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The Forensic Science Society Summer Conference "Benefits of Hindsight" Crowne Plaza Hotel, Glasgow, Drug Profiling, 6th–8th July 2007

'Benefits of Hindsight'
Reporter Jo Barlow, Forensic Science Service

Workshop — Drug Profiling
Convenor: Dr. Niamh Nic Daéid

Dr. Niamh Nic Daéid's workshop was a highly informative and thorough exploration of issues relating to drug profiling. Topics covered included the common methods for production of semi-synthetic and synthetic drugs and analytical methods for characterization of the various impurities within these samples.

Drug profiling is sometimes referred to as 'Impurity Profiling', 'Chemical Profiling', or even 'Drug Characterisation'. The European Network of Forensic Science Institutes (ENFSI) Drug Working Group (DWG) came up with a working definition of what drug profiling scientists should be aiming to achieve, and this is:

> *The use of methods to define the chemical and/or physical properties of a drug seizure for comparing seizures for intelligence (strategic and tactical) and evidential purposes.*

Profiling Methodology: physical examinations of drugs packaging (paper wraps, cling film, bags, tape) and physical characteristics of drugs (resin blocks, cannabis, powder samples, tablets) including colour, odour, logos etc. may all have a real bearing on whether a scientist feels able to link drugs. Additionally it is also possible to conduct biological analysis and/or chemical analysis on particular drugs types, DNA profiling of cannabis plants for example and elemental examinations of organic and inorganic components. So, what happens when the data is obtained? How is it to be interpreted? Any databases should be robust, meaningful and contextualized and a Bayesian approach may further assist.

A concise overview regarding the evolution of drugs of abuse was then discussed. This covered the use of plant products for ritual, spiritual and medicinal purposes such as cannabis and coca; the refinement of natural plant products such as cocaine and morphine; the full synthetic manufacture of plant products; the development of new products based on plant products thus providing greater potency and better specificity, such as fentanyls, barbiturates, and benzodiazapines; and finally, the manufacture of designer drugs such as amphetamines, and MDMA, MDEA etc. which are artificially produced substances for the illicit market which are almost wholly manufactured from chemical compounds in illicit laboratories.

Next, we were provided with an overview of cannabis cultivation, including hydroponic growth, and the difficulties in profiling cannabis were discussed. There is the potential to use morphological, biological and chemical methods, but each has its problems. Morphological examinations may only provide a very tentative idea of the origin of a plant/plants for example. Other issues which make cannabis profiling difficult to do are the natural degradation of cannabinoids, that the concentration of different cannabinoids changes over time depending on storage, different profiles can be seen within a single resin block, and the DNA techniques are laborious and time-consuming.

With semi-synthetic and synthetic drugs, Niamh reasons that the issues for sample linkage become even more complex. We started by looking at the production and analysis of heroin and cocaine. Heroin is the final product of opium cultivation and contains a variety of opiate alkaloids which are based around two chemical structures; phenanthrene alkaloids such as morphine, codeine and thebaine and isoquinoline alkaloids such as papaverine and noscapine. An overview was given regarding poppy cultivation and opium production. It appears poppy cultivation and opium production takes place most intensively in Afghanistan and Myanmar, and that raw opium is produced from the coagulated juice of unripe poppy seeds which provides a rich source of opiate alkaloids. In relation to the chemical profiling of opiates, many laboratories use gas chromatography (GC) to initially confirm identity and quantify samples. Some problems encountered in the profiling of heroin include that diamorphine can de-acetylate to mono acetyl morphine and morphine in the injection block, there is often poor chromatography of some of the larger molecular weight opiates and although it is possible to use derivitisation to make samples more thermally stable, this always compromises chemical profiling.

Following this we looked at some photographs of the various varieties of Coca plant and areas of the world in which

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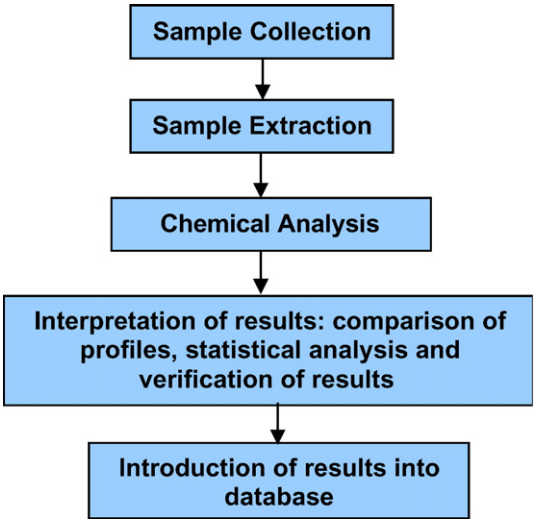
intensive coca bush cultivation occurs. This is mainly Columbia, but also occurs in other parts of South America. Most cocaine which is trafficked contains about 30% cocaine hydrochloride with other substances such as lidocaine, procaine or benzocaine added. The samples are then often bulked up with lactose, sucrose or manose. Analysis of cocaine is most frequently done by GC and GCMS (Gas Chromatography Mass Spectroscopy).

Next came amphetamines which are totally synthetic compounds produced mainly in either large scale or small scale clandestine laboratories, however, they are also legally produced and have medical uses such as in the treatment of the sleep disorder narcolepsy. The common routes of amphetamine synthesis include Leuckart synthesis, reductive amination, nitrostyrene, Ritter reaction, Friedel Krafts alkylation reaction and reduction of Dexatrin. This was expanded on by looking at the major methods of methylamphetamine production and MDMA synthesis.

To summarise this section, Niamh considered what issues need to be thought-out for scientists to get results that can be interpreted in a meaningful and contextualized way. Some of the questions which need to be asked; how are the drugs made and is this via a synthetic route? What are the pre-cursors and pre-pre-cursors, and what happens after the drugs are made? How are adulterants and excipients added? And finally, how do street samples relate to dealer samples? Niamh believes it is very helpful to have an awareness and understanding of the illicit drug industry.

So, what are the stages of drug profiling?



In relation to sampling methods, most laboratories use sampling methods that have been developed in house. The first stage should always be to sample by attributes such as colours, logos and physical appearance. Next is to consider how to obtain a representative sample from a bulk powder of liquid, and some appropriate questions to consider might be; is the sample one item or a mixture?; Must it be homogenized?; How do you ensure homogenization? (I.e. through blending, manual mixing, sonication and vortexing). In addition to this it may be necessary to decide which statistical sampling method to use, and in drug profiling there are two recognized approaches, which are, the 'frequentist approach' including hypergeometric distribution and binomial distribution, and there's also the 'Bayesian approach' which incorporates the calculation of prior and posterior odds.

So, once the sample has been picked it is then central to success to pick the most appropriate instrumental method of analysis. Primarily this will be the GCMS method, but for all methods used, currently, exclusion remains easier than trying to demonstrate that two samples are from the same source.

In summary, although drug profiling is in its early days in forensic casework, there is some good potential. It is in some cases at least possible to identify synthetic routes of production through route specific impurities, to identify common alkaloids/semi-synthetic products, to identify common diluents and adulterants, and to provide intelligence. In relation to identifying a common origin for more than one sample of drug, often the best that can be done is to include or exclude, but the potential to do more remains.

Crime Scene Investigation workshop

Chris Booth, Sussex Police, and Colin Ratcliff, LGC Forensics

Reported by Gayle Taylor, with thanks to Stacey Leadbeater

This workshop was an overview of crime scene investigations from the technical to the practical, with some experiences thrown in as examples.

In the first instance the importance of managing a crime scene must be understood. This management is needed for gathering intelligence and the evidence. A similar strategy used throughout the world.

One small problem is that every jurisdiction has its own standards that must be adhered to; these can change between police forces, state or county lines and countries. There are 43 police forces in England and Wales, 8 in Scotland, the PNSI, SOCA, Military Police, and British Transport Police. These all have there own polices and procedures.

There are a range of incident strategies which the CSM must consider to decide which is best fit for purpose. Whilst deciding on the correct method of investigation the CSM must also consider the standards which are associated with that incident type before work commences.

In the United Kingdoms crime scene management there has been an increase in importance to the police to provide the courts with objective evidence. Courts want tangible evidence to be presented to the jury so there is less of a window for subjectivity. This is increasingly expected due to advances in scientific developments and increased public awareness. Many databases have been set up nationally such as fingerprints, DNA, firearms and footwear which aid in investigations and can provide the factual evidence the courts are looking for. Much of the laboratory processes that go in to providing this evidence have quality management systems in place, however crime scene investigation has little in the way of these types of regulations. This is combated by having set standards.

Standards for professionals in the field:

- There is central training for police at places such as Harpley Hall, but some police forces do their own such as the MET
- Standards and professional bodies are in place
  - o Skills for justice
  - o Council for registration of forensic practitioners (CRFP)
  - o Forensic science society — professional body
  - o Regulator that started 4th June 2007
- Publications that have advice and standards such as major incident room procedure and the murder investigation manual are printed by CENTREX
- Scenes involve police, police staff, laboratory services and external experience which all need coordinating

Roles

- Senior Investigating Officer (SIO) is a police officer in overall charge of the team of detectives. The buck stops here, they rarely go out in reality and spend large amounts of time sat in the incident office.
- Crime scene manager (CSM) who are normally police staff, senior crime scene investigator, who will lead teams of SOCO's or CSI's
- Crime Scene Coordinator (CSC) is a senior manager
- Scientific support manager (SSM) is the head of the department sometimes in smaller operational forces

These role descriptions are not ranked so anyone is able to do the jobs according to the training received.

Incidents are split into categories according to the type and seriousness of the crime. These range from A+ being very serious where the public is at risk, there is public concern and/or the incident is of high media interest. The lowest category is C where the risks are low and the offender is known, the CSM is not usually at the scene in these cases.

Crime Scene Managers have the following responsibilities

- Assessment, planning and strategy of the scene
- Staffing
- Welfare
- Contamination
- Health and Safety
- Managing Post Mortem examinations
- Briefing and the communication
- Advises SIO on strategy and any forensic experts that can be used when needed
- Coordination of other experts

Crime Scene Coordinators have the following responsibilities

- Multiple scenes or complex/high profile cases
- Serial offences
- Major incidents/mass disasters
- Cold case reviews

When at the scene the casualties are assessed and dealt with appropriately. The integrity and preservation of the scene is kept by the use of cordons, logs, a common approach path and active preservation priorities. The scene parameters are set, and it is made sure the specifics are recorded and its known where to stop. The forensic and examination strategies are established for the best value and intelligence to be retrieved. There are communications and briefing between the teams involved. Up to date records are kept of developments and the scene.

The forensic strategy

- The forensic management team
- Forensic opportunities
- Investigative requirement such as finance and time need controlling
- Expertise — team based and problem solving
- Recorded and communicated to the team
- Above all this strategy must be regularly reviewed

Questions to pose

- Direct identification of the offender
- Connecting material
- Incriminating material
- Point of entry and therefore the sequence of events
- Hypothesis testing for investigations
- Type of search — what order? Fibres? DNA? Fingerprints?
- Time scales
- Review constantly
- Identification of priorities — remove clothing from the victim at the scene?
- Recording details to help find relevant material for the case and future work.

Many conflicts exist between the resources available and the priorities of the investigation. It is down to the CSM to decide the following difficult choices. They have to decide on the number of potential items and lines of enquiry, which of the increasingly complex and costly tests to use while not compromising on conflicts such as fingerprints and DNA. This is all a careful balance with public money; questions need to be asked such as is the case an appointed investment?

Other forensic experts are considered based on the cost, information required and the priority of information needed. The CSM does a scene assessment and decides on experts that may be needed and then acts as the link between them and the investigation team.

Crime scene management is about understanding and coordinating a scene.

The second part of the workshop was a series of crime scene examples and pictures to show how easily our thought processes can be influenced during major crime scene investigation by not only our own perception of the scene, gut feeling, but also by that of others. Also discussed were the dangers of subjective thought processes and methods for combating misleading crimes scene theories.

In Brighton a 999 call was received with concern for the occupant of a house due to a build up of milk on the front door step. On arrival to the scene no milk was found and the ambulance crew had wrongly forced entry as only police have the power to do this. The ambulance crew found a heavily blood stained body in the kitchen. They had also had searched the house and broken in through the kitchen window.

An elderly female was found on the floor of the kitchen naked from the waist down. The house had been secure but a baseball cap and knife were found on the side that raised suspicion. At first look the scene was considered as a suspicious death and the crime scene team dealt with the scene according to the evidence first encountered.

It was revealed at the Post Mortem that the lady had died of an aneurism and so suffered heavy blood loss; the baseball cap that had raised suspicion was hers that she used to wear to the shops. This shows people can not be put in to stereotypes and assumptions should not be made, such as the sight of the baseball cap resulted in the theory of a youth being involved in the death.

In Bexhill there was a report from neighbours of a bad smell. A housing officer attended the house and left a note on the door when they got no answer. The police became involved and it was discovered there was a history of domestic abuse in the property, so they entered. In the kitchen they discovered a knife, and lots of blood stains throughout. The female victim was found on her back in the bedroom area.

The police that had entered the premises had called the crime scene team to process the flat, and stated that the victim was in the bedroom after a quick look around. The team were wrapping up their work after 3 h when they discovered another unopened door. Behind this door, in the bathroom they found the boyfriend dead on the floor. He had killed himself after fighting with his girlfriend. In hindsight a thorough search of the property would have been beneficial both to secure the area and thoroughly check the scene prior to the team arriving.

Many other photos and examples were shown to demonstrate some different points. The most important was that first assumptions and impressions can be wrong and sometimes experience can work against you. Some scenes are not murders even though they look that way, many can be elaborate suicides, sudden deaths and even accidents. An important point was made that crime scenes are 360 °C and you should always look up! In one example there was blood spatter on the ceiling that was nearly missed.

When assessing a crime scene it is important to consider time and money constraints, as well as considering the circumstances. Bodies found at crime scenes are now processed at the scene to prevent the loss of evidence that would previously have been attempted to be collected at the post mortem or possibly lost.

It must always be remembered that if a crime scene is incorrectly assessed and interpreted at the outset, then the scene examination and criminal investigation that follows could result in the guilty being freed or the innocent convicted.

Main Session

Following on from the afternoons' two workshops, which included 'Crime Scene Investigation', run by Chris Booth of Sussex Police and Colin Ratcliff of LGC Forensics, and 'Drug Profiling', as described above, the main session was formally opened by Brian Rankin, President Elect, in the absence on the first day of the conference of the current President, Professor Robert Forrest.

Brian Rankin described hindsight as our second best gift, with foresight being the first. He also added that we should remain conscious of not judging the past by today's standards and that forensic scientists must endeavour to always minimize and mitigate risks, and where mistakes do happen, that steps are put into place to ensure it doesn't happen again.

The Cold Case Sapphire Service

Kate Wilkinson, Sexually Motivated Crime, Forensic Science Service

Kate began her session by describing the close working relationship between the Forensic Science Service (FSS) London Laboratory and the Metropolitan Police Service (MPS) Cold Case Sapphire team. The relationship is designed to allow for a 'cradle to grave' service for the MPS unsolved historic stranger rape investigations.

During the session Kate gave a brief history of DNA profiling, which assisted those non-biologists in the audience in more fully understanding what the old and new DNA techniques encompass and what they allow scientists to achieve. Further, Kate described the retention of items from these investigations and the availability of case materials, the use of the National DNA Database (NDNAD) and staff elimination databases, the building of the case including looking at the continuity of the retained materials, the results obtained to date, and the challenges associated with the Cold Case Sapphire work.

All the cases selected for review are those where there was no previous interaction between the victim and suspect prior to the alleged offence, and where the case falls between 1988 and 1996. Before 1996, the lab was the MPFSL (Metropolitan Police Forensic Science Laboratory) and during this time a Sexual Assault Index was kept which retained information on all sexual offence submissions. This index was retained at the laboratory when it moved into Home Office control and became the FSS London Laboratory.

The MPS start the process of conducting a cold case review by determining the suitability of the case before requesting a forensic review, and by doing this it reduces the chances of a case being "NFA'd" (No Further Action) by the CPS. Additionally, before any files go the CPS, full continuity will be addressed and the extensive paperwork retained by the FSS can be used to trace the continuity of samples that were submitted many years ago. Fortunately, with a little bit of foresight, scientists retained numerous samples in their freezers from these sexual offence submissions and marked them as 'retain for future DNA analysis'. This means that there has been a great deal of material to review and test.

An overview of the Single Locus Probe (SLP) DNA test was given, followed by a brief description of gel electrophoresis for the measurement of DNA fragments. SLP (Single Locus Probe) had a high discriminating power and the results could be digitally

recorded which allowed the development of the first DNA database in the FSS. The major drawback of SLP is that it was a pre-PCR (Polymerase Chain Reaction) technique which meant that samples needed to be quite large and contain high levels of nuclear DNA, therefore resulting in massive sample loss when the samples were tested. In addition this technique and its' results are not compatible with current day DNA profiling techniques. In many historic cases samples tested positive for certain body fluids but were not examined as there was not enough sample material. These can now be examined due to the developments that have been made in DNA technology over the last decade.

In relation to the FSS process of DNA extraction, any swab heads would be placed in a white eppendorf tube into which sterile water would be added. This would then be agitated in order to free any cells from the swab head material and create a cell pellet at the bottom. The remaining supernatant would be put into a green eppendorf tube, and now in many cases this is the only material remaining. The SLP extract would then be created by processing the sample from the white eppendorf and these could contain several hundred nanograms of DNA. With current DNA technology scientists are able to work with as little as one nanogram of DNA and it is important not to overwhelm today's systems with too much DNA. Even used, but now apparently empty tubes can contain enough residual DNA to be suitable for the SGM+® test. Kate referred to one case where a seemingly empty tube contained such concentrated DNA that it required three dilutions! Unfortunately some of these tubes have been disposed of in cases where there may have now been sufficient material for re-examination, but that as we know is the benefit of hindsight. The numbering which was once present on these tubes had also worn off in many cases, so the sexually motivated crime unit called upon their colleagues in the FSS Questioned Documents section and Specialist Location and Recovery Section to enhance these marks and determine their origin. Most of the swabs have been examined at some point historically and in a lot of cases the swab head had been removed. In these cases Kate and her team went about examining the inside of swab sleeves whereby there may have been some initial contact between the swab head and the sleeve as it was put back into its container after use.

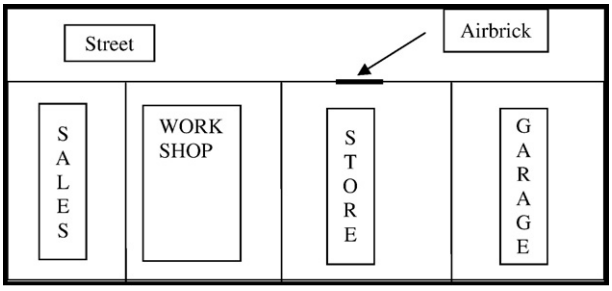
Out of three hundred cases reviewed, two hundred were sent for DNA analysis. Out of these there have been one hundred and sixteen scene to suspect matches, one hundred and eight cases where a DNA profile has been obtained but the offender is not on the NDNAD, and five scene to scene matches. Thirty four of these cases have now reached either a guilty plea or a guilty verdict, two cases have been identified as false allegations, and in twelve cases the victims have been unwilling to proceed. Lawrence Barwick has received a life sentence for rape, indecency and false imprisonment of a ten year old victim; Isse Botan has been sentenced to twelve years imprisonment for the rape of a twenty-three year old victim. In this case the cotton heads of the intimate swabs from the victim had been used up in a previous analysis for DNA, so the team swabbed the swab shaft, tip and swab sleeve and a full SGM+® profile was generated. There are many, many more such examples and this without a doubt demonstrates that these reviews continue to bring about very satisfying conclusions to previously undetected serious crimes.

Fire Investigation Short Stories

Eur Ing Mike Jones, Geoffrey Hunt & Partners

As usual, a very fascinating and entertaining session was provided by Mike Jones. Mike initially discussed the differences in approach that are required between fire investigation and other realms of forensic investigation. In the main this referred to the importance of fire investigators having the ability to use some imagination in developing theories with regards to events surrounding a fire scene, but always ensuring that not too much reliance is placed on these personal theories. The case studies Mike used demonstrated clearly the potential pit falls associated with this essential approach and also gave the opportunity to offer learning experiences to help escape these pit falls in future.

The first case study involved a fire in a video shop – 'The Video Shop Dilemma'. In this fire scene, at the outset, it seemed as though a length of drainpipe had been put through a smashed airbrick in the wall of the premises, petrol poured through and set alight. However, on further inspection it became apparent that on the other side of a locked door in a room adjacent to the main fire, a box underneath a work bench also appeared to have been on fire. Please see the diagram:



Mike found no evidence of heat transfer from the store room where the fire occurred to the workshop where the box was stored. The defence in this case argued that petrol had been poured into the store room through the airbrick, that this was ignited and eventually forced flames through the door and established the fire in the next room. After Mike had given evidence in the case, on the way back to his seat in court he noticed the remains of an airbrick in a box on the bench. This got his mind whirring as he also noticed that the airbrick seemed to show a distinctive pattern to its' breaking. In order to test his burgeoning theories he purchased a number of airbricks and attempted to smash them from different sides to see what sort of patterns would be created. On the sides that were hit were clear impact marks, and yet on the opposite sides were 'shockwaves' or stress relief patterns, so essentially there was always more damage to the brick on the opposite side to where the impact occurred. Mike suggested that this provided evidence that the brick had been smashed from the inside of the building, not the outside. As the jury were unable to come to a decision previously, when Mike went back to court with this case the airbrick findings were not presented as the defence argued that his evidence had been lodged too late.

Next came the 'Mysterious Affair at Nenthead'. Within 6 months of a new family arriving in the village of Nenthead, Cumbria, there had been five incidents of minor arson. In this

latest incident a fire had occurred in a cottage whilst the owner was out. The new family rang the emergency services to report the fire at 3 am whilst out walking their dog! On arrival, the fire brigade found a trail of unburned diesel at the cottage, and it appeared that the kitchen window at the rear of the house needed to be a focal point of the fire investigation. It became clear early on that the kitchen window had been open at some stage during the fire. The back door latches were all intact and showed no signs of tampering, and the fire in the kitchen appeared to be centred on the window.

Mike felt that the kitchen window appeared to be a point of entry and exit as there was some broken glass on the inside and some on the ground outside. So, could the fire have been caused by the owner of the cottage? This quickly became unlikely as he was hundreds of miles away and was under-insured. To this day, the person who caused the fire remains unknown.

Part three of Mike's session was entitled 'The Lucky Survivor'. This account of a gas explosion demonstrated the importance of not using prior experiences to pre-judge new cases. A gas explosion occurred in a modern terraced house and the owner was found in the back garden, naked. Initial thoughts were that it appeared it may be a gas suicide as all the fuel points on the gas cooker were on full. Fortunately this man survived to tell the tale and was able to explain that he had put the gas cooker on to quickly try to warm the house, then the 'phone had rung and he went to answer it. Then something occurred to cause the explosion. Without his version of events this could have been difficult to determine exactly what had occurred.

A Case Study 'He Got Away with Murder'….

Anna-Marie O'Connor, Forensic Science Service

Investigating reports of missing persons is a full time job for all police forces and other investigative agencies worldwide. However, Anna-Maries argues, it remains a sadly undervalued and generally low-profile police function. Thousands of people go missing every year in the UK from all walks of life, and most return fairly shortly afterwards safe and well. But some don't. A small percentage of missing persons will have been the victim of foul play or will have met with another tragic end. It is in the light of this possibility that the police must respond effectively to *all* reports of missing persons so as to identify those cases which require substantially more attention.

Below are some statistics taken from the UK National Missing Persons Bureau which shows the average number of people reported missing each year in the UK who have been/were missing for 14 days or longer.

	Male	Female
Under 14	177	201
14–17	357	601
18+	1265	731

In an example of how poor responses to reports of missing persons can mean that things go horribly wrong, Anna-Marie presented the investigation into missing teenager Joanne Eddison. Joanne was on GCSE study leave from school and was last seen alive on Thursday 16th May 1996 on the band stand of Blackheath Park, London, with friends. According to her friends they parted company and they explained that Joanne was going to visit another friend.

A friend of Joanne's, Liam Tavell, went around to Joanne's house later that day and asked to see her, but Joanne's mum said she thought she might have been with him. Liam said he had not seen her all day. Liam who, like Joanne, was 15 years old and lived with his mother and her boyfriend was not liked by Joanne's father. By 11 pm that day Joanne's father had become distressed about her not coming home and went around to Tavell's house as her friends had told him it was he she had gone to visit. Joanne's father held Liam up against a wall and demanded to know where his daughter was. Liam's mum explained that Liam had been in the house all day.

Joanne was then reported missing from home, and on a search of her bedroom none of her belongings were found to be missing. On day two after Joanne's disappearance the local CID were informed. The Police spoke with Liam Tavell and his mother, made a cursory search of their house and were told the same as Joanne's father by Liam's mother – he had been at home all day. On the third day after Joanne's disappearance a Detective Constable and a Detective Sergeant from the local murder squad were drafted in to assist in the investigation.

Parameters were set out for a search of relevant areas, and some limited house to house enquiries were carried out. British Transport Police search units were also drafted in because part of the search area included a railway line and embankment. The search teams were asked to pay special attention to the embankment and the area at the back of Tavell's house, but nothing of relevance was found. However, the search only took 2 h and the police search dog had not been allowed onto the embankment due to all the rubbish present which may have harmed him.

Some new information started to emerge, including a statement from Joanne's paternal grandmother which claimed that Joanne did not get on with her mum and that she had said she would run away as soon as she could. A neighbour of the Eddisons' claimed that when she had asked Joanne if she was looking forward to her birthday she had responded by saying, "Well I won't be here for it". Joanne's uncle also claimed that he had seen her on the Friday evening after she had gone missing and that when he had shouted to her she had run off.

Liam Tavell lived at 129 Eastcombe Avenue, not far from the Eddison's. On 19th July 1996, just over a month since Joanne had gone missing, a neighbour at number 127 Eastcombe Avenue had complained that a nasty smell was coming from the rear of the Tavell's home. Police officers removed the fence panels at the end of the garden to investigate the smell, and they discovered a body. This was Joanne's body and was conclusively identified later by dental impressions as Joanne had only recently had a brace fitted. Liam Tavell was then arrested for her murder. DNA samples from Joanne's parents were also used to aid body identification and the results demonstrated that the DNA sample taken from the body gave a DNA profile which was likely to be from a child of those two parents. Clothing attached to Joanne's body was examined for semen, blood and saliva but nothing was found. On a jacket found near to the body blood and saliva was detected. No cause of death was determined due to the severe level of decomposition.

Initial scientific examinations of the Tavell home included a fingerprint examination of Liam's bedroom, as both he and Joanne's mum said that Joanne had never been in there. Anna-Marie described the Tavell home as being rather strange in that there were no personal effects, no pictures, no books, and it was extremely clean and tidy. A faint stain on Liam's bedroom carpet gave a positive Kastle–Meyer reaction for blood and when the carpet was rolled back there was visible staining on the back of the carpet and on the underlay. The evidence was mounting up against Liam Tavell but when he was re-interviewed by investigators he continued to insist that he had no idea what had happened to Joanne and he showed no emotion at all. He was charged with Joanne's murder and soon after, Liam's social worker reported to the investigators that Liam had told him Joanne had been in his bedroom and that he had been twirling a pool cue when it slipped out of his hand and hit her on the back of the head. He explained to his social worker that she had then bled, convulsed and died and that he then panicked and disposed of her body over the garden fence. He was subsequently charged with manslaughter on the grounds of gross negligence, for which he was sentenced to three years imprisonment. He was also sentenced to four years imprisonment (to run concurrently) for perverting the course of justice.

Joanne's parents made an official complaint against the Metropolitan Police Service and BTP for their handling of the search for Joanne and their subsequent investigation. Some officers received a formal warning and one officer was disciplined. A paper entitled 'The Police Response to Missing Persons' published in 1999 made numerous recommendations with regards to any report of a missing person. Firstly, the initial response upon receiving a missing person report should allow skilled and trained personnel to effectively grade and classify the report. Accurate records should be kept of the timing, location and any personnel involved in all places searched for the missing person. There should be clear paths of responsibility for dealing with missing persons enquiries and all police forces should ensure that any activity undertaken in response to the report of a missing person is thoroughly documented. This is imperative when a missing person is later found to have been murdered. And finally, inter-agency working is of paramount importance. Interaction between detectives, crime scene investigators and forensic scientists in particular is essential.

Although he couldn't be present on the day, Callum Sutherland, who co-wrote the presentation with Anna-Marie, recommended that all missing persons reports should be dealt with on a 'worst case scenario' basis, and investigators should keep an open mind with regards to who might help the investigation and what experts may be required to assist. A conference should also always be held upon discovery of a body to discuss and propose the best way forward before any action is taken.

Murder of Robert Higgins — supporting unresolved investigations

Detective Joe McKerns, National Policing Improvement Agency (NPIA)

Joe is part of the Crime Operational Support Team in the NPIA, and is a Regional Advisor. Regional Advisors have broad experience in the field of serious crime investigation as Senior Investigating Officers. Regional Advisors can, at the SIOs request, offer strategic advice and practical support to investigators of serious and series crimes and other complex enquiries including cross-border and high profile cases. Where appropriate the Regional Advisor will formulate a Regional Support Team of the experts required by the investigation. So, Joe's primary responsibility is to assist and support SIOs in Scotland, where he is based. Generally he acts as a support in crimes such as murder, rape, abduction, serious sexual offences, and other crime related critical incidents.

Six regional teams of investigative advisers have been put together by the NPIA to assist investigators. These teams are supported with the specialist skills of Crime Investigation Support Officers (CISO's), Behavioural Investigative Advisers (BIA's) and Geographic Profilers, as well as the Regional Advisors. There are also national resources available which include the Serious Crime Analysis Section, the Physical Evidence Section, the National Injuries Database, National Search Advisor, National Interview Advisor, National Family Liaison Officer, and the CATCHEM database (Centralised Analytical Team Collating Homicide Expertise and Management). CATCHEM can provide SIO's with startling figures to spur them into action. For example, it will tell them that 94% of children will be dead within 24 h of going missing.

In relation to all the unresolved cases that Joe becomes involved with, the general programme of liaison with the SIO includes an initial meeting to discuss the detail of the investigation to date, decisions on the appropriate support required, and continual assistance throughout the case until the conclusion of the enquiry.

The case example used for this session involved the murder of Robert Higgins, whose body was discovered on the 1st May 1995 in a farm quarry in South Queensferry. The deceased was not known to venture very far from his home in Dalmeny, West Lothian. It became apparent during the investigation that on the night of his disappearance Robert was seen to have been involved in an altercation in a local public house and had spent most of that evening drinking. Following this he went missing for 2 days which was very out of character for him. Two days later his body was discovered. Following a frustrating investigation with little success the enquiry was eventually wound down, until October 2005, when it was eventually revisited by ex Detective Superintendent Robert Swanson. This is the point at which Joe became involved in the reinvestigation. FSS Specialist Advisor Malcolm Boots drew up a report including several recommendations for the reinvestigation. Meetings were held with the Senior Investigating Officer the Police Force Scientific Laboratory and a budget and timescales were agreed by all in the team.

At the crime scene itself in 2005, several items were found and recovered that were looked at again during this reinvestigation. There were cigarette ends, a knife and a jacket and all were examined by the laboratory. An SGM+ profile was generated from a cigarette end which was then loaded to the National DNA Database (NDNAD) but there were no matches.

One witness in the investigation became increasingly interesting to investigators due to his overly helpful behaviour. This witness came forward after 6 months, giving seven statements in all. Each statement contained increasing amounts of information and detail about his knowledge of the victim and the crime scene. The investigative team found that his statements did not fit in at all with the scene itself. One part of this reinvestigation involved finding the right people to provide advice on the best way to approach questioning this witness.

Many new challenges were faced at every stage in this case, and it became Joe's responsibility to find and advise on the best possible people to assist with addressing each of these challenges. For example, it became apparent that some entomology work may have been helpful at the crime scene but as several years had passed this was not possible, so Joe discussed the scenario with John Manlove who carried out some 'retrospective' entomology from scene photographs, which he later gave evidence in court about.

So, there are many areas in investigations that Joe and his colleagues may assist with in order to bring about a resolution in previously undetected cases.

Forensic review of historic sex cases

Cathy Turner, Forensic Science Service

Cathy delivered an extremely interesting session which detailed the partnership approach which has been adopted by different agencies in the large scale review ongoing into undetected historic sexual offence cases. Particular reference was made to the successes achieved in the north-eastern police forces of England so far. Cathy also discussed the types of materials and documentation which have been retained and reviewed, the scientific techniques employed, the forensic results obtained, court presentation of the findings, and the overall outcome. Cathy placed particular emphasis at all times on collaborative working with the victims of these shocking crimes and the impact she found the reinvestigations had had on them.

First of all, Cathy posed the question, 'Why now?' It seems the main drivers for this large scale review of historic sex cases are improved technologies, particularly in relation to DNA, the size of the National DNA Database (NDNAD) and its excellent representation of the active criminal population. In most of these cases the focus could be placed on predominantly a single evidence type (semen/saliva) so crime related evidence could be targeted.

The evidence that has been retained in these cases appears to have been both the most impressive, but at times frustrating thing about the reinvestigations. Cathy showed a photograph of the Forensic Science Service central archives in Birmingham which is one of many large-scale areas for the retention of materials relevant to crimes which have been meticulously labeled and ordered. It has also been the retained casefiles which have proved to be invaluable to both the scientists in these cases and the police investigators. In some cases the police found that they had no paper records from these cases so it was often the FSS records upon which the cases were built. Within these casefiles were invaluable materials such as the case submission forms, contemporaneous notes, scientific statements, occasionally victims' statements, records of telephone calls and lists of possible suspects. Cathy found that in relation to retained materials, what was available for re-examination varied widely. There were many historic DNA extracts but many had also been destroyed in previous years. Because of developments in DNA testing and the marked increase in sensitivity of these tests, there have been remarkable success rates in retesting of samples. Many of the items which have been re-tested include microscope slides which were prepared during the initial examinations to confirm the presence of semen. These would all be uniquely labeled and preserved with an impenetrable seal. There are many thousands of the slides, and although in the majority of cases they have been stored at room temperature for many years, this appears to have caused few problems in terms of generating DNA profiles, from both the male and female components on the slides.

Other items retained include intimate swabs, reference samples, pieces of fabric, for example, semen stained fabric cut out of a garment and retained. Fibre tapings have also been examined and have proved to be invaluable due to the presence of not only fibre evidence but other debris that has been picked up as well, such as hairs, flakes of blood, and semen. Cathy stressed that the benefits of hindsight are inestimable, given that more DNA extracts could have been retained if we knew then what we know now.

In January 2002 Northumbria Police's Operation Phoenix team approached the Forensic Science Service and proposed a joint project to review all undetected serious sexual offences between 1989 and 1999. The team agreed that these reviews needed to be forensically driven and victim focused. It was also decided early on that any victims from these cases would not be approached until the CPS had agreed that there was sufficient evidence to take each case to a prosecution. A ready prepared support package was also made available on contacting of victims.

Northumbria Police, the Metropolitan Police Service and South Wales Police submitted a project bid to the Police Standards Unit in the Home Office in order to try and secure some funding and support for the cold case reviews, and £280,000 was initially approved in August 2003. The bulk of this was spent on forensic science and proved to be money well spent given that 76-90% of the work reviewed produced a DNA profile.

An evaluation of this work was conducted and this led to a series of recommendations. The main summary point from the evaluation stressed that there are clear and tangible benefits to be gained from carrying out forensic reviews of historic sex cases and that at the very least all police forces should conduct a comprehensive scoping study into the size of the operation required to address this. Further, that all police forces should review their exhibit retention and archiving policies. This extensive evaluation led to the setting up of Operation Advance which was originally focused on targeting cases held on the paper SLP (Single Locus Probe) DNA Database. Operation Advance again applied advanced DNA techniques to old items whereby any successful results were then loaded to the NDNAD

to be searched. Interestingly, the Police Standards Unit conducted a parallel study which looked into the behaviour patterns of offenders and discovered some interesting patterns.

Under this operation 76% of cases reviewed resulted in the generation of a DNA profile. Of these, 35% resulted in a match against the NDNAD. 35 suspects were identified and there have been 21 convictions so far. The primary benefits of these reviews and outcomes include providing an improved service to victims of crime, sending out strong reassurance messages to the public, bringing offenders to justice, the prevention of crime, and savings in investigative costs – many of these offenders pleaded guilty to their crimes.

During her presentation, Cathy emphasized the benefits of the partnership approach and the added benefits of having access to combined FSS and in-force records about each of these cases. It also proved beneficial to have a dedicated CPS lawyer. In relation to case selection and progression, with all cases, a preview would be carried out before any agreement was made to do a full review of the case in question. During this full review all remaining and available materials would be catalogued, the background of the case considered and then careful selection of the samples for testing would be carried out. These reviews are a huge undertaking which means there is a mass of data to work through, so a databse has now been developed which assists in mining the available data.

When a DNA profile has been generated, clearly there are a number of potential outcomes and everything that can be done is done before a victim is approached. Following a DNA match there are always lengthy discussions about what the match means in the context of the case, the victim will be seen and a reference sample taken. Much research is carried out on the victims and the suspects and a full statement is then produced. The decision is made by the victim as to whether or not they want to prosecute, and if they refuse the Senior Investigating Officer has to make a decision on how best to proceed. The general approach is to arrest the suspect and see what he says.

Cathy ended by giving brief details of a couple of case examples and stressed that the concept of these historic reviews is now well proven to be effective and that without the benefits of hindsight they have managed very well due to the application of a bit of lateral thinking!

If I Knew Then What I Know Now!

Dr Anya Hunt, LGC Forensics

Anya started her session by contemplating the benefits for scientists studying law and lawyers studying science. Anya feels that the qualifications required of scientists are very similar to those required of lawyers but that ultimately their brains are wired to work differently. However, both need to have a good knowledge of the legal framework, have good practical skills, take a rigorous approach to their work, and be able to think 'outside the box'.

So what can scientists learn from studying law? Well, primarily an understanding of the legal thought process, and perhaps learning different ways of presenting scientific findings. Scientists are not taught to write essays for example so scientific writing presents arguments in a very different way, and in most forensic reports there is little or no mention of the law involved. Understanding this legal thought process, Anya finds, is an excellent way of stopping the panic scientists can feel when faced with an unexpected line of questioning.

So, in case law, a person cannot ordinarily be found guilty of a serious criminal offence unless two elements are present. These are *Mens Rea* where intention must be distinguished from motive. This intent can be either direct or oblique. Direct intention is where the accused has a clear foresight of the consequences of his actions and desires those consequences to occur. Oblique intention is where the result is a virtually certain consequence of the defendant's actions. Then we have to consider intention versus recklessness. Recklessness is where the accused foresees that particular consequences may occur and proceeds with the given conduct not caring whether those consequences actually occur or not. Criminal negligence occurs where the accused did not actually foresee that the particular consequences would flow from his actions but the reasonable person, in the same circumstances, would have foreseen those consequences. On looking at R v Moloney (1985) and R v Hancock and Shankland (1986) we find that foresight is not enough to be seen as intention. As an example, in the Theft Act (1968) a person is guilty of theft if he dishonestly appropriates property belonging to another with the intention of permanently depriving the other of it. It is immaterial whether the appropriation is made with a view to gain, or is made for the thief's own benefit. Each part of this needs to be proven in a court of law, but do scientists consider all of these things? Anya argues that perhaps they do not and it is this which causes problems when being questioned.

The other element is *Actus Reus* which means that an act does not make a person guilty unless their mind is also guilty, i.e., the general test is one that requires proof of fault, culpability or blameworthiness both in behaviour and mind. These two elements of *mens rea* and *actus reus* must both be proven.

In sexual offences for example, Anya questioned how science can specifically address issues surrounding consent in these cases. By assessing damage to clothing, injury, scientific corroboration of versions of events given by victims and the accused, and a Bayesian approach to the likelihood ratio. But, how can this help with the legal contextualisation? Does it help in determining if the act was deliberate? Do the versions of events fit in with the findings? Could other versions of events result in similar findings? So, does a greater understanding of law help a scientists do a better job? Anya strongly believes that it does, and that in particular helps better prepare scientists for lines of questioning that they have not thought about previously.

Setting Context in Context

Professor Jim Fraser, Centre for Forensic Science, University of Strathclyde

The abstract for Jim's presentation reads — "The phenomenon of context or observer effects is widely recognised in the scientific literature and yet the problem this poses for forensic science practice has only been raised comparatively recently and in general terms. Furthermore, there is limited published guidance on how the

context effects can be addressed in a realistic manner by forensic practitioners. This presentation explores the scope and significance of this phenomenon with particular reference to shoe mark and fingerprint evidence. It also considers the context effect in dynamic investigative environments and challenges some of the apparently unrealistic approaches to dealing with the issue. Notwithstanding this, the aim of the presentation is to explore this complex area in order to develop a more detailed understanding from which forensic practice can effectively limit any adverse effects".

Jim started his session by saying that rather than lamenting over the benefits of hindsight, he prefers to 'critically reflect'. From Risinger, Saks et al.(2002) Jim quotes "An elementary principle of modern psychology is that the desire and expectations people possess influence their perceptions and interpretations of what they observe". So, for example, if you are an odontologist, it's irrelevant what the DNA result from the bite mark in question is and you are better off not knowing it. Science is objective and seeks to find what 'is' rather than what 'ought' to be. It observes and tests in a carefully crafted manner and controls errors and prejudice by experimental methodology.

The fundamental problem? Science is objective but scientists are not. Jim recommended some useful books on similar topics – 'Irrationality' by Stuart Sutherland, for example, and then continued to look at subjects such as perceptual bias, cognitive bias, and confirmation bias. Recently an ultrasound scan picture had been shown in a newspaper with the title 'Jesus Christ', but what would this image have looked like had we not been told that?

Following this Jim discussed the now infamous 'Shirley McKie' case in which fingerprint evidence was called into question. In a study relating to this a number of fingerprint experts were presented with finger marks from real cases where half of these had previously been judged as exclusions and half as identifications. The marks were then re-examined with different contextual information provided and resulted in four of the original identifications changing to exclusions, one identification to a 'cannot decide' and one exclusion to an identification. In other studies, one conducted by the University of Lausanne, no contextual bias was found, but the study was conducted differently. In the Netherlands Forensic Institute no operator bias was found in footwear mark examiners, but again each of these studies had different experimental designs.

Jim feels it is safe to say that extrinsic information, particularly in relation to forensic evidence, is a dangerous commodity. Specifically, Jim talked about the forensic examination of damage to clothing. In Boland & McDermott et al.(2006), a table was represented which detailed the differences between students and scientists findings and descriptions with damaged clothing. For example, what is meant by 'recent' damage, 'fresh' damage, 'significant force'?

The law is normative — it sets out how things 'ought' to be. E. g. the guilty should be punished; juries are good things to have. But how does the law view science? How 'ought' science to be? The courts expect it to be factual, exact (error free), black and white and conclusive. Jim finished by posing the question — 'When are we going to tell the lawyers"? More than often, it is not the fault of the expert witness, but that they are expected to fit in with the legal system and therefore do or say something that is not appropriate. As usual, Professor Jim Fraser gave much food for thought.

Cold Case Reviews — If Only Offenders Read the Text Books

Hazel Johnson, Forensic Science service & Retired Detective Superintendent Malcolm Ross

On the 10th March 1994 the body of a male was discovered next to a skip in Acock's Green, Birmingham. Police officers and scientific support personnel were called to the scene to investigate, and initial thoughts were that the deceased may have been a tramp who had died during the night. There was little if any signs of disturbance in the area close to the body, however, there was a black bin bag beside the body which, when moved, revealed a large bloodstain on the ground underneath it. During the post mortem of the male his outer clothing was found to be quite dirty, but inner clothing was clean. Documents in the mans wallet suggested he may be a local man, Peter Armstrong.

On the Wednesday prior to his death, he had been to his daughter's house for the evening and on his return home he went through the contents of the skips at the rear of the local supermarket for discarded foods. This was something he was known to do regularly.

Peter was found to have some head injuries and there was evidence of anal rape. Recovered semen was analysed using the early DNA test known as Single Locus Probe (SLP). A Pepsi bottle near to the body revealed a partial fingerprint in blood on the label. This fingerprint did not match Peter so became of considerable interest to the investigators. However, there were no strong suspects at this stage.

On the 21st of April 1994 the body of Rosella Middleton was found in her 10th floor flat in Perry Barr, Birmingham. On her corset and on external swabs taken from her body, traces of semen were found. These were poor quality and when tested suing the SLP DNA profiling test no DNA profile was obtained. A scarf, not belonging to Rosella, was found near to her body and from which a number of head hairs and possible dog hairs were recovered. The head hairs were African-Caribbean in appearance. The scarf was also stained with blood and contained traces of semen. For some reason, the information regarding the potential origin of the head hairs was not fed back to the incident room at an early stage.

Quite early on the scientist dealing with Rosella's murder asked Hazel if she believed the murders of Rosella and Peter were linked. All the factors seemed different but there was an element of doubt. The differences were that these were murders on both a male and a female; Peter was 57 years of age and Rosella 83 years of age; and one murder was committed outdoors the other indoors. Early on there was no forensic evidence to link the cases and some from some amateur behavioural analysis it was decided the cases were not linked.

In June 1994 a 73 year old male was raped in Birmingham city centre. Semen recovered was DNA profiled and matched the DNA profile from the Peter Armstrong murder investigation. A possible suspect was under scrutiny by investigators so his fingerprints were compared to that found on the Pepsi bottle at

the Armstrong murder scene and they matched. In December of that year Frank Moe was arrested at his home and in May 1996 he was found guilty of the murder of Peter Armstrong and sentenced to life imprisonment. Interestingly, in 1975 Moe had been arrested and charged with the murder of Walter Nevitt whose body had been found in a skip. Moe was granted an absolute discharge and released back into the community in 1992.

Rosella's murder investigation remained open. Rosella was born in Birmingham and remained there her whole life. At the time of her murder she was a widow and lived alone in her 10th floor flat in Perry Barr. Rosella's son had raised some concern that he had not had any contact with his mother for the few days prior to her death so he went to her flat and sadly discovered his mother's body. She had her outdoors coat on and a scarf around her neck, a shopping bag next to her with recent purchases and money was in her purse so it did not appear that she had been robbed. The door keys to the flat were just inside the front door.

Officers were called to the scene and secured it. When the house was later searched, in addition to the semen found on Rosella, a small blood mark was found on the door frame, and rumours were starting to surface that an African-Caribbean man living nearby may be involved in the murder. A drawing was found on one of the walls in the flat of a Rasta man with a speech bubble containing writings that have never been understood. The scene was attended by a pathologist who described it as a brutal attack in-situ. There was extensive blood staining on a blanket, her coat, clothes and scarf. Rosella had bruising around her face and on her scalp and she also had some vaginal injuries. Her hyoid cartilage had been fractured but there was not sufficient evidence to demonstrate mechanical strangulation.

More testing was done on the blood staining on her clothing, hundreds of witness statements were gathered and Crimewatch even did a reconstruction of events for national television. But, after many months of investigation police failed to identify the offender.

In 1998 DCI Pretty instigated a thematic forensic review of the case which resulted in the generation of a partial SGM DNA profile from Rosella's corset and a full SGM DNA profile from blood staining, but this matched Rosella. An intelligence led mass screen was initiated which used some elimination criteria already known. Frank Moe was identified as a person of interest and was asked to provide a sample in order to eliminate him from the enquiry. Unfortunately for Moe he could not be eliminated and after numerous legal arguments about his mental capacity he was deemed fit to stand trial for Rosella's murder. He was convicted and sentenced to life imprisonment. To conclude the session Hazel and Malcolm recommended that all potential evidence be considered and that a team approach often gives the best solution; ensure scientists in the case are aware of all exhibits/items available and remember that not every offender has read the text books and follows the rules.

Finally Hazel dedicated the presentation to forensic scientist Dave Loxley who died in June of this year. Dave was a biologist and the driving force behind the continuation of forensic work in this case.

Investigation of Generation Specific Class Characteristics in the Handwriting of Foreign Script

Dr Ian Turner, University of Derby

An important aspect of forensic document analysis is determining the author of a questioned document; examiners are very proficient at matching a questioned document to specimens. Determining information about the author from a questioned document is much more difficult and to date there has been little successful work on identifying the ethnic origin of an author. Around 300 million people worldwide speak Punjabi, Bengali and Urdu. In the study presented during this session, a comparison was made of the handwriting of native speakers who are resident in a Punjabi, Bengali or Urdu speaking country, first generation immigrants and the children of first generation immigrants.

Class characteristics — what are they? Characteristics which are common to a group, such as a particular writing system, family grouping, foreign language system, and/or professional group. The inspiration for one study which has now been published (Cheng et. Al.) was in looking at the class characteristics in the English handwriting of the three main racial groups in Singapore; Chinese, Malay and Indian. As both English and native languages are taught at the schools this study aimed to examine if the native language showed in the class characteristics of the English handwriting.

Ian's studies have included looking at Chinese, Arabic and Tamil scripts. 150 specimens split evenly across the groups were used for examination. The specimens were from individuals of a wide age range and school backgrounds and all were asked to copy a control passage. The specimens were then scrutinized for features distinctive of racial group and for features that looked common against a single racial group. Those who did and did not exhibit particular features were counted and these results were then subject to a chi-squared test. The features of interest were labeled and the study found that some of the features were statistically significant. One feature, for example, appeared to be a class characteristic present only in the Indian group.

Punjabi is spoken by 104 million people worldwide and Gurmukhi and Shahmukhi are the two official written languages. This particular study looked at 1st generation Punjabi's who were born and educated in a Punjab country but who had migrated to the UK; and 2nd generation Punjabi's who had been born and educated in the UK. A blind trial was then carried out which studied prepared passages from a range of individuals in these groups. The passages were scanned at 2400 dpi (dots per inch^2) and then examined. The examinations involved looking carefully at the alignment of text on the page, the angularity of the text, the order of the strokes, the length of the strokes etc. Ian felt that the group being tested was a little small for the results to be very effective or significant but found some significant statistical differences between first and second generation Punjabi handwriting.

Urdu, a language spoken by 160 million people worldwide, and is the official language of Pakistan. There are 500,000 speakers of Urdu in the UK. In this part of the study a similar exercise was carried out but used specimens from 200 individuals. Once more some differences were demonstrated between the two groups. Statistical differences were present between all populations which Ian feels poses the question —

Are there wider implications for the potential to identify gender, ethnic origin, and descendancy from a questioned document? The next stage in this research is now to do some studies involving larger sample sizes and already investigations have started into Bengali script and the forging of foreign script by non-writers. We wait with interest.

10 Years Involvement in Case Reviews

Roger Robson, Forensic Access Ltd.

Roger's presentation explored the concept of case reviewing; assessing the skills required by the forensic examiner in order to uncover potential new lines of enquiry where previous examinations have failed. The session also gave an insight in to some recent case examples and some personal insights into the potential pitfalls during case reviews.

Roger gave several descriptions of what he feels a review is all about; these include, a basic peer review of a case prior to a trial date; a pre-trial review on behalf of the prosecution or defence; a fresh approach to a live investigation that appears to be going nowhere; the application of new technologies to older investigations; a thematic review to unsolved 'cold cases'; a full re-investigation exploring all evidential leads of a cold case of a politically sensitive nature. Rogers experience has taught him to follow some guiding principles when getting involved with a case review of any type. These include: using a fresh team of scientists and investigators; actively work as part of that team; agree on the aims and objectives of the review; set the strategy and budget; openly discuss any sensitivities and predicted fall out; be prepared to examine every remaining scrap of evidence; and use reconstruction led searching. Most of all, Roger recommends "Make no assumptions, don't give up, and don't be afraid to ask for a bit of luck".

Following on from many years of involvement in these case reviews and learning a lot from that experience, Roger very kindly shared some of his 'trade secrets'.

- ❖ Lead, don't be led
- ❖ Start at the beginning and avoid reliance on one technique
- ❖ Don't dismiss the obvious but be prepared to look 'outside the box'
- ❖ Solid bench skills and motivation are key
- ❖ Keep reviewing and refining
- ❖ Don't forget, you're treading where others have been unsuccessful, so it is not going to be an easy ride.

Some cases that got a mention included, Sarah Payne, Rachel Nickell, Ivy Batten, Damilola Taylor, Kate Bushell, Linda Bryant, Princess Diana, Billie-Jo Jenkins, and Lynette White. Lynette White was a prostitute who was murdered in Swansea in 1988. Three men had been accused of her murder and public outcry and demonstrations followed. The convictions of the three men were overturned at the Court of appeal, and all three were released. In 2000 South Wales Police insisted that the case be reopened and the crime scene was re-visited whereby painstaking examinations took place. Blood stains were discovered underneath the paint on the skirting boards of the house where Lynette's body was found, and 48 other exhibits remained, some of which had never been examined. In 2002 a new DNA profile was generated which contained a rare allele. A search of the National DNA Database was conducted using the Familial Searching service and this resulted in the identification and arrest of Jeffrey Gafoor. He pleaded guilty to Lynette's murder.

Sarah Payne, an 8 year old girl, went missing in Sussex in 2000. A local paedophile was arrested and Sarah's body was found 9 days later in a partial grave. After the examination of around 500 items some forensic evidence was gathered. During a pre-trial review some concerns were raised about the potential for contamination with some of the exhibits and there were also concerns about the strength of the fibre evidence. A review team was brought in to assess the findings in more detail. New techniques were applied to enhance the strength of the evidence and in 2001 Roy Whiting was convicted of Sarah's murder.

To end the session, Roger made some suggestions about where we go from here with case reviews. Scientists should more easily accept the application of new techniques and critiques of earlier work, as it is to the benefit of our profession. National guidelines are needed for search techniques and there should be greater peer checking and demonstrations of competency. But who should do this? The Council for the Registration of Forensic Practitioners, or the National Forensic Providers Group perhaps. The introduction of the Forensic Regulator will certainly be an excellent start.

"Who You Gonna Call"?

Andy Wade, First Forensic Limited

The benefit of hindsight is an important concept but hindsight is only useful when we make the most of what we have learnt. It may bring enormous benefits when used properly and can benefit an enquiry at its early stages.

On the 12th February 2006 at 00.15 h a fire occurred in a 3rd floor flat of a tenement block in Dundee. Any visited the scene approximately two weeks later. Jagtar Ram had jumped from the top floor during the fire and died whilst other occupants were either rescued or jumped. The fire had started in a wheelie bin inside a communal hallway near to the stairs and the fire was funneled up the stairs. The potential causes of the fire were considered in great detail and the occupants were all questioned about their knowledge of the incident. The four occupants in the first floor flat explained that they had been in the flat most of the day and that one of them had emptied the wheelie bin at around 19.30 h. One person in the second floor flat said that they had been out just to walk their dog and had gone to bed at 22.30 h. Two occupants in the 3rd floor flat had a full bin bag of rubbish which included materials used by smokers. It later transpired that there had been some ignition of materials in or around the wheelie bin and that this had been done with a naked flame. One man, who had originally claimed to investigators that he had left the apartment block at 23.00 h changed his story and also added that he may have put a cigarette in the wheelie bin on leaving. When pressed further, he admitted that he had lit the bins with a cigarette lighter after rowing with his girlfriend.

In another incident which involved a fire in flats in Edinburgh on the 14th August 2005, two people were rescued. A petrol can was found just outside the front entrance and fire

had spread right through the hallway. Stephen McKenzie was sleeping in the lounge at the time and claimed that he opened the top lock of the front door, picked up the petrol can from the corridor and escaped uninjured and unburnt. So, the question had to be asked, could he have unlocked the door, picked up the petrol can and escaped without sustaining any injuries? An Alex Munro became of interest to investigators — he was known to have a turbulent relationship with a lady from one of the flats, he had been out drinking on the night of the fire, and fascinatingly, when detectives went to interview him, scrawled on one of his walls were the words "I'm so f*****g sorry". Some of his clothing was recovered and this showed signs of melting fibres all down the right arm of a jumper and all down the right side. He made a full confession and said that he had poured petrol through the letterbox into the hallway of the flats and ignited it.

In the next case presented, which again involved a fire, but this time in a semi-detached house in the West Midlands, the home owner shouted to his wife and son to get out of the house due to a fire in the living room. The home owner had very badly burnt hands and other rather severe injuries. On examination of the scene it appeared that petrol had been poured onto the kitchen carpet and set alight. The home owner died from his injuries a week after the fire and gave investigators no information prior to his death with regards to how the fire may have started. Unfortunately all his clothes had been destroyed by hospital staff. At the latter stages of this investigation there appeared to be no information indicating the involvement of a third party and it was felt that the burns sustained by the deceased were an indication of close involvement in the starting of the fire. M-Scan carried out their effective 'petrol branding' technique which linked the petrol to a local Shell garage. This resulted in CCTV footage being recovered from the garage and within this footage were images of a male who looked remarkably like the deceased purchasing a can of petrol. There is still uncertainty regarding the reasons behind this incident but it could be any number of things; a possible suicide attempt, or an insurance scam perhaps. An open verdict was recorded.

So, in summing up, Andy came back to the issue of hindsight and how beneficial it can be if we use it properly to re-interpret what we have done and make full use of forensic science.