THE 'DEFENCE' FORENSIC SCIENTIST

FORENSIC SCIENCE IN CRIMINAL DEFENCE, CIVIL LITIGATION AND INDUSTRY

lecturer

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purpose of lecture

The purpose of this lecture is to provide Forensic 701 students with some insight into:

- the role of the forensic scientist in criminal defence work
- forensic science in New Zealand outside ESR
- document preparation for Court
- Courtroom procedures for scientists
- the role of forensic science in civil litigation
- the role of forensic science in industry
- work opportunities for Forensic 701 graduates

THE FORENSIC SCIENTIST IN CRIMINAL DEFENCE

scientist's role in defence team

What is the role of the forensic scientist in criminal defence work? The scientist:

- provides independent and impartial scientific advice to a defence barrister or team of barristers
- reviews ESR working papers, analytical results, and statements
- interprets scientific evidence for defence counsel and gives them an understanding of the relevant technical and scientific matters
- assists defence counsel in identifying what the Prosecution's theory is and defining clearly what the defence contention is

- evaluates likelihoods associated with the various contentions
- attends at Court to listen to the technical evidence of Crown expert witnesses and explain its significance to defence counsel
- assists with formulating lines of questioning for cross examination

An independent forensic scientist can also assist defence counsel (and the Court) by:

- identifying areas where there is disagreement on the significance of scientific or technical evidence so that uncertainty can be resolved
- identifying areas where there is no dispute in relation to technical evidence so no time is wasted addressing points that are not in issue

These are the most common tasks. Less commonly the defence forensic scientist:

- examines items of physical evidence (e.g. garments, footwear)
- collects samples (e.g. blood stains for DNA processing) or takes impressions
- tests the function of an item (e.g. a firearm's trigger group)
- carries out independent analysis of a substance (e.g. seized drug) or biological specimen (e.g. blood for ethanol)
- attends at Court to give evidence.

Who makes up a Defence Team?

A defence team normally comprises:

- A Defence Barrister
- Junior Counsel
- Licenced Private Investigators
- Forensic Scientists
- Forensic Technicians

Defence barristers…….

- Usually have no formal training in science
- Sometimes do not understand technical evidence
- With few exceptions have never conferred with a forensic scientist.

Scientific evidence is not familiar currency for many barristers. They need the assistance of forensic scientists to fully comprehend its significance.

Licenced Private Investigators

Licenced private investigators are an indispensable part of a criminal defence team. A forensic scientist advising the defence may be required to liaise extensively with private investigators. Private investigators are private detectives, and their interaction with defence scientists is analogous to that of Police with Crown scientists. Private investigators can perform the following functions:

- intelligence gathering
- locating items of interest (e.g. physical evidence, garments, vehicle parts, security video footage, maintenance records, meteorological data .....)
- ascertaining times of phone calls; taxi routes and destinations; times and amounts of financial transactions
- interviewing persons who may be called as defence witnesses and taking written statements from them.

Few licenced private investigators in New Zealand specialise in criminal defence work. Those that do are former Police officers.

Types of defence

Many different types of defence strategies are employed by barristers. Strategies that are encountered by the defence forensic scientist in the course of casework can be subdivided as follows:

1. Defence founded almost wholly on technical or scientific evidence that convincingly contradicts the Crown's or Plaintiff's theory (very rare). Example: Plaintiff's contention is that metallic contaminants generated by using a disc grinder to cut the guardrails of a fishing vessel completely covered the Plaintiff's luxury yacht causing $300 000 damage to paintwork. Defence contention: the putative angle grinder swarf is actually volcanic ash and probably comes from White Island Volcano.
2. Defence based on accommodating unfavourable evidence with technical evidence lending considerable support to defence contention (uncommonly encountered). Example: complainant alleges rape, defendant admits sexual intercourse took place but maintains it was consensual. Certain distinctive damage to complainant's lower garments is adduced by Crown as evidence indicating forceful removal of garment

hence supporting claim of rape. Defence simulation experiments are unable to simulate damage to test garments when being worn and are only able to reproduce the damage when the garment is 'empty'. On basis of experimental results, defence suggests that damage is factitious, thereby casting grave doubt on credibility of complainant.

3. Defence based on highlighting existence of reasonable doubt regarding an accused person's actions, intentions, whereabouts, …….. (probably most common). Example: 'My client admits he went to the address with two others where the deceased received a stab wound and bled to death, but he never intended to cause him harm, he just went to retrieve a motorbike. My client, he's in his fifties, he was just brought along to ride the motorbike back, if the three co-accused had really wanted to do harm to the deceased, why would they just stab him in the leg, why didn't they stab him in a vital area, and why did they bring a slightly built older man into the gang pad when they could have brought the much younger 100 kilogram guy who was left waiting outside in the car?
4. Defence based on obfuscation of facts or technical issues (the 'naughty schoolboy' defence): "For starters, the classroom hasn't got any windows, and if it has, they aren't broken, and if they are broken, I didn't do it, and if I did do it, was an accident'. (quite common, not a defence at all, and a waste of the Court's time).
5. 'Cute' defences e.g. (wilful damage) "my client couldn't have scratched those obscenities in the paintwork of that expensive car, the words aren't in his handwriting"; or (murder) "I wasn't there at the time, I didn't bludgeon her to death with the hammer, honest, I was actually at Puhoi when it happened, tending my cannabis plantation".

Scientist's role in various types of defence

1. Defence wholly reliant on technical evidence: Extensive liaison pre-trial with barrister; considerable analytical or determinative work or examination of items; voluminous paperwork (reports, letters, Brief of Evidence, Affidavits); lengthy viva voce evidence; several days in Court listening to evidence of other experts; scientist provides extensive advice to Counsel on cross-examination of experts. Total time: several or many hundreds of hours work.
2. Defence significantly reliant on technical evidence: Many hours' liaison pre-trial with barrister; possibly some analytical or determinative work, possibly some examination of exhibits and/or simulations; significant paperwork (reports and letters); viva voce

evidence and a few hours in Court listening to evidence of other experts; considerable advice to Counsel on cross-examination of Crown experts. Total time: typically many tens of hours.

3. 'Reasonable doubt' defence: A few hours' liaison pre-trial with barrister; no analytical or determinative work, possibly some examination of exhibits; significant paperwork (reports and letters); no viva voce evidence; many hours in Court listening to evidence of other experts; some advice to Counsel on cross-examination of Crown experts. Total time: a few tens of hours.
4. 'Obfuscatory' defence: Little scope for useful involvement of forensic scientist
5. 'Cute' defence: Little scope for involvement of forensic scientist.

What does a 'defence' scientist do? examples from recent casework

A review of recent casework gives an idea of what type of work is undertaken in an independent forensic science company:

Criminal defence

- homicides involving blunt force injury, sharp force injury, firearms
- drugs: cannabis (provenance from palynofloras); methamphetamine yield calculations
- assault
- unlawful sexual connection
- armed robbery (geometric analysis of security video footage)
- arson
- equipment sabotage (toolmarks)
- drink drive (blood-ethanol calculations)
- theft as a servant

Materials science

- failure of flooring materials
- alkali-aggregate reaction in concrete
- other concrete problems
- refractories failure
- 19th century concrete

General chemistry

- methamphetamine laboratory clean-ups
- food contamination

Engineering

- mining
- aeronautical
- automotive
- combustion equipment development

Miscellaneous

- Admiralty action
- document authentication
- insurance assessments
- medical misadventure
- intermetallic compounds

Points for discussion

Defence forensic work is extremely varied.

Even though a forensic scientist can claim expertise in only a few fields for the purpose of giving expert evidence in Court, they can nonetheless assist a barrister in many other fields. Reasons: 1) formal training in forensic science covers most areas of relevance to criminal defence; 2) the physics and chemistry component of a BSc degree provides adequate background to enable a forensic scientist to answer a barrister's technical questions from first principles without the need to have first-hand, experienced-based knowledge of the problem.

R v WILLS

introduction

The case R v Wills provides a good illustration of how a defence scientist operates within the framework of a criminal defence team.

background

Mr Grant Wills was charged with the murder of Mr S in 2003. He was also charged with attempting to murder Ms K. Mr S and Ms K were partners. They lived in the same household as Mr Wills and his two young children to Ms K. This domestic arrangement had been in place for several years. Ms K ran a plastering business in which Mr S worked. Because of his state of health, Mr Wills spent a good deal of time at home, caring for the two young children. Ms K did the cooking and cleaning.

The following points are not in dispute. There was a call to the Police on 20 March 2003. Mr S was found in a blood-soaked bed bludgeoned to death. A sarg (Thai pestle used in food preparation) was found with Mr S's blood on it. The scene was extensively spattered and stained with blood. Mr Wills and Ms K had attempted a cleanup.

Mr Wills admitted to showering and changing his clothing after the cleanup. Ms K did not specify what she had worn at the time she was assaulted. Several bloodied garments were found in rubbish bags at the scene.

prosecution contention

The prosecution contention was that Mr Wills had bludgeoned Mr S to death in a fit of rage and had also assaulted Ms K. The motive was alleged to be jealousy. The prosecution also alleged that Mr Wills forced Ms K to clean up after the attack and then prevented her from calling the Police.

defence contention

The defence contention was that Ms K bludgeoned her partner Mr S to death in an alcohol-fuelled rage. The defence would also contend that the cleanup was co-operative, not coercive. An unusual contention on the part of the defence was that Ms K and Mr Wills had agreed before calling the Police to the scene that Ms K would deny involvement in the death of Mr S; and that Mr Wills would neither confirm nor deny any involvement. The defence explanation for Mr Wills and Ms K arriving at this agreement was that they thought the best

way of ensuring the children would be cared for in the aftermath would be for Mr Wills to 'take the rap', which would allow Ms K to care for their children.

investigations by defence

The defence barrister engaged the assistance of a licenced private investigator. At the outset, the prosecution contention that the motive for the murder and assault was jealousy seemed implausible, because the living arrangement involving Ms K, Mr Wills, their children, and Mr S seemed amicable and had been in place for some time without incident. Furthermore, Mr Wills' state of health was such to raise considerable doubt about his ability to perpetrate a sustained attack on two younger able-bodied people. The defence also doubted that Ms K had been prevented from calling the Police as she alleged, because she had access to several mobile phones.

The private investigator made some initial inquiries and established that Ms K and Mr S had a stormy relationship, and that the effects of alcohol consumption by Ms K at times had to be balanced by administration of a Thai herbal medicine said to have soothing properties.

The defence formed the view that Ms K probably bludgeoned her partner to death.

Defence scientists reviewed the file collated by ESR scientists. The file described blood spatter and blood stain evidence. Projected spatter was evident on walls, furniture and clothing, but had been rendered difficult to interpret unambiguously in some cases because of cleanup attempts.

(Defence scientists do not normally have the opportunity to examine blood spatter at scenes. By the time their services have been engaged, cleanups have been carried out, and all they have to work with are photographs in Police photographic exhibit booklets. Clothing exhibits however are held before the commencement of a trial at ESR so were available for study.)

Integration of ESR's DNA evidence with blood stain evidence led the defence scientists to the following interim conclusions:

- Presence of dilute blood staining identified by ESR scientists on the lower garments attributable to Mr Wills and Ms K tended to support the contention that both had participated in a cleanup;
- There was very little blood and no projected spatter on Mr Wills' clothing, which did not support the contention that he had been in close proximity to Mr S or Ms K when they bled;

- Blood on Mr Wills' 'clean' jeans was attributable to Ms K who acknowledged it was transferred directly when she lay with her head on Mr Wills' jeans;
- A pair of silky blue pyjama trousers which was heavily stained with blood from the deceased and had been discarded in a rubbish bag needed to have their wearer identified.

The 'ownership' of the blue pyjama trousers was a mystery. Had the deceased been wearing them? If so this would imply transfer of his blood to his own lower clothing. Or had Ms K been wearing them? If she had, this would suggest close proximity to the deceased when he bled.

Points of relevance to the outstanding issue of the ownership of the blue pyjama trousers were:

- The deceased was found wearing his normal bedtime attire;
- Ms K admitted to wearing a blue pyjama top that matched the blue trousers;
- The blue pyjama trousers lacked a fly and were too small to fit Mr Wills.

The defence wished to resolve the uncertainty surrounding who was wearing the blue pyjama trousers so asked one of the scientists in the defence team to examine this item of clothing.

examination of clothing exhibits

access to exhibits

Access to items at ESR by defence scientists is regulated by the "Defence Access Rules". These rules form an appendix to the Second Edition of the New Zealand Law Society's *Rules of Professional Conduct for Barristers and Solicitors*. (Later editions however do not include any rules governing access to exhibits by defence scientists. Note that s24 of the New Zealand Bill of Rights Act 1990 is relevant to defence access to items of evidence. The Act states that *"Everyone who is charged with an offence .....[s]hall have the right to adequate time and facilities to prepare a defence"*; according to policy guidelines issued by the Ministry of Justice (see http://www.justice.govt.nz/pubs/reports/2004/bill-of-rights-guidelines), the term "facilities" should be interpreted broadly to include access to evidence.)

examination of exhibits by defence scientists

Examinations of exhibits by defence scientists are overseen by a member of ESR's scientific staff, and if the Police wish, by the officer in charge of the case. Items of physical evidence which are to be introduced as prosecution exhibits in the course of a trial formally remain in the custody of ESR or the Police while being examined by a defence scientist.

ESR permit visiting defence experts to examine items of physical evidence using the same examination facilities as ESR staff use in the course of normal casework. ESR scientists overseeing the examination ensure that visiting scientists observe the in-house procedures put in place to guard against dispersal of biohazard material (from exhibits) or stray DNA (from scientists). ESR also (generously!) provide items such as scalpels, presumptive test reagents (e.g. Combur sticks), disposable surgical masks and gowns, and sample containers. There is even a stereomicroscope available. A scientist undertaking examinations for the defence should of course not expect to have such items provided and should come prepared.

blue pyjama top

Examination of the blue pyjama top revealed two populations of bloodstains. On the exterior of the garment were stains representing direct transfer, drips and runs of blood known from ESR's DNA work to be Ms K's.

The interior of the pyjama top's front panels bore a second type of blood stain. There were five spatter arrays that clearly represented blood projected from a source. Geometric analysis suggested that the source lay close to the target fabric. What was the source? and whose blood was it?

A sample was taken for DNA extraction, amplification and profiling. The profile was indistinguishable from that of Ms K. The defence scientists speculated that the blood inside the pyjama top had been flicked there from Ms K's injured finger.

This finding did not shed light on the correctness or otherwise of the defence hypothesis that Ms K had bludgeoned Mr S. It did however tend to cast doubt on her claim that she had remained unconscious while being assaulted by Mr Wills.

simulations

At autopsy it was apparent that most of the deceased's head injuries displayed a radial symmetry. None was bilaterally symmetric. Simulations with a sarg purchased for the purpose and basic geometric considerations showed that the blunt point of the sarg had been brought into contact with Mr S's head and that the heavy stone pestle had not been swung as a club. The defence used this finding to suggest that the sarg had been wielded in the same way as it had been used for food preparation.

blue pyjama trousers

Examination of the blue pyjama trousers by ESR had already established the presence of extensive staining with blood of Mr S, the deceased. Examination of the blue pyjama trousers

by a defence scientist identified a second, somewhat inconspicuous, population of bloodstains.

This second population of blood stains comprised spots of clotted blood. The DNA profile obtained from the clotted blood was indistinguishable from Ms K's profile.

The presence of Ms K's clotted blood on the blue pyjama trousers lent support to the defence contention that she had been wearing the trousers that she had distanced herself from.

summary

The defence was led to the conclusion that notwithstanding Ms K's claim that she was unconscious during the attack she was probably ambulatory. The defence thought that contrary to her claim that Mr Wills had attacked her, Ms K had received her injuries from Mr S while he defended himself from her.

presentation of evidence

DNA findings acquired by the defence were incorporated into an Affirmation by the defence scientist. The Affirmation was then turned over to the prosecution for their experts to scrutinize. The prosecution did not contest the findings of the defence scientist. The prosecution and defence agreed that there was no need for the defence scientist to appear to give evidence in person, and the judge circulated copies of the defence scientist's Affirmation to the members of the jury.

The jury deliberated but could not arrive at a decision.

sequel

In 2005, Mr Wills was tried again for the attempted murder of Ms K and for the murder of Mr S.

At the conclusion of Mr Wills' second trial, the jury was unable to arrive at a unanimous decision. In June 2005, the Solicitor-General refused to allow the case to proceed to a third trial and ordered a stay on any further prosecution.

Casework: example of scientist's involvement in civil claim

background

A plaintiff makes a claim against a supplier of limestone paving tiles that are failing prematurely in service by a mechanism involving surface disintegration. An industry expert engaged by the plaintiff gives affidavit evidence saying the cause of the damage to the tiles is acid rain and that the tile material has failed because it is substandard.

site visit

A visit to the site by the defence scientist revealed however that tiles exposed to weather are not suffering surface disintegration and that the tiles that exhibit signs of distress are restricted to zones which are sheltered from rain.

defence scientist's findings

The scientist engaged by the defence advised the defendant's barrister that the plaintiff's expert is incorrect in asserting that acid rain caused the damage. The scientist also pointed out that limestone of exactly the same type has been used for centuries in a variety of climates and has a record of good durability.

The defence decided to establish exactly what mechanism caused the damage to the tiles.

further investigations

Using X-ray diffractometry, microscopy and electron microbeam analytical methods, the defence established that a sodium sulfate cryptoflorescence has crystallized beneath the surface of the limestone tiles and that this was the proximate cause of damage. The ultimate cause of damage was presumed to be some mechanism providing sodium and sulfate ions from an unidentified source.

After discussions between defence counsel and defence scientist, it was decided to establish the ultimate cause of damage.

rationale for establishing deterioration mechanism

The reason the defence wished to establish the mechanism responsible for damage is that in civil matters, a case is decided on the 'balance of probability' standard of proof. The more stringent criterion of 'beyond reasonable doubt' applies only to criminal matters. The defence team considered that doubt in relation to mechanism could prejudice the defence case more than the plaintiff's case, so further work was undertaken to identify the source of the sodium and sulfate.

The first step for the defence was to establish whether the limestone contained either sodium or sulfate, because presence of either would lead to the suggestion by the plaintiff that the limestone itself was intrinsically faulty which would in turn inevitably lead to a judgment against the supplier of the limestone.

Petrographic examination of the limestone revealed that it lacked sodium- or sulfate-bearing phases. The defence team felt this evidence would deprive the plaintiff's experts of any opportunity to suggest that the limestone might be the source of the problematic sodium and sulfate.

Attention next focused on the source of the problematic sodium and sulfate ions. The mortar on which the tiles were bedded was identified as a likely source.

These findings were incorporated into a lengthy Brief of Evidence which was made available to the plaintiff's experts through the plaintiff's solicitors. The defence team thought they had a solid defence to the plaintiff's claim.

Plaintiff's new evidence

The night before the hearing, a Brief of Evidence in Reply was received from a 'new' expert, a forensic engineer, who had been engaged by the plaintiff three days earlier.

The plaintiff's new expert accepted in his brief the defence contention that cryptoflorescence composed of sulfates caused damage to the tiles and that the bedding mortar beneath them was a possible source of the problematic sulfate salts.

The plaintiff's new expert also asserted in his brief that it is possible that *"…. sodium and sulfate ions are generated from within the rock"*. He also noted that limestone is susceptible to attack *"…. from even mildly acid liquids such as vinegar"*.

The defence had anticipated correctly that the plaintiff when confronted with evidence suggesting that sulfate cryptoflorescence caused tile damage would advance the possibility that the source of the damaging sulfates was the tiles themselves.

The defence did not expect the novel speculation of damage by unspecified *"mildly acid liquids"* to be raised the night before the hearing.

dealing with unfavourable evidence

On the day of the hearing, the defence team conferred and discussed how to deal with the new potentially damaging speculation received from the plaintiff's new expert. The defence team decided to get the plaintiff's expert to:

- confirm during cross-examination that he agreed with the defence's position on the cause of damage;
- concede that his suggestion that sodium and sulfate came from within the limestone was nothing more than speculation;
- concede that unspecified acidic liquids had not in fact damaged the tiles.

The defence felt that this would remove all ambiguity in relation to damage mechanism and would present the scientific facts in a balanced way that would allow the judge to decide the case on its scientific merits. (Note that civil cases are heard before a judge only; there is no jury as there normally is in a criminal trial).

Here are some excerpts from the cross-examination of the plaintiff's expert Mr X that illustrate how a barrister who has been properly briefed by a scientist can deal with potentially damaging speculations advanced by an expert acting for the other side:

You refer to acid, there's no sign of acid damage here, is there? .....There is nothing that indicates to me that there has been a general or even a localised acid attack on the surface.

So coming back to my question about acid, we can put acid aside as a factor. You would accept that? .... I think so.

Dr Y has identified only one mechanism of attack, if I can put it that way, and that is salt, essentially. Do you accept that? .... Yes I do I don't argue with that.

As I read paragraph 21 of your brief, you are essentially accepting the evidence of Dr Y in respect of cryptoflorescence, and certainly in respect of the potential source [of salts] being something beneath the tiles – have I stated that correctly? .... I accept his explanation of the process.

You were saying on a purely speculative basis that the same components might have been present in a different batch of stone, is that your argument? ....Yes it is.

Right. And apart from raising that as a possibility you have no evidence to support that do you? ....No I don't.

Thank you Mr X. [end of cross-examination]

By eliciting these responses, the defence ensured that

- the scientifically unfounded suggestion that tiles might have been damaged by acid is put out of contention;
- the suggestion that salt constituents come from within the limestone is shown to be merely speculative;

- the mechanism causing damage is shown to be unrelated to the chemistry of the limestone (hence is beyond the control of the defendant who supplied the tiles).

DOCUMENT PREPARATION FOR COURT

The following are the documents that forensic scientists may be required to prepare or assist a barrister prepare for Court work:

Affidavit

An affidavit is a written document that is sworn under oath before a solicitor or a Justice of the Peace (JP). The oath is sworn on a Bible. A person who has sworn an affidavit is referred to as the deponent of that affidavit. A deponent deposes to whatever is asserted in the affidavit they have sworn.

Some District Law Societies permit barristers and solicitors to charge for having an affidavit sworn before them. In Auckland, the service is normally provided free or for $5. In the Bay of Plenty and elsewhere it costs $20.

Affirmation

An affirmation is a formal assertion or declaration asserted to be true without religious reference. This is the only way in which it differs from an Affidavit.

Brief of Evidence; Statement

A Brief of Evidence (Brief for short) is a document prepared by a forensic scientist or other expert witness setting out factual matters and technical arguments for use in civil litigation or criminal proceedings. A Statement is essentially the same as a Brief of Evidence.

Some barristers prefer their expert witnesses to give their Evidence in Chief by reading from a Brief of Evidence. For this reason, a Brief of Evidence must be written in a style that allows its author to read it aloud in Court. Sentences should not be so long that the reader needs to draw breath mid-sentence.

A Brief of Evidence should be written so that a Barrister who wishes to elicit their expert's Evidence in Chief in the form of a series of questions may do so. Few barristers attempt this, possibly because it requires considerable pre-trial preparation, but it is a very effective way to maintain a jury's attention.

The style and content of a Brief of Evidence must be adjusted to suit the intended audience. A Brief dealing with evidence to be given in a jury trial would normally be written in a narrative style using plain English and no jargon, because the trier of fact is a jury of twelve laypeople.

In contrast, a Brief of Evidence intended to be read in a civil case can contain a good deal of complex or technical material and can incorporate longer sentences and polysyllabic terms, because the trier of fact is a Judge who will be accustomed to dealing with technical matters.

Note also that a juror who does not understand a term has no opportunity to ask questions to clarify uncertainty, whereas a Judge has the opportunity to use a dictionary or to ask the expert witness for clarification.

A Brief may have headings and subheadings, but these should not be read aloud. The paragraphs should be individually numbered for ease of reference.

If a Brief has been read aloud in the course of a criminal proceeding, it is signed by the witness and given to the Court Registrar or Clerk and becomes part of the trial's written evidence.

A Brief of Evidence or Statement must be clear, concise and comprehensive without containing superfluous detail. Any information that is not essential can be scheduled (put in an appendix or appendices). Any appendices should be prefixed with a sentence indicating that the appendix is not intended to be read aloud.

In contrast to a report which is intended to be read, a Brief of Evidence is intended to be listened to. The "audience" is normally a jury, so the content must be clear to those with no scientific knowledge. While many manuals and monographs on technical writing recommend avoiding jargon in documents intended for laypeople, it is nonetheless acceptable to use technical terms if the meaning of the term is clear from its context.

All pages of a Brief of Evidence or Statement should be signed and dated. Briefs and Statements do not need to be sworn before a solicitor.

(The term 'statement' is also used by Police and Licenced Private Investigators for the written record of an interview between the Police officer or investigator and an interviewee. Statements of this type are used by barristers as the basis for affidavits or other documents intended for use in Court).

Deposition

A Deposition is a document similar to a Statement that is prepared specifically for a Depositions hearing. It will contain marginal or parenthetic notes reminding the author to (for instance) refer to a specific photograph in a Police Photograph Booklet that depicts a feature of interest.

All pages of a deposition should be signed and dated. A Deposition does not need to be sworn before a solicitor.

Interrogatory

An interrogatory is a formal request for information, often of a technical nature, made by one party to a civil action to another party. The party requesting the information may require that the information is provided in the form of an Affidavit. Examples of the type of information required: 'How many hours had the tail rotor been in service before it failed?' or 'what was the water to cement ratio of the concrete used for the precast beam that failed and what type of load cell equipment was used to weigh the mix components at the concrete batching plant?'

Normally it is the task of the barrister or instructing solicitor to prepare interrogatories, but because their content is technical in nature, their preparation requires the assistance of a scientist.

technical report

Technical reports are the most common "output" of an independent forensic scientist.

They can be very short (a few pages) or long (many tens of pages).

They can be illustrated. This is particularly helpful if the readership is likely to include people with no technical background.

Long reports need to be subdivided into sections, each with its own heading. These lecture notes are subdivided as follows:

HEADING 1

HEADING 2

Heading 3

Heading 4

Short reports may need no internal subdivision, but for ease of reference paragraphs should be numbered consecutively. The need to refer to individual paragraphs arises frequently (for example, in the course of telephone conversations with clients or barristers; in written correspondence; and during cross-examination).

Scientific findings embodied in a technical report can be formally put into evidence in at least three ways. For criminal proceedings, the report can be reworded and converted into a Statement or Brief of Evidence. The report can also be put into evidence as an Exhibit. For civil matters, a technical report is normally annexed to an Affidavit. The Affidavit is formally filed, and together with the annexed technical report, is made available to the opposing party or parties to be perused before being included in the Bundles of Documents.

Statement of Claim

A Statement of Claim is the document used to formally initiate a civil proceeding. A Statement of Claim sets out the nature of a plaintiff's claim and the relief sought.

A Statement of Claim contains particulars of claim, meaning information on times, places, dates, transactions and items of interest such as goods, materials, contaminants, equipment and so on. Particulars may need to include technical or scientific information, and a barrister may require considerable assistance from a forensic scientist (or forensic engineer) when preparing particulars.

Paragraphs must be numbered so that a Defendant can refer specifically to allegations contained in a Statement of Claim in their Statement of Defence.

Statement of Defence

A Statement of Defence is the document filed by the defendant to any proceeding they intend to defend. A Statement of Defence details Particulars and also systematically either admits or denies allegations contained in a Statement of Claim.

Bundle of Documents

Bundles of Documents are assembled for the substantive hearing of civil claims. A Bundle of Documents comprises all relevant Affidavits, technical reports, correspondence that is not legally privileged, photographs, Statements of Claim, Statements of Defence, and Counterclaims.

The content of Bundles of Documents is agreed on in pre-trial conferences. By convention, the Plaintiff in a civil action assembles the required documents.

Other documents encountered by Forensic Scientists

Notes of Evidence

The transcript of a trial or other hearing; when taken before a Judge, the transcript is referred to formally as "Her (or His) Honour's Notes of Evidence".

Summary of Facts

A document produced by the Police outlining the essential facts of a case from the Prosecution's perspective.

Judgment

A judgment is a Court's final determination of the rights and obligations of the parties to a civil case. (Compare verdict, which is the decision of a jury after a criminal trial).

Note: a forensic scientist is an impartial expert and should not take an interest in verdicts or judgments. Defence scientists are however sometimes asked by barristers who are considering applying for leave to appeal to review a judgment.

Letters

Letters to barristers are probably the document most commonly prepared by defence scientists. Most letters from a barrister require a written response. Any communication in relation to a case or technical matter must be conveyed in writing.

Letters should be sent by post as well as by fax or email so that the recipient has the original.

The main body of the letter is prefixed by a notice of confidential information.

A copy of the letter stamped "file copy" is put into the case file.

Filenotes

Filenotes are "in-house" documents. They are used to record anything that happens in relation to a case, even if the event or communication is seemingly quite insignificant. Filenotes can be made in handwriting on lined refill but it is preferable if possible to type them. Use of a telephone with headset allows the use of both hands for typing in the course of a telephone conversation.

Example:

filenote **Cxxxxx-1 (Txxxxx)** **091003**

Call from Bill Cxxxxx 1135-1137 to say thank you for the report and the judge had read the letter and had found it most helpful and that Mr Txxxxxx received a community service sentence not a custodial sentence and please send an account by fax.

NGP

The filenote records a short (2 minute) telephone call received from Bill Cxxxxx at 1135 am on 09 October 2003 in relation to his client Mr Txxxxxxx.

The filenote is printed and put into the case file.

Handling letters and filenotes in this manner ensures that the progress of a case can be reviewed quickly when the need arises – e.g. when a barrister telephones in relation to a case.

COURTROOM PROCEDURES FOR SCIENTISTS

Preamble

Duty to the Court

The overriding duty of a Forensic Scientist is to the Court, not to whoever has retained them or is paying their fee.

A Forensic Scientist has a duty to provide scientific evidence that is impartial, carefully considered and factually correct. This means being very well prepared.

Preferably the evidence should be presented clearly, dispassionately and factually. Forensic scientists are not advocates.

High Court rules

High Court Rules govern the conduct of all expert witnesses including forensic scientists.

Giving oral evidence

The following describes a fairly routine series of events:

Scientist arrives at Court and confers with Counsel who is to elicit his or her Evidence in Chief; this is the last practical opportunity to clarify any outstanding matters or uncertainties.

Court hearings normally start at 1000 hr; there is a break 1100-1115, 1300-1415 hr (lunch) and 1515-1530. Court finished at 1700 hr. These breaks are the only opportunity in which a scientist is able to confer with counsel they are assisting.

in Court

When called, the Court Clerk or Registrar will show a witness to the witness stand and offer them a chair if there is not one there already. Some Courts (e.g. Waitakere District Court and Hamilton High Court) have uncomfortable seats fixed to the floor so there is no choice - the witness has to remain seated.

The witness is then sworn or makes an affirmation.

Evidence in Chief is then elicited from the witness by Defence counsel. Evidence in Chief comprises whatever is read from the Brief of Evidence, plus any Supplementary Evidence in

Chief that may be thought necessary. At the conclusion of the Evidence in Chief, a witness is asked by defence counsel to "remain there and answer any questions".

Cross-examination is then conducted by counsel for the Prosecution.

After cross-examination of a defence witness (expert or other) defence counsel is entitled to re-examine their witness though may elect not to. Re-examination is restricted in scope to topics that have been raised in cross-examination.

At the conclusion of a witness's evidence, the Judge may ask the witness questions. It is not uncommon for a judge in a civil or criminal case to ask expert witnesses questions during their Evidence in Chief.

At the conclusion of any questions from the judge, a witness is excused.

Giving oral evidence

Golden rule: always give your evidence to the trier of fact. Address the jury in a criminal trial, the judge in a civil matter. When receiving a question from defence counsel or the cross-examiner, turn slightly and face them, but do not answer them directly. Instead, turn and give the answer to the judge (civil trials) or the jury (criminal trials).

This reduces the risk of getting into an argument with the cross-examiner.

As a defence scientist, treat questions from the cross-examiner and from the barrister that has retained you in exactly the same way – unless a cross-examiner starts running down your qualifications or engaging in other tactics that are not fair. Then just outpoint them.

Cross-examination can be challenging for expert witnesses. The following excerpts from a case involving physics and geometry of clothing damage illustrate some useful points:

CROSS EXAMINATION

At the commencement of the cross-examination, the examiner is seeking to suggest that the witness is inadequately trained or is not qualified for the purpose of garment damage evaluation.

Mr Powell, your undergraduate degrees were in geology and geography ……That's right, yes.

Correct me if I'm wrong, but geology and geography are obviously about rocks and land and things like that? …….Amongst other subjects including physics and geometrical method and analysis of forces, yes, it is about rocks and land.

In answering the question, the witness has given the important part of the answer first. This deprives an examiner of any opportunity to halt a witness in mid-sentence by quickly putting another question.

Later, the examiner tries to insinuate that simulation experiments performed by the defence are invalid because jeans of a different size to the complainant's were used:

The jeans that you put on your colleague, are they the same size jeans that had been produced as exhibit 3, the ones you examined? …… They're not the same size, they're the same fit.

Emphasis given to the word 'fit' hammers home to the jury the important point that fit, not size, governs style and geometry of damage to a garment.

Near the end of the cross-examination:

Do you accept that this notion of garment damage examination, it's not a precise science, is it? ……. With the advent of publications like Jane Taupin's it's becoming one.

Do you say it is a precise science? ……. Analysis of the forces involved is governed by the laws of physics that govern everything else.

And those laws are variable and change from situation to situation? …….. No, they're laws.

At this point the examiner seems to have lost interest in asking further questions and re-examination by counsel for the defence commences.

RE-EXAMINATION

You talked about the laws of physics, when you did your undergraduate training in geology, are the laws of physics you were taught then any different to the laws of physics you apply today looking at fabric damage? ……. No.

Defence counsel has sensed that the issue of relevance of undergraduate qualifications may have detracted from the witness's credibility so has rehabilitated the witness by asking this question in re-examination.

Stenographer

All proceedings in New Zealand Courtrooms are currently recorded by a stenographer either in the Courtroom or elsewhere. Even though they are skilled fast typists, they cannot take a record of proceedings at the pace we normally speak. Some guidelines:

- Speak slower than normal. A useful rule is do not resume speaking if you can hear the sound of the stenographer typing – let them catch up before resuming your oral

evidence. Stenographers usually look towards the witness when they are ready to resume taking Notes of Evidence.

- Use short sentences.
- Spell unfamiliar words.
- Speak into the microphone.

Addressing others in the Courtroom

Judges are addressed as Sir or Ma'am and are referred to as His Honour, Her Honour, Their Honours and so on. Examples: (after a stupid question was put in cross-examination): "I can't answer that question, Sir, it doesn't make any scientific sense." Or in response to a question: "As Your Honour observed earlier Sir, the tyre of the spare wheel survived the fire ……"

The Registrar is addressed as Madam Registrar or Mr Registrar.

Note that there is no opportunity for an expert witness to communicate from the stand with either counsel for the prosecution or defence. (This can be frustrating for a witness when a vital piece of evidence has not been elicited by counsel.) The expert witness's discourse is with the trier of fact – either the Judge or the jury.

Do's and don'ts in Court

- Never speak to a juror
- Never speak to the accused in the Courtroom
- Always stand when the Judge enters the Courtroom
- Always switch off your cellphone
- Don't shuffle papers when taking notes in the public seating. If you have to pass a note forward to counsel, do so unobtrusively
- Ensure that counsel you are assisting has sought the Judge's permission for you to take written notes if you are listening to the evidence of another expert
- As a matter of courtesy, meet the expert to whose evidence you will be listening before they give their evidence and tell them that you will be listening from the public gallery
- Never talk to anyone outside the Courtroom after commencement of your cross-examination until the subsequent re-examination has been completed

- Only address the judge when spoken to by him or her, unless for some reason it is not possible to answer a question put in cross-examination, in which case explain why.

THE ROLE OF FORENSIC SCIENCE IN CIVIL MATTERS

civil forensic science

Forensic science figures prominently in civil matters: examples:

- Failure of materials: e.g. corrosion in sewers, degradation of factory floors
- Premature failure-in-service of equipment
- Trades disputes
- Workplace drugs testing and employment
- Aviation
- Consumer Guarantees Act

Allied areas

Areas that are closely allied to forensic science where a forensic science can often assist include:

- Quality assurance in industry
- Contamination problems
- Insurance claims
- Building disputes (Building Disputes Tribunal, Weathertight Homes Resolution Service)
- Disputes Tribunal (previously Small Claims Court) matters
- Environmental science
- Issues related to Resource Management Act

USING FORENSIC SCIENCE IN INDUSTRY: SOME EXAMPLES

determining the source of metallic contaminants:

A commonly encountered problem in industry: metallic particulates as contaminants in foodstuffs, or being shed by machinery.

Why important

1) quality assurance in food industry; 2) catastrophic failure of equipment can sometimes be averted if the source of metallic particulates can be determined rapidly and the failing component replaced or repaired.

Questions

What is the alloy? Where could it come from in this production line/hydraulic system/diesel engine/refinery/factory? What type of action or process caused the particle to be liberated?

Techniques

Applying the following techniques allows the source of metallic particles to be identified in favourable circumstances:

- Presumptive microchemical tests (destructive) or X-ray diffractometric analysis (non-destructive) are used to identify the general class of alloy (e.g. brasses, Al-Si alloys, stainless steels, other ferrous alloys, Zn-bearing). This allows target analytes to be specified (e.g. if stainless steel, is Mo present? If so, implies either 316 class or 440C; if a brass, Pb implies a free-cutting type)
- SEM-EDS or EPMA indicates composition of alloy; SEM imaging is useful for particles >~50 μm
- metallographic microscopy gives information on microstructure and therefore whether the part is forged, cast, extruded, cold-worked, or sintered;
- stereomicroscopy and examination of Mikrosil® casts can provide information on toolmarks and the process responsible for liberating the particle (e.g. rotational wear, impact, cutting by tool).

The methods applied to solving many technical problems in industry are essentially the same as those applied by forensic scientists to evidence in criminal proceedings: microanalysis, microscopy, toolmark examination. Bayesian methodology is also applicable.

Application of Bayesian methodology to industrial problems

Bayesian evaluation of evidence is as important in industry and civil forensic science as it is in criminal matters. An example from casework: An hydraulic motor on a mobile concrete pump fails catastrophically after 2000 hours ttis (total time in service). An insurer declines a claim submitted by the owner of a concrete pump. The basis for the insurer doing so was that their expert had examined filters, found that they retained numerous metallic particles and concluded that the presence of the particles "indicated that the filter had been accumulating wear particles for some time". This conclusion carried the attendant implications of neglect or inadequate maintenance, on which basis an insurer can decline a claim.

The insurer's expert adduced in support of this inference of neglect the fact the hydraulic fluid contained higher than normal levels of Fe, Cr, Mn, Cu, Sn and Zn, the constituents of the alloys making up the flapper plate and slipper piston barrel components.

So a summary of the positions of the parties:

Insurer: failure of pump is due to inadequate maintenance

Owner: failure of pump is due to an unknown cause that is something other than inadequate maintenance.

Note:

- the two competing contentions are mutually exclusive;
- the two competing contentions are also comprehensive;
- while the probabilities attached to the various contentions cannot be quantified but intuitively must sum to unity (pE/C + pE/nC = 1);
- the probabilities that are attached to the contentions of the opposing parties represent the numerator and denominator of a Bayesian Likelihood Ratio.

A 'qualitative' Bayesian analysis of the evidence relating to the metallic particles on the filter is:

Numerator of Bayesian Likelihood Ratio (corresponding to insurer's expert's view): The likelihood of finding numerous metallic particles on a filter given the contention the hydraulic system has been inadequately maintained is very high (almost certain, so ~1);

Denominator of Bayesian Likelihood Ratio (view of insured's expert): The likelihood of finding numerous metallic particles on a filter given the contention the hydraulic system has failed due to some cause other than inadequate maintenance is very high (almost certain, so

~1), because circulation of hydraulic fluid carries metallic particles to a filter during inception of failure and in this instance there is no way of telling whether a population of particles has accumulated progressively and over a long period of time, or contemporaneously with failure of the pump and almost instantaneously.

Qualitative evaluation of evidence advanced by scientist retained by pump's owner: It is about equally likely to see metallic particles on a filter of a pump that has failed catastrophically and suddenly as if it has failed progressively as a result of neglect. The Likelihood Ratio is ~1/~1, which is about unity, so the evidence from the particles on the filter and from trace element chemistry of the hydraulic fluid adduced by the insurer's expert is of no probative value.

This evaluation of the evidence raises the question: What were the proximate and ultimate causes of failure of the concrete pump?

Independent examination and analysis of the material retained on the filter indicated inter alia that the particles were not wear particles but were particles generated by energetic impact of componentry.

Microscopy and X-ray diffractometric analysis also revealed the presence of fine particles of tricalcium silicate on the filter; the same material was found in the hydraulic fluid reservoir. Tricalcium silicate, which is anhydrous and crystalline, is the primary component of modern New Zealand Portland cements. It is chemically and crystallographically distinct from the rigid calcium silicate hydrate gel produced by the hydration of cement that takes place when concrete is mixed and hardens.

Examination of the hydraulic system indicated that migration of cement powder particles or other components of fresh concrete into the hydraulic system was unlikely as such material would have to negotiate numerous intact seals against a large pressure gradient.

Available evidence led to the conclusion that failure of the hydraulic motor on the concrete pump was due to cement powder having been introduced into the hydraulic system. This caused frictional overheating, expansion and disintegration of moving parts. The concrete pump had probably been sabotaged.

WORK OPPORTUNITIES FOR 701 GRADUATES OUTSIDE CRI'S

Many of the skills acquired in the course of a forensic scientist's formal training are applicable in other fields, in particular the food industry, manufacturing, mechanical and

general engineering; quality assurance, contamination, insurance, pharmaceutical and healthcare industries, environmental science, cleaner production technology, equipment design, occupational health and safety……..

This is important because in New Zealand and worldwide, there are far fewer job vacancies in forensic science than forensic science graduates.

Useful skills for 701 graduates seeking employment in forensic science

- literacy
- report preparation skills including keyboard skills
- optical microscopy
- general chemistry
- manual dexterity
- driver's licence
- firearms licence
- photography and photomicrography (optical and digital)

FORENSIC SCIENCE OUTSIDE ESR IN NEW ZEALAND

other Crown Research Institutes

IRL (Industrial Research Limited): forensic engineering; SEM-EDS analysis and electron microscopy (Dr Neville Miller)

IGNS (Institute of Geological and Nuclear Sciences Limited): forensic geology, forensic mineralogy and petrology (Dr David Skinner); forensic palynology (Dr Dallas Mildenhall)

AgResearch: forensic entomology (Mrs Dallas Bishop)

Landcare Research: forensic entomology (Dr Trevor Crosby)

other organizations and companies

DNA Diagnostics Limited (DNA for criminal defence and paternity determination)

Canterbury University (Professor Steve Weaver, forensic petrology of greenstone)

Belgravia Building Consultants Limited (Michael Wesseldine, forensic concrete engineering)

Metal Test Limited (Clive Jennings, metallurgy)

Forensic & Fire Investigation Limited (Marnix Kelderman)

Fingerprint and Forensic Services Limited (Peter Burridge and Kevin Sturgeon)

Microfossil Research Limited (Dr Mark Horrocks, forensic and paleoenvironmental palynology; forensic botany)

Forensic & Industrial Science Limited: general forensic science (criminal and civil); materials science including microscopy and microanalysis; industrial chemistry and science.

Individual scientists

Dr Peter Cropp (forensic biology)

Dr Arie Guersen (DNA)

Linda Morrell (questioned document analysis, handwriting analysis)

Rory Shanahan (physical evidence, drugs, alcohol, general forensic science)

Robert Sadler (forensic veterinary medicine)

Forensic pathologists: Professor Timothy Koelmeyer; Professor Rex Ferris; Dr Jane Vuletic; Dr Martin Sage; Dr Ken Thomson, Dr Stephen Kirkwood; Dr Alison Cluroe

Other areas of forensic specialization

Other areas of forensic specialization in New Zealand include:

- Computer forensics
- Forensic accounting
- Forensic psychiatry
- Forensic psychology
- Forensic odontology

summary of differences between the work of a Defence scientist and Crown counterparts

	Defence	**Crown**
civil cases	many	very few
criminal cases	common	almost exclusively
materials encountered	physical and non-biological	physical, biological
chemistry	predominantly inorganic	organic and biochemistry
instrumental methods used	infrequently	routinely

interpretations based primarily on ….	first principles	examiner's experience
Bayesian methodology	yes	yes
documents prepared	large variety	restricted range
items or exhibits examined	infrequently	routinely
items for examination	small number	very large volume
volume of paperwork	very high	high
Court attendance	frequent	very frequent

Introductory notes

Name

I work for Forensic and Industrial Science as a forensic scientist

I have been asked by Dr Douglas Elliot to give a lecture on forensic science from the defence scientist's perspective

Dr Elliot has asked me to say a little about my background.

I graduated in 1997 with a PG Dip in For Sci

Before I studied forensic science I was working as a materials scientist

I trained as a geologist specialising in petrology which is the science of geological materials

In criminal cases I undertake defence work almost exclusively.

In civil cases involving litigation, I act for either plaintiff or defendant.

So I'm not exclusively a defence scientist – I am an independent forensic scientist

additional comments

methamphetamine lab remediation: what items retain contaminants? what can be restored? what must be discarded?

Paperwork side of forensic science not emphasised