Research and Innovation
Roadmap
2017-2020
About NIFS

The National Institute of Forensic Science (NIFS) is a directorate within the Australia New Zealand Policing Advisory Agency (ANZPAA). Our strategic intent is to Promote and Facilitate Excellence in Forensic Science. Our role is to deliver support to the forensic science community in the areas of coordination, innovation, information management, education and training, and quality. Our program of work is underpinned by a Strategic Plan approved by the ANZPAA Board of Australia and New Zealand Police Commissioners and the Chief Police Officer of ACT Policing. The Australia New Zealand Forensic Executive Committee (ANZFEC), comprising representatives from the government forensic service providers of our funding agencies, has oversight of the delivery of the Strategic Plan via our annual Business Plan.

About this document

Title: Research and Innovation Roadmap
National Institute of Forensic Science Australia New Zealand
Date: © October 2017
Available from: www.nifs.org.au
Enquiries: secretariat.nifs@anzpaa.org.au

Acknowledgements

This Roadmap is the direct result of the hard work and collaboration of the ANZPAA NIFS and ANZPAA teams, as well as the significant and valued input from the forensic science community including forensic science service providers, academic institutions and forensic technology providers.

Photo credits
Victorian Institute of Forensic Medicine
Western Australia Police
Introduction

The ANZPAA NIFS Research and Innovation Roadmap (the Roadmap), has been developed to guide future investment in forensic science across Australia and New Zealand. It is the result of extensive engagement with members of the forensic science community including forensic science service providers, academia and forensic technology providers.

The issues and considerations identified throughout the consultation period have been formulated into questions that address the needs of the many forensic science disciplines. This document provides an overview of the areas of focus and groups them into one of the forensic responses, which have been aligned to strategic policing priorities.

Agencies and interested parties can, by request to ANZPAA NIFS, obtain a copy of the individual questions identified which will be updated yearly in consultation with the ANZPAA NIFS networks. This includes the Specialist Advisory Groups (SAGs), the Scientific Working Groups (SWGs) and the Research and Innovation Advisory Committee (RIAC).

It should also be noted that some questions will be easier to address than others, and it is anticipated that collaboration between agencies will assist in achieving the desired outcome through information sharing and leveraging resources.

The Roadmap will be used in conjunction with the ANZPAA NIFS Research and Innovation Strategy (the Strategy), to support initiatives that aim to address one or more of the questions that form part of the Roadmap.

The Roadmap contains a large number of initiatives that ANZPAA NIFS cannot support or progress alone, and it is anticipated that this document will be a resource for the forensic science community to direct resources towards end user requirements.

It is important to note that the questions raised may not be addressed by one initiative alone, and there may be a need for multiple projects over a significant period of time to address the ultimate issue.
Crime, Disruption Prevention and Resolution

The ultimate aim in the application of forensic science is to assist police and the broader judicial system in disrupting, preventing and solving crime. For forensic science to meet this aim, it must continually develop to take advantage of innovations in science and technology and adapt and respond to the changing nature of crime and the investigative response. Forensic science must also ensure that it meets the operational need of its stakeholders. At the same time, forensic science needs to ensure its services are robust through strong underpinning science (forensic fundamentals) applied to the methods and resulting opinions.

The steps involved in identifying and operationalising advances in forensic science are demonstrated in Figure 1.

*Figure 1:*
Forensic Science Response to Crime Disruption, Prevention and Resolution
Forensic Science Response to Strategic Policing Priorities

Forensic science disciplines are not only influenced by advances in science and technology but also the needs of the criminal justice system. The primary end users for forensic science in Australia and New Zealand are the police agencies across the different jurisdictions, and as a common policing agency, ANZPAA co-ordinates the national response to a number of defined priorities which serve to drive excellence in policing.

The annual ANZPAA Business Plan outlines the ANZPAA priorities assigned by the ANZPAA Board (Police Commissioners of Australia and New Zealand and the Chief Police Officer of ACT Policing). As well as the ANZPAA priorities, there are a number of current and emerging issues related to policing that have implications for forensic science service provision. These have been identified through a scan of strategic policing documents in Australia and New Zealand.

By recognising the ANZPAA and policing priorities, forensic science can identify potential responses and services that can assist in addressing these priorities. The interaction between these priorities and the potential for a forensic science response is illustrated in Figure 2 and detailed in the following pages.

![Figure 2: Interaction between Forensic Science and Strategic Policing Priorities](image-url)
Advances in Technology

Serious & Organised Crime
Road Safety
Firearms
Terrorism & National Security
Family & Domestic Violence
Alcohol, Illicit Drugs & Misuse of Pharmaceuticals

Forensic Intelligence

Workforce Development

ANZPAA PRIORITIES

As a directorate of ANZPAA, NIFS supports these priorities by promoting and facilitating excellence in forensic science. This Roadmap is one initiative to address these priorities.

Policing Priorities

These priorities have been highlighted because of their potential to impact forensic science service provision. This Roadmap has been developed in consideration of these impacts now and into the future.
Policing Priorities

FORENSIC RESPONSE

By harnessing research and innovation, forensic science can adapt and develop capabilities to provide robust service delivery. The areas of focus identified in the Roadmap have been aligned to a forensic response to highlight interaction with ANZPAA and broader policing priorities.

Capability Development
Initiatives directed towards new techniques and new instruments to develop new capabilities

Service Delivery Improvement
Initiatives that aim to improve the way current capabilities are undertaken, including the way that results are reported, as well as initiatives related to certification and/or accreditation

Forensic Fundamentals
Initiatives that ensure sound science underpins the methods and opinions that are currently in use

Operational Requirement
Initiatives designed to build on or strengthen current capabilities to address an operational need

Intelligence Application
Initiatives that use the data available in different ways as well as the development of alternative operational models

Increasing Efficiency
Initiatives related to achieving more with less, such as process improvements to reduce the turnaround time for results

Education and Training
Initiatives geared towards the people involved including educating practitioners, improving training programs and efforts in cross-jurisdictional collaboration

Operating Environment
Initiatives that address the external influences for forensic science, such as educating clients and identifying ways to improve the way forensic evidence is presented
Short-term *Priority*

- Assess the reliability of emerging DNA analysis techniques and develop a roadmap for implementation.
- Develop expert systems for the analysis and interpretation of DNA data.
- Investigate emerging technologies for the identification of illicit drugs, precursors and explosives.
- Identify novel methods for the estimation of time of deposition for biological fluids.
- Enhance methodologies for the assessment and comparison of striae on bullets and casings.
- Develop techniques for the analysis of digital evidence.

Medium-term *Priority*

- Assess applications for the 3D capture of fingerprints.
- Develop a voice identification capability.
- Identify techniques to assist in determining the age of wounds.
- Investigate the use of biomarkers in cause of death investigations.
- Assess the use of virtual reality systems for crime scene reconstruction and evidence presentation.

Long-term *Priority*

- Develop additional methods for the identification of cell types and biological fluids.
- Identify methodologies to address the limitations of data analysis from proprietary systems.
- Investigate techniques to access and interrogate cloud storage data.
Short-term **Priority**

- Investigate the transfer, persistence and recovery of DNA under varying conditions.
- Establish statistically significant cross-jurisdictional databases for trace evidence.
- Investigate the transfer, persistence and frequency of trace evidence.
- Assess 3D mapping of the surface topography of bullets and casings.
- Investigate 3D laser scanning and 3D printing of physical evidence.
- Develop a statistical framework for reporting of fingerprint results.

Medium-term **Priority**

- Further develop post-mortem imaging capabilities.
- Enhance methods for investigating spurious peaks in routine DNA analysis.
- Identify improved techniques to develop latent prints on difficult surfaces.
- Develop population databases for dentition and skeletal features.

Long-term **Priority**

- Further develop presumptive drug testing and screening methods.
- Conduct empirical studies to support time of death and age estimation in the medical sciences.
Short-term *Priority*
- Identify quality and quantity requirements for handwriting and signature examinations.
- Develop population databases for features or sub-components of handwriting.
- Conduct empirical studies to update fundamental principles underpinning bloodstain pattern analysis.
- Further investigate error rates for feature comparison disciplines.
- Conduct empirical studies to support the interpretation of skeletal trauma.

Medium-term *Priority*
- Conduct empirical studies to support the interpretation of indentations and document security features.
- Further investigate lay person understanding of forensic science results.
- Assess electronic workflows for feature comparison disciplines.
- Identify the limitations of applying studies based animal models to humans for the medical sciences.
- Further develop proficiency tests and collaborative trials for the medical sciences.

Long-term *Priority*
- Investigate sequential unmasking options for medical science examinations.
- Conduct empirical studies to validate the enhancement of speech from recordings.
Short-term *Priority*

- Identify suitable tissue stimulants for terminal ballistic testing.
- Develop additional techniques to restore obliterated serial numbers.
- Identify methodologies for the examination of compromised electronic evidence devices.
- Investigate the implications of the expanding internet on future crime and its detection.
- Identify methodologies to enhance data exchange for investigation of cross-border crimes.
- Identify the requirements for accurate facial identification.
- Enhance screening techniques for detecting biological material.
- Assess the reliability of elements of bite mark evidence.

Medium-term *Priority*

- Assess the suitability of direct PCR for a wide range of sample types.
- Identify opportunities for masking agent and precursor reagent analysis to assist in illicit drug detection.
- Expand roadside drug testing methods to other illicit drugs or pharmaceuticals.
- Identify options for the long term storage of DNA extracts.
- Develop techniques for the enhanced detection of partially burnt propellant.
- Assess the reliability of 3D laser scanning for the measurement and representation of crime scenes.
- Investigate emerging techniques for the development of fingermarks.

Long-term *Priority*

- Develop methodologies for effective comparison and discrimination of documents.
- Identify handling/decontamination requirements for forensic evidence contaminated with radionuclides.
Short-term *Priority*
- Identify intelligence applications for:
  - Chemical criminalistics.
  - Document examination.
  - Fingerprints.
- Investigate field deployable drug analysis methods.
- Further develop the ‘lights-out’ approach to fingerprint identification.

Medium-term *Priority*
- Investigate physical profiling of illicit drug concealments to assist in crime disruption.
- Develop early warning systems through the analysis of drug trend information.
- Identify applications for cross-jurisdictional biometrics databases.
- Establish intelligence database applications for chemical analysis.

Long-term *Priority*
- Establish intelligence database applications for shoemarks.
- Assess designer drug trends and the ability to predict the development of new psychoactive substances.
- Enhance analysis of drug trends and usage through waste water analysis.
**Short-term Priority**
- Investigate potential applications for Rapid DNA Instruments.
- Assess emerging capture and interpretation tools for chemical criminalistics data.
- Identify pre-processing and quality assessment methodologies to improve facial recognition systems.
- Enhance methods for the review of long galleries in facial recognition systems.

**Medium-term Priority**
- Assess the value of the incorporation of identification tags to assist in the analysis of chemicals.
- Identify the benefits of molecular autopsy techniques for cause and time of death determination.
- Develop novel methods to streamline forensic entomology cases.
- Assess emerging techniques to streamline and enhance glass discrimination.

**Long-term Priority**
- Develop methodologies to triage and interrogate big data.
- Investigate electronic case file options for document examination cases.
Short-term *Priority*

- Develop methodologies for cross-discipline forensic examination approaches.
- Demonstrate feature comparison discipline validity through cross-jurisdictional data compilation.
- Create education and training resources for emerging DNA analysis techniques.
- Create education and training resources for quality control and contamination minimisation measures.
- Develop novel recruitment strategies for experts in feature comparison disciplines.

Medium-term *Priority*

- Develop novel techniques to reduce the time taken to acquire expertise in feature comparison disciplines.
- Create cross-jurisdictional training packages to enhance and streamline feature comparison disciplines.
- Investigate contamination minimisation measures to address increasing trace detection sensitivity.
- Create education and training resources to raise awareness of the limitations of forensic analyses.
- Develop models for effective inter-agency information sharing, training and business continuity.

Long-term *Priority*

- Identify the barriers impeding the adoption of new technology.
- Develop initiatives to support the use of evaluative reporting.
Short-term *Priority*

- Assess expertise through lay person testing for feature comparison disciplines.
- Identify techniques/protocols to reduce the risk of post-traumatic stress from graphic content exposure.
- Develop novel methods to measure the effectiveness or impact of forensic science.
- Identify the external impacts affecting forensic science service delivery.

Medium-term *Priority*

- Develop mechanisms to apply activity level reporting to forensic science.
- Develop cross-discipline, cross-jurisdictional frameworks to address human bias factors.
- Conduct qualitative assessments of the use of forensic evidence by the criminal justice system.
- Develop cross-jurisdictional peer review programs to address the limited availability of experts.
- Identify opportunities for technology to improve the understanding of forensic evidence in court.
- Develop frameworks to share big data between jurisdictions.

Long-term *Priority*  

- Further develop forensic science standards.
- Further develop accreditation and certification programs for medical science examinations.
- Investigate public perception issues related to the use of genetic information for forensic analyses.
“...we must look forward and think about the capabilities that our communities will need in five, ten or fifteen years’ time and, to the best of our abilities, ensure that whatever challenges the future brings, there is a robust forensic science capability that the community can rely upon.”

Simon Walsh, 2017
National Manager, Specialist Operations
Australian Federal Police