "*The Commission on Proceedings Involving Guy Paul Morin*" (1998), pp. 343/344

D. Internal and External Review

The limitations of the internal review of Mr. Christianson's work have been discussed above, as have the changes which have been made in the FLS policies dealing with case review.

In 1990/91, there was essentially no external general review of FLS work although there were periodic reviews made by headquarters staff from Ottawa. For non-accredited forensic labs, this was a common situation.

In 2006, this situation has changed dramatically. All FLS labs are now accredited by the Standards Council of Canada which requires that they have an extensive internal review system in place and that they undergo an intensive external review every two years. ASCLD/LAB accredited labs have similar requirements but are normally only audited externally every five years. There currently are over three hundred forensic science laboratories accredited by ASCLD/LAB.

Testimony monitoring is sometimes done by peer observation when feasible but is more commonly based on written requests for comment from prosecutors, defence counsel and judges.

Proficiency testing is mandated in accredited labs with each examiner being tested at least once per year. The tests are generally external and open (i.e., it is known that it is a test.) Blind tests (i.e., it is not known that it is a test) are extremely difficult to produce for many types of examinations and are therefore much less common.

Disclosure of complete forensic laboratory case files was not a common occurrence in 1990/91 but is much more common today and the contents of the files are significantly more comprehensive.

V. SUMMARY (The relevant section of this report appears in brackets.)

1. In 1990/91, when the Harder case was investigated, microscopic hair comparison was widely used and accepted in forensic science**.** Nuclear DNA was rarely used for hair comparison, and mtDNA had not yet been introduced for this purpose. (II.A)

2. It was (and still is) generally accepted that well trained and experienced forensic hair examiners can effectively determine that a questioned hair did not originate from the same source as a known sample or, assuming valid samples, that they are microscopically similar and could have originated from the same source (or another source with the same microscopic characteristics.) Regardless of an examiner's expertise, it can never be stated that two hairs came from the same individual to the exclusion of all others. (II.B)

3. Mr. Christianson was well trained and fully qualified to perform the hair and fibre examinations in the Harder case. (III.A)

4. The methods Mr. Christianson used for his examinations were well documented in a Methods Manual and were, with minor exceptions, generally accepted in forensic science. The exceptions were use of lower magnifications than commonly employed, no requirement for protective gloves during examinations, and no requirement for independent verification of conclusions. (III.B)

5. Mr. Christianson's work notes, although in accordance with FLS procedures and general practice in the field at the time, were less detailed than what would be expected in an accredited lab today. This limited his supervisor's ability to validate the results based on his review of the work notes and report. (III.C. and E)

6. The conclusions provided in Mr. Christianson's Forensic Laboratory Report were expressed in terms that were in accordance with FLS guidelines at the time i.e., "*consistent with having originated from the same person*". The basis for the conclusion i.e., microscopic comparison, was not provided. (III.D)

7. The Laboratory Report was very brief and did not mention the other hairs that were recovered from the exhibits. (III.D)

8. Mr. Christianson's testimony was quite straight forward and in accordance with what most forensic hair and fibre examiners, given the same observations, would have provided at that time. He acknowledged that microscopic hair examination does not provide a positive identification and that he could not provide population distribution numbers. The only testimony that some examiners might not agree with is his statement that the chances of a random match between hairs from two different sources are "*very small*." (III.F)

9. Since microscopic hair comparison and mtDNA analysis are based on totally different parameters, it is not unexpected that they will sometimes produce different conclusions. It is, however, surprising that the three hairs which were considered "*consistent with*" the known sample by Mr. Christianson, were considered by the mtDNA analyst Mr. Bark as not only different from the known sample but also different from each other i.e., they were from three different sources. (III.G)

10. Either Mr. Christianson's observations were incorrect, the mtDNA results were incorrect, or the microscopic similarity of the questioned hairs to the known sample was a chance occurrence. The possibility of the latter seems remote but must be considered. (III.G)

11. Microscopic hair comparison continues to be a useful technique in forensic science for exclusionary purposes and may be helpful for inclusionary purposes in certain circumstances. (IV.A)

12. There is nothing apparent in any of the material reviewed to suggest that the forensic examinations, conclusions or testimony in the Harder case were influenced in any way by the fact that they were performed in a laboratory that is part of a law enforcement agency. (IV.B)

13. Reviews, both internal and external, of forensic science laboratories and their work have increased significantly since 1990/91. (IV.D)

VI. REFERENCES

A. Inquiry Documents

FSS Statement of John Edward Bark re: James Driskell, 02 December, 2002

Letter of Retainer, M Code to D Lucas, 01 May, 2006

Order in Council re: Driskell Inquiry, 07 December, 2005

Statement of Tod Christianson to Commission Counsel, 17 May, 2006

Summary of Discussion of Tod Christianson with D Lucas, 27 June, 2006

Supplementary Report of Cst. CW Pearson 90/10/17

Transcript of Testimony of Tod Christianson in R. v. Driskell (Date unknown)

B. RCMP FLS Documents

Case Receipt Unit SOP: "*Case Receipt and Exhibit Handling*" (16 August, 2003)

Evidence Recovery Unit Methods Guide (17 March, 2006)

Evidence Recovery Unit Learning Guide (02 March, 2006)

FLS Winnipeg Lab File 90-1296

FLS Winnipeg Quality Manual Supplement (02 March, 2005 with revisions in 2006)

Hair and Fibre Section Methods Manual (1983 with revisions in 1984 and 1986)

Hair and Fibre Section Training Manual (Including Instructor's Guide); (Revised Version February, 1985 with subsequent revisions in 1987, 1988 and 1989)

Laboratory Services Manual: Chapter 2 "*Laboratory Operations - General*" (28 April, 1993)

Laboratory Policies and Procedures Manual: Chapter 2 "*Laboratory Operations - General"* (28 February, 2006)

ibid: Chapter 5 "*Research and Development*" (19 February, 2006)

ibid: Chapter 6 "*Learning and Development*", (01 December, 2005)

ibid: Chapter 11 "*Internal Reviews and Audits"* (08 December, 2005

:

Quality Manual (01 March, 2002 with revisions in 2003, 2005 and 2006)

Summary of Policy Changes re: Forensic Hair Examinations (16 July, 2003)

Tod Christianson Personnel File (relevant portions only)

C. Research Papers and Reviews

Barnett, PD and RR Ogle; "*Probabilities and Human Hair Comparison*"; J. Forens. Sc., Vol. 27, 272-278 (1982)

Deedrick, DW; "Hair, Fibres, Crime, and Evidence"; Forens. Sci. Communications, Vol. 2 Number 3(2000)

Gaudette, BD; "*Probabilities and Human Pubic Hair Comparisons"*; J. Forens. Sci., Vol. 21, 514-517 (1976)

Gaudette, BD; "*Some Further Thoughts on Probabilities and Human Hair Comparisons*"; J. Forens. Sci., Vol. 23, 758-763 (1978)

Gaudette, BD; "*A Supplementary Discussion of Probabilities and Human Hair Comparison*"; J. Forens. Sci., Vol. 27, 279-290, (1982)

Gaudette, BD and ED Keeping; "*An Attempt at Determining Probabilities in Human Scalp Hair Comparison*"; J. Forens. Sci., Vol. 19, 599-606 (1974)

Houck, MM and RE Bisbing; *"Forensic Human Hair Examination and Comparison in the 21st Century*"; Forens. Sci. Review, Vol. 17, 51-66 (2005)

Houck, MM, RE Bisbing, TG Watkins and RP Harmon; *"Locard Exchange: The Science of Forensic Hair Comparisons and the Admissibility of Hair Comparison Evidence: Frye and Daubert Considered*"; www.modernmicroscopy.com (March 02, 2004)

Houck, MM and B Budowle; "*Correlation of Microscopic and Mitochondrial Hair Comparisons*"; J. Forens. Sci., Vol. 47, 1-4 (2002)

Melton, T, G Dimick, B Higgins, L Lindstrom and K Nelson; "*Forensic Mitichondrial DNA Analysis of 691 Casework Hairs*"; J. Forens. Sci., Vol. 50, 73-80 (2005)

Rodger, WJ; "*Does Forensic Science Have a Future?*"; J. Forens. Sci. Soc., Vol 24 #4 (1984)

D. Miscellaneous Documents

Bromwich, Michael R; "*An Investigation Into Laboratory Practices and Alleged Misconduct in Explosives-Related and Other Cases*"(April 1997)

Bromwich, Michael R; "*Fifth Report of the Independent Investigator for the Houston Police Department Crime Laboratory and Property Room"* (May 11, 2006)

Kaufmann, The Honourable Fred; "*The Commission on Proceedings Involving Guy Paul Morin*" (1998)

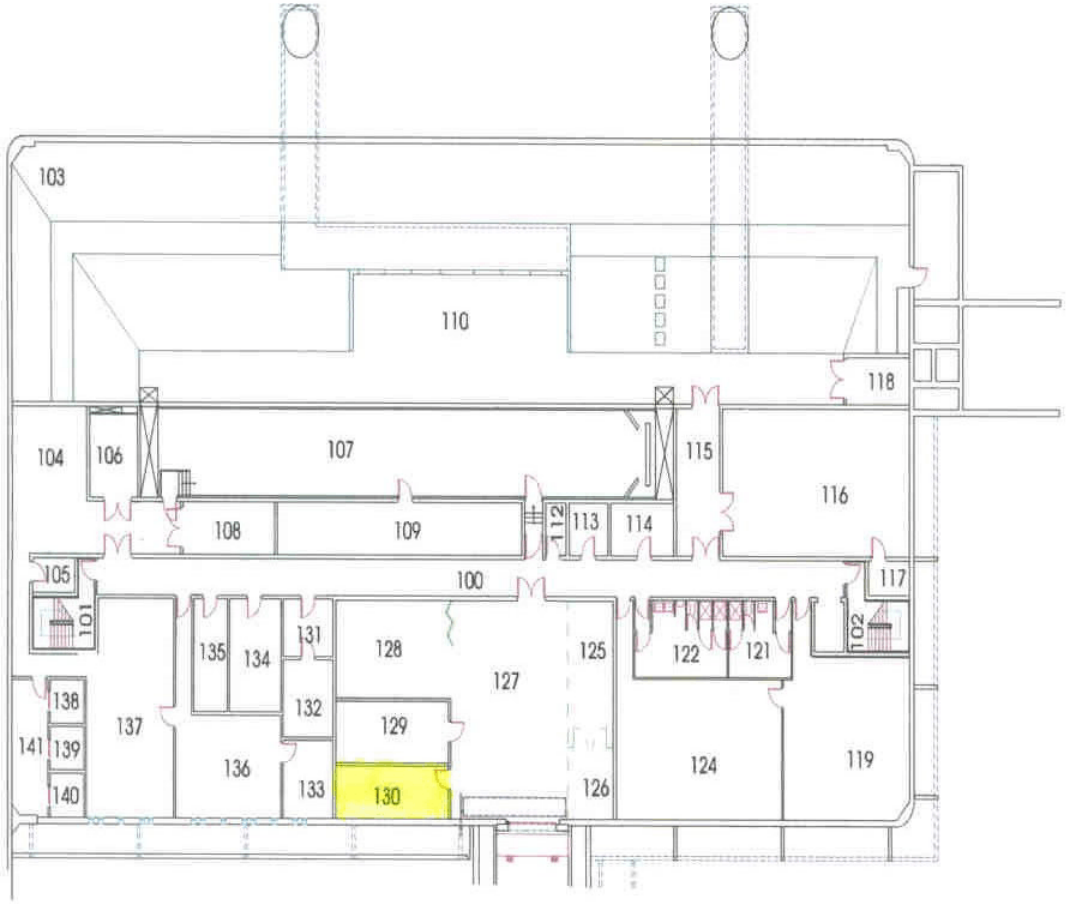
The Centre of Forensic Sciences; "*Hair Information Sheet*" (ca 2004)

Transcript (partial) of testimony of Tod Christianson in R. v. Starr (1995)

Transcript (partial) of testimony of James Cadieux in R v. Unger and Houlahan (1992)

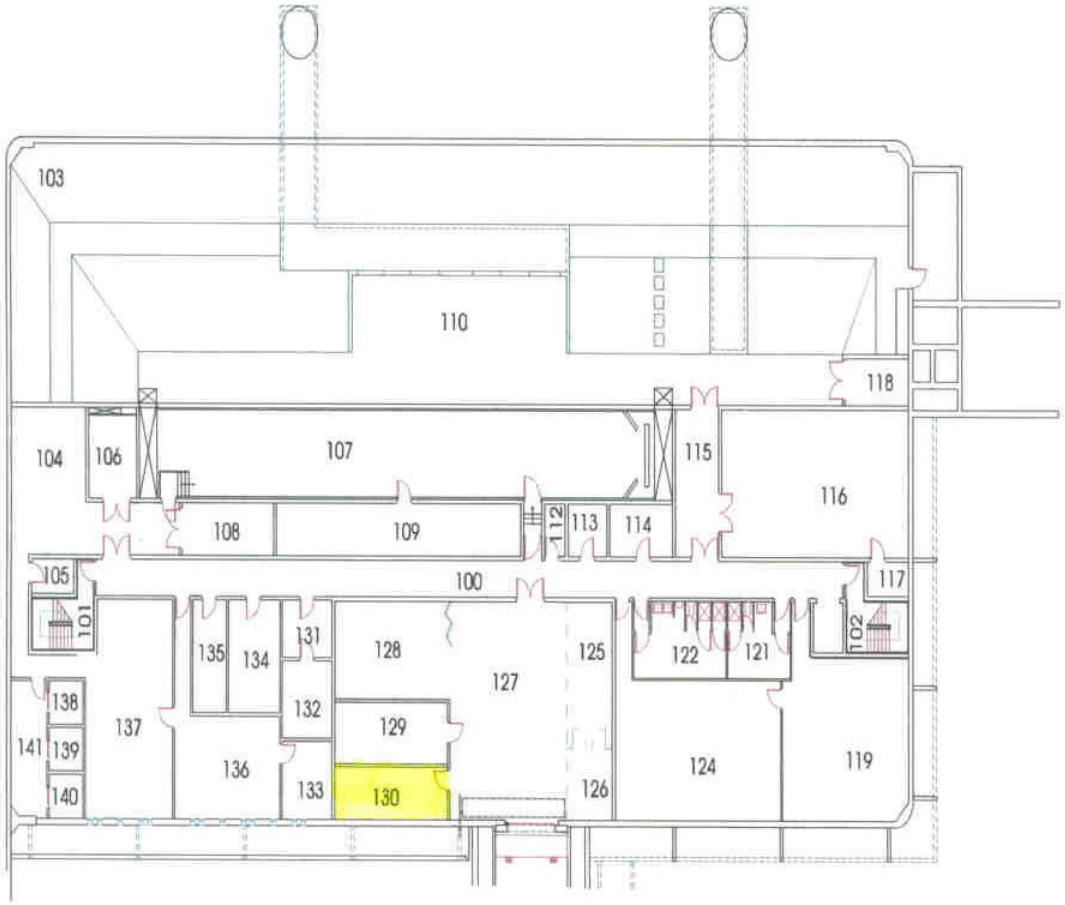
Transcript of testimony of James Cadieux in R. v. Sanderson (1997)

APPENDIX
FLS Winnipeg Floor Plans[88]



Main Floor

[88] FLS Winnipeg "*Quality Manual Supplement*" (2006-06-07). Yellow "*Hi-Lited*" areas are the former H&F Section. The doors between Room 212 and 203 , 212 and 220, 208 and 205 did not exist in 1990/91


103
110
118
104
106
107
115
116
108
109
112
113
114
105
100
117
101
102
135
134
131
128
125
122
121
127
138
137
132
129
141
139
136
133
130
126
124
119
140

Lower Floor