

FSI MARKS 40 YEARS AT FRONTLINE OF CRIMINAL INVESTIGATIONS

With 2015 marking the 40th anniversary of Forensic Science Ireland (FSI), it is now widely anticipated that a new laboratory will be built on a site near Celbridge, Co. Kildare. Lynn Carroll, Laboratory Analyst, outlines the pivotal role played by the State's forensic lab in the support of Irish justice over the past four decades.

The objective of Forensic Science Ireland is to assist in the investigation of crime and to facilitate the administration of justice in an effective manner, with a highly trained and dedicated staff providing scientific analysis and objective expert evidence to international standards.

Many of the analysis types carried out have evolved with the advancement of technology, resulting in a wide range of methods currently being employed by the laboratory; varying from older 'tried and tested' techniques to modern robotics.

However, despite technical refinements, the basic tenet remains: to quote Dr Edmond Locard, French pioneer of forensic science, "*every contact leaves a trace*".

The laboratory is an associated office of the Department of Justice and Equality, although operationally independent, and is located at the Garda Headquarters in Dublin's Phoenix Park.

The Forensic Science Laboratory first opened its doors 1975 as a section of the State Laboratory in Leinster House; manned by Dr James O'Donovan and Noel Trench. It subsequently moved to the Institute for Industrial Research and Standards (IIRS) in Glasnevin, where scientific staff numbers were doubled to four, before moving to its permanent base in Garda HQ in 1978.

Dr O'Donovan remained the Director of the Forensic Science Laboratory until his retirement in 2002, when he was succeeded by Dr Sheila Willis, who remains the current Director General.



Pat Kelly, Analyst for the DNA Section at Forensic Science Ireland.

Over subsequent years, laboratory accommodations have been extended to facilitate growing personnel numbers, although capacity has long since been surpassed. Following several false starts, it is now anticipated that a new laboratory will be completed at a site in Backweston, near Celbridge, Co. Kildare.

At present, a total of five directors, 53 scientific, 20 analytical and 13 support staff, all civil servants, are employed in the laboratory. Approximately 12,000 cases are processed annually, although the number of tests and examinations carried out in relation to these cases greatly exceed this number.

The lab aims to work on cases that make a difference and prioritises those in which examinations should help progress investigations. Every effort is made to work closely with Garda investigators to optimise the potential of the testing that can be undertaken.

USING ROBUST SCIENCE

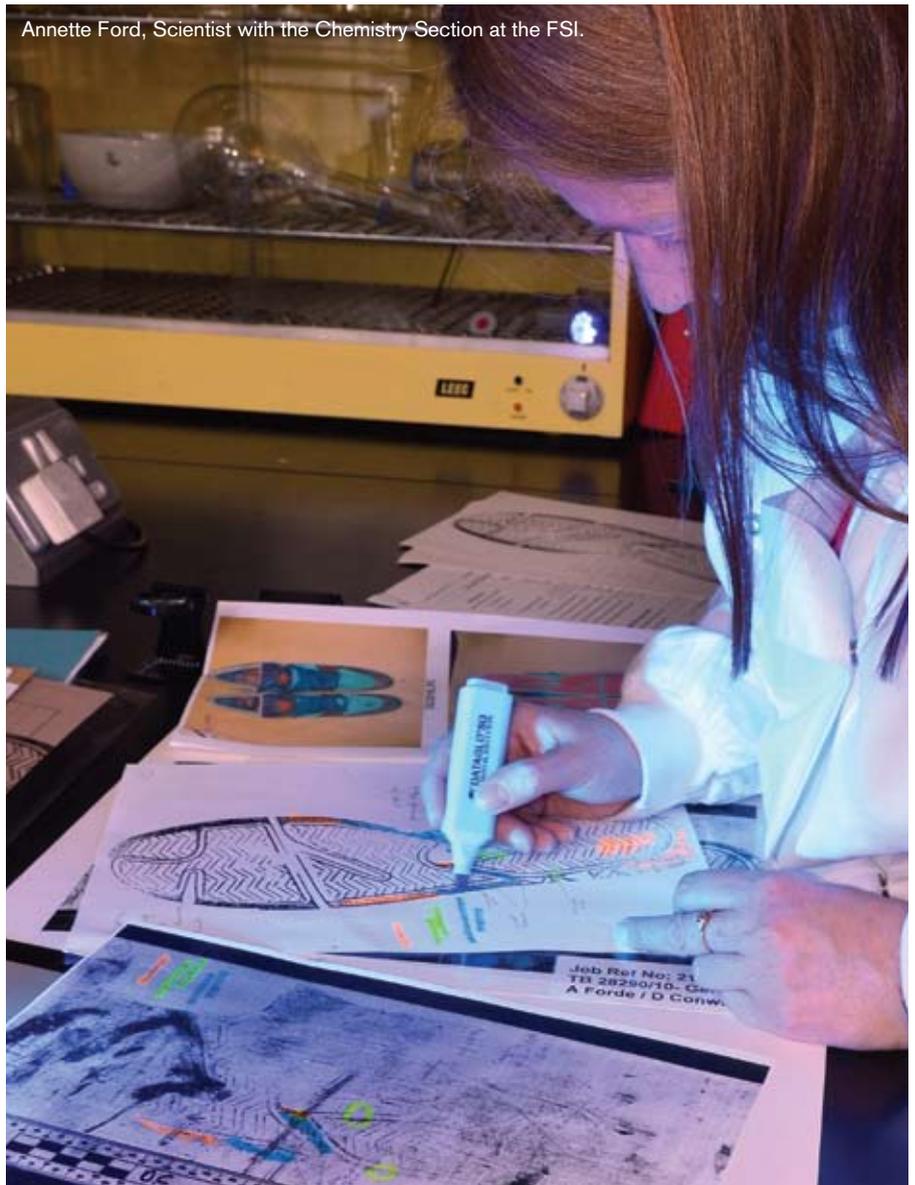
Regular customer surveys provide feedback on this service and at an organisational level. The mission of FSI is to use robust science in the investigation of crime and to produce balanced expert reports to support justice.

In 2003, the laboratory succeeded in gaining ISO 17025 accreditation for work practices and procedures in the processing of DNA, cannabis and glass analysis cases. The scope of accreditation



has been extended to include all routine analysis since then.

Every year the FSI agrees a Service Level Agreement (SLA) with its major customer, An Garda Síochána, and also provides assistance to other agencies, such as the Garda Síochána Ombudsman Commission (GSOC), Military Police, Customs & Excise and the Department of



Annette Ford, Scientist with the Chemistry Section at the FSI.

Agriculture.

The challenges facing FSI are unique. Firstly, the work involves the testing of unknown entities. Unlike other testing laboratories that, in general, would compare samples against predetermined standards, there is often not that luxury and so the analytical skills and knowledge required of staff to examine unknown samples is challenging and demanding.

This is coupled with an additional layer of complexity, in that the significance of the scientific finding must be viewed in light of the context of the finding for any given case.

Due to the sensitivity/security of the circumstance surrounding the lab's work it has reduced the ability to publish scientific findings particularly in interesting cases. The work is organised into three broad disciplines – Chemistry, Drugs and Biology/DNA – with staff in each one

grouped into teams to work on specific case types.

TRACE EVIDENCE

A wide range of case types are investigated in the Chemistry Section, including assault and murder, armed robbery, traffic accidents, burglary, criminal damage, fraud, arson, and explosives.

Many of these cases involve trace evidence, which is recovered and compared with reference samples, such as glass, paint, fibres, firearm residue (GSR). Trace evidence often supplies answers in relation to timing.

Marks and impressions are also examined, such as footwear and tyre-track impressions left at crime scenes, manufacturing marks on plastic bag and duct tapes. Debris samples from suspicious fires are analysed for hydrocarbon fire accelerants (e.g. petrol,

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paraffin oil) to assist in determining whether a fire was malicious.

Suspect materials are examined to determine if they contain explosives, as defined in the relevant legislation. The chemistry section has recently completed two research projects in the area of gunshot residue, the results of which will help inform expectations in the interpretation of GSR cases.

CONTROLLED SUBSTANCES

Staff in the Drugs Section analyse suspect materials seized under the Misuse of Drugs Acts. The throughput of this section is high, almost 10,000 individual cases per year, consisting of many more samples.

A number of analytical procedures are used to determine if a substance is a controlled drug, the most common of which is gas chromatography coupled with mass spectrometry (GC/MS). GC/MS provides a powerful means of positively identifying a controlled substance.

Typical drugs of abuse historically analysed have been cannabis, cannabis resin, cocaine, heroin, and MDMA. In recent years however, a major focus of this area has been on the identification and characterisation of newly synthesised and previously unknown drugs.

This provides the challenge in ensuring that the techniques used are sufficiently discriminating to identify new compounds. Many of these synthetic drugs were associated with the "headshop" phenomenon, and sale of such continues to thrive online.

INTER-AGENCY WORK

Frequently the FSI is the first state agency to detect a 'new' drug, and strong links are maintained with international organisations, such as the UNODC Early Warning Advisory Group. FSI also monitors trends in drug purity in support of the National Advisory Committee on Drugs (NACD).

In the DNA/Biology Section, DNA profiles are extracted from suspect items and compared with reference profiles obtained from suspects to assist the investigation of crimes ranging from burglaries to murder.

Blood Pattern Analysis (BPA) is also carried out to clarify the sequence of events in violent crimes and identify the most relevant specimens for further analysis.

ABOUT THE AUTHOR

Lynn Carroll graduated from Dublin City University in 2005 with a BSc in Chemistry with German. After gaining experience in the pharmaceutical and adhesives industries, she assumed the role of Laboratory Analyst with Forensic Science Ireland in 2008.

She has been a member of the Drugs Section since then, with a recent move into the toxicology area. Carroll returned to Dublin City University in 2013 to study part-time for the MSc in Science Communication, DCU, which she aims to complete in September.



Damage to clothing in assault cases is examined and interpreted. Forensic Science Ireland is a leader in the field of body fluid identification and the generation and interpretation of DNA profiles. New technology has been embraced, resulting in highly discriminating DNA profiles from traces of material, which is necessary in order to cope with inter-state comparisons at EU level, as defined in the Prum Council Decision of 2008.

ADDITIONAL CHALLENGES

The most revolutionary changes in the laboratory in the last 40 years have occurred in the DNA area. Many of the DNA processes have been automated using robotic liquid handling instruments, and the kits currently used comply with recommendations by the European Network of Forensic Science Institutes (ENFSI).

FSI is the first laboratory in the UK or Ireland to be accredited for the use



John McCullough, Team Leader of the FSI's Chemistry Section.

of these NGMSElect kits to produce 17 locus profiles.

Not only does this panel of markers allow for greater differentiation between individuals but also the increased sensitivity of the kit facilitates the generation of full DNA profiles from tiny quantities of DNA or degraded samples, which are routinely encountered in casework.

This increased sensitivity has brought with it additional challenges. In particular, this includes the increased levels of contamination, which necessitated the allocation of extra resources to anti-contamination measures. It also included more stringent cleaning/decontamination regimes within the lab and to the education of An Garda Síochána. Adherence to these strict procedures will be tantamount in achieving a successful transition to the new premises.

DNA DATABASE

The Criminal Justice (Forensic Evidence and DNA Database System) Act, executed on 23 June 2014, provides for the establishment and operation of the National DNA Database system by Forensic Science Ireland.

A group composed of staff from FSI, the Department of Justice, AGS, The Irish Prison Service, Irish Youth Justice Service, Garda Síochána Ombudsman Commission, Courts Service of Ireland and Coroner Service worked on implementing the Act.

The DNA database was set up in June 2014 to serve as a major intelligence resource for Gardáí in the investigation of crime. The Act also legislated that the name of the laboratory would change to Forensic Science Ireland from the Forensic Science Laboratory.

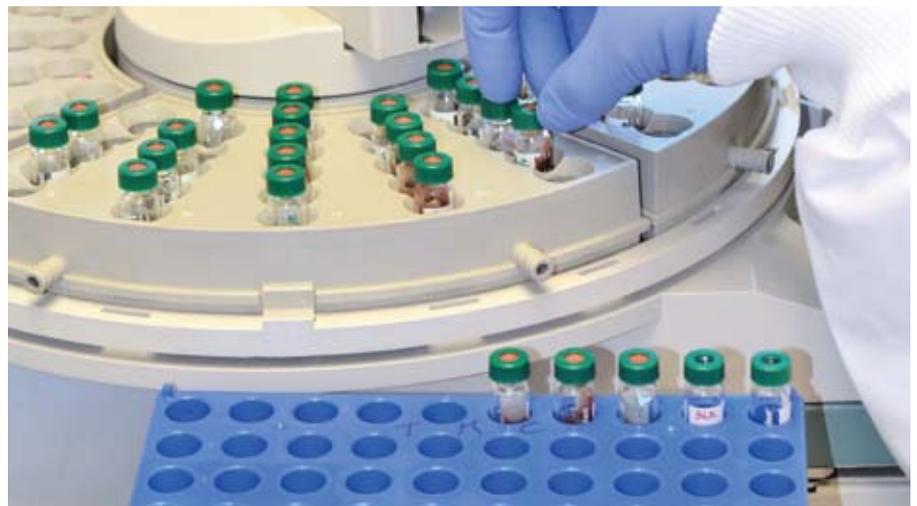
The database contains DNA profiles from unsolved cases. Separate indices will contain profiles of persons defined by legislation.

Permitted searching of the sets of profiles is also subject to legislation. Indices will also be set up to help in the identification of human remains where other methods of identification are not possible.

The actual data will be held on purpose built software supplied by the FBI to agencies around the world. This software – CODIS (Combined DNA Index System) is used in over 40 countries,



Minister for Justice and Equality, Frances Fitzgerald, visited the lab in September 2014 to view the progress in relation to implementation of the DNA database, which included full tour of the lab and a briefing on the work of each section. Pictured (l-r): DNA Section's Dr Bríd Martina McBride, Serious Crime Team Leader, and Dr Yvonne O'Dowd, Scientist, Minister Fitzgerald, Wesley Farrell, DNA Section Analyst, and Dr Sheila Willis, Director General of Forensic Science Ireland.



including 18 EU member states. It was installed in FSI in 2012.

FSI is at the forefront of developments in all areas of forensic science; laboratory staff are involved in a number of external agencies, including the European Network of Forensic Science Institutes (ENFSI) and the Association of Forensic Science Providers (AFSP), where information is shared on a European-wide level. The staff routinely provide training for specialist Gardáí and other stakeholder groups.

Forensic Science Ireland was founded on principles of balance, transparency, robustness and logic. The lab has experienced growth and success; from the initial accreditation in 2003, to more recent achievements including the

Taoiseach's Award 2012, Excellence Through People certification, and Irish Laboratory Awards 2013 and 2014.

The lab has maintained strong links with universities, collaborating on scientific publications, and facilitating work placement students. Most importantly, FSI has played a pivotal role in the support of Irish justice for the past 40 years, and will continue to do so.



**For updates on FSI activities visit www.forensicscience.ie*