Monday, May 26, 2025

12: Scenes of Crime: Trace Evidence and Interpretation
09:00 - 12:45 Liffey Hall 1

Scenes of Crime: Trace Evidence and Interpretation

Animal Plant and Soil Traces - Microbial forensics, Soil forensics, Wildlife forensics …… all coming together in one EWG 09:00 - 12:45

I. Kuiper[1], *L. Dawson*[2], *A. Hellmann*[3]

[1]Netherlands Forensic Institute, The Hague, Netherlands, [2]The James Hutton Institute, Aberdeen, United Kingdom, [3]Federal Criminal Police Office/Bundeskriminalamt, Wiesbaden, Germany

Workshop Description: Within the ENFSI Animal Plant & Soil Trace (APST) working group, a very broad range of (forensic) disciplines come together, because they share some general basic principles: they deal with trace evidence of a biological nature which can be investigated by morphological traits, chemical and geological composition and/or the DNA. The investigative question can be where did the sample come from? Or what is the probability of the trace sample originating from the crime scene? In addition, the use of botanical traces will also be discussed in helping answer these types of question. Practitioners working with these traces require knowledge of a range of disciplines, including taxonomy, inter- and intra-species variation, population structure, distribution, reproduction strategies, and effects of sample biological deterioration. We will provide case relevant examples of soil and botanical comparison in criminal casework, wildlife forensics, microbiome-analyses to illustrate how established and new technologies, and types of databases, coupled with expert knowledge can be used to obtain potentially high evidential power in forensic casework.

10: Legal and Ethical Aspects: Presentation of Evidence
09:00 - 12:45 Liffey Hall 2

Legal and Ethical Aspects: Presentation of Evidence

Reducing the Likelihood and Consequence of Error and Bias: Lessons from the NIST/NIJ Human Factors in Forensic Science Series 09:00 - 12:45

M. Taylor[1], *T. Hicks*[2], *J. Kennedy*[3], *N. Osborne*[4]

[1]National Institute of Standards and Technology (NIST), Gaithersburg, United States, [2]University of Lausanne, Lausanne, Switzerland, [3]Kansas City Police Crime Laboratory, Kansas City, United States, [4]National Institute of Standards and Technology (NIST, Contractor), Auckland, New Zealand

Workshop Description: This workshop will present the National Institute of Standards and Technology (NIST)/National Institute of Justice (NIJ) Expert Working Group (EWG) Series on Human Factors in Forensic Science. The

first report, published in 2012, examined human factors in latent print comparison. This report was followed by the handwriting examination report (2020), and the DNA interpretation report (2024). These reports apply a systems approach to understanding human factors as they relate to each forensic science discipline and contain recommendations that are designed to improve practice and reduce the likelihood and consequence of error and bias in forensic science.

This workshop will draw from a wide range of human factors research that can be broadly applied across multiple forensic disciplines. By “looking back to look forward,” we will show how common recommendations for reporting and communicating forensic science results can help promote quality, harmonization and consistency.

This interactive workshop will focus on empowering forensic practitioners and managers to effectively integrate human factors recommendations into their practices. We will explore several key areas of interest, including:

- Enhancing Quality Assurance (QA) and Quality Control (QC).
- Addressing variability in analytical and interpretation tasks.
- Improving the communication of forensic results, both quantitatively and qualitatively.
- Reporting the caveats and limitations of forensic results and opinions.
- Understanding the complexities and challenges of using results to help answer "how" and "when" questions related to the deposition of trace material (e.g., DNA, paint, glass, GSR).
- The critical role of management and leadership in guiding and supporting forensic scientists.

03: Digital Evidence: Artificial Intelligence
09:00 - 12:45 Wicklow Hall 1

Digital Evidence: Artificial Intelligence

Holistic Approach to Human Identification: Integrating Evidence Lines 09:00 - 12:45

R. Guerra[1,1], *Ó. Ibáñez*[2,3], *E. Bermejo*[4]

[1]University of Granada, Legal Medicine, Toxicology and Physical Anthropology, Granada, Spain, [2]University of A Coruna, Computer Science and Information Technologies, A Coruña, Spain, [3]University of A Coruña, Computer Science and Information Technologies, A Coruña, Spain, [4] Panacea Coop Research, Ponferrada, Spain

Workshop Description:

Human identification remains a critical challenge for forensic experts worldwide. In the field of Forensic Anthropology and Odontology (FAO), combining various approaches and techniques is essential to overcome the complexities of identifying unknown individuals, particularly in skeletonized

remains. This workshop focuses on the integration of different lines of evidence, including both antemortem and postmortem data, to enhance the accuracy and efficiency of human identification.

Participants will be introduced to human identification software, and powerful tools to streamline the process of managing and analyzing evidence from multiple sources. This workshop provides practical training on how to effectively facilitate the comparison of data from forensic disciplines such as anthropology, odontology, and other medico-legal sciences.

Key topics include:

- Best practices for handling and comparing antemortem and postmortem data
- Techniques for integrating evidence from multiple forensic experts
- Hands-on exercises to practice data input, analysis, and case management

By the end of the workshop, participants will gain a deeper understanding of how to integrate complementary forensic methodologies to improve human identification outcomes.

04: DNA and Body Fluids: DNA Typing with Potential Forensic Applications
09:00 - 12:45 Wicklow Hall 2 (A)

DNA and Body Fluids: DNA Typing with Potential Forensic Applications

Sequencing 101 09:00 - 12:45

R. Oefelein[1], *L. Devesse*[2], *K. Lord*[1], *C. Glynn*[3]

[1]DNA Labs International, Deerfield Beach, United States, [2]Qiagen, Garstligweg, Switzerland, [3]University of New Haven, Henry C Lee Institute of Forensic Science, New Haven, United States

Workshop Description: What is a library? If it is whole genome sequencing, why don't I get the whole genome? This workshop is designed to be a crash course in all things sequencing. Existing commercial and custom panels for autosomal short tandem repeat (STR), X-STR, Y-STR, mitochondrial, and single nucleotide polymorphism (SNP) testing will be discussed. Additionally, the differences between targeted sequencing, shotgun sequencing, amplicon versus ligation-based libraries, and additional sequencing methods will be compared. Whether or not bioinformatics is required based on the sequencing method will be explored, as well as the types of bioinformatic processes that may be employed including imputation. With any new technology comes the introduction of this procedure in the courtroom as well as the inevitable court challenges. Successfully presented expert witness testimony will be previewed as well as a look at ongoing court challenges. Finally, cases

where sequencing has been utilized will be highlighted. The presenters of this workshop will span industry experts, a bioinformatician, and active casework users of sequencing technologies.

09: Interpretation: Evidence Evaluation
09:00 - 12:45 Wicklow Hall 2 (B)

Interpretation: Evidence Evaluation

The AFSP-BFF Casework Practitioner Survey on DNA Background Control Sampling Strategies: Share your thoughts and opinions. 09:00 - 12:45

N. Stevenson[1], *M. Breathnach*[2], *I. Fraser*[3], *G. Davidson*[4]

[1]Scottish Police Authority Forensic Services, Research, Development and Innovation Team, Gartcosh, United Kingdom, [2]Forensic Science Ireland, Dublin, Ireland, [3]Forensic Science Northern Ireland, Carrickfergus, United Kingdom, [4]Cellmark Forensic Services, Chorley, United Kingdom

Workshop Description: While there is a wealth of research in the area of DNA transfer and persistence, the practical application and interpretation of results in real-life casework can be challenging. In order to evaluate the significance of 'crime-related' DNA transfers following contact between nominals in a case, it is key to understand how a DNA transfer might have occurred. Often, an assessment of the prevalence of DNA by considering background levels of DNA from 'non-crime' related areas/items can assist with an evaluation of the results using a Bayesian framework.

However, the choice of where to recover background samples from, how many and even whether they should be taken at all can be challenging and subjective.

In order to provide best practice guidance, it was first important to assess the variability in current casework background sampling strategies within UK and Ireland Forensic providers. Therefore, the AFSP Body Fluids Forum undertook a survey of reporting forensic scientists with varying levels of relevant experience and asked key questions on proposed strategies in four 'typical' sexual assault casework scenarios.

Workshop participants will take part in an interactive survey using two of those casework scenarios. Thereafter, the outcome of the interactive workshop survey and the AFSP survey will be presented and discussed.

This workshop provides the opportunity to discuss approaches to this issue with a variety of forensic practitioners and learn from their past experiences and case challenges in order to refine future sampling strategies.

12: Scenes of Crime: Trace Evidence and Interpretation
09:00 - 12:45 Liffey Meeting Room 2

Scenes of Crime: Trace Evidence and Interpretation

Finding and Recognizing Human Bones in a Crime Scene: A Hands-On Workshop by the Forensic Anthropology Society of Europe 09:00 - 12:45

(FASE)

Z. Obertova[1], *D. Brits*[2], *A. Petaros*[3]

[1]The University of Western Australia, Centre for Forensic Anthropology, Perth, Australia, [2]University of Witwatersrand, Faculty of Health Sciences, Johannesburg, South Africa, [3]Swedish National Board of Forensic Medicine, Department of Forensic Medicine, Linköping, Sweden

Workshop Description: This practical workshop, organized by the Forensic Anthropology Society of Europe (FASE), aims to equip participants with practical skills and theoretical knowledge in the search and identification of human bones at crime scenes. Police and crime scene investigators are typically the first responders when skeletal finds are reported, while forensic anthropologists commonly only interact with the crime scene remotely and are subsequently responsible for the analysis of the remains. Knowledge exchange and efficient communication between crime scene investigators and forensic anthropologists regarding the human remains is key for a competent scene management and comprehensive recovery operation.
Participants will engage in a series of interactive sessions that cover the methods and techniques used in locating and recognizing human skeletal remains. Emphasis will be placed on differentiating human remains from animal bones, identifying key anatomical features of human bones, assessing taphonomic changes, utilizing appropriate documentation techniques, and understanding the legal implications of a thorough bone recovery in forensic contexts.
By the conclusion of the workshop, participants will have gained essential skills that will enhance their proficiency in the identification and recovery of human remains from crime scenes. This workshop will not only serve as an educational platform but also foster collaboration and networking among forensic professionals across Europe and beyond.

12: Scenes of Crime: Capturing the Crime Scene
09:00 - 12:45 Liffey Meeting Room 3

Scenes of Crime: Capturing the Crime Scene

INSITU: An app for Crime Scene Documentation 09:00 - 12:45

R. Irmler[1], *J. Joswig*[2]

[1]Federal Criminal Police Office, Forensics, Wiesbaden, Germany, [2]Berlin Police, LKA KTI FEQM, Berlin, Germany

Workshop Description: Documenting all relevant information at a crime scene is often time-consuming and demands significant effort from police officers and forensic personnel to comprehensively capture evidence and traces. In many police authorities these tasks are still handled manually - such as writing notes, sketching crime scenes, maintaining lists of collected evidence and entering all information into police databases. That can lead to errors, duplicated data, and overall inefficiency.
The aim was to develop a solution that enables the digital documentation directly on site in a collaborative and holistic manner. INSITU is a software

system consisting of a smartphone app, a web application and a central backend for data synchronisation. The project is a joint initiative by the Berlin Police and the Federal Criminal Police Office (BKA). INSITU will enhance the efficiency, accuracy, and collaboration during crime scene documentation by reducing time-consuming processes, preventing data duplication, and improving overall communication.
The development of the INSITU app is based on a human-centred design approach, involving all 20 German police authorities to ensure the app addresses the specific needs of police officers.
INSITU has the potential to harmonize and standardize the quality of crime scene documentation beyond Germany together with other countries, which in turn can lead to a better exchange of information in law enforcement.
At the EAFS 2025 we offer a hands-on workshop by using the INSITU app in a small crime scene scenario. Participants have the opportunity to jointly document evidences and traces, getting to know INSITUs features and automation processes.

01: Case Studies: Multidisciplinary cases
09:00 - 12:45 Liffey Meeting Room 4

Case Studies: Multidisciplinary cases

Forensic Synergy: Integrating Evidence Across Disciplines 09:00 - 12:45

J. de Koeijer[1], *B. Aarts*[2], *K. Herlaar*[3]

[1]Netherlands Forensic Institute, Special services and expertise, The Hague, Netherlands, [2]Netherlands Forensic Institute, Biological traces, The Hague, Netherlands, [3]Netherlands Forensic Institute, Chemical and physical traces, The Hague, Netherlands

Workshop Description: A gruesome murder of an elderly man by two ruthless perpetrators. Two suspects, each with their own story, trying to pin the violent acts on each other. Who is telling the truth? What do the traces reveal? The Public Prosecution Service approaches the Netherlands Forensic Institute (NFI) and requests an interdisciplinary forensic investigation (IFI). A comprehensive forensic investigation follows, providing evidence for the potential involvement of the suspects in the crime and also distinguishing their respective roles in the assault. The results are summarized in an IFI report, offering a combined evidential value in light of the current scenarios.
In this workshop, we will guide you through the process of:

- Consulting and coordinating with judiciary to determine the framework of circumstances;
- Managing and filtering contextual information for various forensic disciplines;
- Analysing the case resulting in a forensic advice report;
- Coordinating different activity level evaluations considering various scenarios;
- Using graphical models to visualize and analyse forensic evidence;
- Combining all results into one interdisciplinary report.

06: Education and Training: Continuous professional development
09:00 - 12:45 EcoCem Room

Education and Training: Continuous professional development

The Sydney Declaration - is this it? 09:00 - 12:45

S. Willis[1], *C. Roux*[2], *N. Nic Daeid*[1], *F. Crispino*[3], *M. Miranda*[4], *P. Margot*[5]

[1]University of Dundee, Leverhulme Research Center for Forensic Science, Dundee, United Kingdom, [2]University of Technology, Sydney, Centre for Forensic Science, School of Mathematical and Physical Sciences, Sydney, Australia, [3]Université du Québec à Trois- Riviéres, Department of Chemistry, Biochemistry and Physics,, Trois- Riviéres, Québec, Canada, [4] Farmingdale State College, The Centre for Criminal Justice Studies, New York, United States, [5]University of Lausanne, Forensic Science, Lausanne, Switzerland

Workshop Description: Published in 2022, The Sydney Declaration proposed a definition of forensic science and seven principles with the overarching goal of providing a global shared understanding of this discipline. The authors of The Sydney Declaration developed the principles with the idea that they would “inform education, training, research and operational practices” and “foster the development of a forensic science culture…unified by purpose and principles rather than means” (Roux et al 2022, p. 8). Based round the idea that the trace is the central concept of all branches of forensic science and, as the vector of information, needs to be understood and explored to gain an understanding of potential and limitations of forensic science.
The underlying assumption is that various initiatives undertaken to address criticisms of forensic science are not expected to be sufficient because they are based on means without an understanding of the true nature of traces and purpose. Much needed appropriate education and research are not pursued without this understanding.
The workshop will be an account of activities since original publication together with examples of application and an opportunity to contribute to critically review the Declaration. The workshop is suited to anyone interested in the principles of forensic science and how best to get advantage from it. This applies to stakeholders as well as practitioners.
The format will be a series of presentations and an opportunity for participants to contribute.

08: Forensic Medicine and Toxicology: Forensic Medicine
09:00 - 12:45 Wicklow Meeting Room 1

Forensic Medicine and Toxicology: Forensic Medicine

Technological Advances and Challenges in Post-Mortem Interval (PMI) 09:00 - 12:45

P. Setia[1], *P. Purohit*[2], *YS Bansal*[3]

[1]All India Institute of Medical Sciences, Department of Forensic Medicine and Toxicology, Jodhpur, India, [2]All India Institute of Medical Sciences, Department of Biochemistry, Jodhpur, India, [3]Post Graduate Institute of Medical Sciences, Department of Forensic Medicine and Toxicology, Chandigarh, India

Workshop Description:

1. Classical methods estimating post-mortem interval (90 minutes)

The most significant characteristic feature during an autopsy is the post mortem interval (PMI). The traditional approaches, are very subjective and are influenced by a variety of circumstances. These methods form the corner stone in forensic investigations. The learning objectives include-

- The advantages and disadvantages of classical methods.
- The significance of classical methods of PMI in real-time scenarios.
- Case studies utilizing classical methods of PMI estimation will be discussed
- Feedback and quizzing

2. Proteomics in post-mortem interval- promising role (90 minutes)

New approaches involving estimation of various cellular proteins like autophagy proteins, muscle proteins etc using different look promising. The learning objectives include-

- The role of proteomics and challenges in PMI estimation
- Case studies utilizing proteomic methods of PMI estimation will be discussed
- The role of animal studies will be discussed
- The speaker's experience of using proteomics as a useful tool in PMI estimation
- Open discussion, Feedback, quizzing

3. Genomics in post-mortem interval-way ahead (90 minutes)

The application of molecular biology techniques in forensics has increased tremendously. Currently thanatobiology, thanatomicrobiome have shown great promise in this field. The learning objectives include-

- Role of genomics and challenges in PMI estimation
- The role of animal studies will be discussed
- The speaker's experience of using genomics as a useful tool in PMI estimation
- Case studies utilizing genomic methods of PMI estimation
- Feedback and quizzing

4. Volatile organic compounds and their role in determining PMI
The authors will share their experiences of using VOC for determining PMI

09: Interpretation: Likelihood Ratios
09:00 - 10:30 Wicklow Meeting Room 2

Interpretation: Likelihood Ratios

Introduction to the Likelihood-Ratio Framework for Evaluation of 09:00 - 10:30

Forensic Evidence

G.S. Morrison[1]

[1]Aston University, Forensic Data Science Laboratory, Aston Institute for Forensic Linguistics, Birmingham, United Kingdom

Workshop Description: Among experts in forensic inference and statistics the likelihood-ratio framework is widely regarded as the logically correct framework for evaluation of forensic evidence. Its use is also recommended by key organizations, including by the European Network of Forensic Science Institutes. There is, however, a great deal of misunderstanding about likelihood ratios among lawyers and forensic scientists.

The likelihood-ratio framework makes explicit the questions which must logically be addressed by the forensic scientist and considered by lawyers, judges, and trier's of fact in assessing the work of the forensic scientist.

This workshop explains the logic of the likelihood-ratio framework in a way which is accessible to a broad audience and which does not require any prior knowledge of the framework. It uses intuitive examples and audience-participation exercises to gradually build a fuller understanding of the likelihood-ratio framework.

Feedback from participants of earlier instances of this workshop:

"I have attended several presentations on the likelihood-ratio framework over the last few years. Yours was the first that actually made it understandable." (Head of the forensic science division of a large public defender office)

"A strength of the workshop was that it was very interactive. It was nice to see how the likelihood ratio applied to forensic evidence contexts and working through concrete examples helped me to understand and practice the concepts. I also thought that it was helpful to work through simple and fun examples to ease into the more complex forensic type problems. Great workshop overall!"

03: Digital Evidence: Forensic Visualisation (VR, AR, 3D)
09:00 - 12:45 Wicklow Meeting Room 3

Digital Evidence: Forensic Visualisation (VR, AR, 3D)

Visualisation of Forensic 3D Reconstructions: Retrospective Look and Discussion on the Opportunities and Risks of a Unique Reporting Method 09:00 - 12:45

M. Glardon[1], *K. Busse*[1], *F. Riva*[2]

[1]University of Bern / Insitute of Legal Medicine, Forensic Medicine and Imaging, Bern, Switzerland, [2]University of Lausanne, School of Criminal Science, Lausanne, Switzerland

Workshop Description: The 3D reconstruction of forensic cases offers unique opportunities to combine information from various traces. However, the possibility to create impressive visualisations of a possible scenario also comes with risks and an illusion of accuracy.

To enable an enriching exchange, the participants should already have some experience with the generation or the use of 3D reconstruction for reporting. This is not an introductory workshop. Magistrates who had to present or assess 3D recontructions in court are also warmly welcomed.

In the workshop, we aim to show the successful use of 3D recontruction to combine informations from multiple different traces (shooting incident reconstruction, BPA, medical imagery, MVC reconstruction). We will also show visualisations that where missunderstood by the parties and the courts or inadequate to show accurately the succession of events.

The cases shown are meant to prompt a discussion amongst the participants about their own successes or mishaps in using 3D reconstruction. The participants are welcome to contact the workshop authors in advance to show cases of their own case portfolio (we will do a pre-screening to ensure that we stay on schedule and have a representative sample of cases).

11: Marks, Impressions and Biometric Traces: Document, Handwriting and Signature
09:00 - 12:45 Wicklow Meeting Room 4

Marks, Impressions and Biometric Traces: Document, Handwriting and Signature

How to Examine Digitally Captured Signatures? 09:00 - 12:45

T. Dziedzic[1], *J. Morris*[2]

[1]Institute of Forensic Research, Forensic Handwriting and Questioned Documents Examination, Krakow, Poland, [2]Scottish Police Authority, Forensic Services (SPAFS), Chemistry and Documents, Gartcosh, United Kingdom

Workshop Description: One of the modern modes of authorising electronic documents (e.g. in pdf format) is the use of digitally captured signatures (further as DCS; aka dynamic or online signatures). Composed of a series of data points recorded while sampling the writing movement, which are encrypted together with the document data, a DCS combines advantages of a biometric and a cryptographic signature. Due to their rapidly growing popularity in business and public administration, DCSs have already became objects of litigation and DCS-related cases have been mandated to forensic laboratories. As determining the authorship of a DCS requires – to some extent – a different examination procedure than conventional (pen-and-paper) handwriting, ENFHEX (Handwriting Working Group of ENFSI) has created a Best Practice Manual for this type of evidence and is currently training its member experts on the relevant method.

The workshop will introduce participants to this newly developed method and guide them through a practical phase where they will have the opportunity to apply the acquired knowledge by examining simple mock

DCS cases. It addresses the widespread demand for training in the examination DCS.

11: Marks, Impressions and Biometric Traces: Fingerprint Development
09:00 - 12:45 Wicklow Meeting Room 5

Marks, Impressions and Biometric Traces: Fingerprint Development

Vacuum Metal Deposition: The Basics, The Applications, The Future 09:00 - 12:45

R. King[1,2], *J. Hicks*[2], *A. Horvath*[2]

[1]University of South Wales, Forensic Science, Pontypridd, United Kingdom, [2]West Technology Forensics, Research and Development, Bristol, United Kingdom

Workshop Description: Vacuum Metal Deposition (VMD®) is a pivotal technique in forensic science, renowned for its effectiveness and sensitivity in enhancing latent fingermarks from an unprecedented range of evidence types. Whilst the fundamental principles of VMD remain unchanged, the technology has evolved significantly over recent decades, with modern solutions now widely accessible to fingermark enhancement laboratories, irrespective of their size.
This workshop aims to provide a comprehensive overview of VMD, focusing primarily on its application in fingermark enhancement. Participants will gain insights into the theory and mechanisms involved in VMD, including the creation of a vacuum environment, the selection of metal sources, and the deposition methods that are used.
The core of the workshop will delve into the process of using VMD to visualise latent fingermarks on various substrate types, including non-porous materials like plastic, glass, and metal, and porous surfaces such as fabric and paper. Participants will explore the practical aspects of VMD in forensic laboratories, including the preparation of samples, the optimisation and automation of deposition parameters, and the basic imaging of enhanced fingerprints. There will be opportunities for attendees to process their own samples (please feel free to bring along any sample types of interest to you).
Case studies will also be presented to illustrate the successful application of VMD in real-world forensic scenarios, highlighting its impact in solving crimes and securing convictions. Looking ahead, the workshop will address future prospects of VMD technology in forensic science and provide an overview of recent research and development outputs.

10:30 - 11:15 Auditorium

MORNING COFFEE BREAK

09: Interpretation: Forensic Statistics
11:15 - 12:45 Wicklow Meeting Room 2

Interpretation: Forensic Statistics

Calibration and Validation of Likelihood-Ratio Systems 11:15 - 12:45

G.S. Morrison[1]

[1]Aston University, Forensic Data Science Laboratory, Aston Institute for Forensic Linguistics, Birmingham, United Kingdom

Workshop Description: Publications such as Forensic Science Regulator (2021) "Codes of Practice and Conduct: Development of evaluative opinions" and Morrison et al. (2021) "Consensus on validation of forensic voice comparison" have emphasized the importance of both calibrating and validating forensic-evaluation systems that output likelihood ratios. This workshop provides an introduction to both of these (related) topics.

Participants will gain an understanding of how to conduct empirical calibration and empirical validation of likelihood-ratio systems, including:
• an understanding of the meaning of calibration and validation in relation to likelihood ratios;
• requirements for data used for calibration and validation;
• the use of statistical models (including logistic regression) to perform calibration;
• the calculation of the log-likelihood-ratio cost (C_{llr}) as a validation metric; and
• the use of Tippett plots to represent validation results and to support (or not) the likelihood-ratio value calculated for the comparison of the items of interest in the case.

This is an updated version of a workshop that received positive feedback at EAFS 2022. Updates include coverage of Morrison (2024) "Bi-Gaussianized calibration of likelihood ratios".

Feedback on the EAFS 2022 workshop from the deputy director of a national forensic laboratory:
"The workshop was very well prepared and conducted. Although I have only a basic knowledge of likelihood ratios, you explained everything very clearly. You are most definitely one of the few people who have a great talent to be a very-very good teacher."

12:45 - 13:45 Wicklow Hall 2 (A)

WELCOME LUNCH BREAK

12: Scenes of Crime: Capturing the Crime Scene
13:45 - 15:15 Liffey Hall 1

Scenes of Crime: Capturing the Crime Scene

Visualising the Future – Where to from Here 13:45 - 15:15

N. Nic Daéid[1], *E. Ljungkvist*[1], *R. Buckley*[2], *A. Myyrä*[3]

[1]University of Dundee, Leverhulme Research Center for Forensic Science, Dundee, Scotland, United Kingdom, [2]Metropolitan Police Service, Crime Scene Examination and Fire Investigation, London, United Kingdom, [3] National Bureau of Investigation Forensic Laboratory, Marks-team, Helsinki, Finland

Workshop Description: The ENFSI OOS conference in May 2024 “Visualising the Future” was a big success with the exploration of the recording of crime scenes using photographic and 3D imaging methods. Three strands were focused on:

- 3D imaging methods; technical methods and production.
- Assisting the investigation and end users; case studies exploring value added.
- Improvement and pedagogy; proficiency testing, assessment, validation and collaborative exercises.

This workshop at the EAFS 2025 is a following up with a focus on the current rapid development of visualisation technologies external to forensic science and the need for an increased collaboration between academics and practitioners, leveraging emerging technologies and drawing learning and approaches from different areas of practice. This workshop emphasises the need for integrating technological transformation into:

- Understanding end-user’s needs regarding imaging and visualisation technologies
- Strengthening Collaboration
- Training and Development for Forensic Practitioners
- Expanding Network and Community Engagement

The results from this workshop will be the input for the coming ENFSI conference August 2025 “Visualising the Future”.

Read more about the ENFSI OOS 2024: https://www.meetdundeecityregion.co.uk/attending/conferences/enfsi-oos-2024

12: Scenes of Crime: Trace Evidence and Interpretation
13:45 - 17:30 Liffey Hall 2

Scenes of Crime: Trace Evidence and Interpretation

What’s That Crawling Around? Insects as an Important Tool in Criminal Investigations 13:45 - 17:30

L. Lutz[1], *L. Thümmel*[1], *J. Amendt*[1]

[1]Institute of Legal Medicine, University Hospital, Goethe-University, Forensic Entomology, Frankfurt am Main, Germany

Workshop Description: Although insects are a common, useful and easily collected trace in criminal investigations, they are still too rarely recognized, sampled and analyzed. A lack of awareness of the potential of entomological evidence and lack of knowledge of proper preservation methods are reasons why insects are still a vastly underused investigative tool. This workshop focuses on the key principles of forensic entomology in both criminal investigations and research. It will introduce participants to the theoretical background of forensic entomology, present real case

studies and explain new innovative techniques (FTIR spectroscopy) for analyzing entomological evidence and training CSI officers. The participants will learn:

- A short history of forensic entomology: Why, how and when do insects become important?
- Sampling Insects – Best Practise
- Temperature modelling of the crime scene
- A current training concept in Germany: first experiences
- What does an entomological report include? Do's and Dont's
- New techniques in forensic entomology

The course will be interactive, with small exercises and group discussions, and hopefully after the course we'll have more insect enthusiasts among forensic scientists and practitioners.

03: Digital Evidence: Artificial Intelligence
13:45 - 17:30 Wicklow Hall 1

Digital Evidence: Artificial Intelligence

Expanding Digital Forensics as a Service: Insights and Innovations in the Hansken Platform 13:45 - 17:30

H. Henseler[1,2], *H. van Beek*[1,3]

[1]Netherlands Forensic Institute, Hansken, The Hague, Netherlands, [2] University of Applied Sciences Leiden, Department of Computer Science, Leiden, Netherlands, [3]Open University of the Netherlands, Faculty of Science, Heerlen, Netherlands

Workshop Description: This workshop targets law enforcement agencies, forensic labs, and judicial bodies engaged with or exploring Hansken, the open platform for Digital Forensics as a Service (DFaaS). This session will delve into recent developments within the Hansken Community, including practical advancements, best practices, and technical insights shaping the platform’s role in digital investigations.

Participants will gain an overview of Hansken’s evolving Community support model, explore recent innovations like the Aardwolf project for uncovering unknown applications, and hear firsthand lessons from Hansken’s role in the Marengo trial, a high-profile criminal case. Addressing the complex challenge of privileged information, we will cover effective handling techniques to secure sensitive data. For organizations focusing on streamlined implementation, “Hansken in Containers” presents a modernized approach to make deployment and maintenance scalable and adaptable to IT infrastructure needs.

The workshop also includes interactive sessions on Hansken’s analytical features, such as visualizing and analyzing trace relationships and integration of Large Language Models, providing investigators with dynamic insights into case data. Together, these topics highlight Hansken’s capabilities to facilitate collaboration, support courtroom evidence

presentation, and improve digital trace analysis.

12: Scenes of Crime: Forensic Archaeology and Anthropology
13:45 - 17:30 Wicklow Hall 2 (A)

Scenes of Crime: Forensic Archaeology and Anthropology

Forensic Archaeology and Disaster Victim Recovery 13:45 - 17:30

P.M. Barone[1,2], *C. Davenport*[3], *M. Groen*[4], *J. Struik*[5]

[1]The American University of Rome, Rome, Italy, [2]Forensic Geoscience Italy, Rome, Italy, [3]Blake Archaeology and Anthropology Services, Sheffield, United Kingdom, [4]Netherlands Forensic Institute, The Hague, Netherlands, [5]Dutch National Police, The Hague, Netherlands

Workshop Description: This workshop explores the role of forensic archaeology in large-scale mass incidents, with focus on aviation disasters. By recreating a simulated air crash scenario, participants will engage in a practical experience designed to mirror real-world mass disaster recovery operation. This approach will offer insights into the complexities of victim and evidence recovery and the integration of forensic archaeologists within disaster response teams.
The workshop will cover key forensic archaeological methodologies, including site survey, 3D documentation and recovery of human remains, personal effects and crash related evidence. Participants will learn best practices for preserving evidence, maintaining chain of custody, and how to work collaboratively with pathologists, forensic anthropologists, and law enforcement agencies.
The international relevance of this workshop lies in its ability to raise awareness to standardized field protocols that could be applied in the event of mass incidents. Air crashes of ten require cooperation between multiple teams and countries, making it vital to develop common field protocols for efficient and respectful recovery operations. By enhancing the understanding of how forensic archaeology could support field recovery operations, this workshop will also contribute to humanitarian response and justice for victims and their families.

04: DNA and Body Fluids: Evaluative Reporting of DNA Findings
13:45 - 17:30 Wicklow Hall 2 (B)

DNA and Body Fluids: Evaluative Reporting of DNA Findings

Evaluation of Cases of Alleged Sexual Assault at Forensic Science Ireland: Formulating Issues, Hypotheses, Scientific Strategy, and Expectations 13:45 - 17:30

M. Breathnach[1]

[1]Forensic Science Ireland, Celbridge, Ireland

Workshop Description: The evaluative approach recommended by ENFSI for reporting of scientific findings has been regularly used by casework scientists from Forensic Science Ireland (FSI) in the Irish Courts. The sexual

assault team in FSI have developed accredited sampling methodologies which have allowed for the robust evaluation of scientific findings in cases of alleged sexual assault, within the logical framework using all the available published data and in-house expertise.

The aim of this workshop is to provide participants with real-life case studies from Forensic Science Ireland, which have been rigorously tested in the Irish courts. To provide an opportunity for participants to identify the issue(s) in the case and the prosecution's and defence's propositions. The workshop will explore and discuss the expectations given the propositions in these cases and the use of available datasets. Participants will form a suitable sampling strategy and any pitfalls that scientists may encounter with this approach. The workshop aims to be an interactive discussion session.

We will provide the participants with the sampling strategy employed at FSI in these real-life cases and all outcomes of these scientific examinations. The participants will be in a position to develop the Likelihood Ratio (LR) and how additional contextual information may have impacted on the final LR. We will demonstrate the Bayesian approach and how it was used in the reporting of the scientific findings and how the scientists presented this evidence in court.

03: Digital Evidence: Artificial Intelligence
13:45 - 15:15 Liffey Meeting Room 2

Digital Evidence: Artificial Intelligence

Deepfakes: Authenticity Challenges and Forensic Validation 13:45 - 15:15

Z. Geradts[1]

[1]University of Amsterdam / Netherlands Forensic Institute, Multix / Digital and Biometric Traces, Den Haag, Netherlands

Workshop Description: This workshop delves into the fascinating yet complex world of deepfakes, offering both theoretical insights and practical experience. Participants will gain an in-depth understanding of how deepfakes are created, detected, and verified in forensic contexts, with an emphasis on recent advancements in detection techniques.

Understanding Deepfake Technology

We'll begin with a comprehensive overview of deepfake creation, covering the fundamentals of generative adversarial networks (GANs) and the tools and techniques used to produce convincing synthetic media.

Hands-On Deepfake Creation and Detection

Attendees will engage in hands-on activities, learning to generate deepfake content in a controlled environment and exploring basic tools to spot manipulation. This exercise provides insights into the ease of creation, helping participants understand the need for sophisticated detection methods.

Forensic Detection Techniques

Explore cutting-edge research on deepfake detection, including AI-based methods and physiological cues. Special focus will be given to recent innovations, such as monitoring blood flow patterns to reveal subtle inconsistencies unique to manipulated content.

AI-Powered Detection Methods
Dive into the latest AI advancements in deepfake detection, with an exploration of machine learning algorithms designed to identify anomalies in facial expressions, eye movement, and other micro-expressions. Participants will learn how AI-based forensics tools contribute to the forensic process, bolstering authenticity verification.

Learning Outcomes:
By the end of the workshop, participants will have a well-rounded understanding of the creation and detection of deepfakes, with practical skills in limits of identifying fake media.

08: Forensic Medicine and Toxicology: Forensic Medicine
13:45 - 15:15 Liffey Meeting Room 3

Forensic Medicine and Toxicology: Forensic Medicine

Sudden Unexpected Infant Death (SUID): A Global Problem, A Chicago Perspective 13:45 - 15:15

M. Reynolds[1], *R. Ahadi*[2], *F. Clark*[2], *C. Lawrence*[2], *G. Lowell*[2], *K. Quinlan*[2]

[1]Cook County Office of the Medical Examiner, Pathology, Chicago, IL, United States, [2]Rush University Medical Center, Pediatrics, Chicago, IL, United States

Workshop Description: Sudden Unexpected Infant Death (SUID) has been a scourge upon humanity since time immemorial, and takes the lives of approximately 3500 infants each year in the United States. In Cook County, Illinois (including the City of Chicago), approximately one infant dies suddenly and unexpectedly during sleep each week. In 2019, the Cook County Office of the Medical Examiner became a partner in the Centers for Disease Control and Prevention (CDC)-funded SUID Case Registry, establishing a surveillance system now used to inform prevention programming. In 2023, the Cook County SUID Case Registry and Prevention Team began using a modified Injury Equity Matrix (IEM) tailored to examine SUID. Use of the modified IEM has facilitated new ways of thinking about SUID prevention and led to proactive safe sleep approaches.

This workshop will introduce participants to historical perspectives on SUID, give an overview of modern forensic investigation and case workup from the perspective of a practicing pediatric and forensic pathologist, and review data from the Cook County SUID Case Registry and community intervention efforts. Attendees will be guided through practice using the modified IEM for two sample cases, and will discuss the potential prevention recommendations that emerge from this practice. The learning objectives are: 1. Understanding the history and terminology of SUID and the classification of such deaths, 2. Understanding the forensic investigation and medicolegal workup of such cases, and 3. Using the modified IEM as a tool to barriers to safe infant sleep practices at individual and community levels.

06: Education and Training: Other
13:45 - 15:15 EcoCem Room

Education and Training: Other

What Does Learning, Training, and Teaching Research Look Like in the Forensic Sciences? 13:45 - 15:15

F. Carlysle-Davies[1], *H. Tidy*[2]

[1]University of Strathclyde, Centre for Forensic Science, Glasgow, United Kingdom, [2]Teesside University, Science, Middlesborough, United Kingdom

Workshop Description: Forensic Science offers some unique opportunities where research in Learning, Training and Teaching is concerned, with a wide range of subjects covered from core scientific principles to refined legal presentation skills and everything in-between. This makes the Forensic Sciences perfectly placed for those at the forefront of teaching these subjects to be able to actively engage in wide-ranging educational research for the benefit of not only the forensic sciences but beyond. However, as the majority of those working in forensic science come from a scientific background the move into educational research can be a challenge.

This workshop is designed to be an interactive opportunity for those wishing to consider their own teaching and training practices. Attendees will consider how they innovate to provide a more fulfilling student experience with an aim to develop effective research projects and publications. The facilitators will begin by sharing a case study of how a collaboration in the forensic sciences was borne to produce educational research that was published through a peer reviewed journal in 15 months. The workshop will also cover tips and tricks for handling things such as ethical approval for surveys and methods for qualitative evaluation of survey outputs.

As a group we will explore what opportunities there might be to shape and define educational practices in the forensic sciences through our own learning environments and students. Those attending will be inspired to consider turning their practices into educational research activities as well as networking with those in the session.

05: Drugs: Emerging Trends/Threats
13:45 - 17:30 Wicklow Meeting Room 1

Drugs: Emerging Trends/Threats

Strategies and Tools for Interpreting Mass Spectra of Emerging and Unknown Drugs 13:45 - 17:30

A. Moorthy[1], *S. Shuda*[2], *E. Sisco*[2]

[1]Trent Universty, Peterborough, Canada, [2]National Institute of Standards and Technology, Gaithersburg, United States

Workshop Description: Mass spectrometry is the most commonly

employed instrument for analyzing seized drugs, and yet correctly interpreting mass spectra can still be a challenge--particularly when analyzing emerging and unknown drugs in complex mixtures. In this workshop, we will (1) cover the basics of gas chromatography mass spectrometry (GC-MS), direct analysis in real time mass spectrometry (DART-MS) and standard data analysis procedures, (2) describe some well-known and lesser-known challenges faced during mass spectral interpretation, and (3) share some strategies and state-of-the-art software tools currently available to support mass spectral interpretation. We will also provide attendees the opportunity to practice employing freely available software tools and mass spectral libraries on de-identified case samples.

04: DNA and Body Fluids: Transfer, Persistence, Prevalence and Recovery
13:45 - 17:30 Wicklow Meeting Room 2

DNA and Body Fluids: Transfer, Persistence, Prevalence and Recovery

Intervision DNA Reporting Given Activity Level Propositions 13:45 - 17:30

T. Hicks[1], *N. Laan*[2], *B. Aarts*[3], *E. Wijnhorst*[2]

[1]University of Lausanne | UNIL · Ecole des sciences criminelles (ESC), Lausanne, Switzerland, [2]Netherlands Register of Court Experts, Utrecht, Netherlands, [3]Netherlands Forensic Insitute, Humaan Biologische Sporen, Den Haag, Netherlands

Workshop Description: Questions concerning DNA are shifting from “Who is the donor?” towards “How did it get on the crime scene?”. Experts are asked more frequently to report considering activity level propositions. Reporting DNA-results given activites has been demarcated by the Netherlands Register of Court Experts (NRGD) together with experts from this field. The NRGD assures the quality of the registered experts, but also has the goal to improve the quality where possible. This workshop will focus on improving the quality of DNA reports considering activities by letting attendees assess these and discuss those assessments during the workshop. Accordingly, attendees will learn what the hallmarks are for a good quality DNA report considering transfer mechanisms. Experts can learn from one another and improve the quality of their own written reports. Attendees not reporting in this way can learn how these reports are written, how to assess, and how reporting can be improved.

The NRGD has anonymized DNA reports containing evaluations of biological results given activity level propositions. Attendees of this workshop are encouraged to submit their own reports. If necessary, the NRGD will translate the reports to English. We will anonymize the report such that it cannot be related to the author or institute. Prior to the workshop all attendees will be send a few reports including assessment forms and will be asked to assess the reports. All assessments will be analysed to determine any points of improvement, similarities and inconsistencies that will be discussed during the workshop.

11: Marks, Impressions and Biometric Traces: Document, Handwriting and Signature
13:45 - 17:30 Wicklow Meeting Room 3

Marks, Impressions and Biometric Traces: Document, Handwriting and Signature

How to Evaluate the Performance of Fingerprint Laboratories: EU-Funded Direct Grants and the Testing Program of the ENFSI-FINWG – A Successful Story of Fruitful Support. 13:45 - 17:30

A. Mattei[1], M. Hilgert[2], R. Steiner[3], M.A. Fabiano[1], J. Broezl[2], S. Claveria Juste[4], F. Zampa[5], B. Chanson[6], I. Hefez[7], R. Ramotowski[8], G. Fiumara[8]

[1]Raggruppamento Carabinieri Investigazioni Scientifiche, Reparto Investigazioni Scientifiche di Messina, Messina, Italy, [2]Bundeskriminalamt, KT-14, Wiesbaden, Germany, [3]University of Lausanne, Ecole des Sciences Criminelles, Lausanne, Switzerland, [4]Divisió de Policia Científica. Policia de la Generalitat – Cos de Mossos d'Esquadra, Unitat Central d'Inspeccions Oculars, Sabadell, Spain, [5]Raggruppamento Carabinieri Investigazioni Scientifiche, Reparto Investigazioni Scientifiche di Parma, Parma, Italy, [6] Switzerland Federal Police Office, AFIS/DNA Services, Bern, Switzerland, [7] Bar-Ilan University, Ramat Gan, Israel, [8]National Institute of Standards and Technology, Special Program Office, Gaithersburg, United States

Workshop Description: As early as 2004 the ENFSI Fingerprint Working Group (FINWG) has organised proficiency tests (PTs) and collaborative exercises (CEs) as a way of raising standards within the fingerprint profession.
What emerged from the review of the PTs and CEs carried out within FINWG between 2004 and 2012, was the extreme heterogeneity of the material provided for both visualisation and comparison tests. The exercises were often run by different Forensic Science Institutes, which may unconsciously transfer their own subjective thoughts into the testing material, without the necessary guidance defining and explaining the testing criteria.
Under these premises the Direct Grant (DG) 2013 "TVEFS-2020" work package (WP) T3 was created, as part of activities under the EFSA 2020, to set down the rules under which PTs and CEs need to be developed within the fingerprint domain.
This workshop will explain the boosting effect of the DGs 2013, 2020 and 2022 on the improvement of the procedures applied to design the annual testing program. The leading role of the FINWG will be outlined, as well as the functions of the *ad hoc* Advisory Group. Moreover, the document "Guidance on the conduct of PTs and CEs within the ENFSI FINWG" (2021) will be presented, as well as the "Guidance the selection of commercial PTs in the fingerprint domain". This workshop will present also the outcomes of the most recent FINWG 2024 CEs, realised under the DG 2022 "FOR-FUTURE" WP3, and the on-going activities for 2025. Participants will be engaged in an interactive discussion.

11: Marks, Impressions and Biometric Traces: Document, Handwriting and Signature
13:45 - 17:30 Wicklow Meeting Room 4

Marks, Impressions and Biometric Traces: Document, Handwriting and Signature

When PDF Stands for Possibly Digitally Forged: Forensic Analysis of PDF Document Files 13:45 - 17:30

C. Merceron[1], T. Souvignet[1]

[1]School of Criminal Justice, University of Lausanne, Lausanne, Switzerland

Workshop Description: With the PDF format becoming the standard for digital documents, document experts are increasingly called upon to assess the authenticity and integrity of PDF files. The nature of PDF documents, positioned at the crossroads of traditional and digital documents, calls for a tailored approach of examination drawing from both fields of expertise. This workshop aims to create synergies between traditional (physical) document experts and digital forensic specialists and equip them with essential skills to detect and analyze modifications in PDF documents. The session begins with a detailed overview of the PDF format, covering its technical structure and relevant ISO standards, to provide a shared foundational knowledge. Attendees will create and modify PDF documents following varied case scenarios, producing typical traces of modifications. They will then analyze these altered files to identify traces stemming from these modifications. Furthermore, the workshop organizers will present them with challenging modified documents to strengthen their newly acquired skills.
By the workshop's conclusion, attendees will be initiated to detect these key traces, enhancing their ability to examine PDF document authenticity and integrity in real-world cases.

03: Digital Evidence: Digital Imaging
13:45 - 17:30 Wicklow Meeting Room 5

Digital Evidence: Digital Imaging

13:45 - 17:30

Exploring the Role of Artificial Intelligence in Shaping the Future of Forensic Facial Comparison

A. Guativonza[1], *O. Ibañez*[1], *E. Bermejo*[2]

[1]University of A Coruna, CITIC, Coruna, Spain, [2]Panacea Cooperative Research, Research, Granada, Spain

Workshop Description:

This workshop will focus on laying out the foundations of forensic facial analysis, covering essential concepts and techniques, followed by a detailed overview of current applications and state-of-the-art advancements. To that end, we will analyze different approaches used in facial identification, such as morphological description, photo-anthropometry and facial superimposition, as well as the recommendations from international working groups.

Participants will be introduced to the evolving role of Artificial Intelligence in the field of forensic facial comparison, focusing on how this can create useful tools for forensic experts. Emerging technologies in forensic facial

analysis, such as AI-based photo-anthropometry and 3D/2D superimposition, will be discussed in detail, highlighting the statistical foundations of facial variability. The workshop features hands-on demonstrations and practical exercises with innovative AI tools, providing participants with practical experience in applying these methods.

Key sections include:

1. **Introduction to Forensic Facial Comparison** – Overview of techniques and their limitations, real-life case studies, and group discussions.
2. **AI in Forensic Science** – Understanding AI's role in improving facial recognition, detecting deep fakes, and mitigating the limitations of traditional techniques.
3. **Emerging Technologies** – Exploration of cutting-edge tools such as 3D facial superimposition and AI-based ranking for candidate exclusion.

Prerequisites: Participants are encouraged to bring a laptop with access to Google Chrome and a mouse, in order to get the most out of this experience. No additional software installation is required.

15:15 - 16:00 Auditorium

AFTERNOON COFFEE BREAK

12: Scenes of Crime: Capturing the Crime Scene
16:00 - 17:30 Liffey Hall 1

Scenes of Crime: Capturing the Crime Scene

Advancing Crime Scene Investigation: Towards a Systematic, Transparent and Scientifically Grounded Framework 16:00 - 17:30

M. Zuidberg[1], *M. de Gruijter*[1]

[1]Netherlands Forensic Institute, Specialized Services and Experience, The Hague, Netherlands

Workshop Description: Crime Scene Investigation (CSI) is crucial for effective forensic examination, yet concerns about the robustness and transparency of current practices persist in the Netherlands. Various CSIs investigating the same mock crime scene yield differing results, highlighting implicit decision-making processes that can undermine investigations. To address these challenges, we present a joint research initiative titled “Scenario-based Crime Scene Investigation: Towards a Robust and Transparent Method,” which involves collaboration among the Dutch Police, Public Prosecution, and Forensic Institute.
This workshop builds on a previous session held three years ago, where we introduced the initial steps in this development. We will showcase the

advancements made since then and outline a newly developed framework that introduces a systematic approach to CSI through explicit thinking steps designed to enhance the quality and consistency of evidence collection. Participants will engage with practical exercises, allowing them to apply these scientifically grounded steps in real-time scenarios. This aligns with the principles articulated in the Sydney Declaration, emphasizing the need for a more scientific approach to crime scene investigations.
Our workshop not only aims to disseminate recent insights and advancements in our research but also provides a platform for experts to offer valuable feedback. This interaction is vital for reinforcing the relevance of CSI within the forensic science domain and shining a much-needed light on this critical area of research.

03: Digital Evidence: Artificial Intelligence
16:00 - 17:30 Liffey Meeting Room 2

Digital Evidence: Artificial Intelligence

Using AI in Forensic Science – Could We? Should We? – An Update from the ENFSI AI Task Force 16:00 - 17:30

N. NicDaeid[1], *T. Russier*[2], *R. Ypma*[3]

[1]University of Dundee, Leverhulme Research Centre for Forensic Science, Dundee, United Kingdom, [2]Service National de Police Scientifique, Chef de la Division des Supports Numériques, Paris, France, [3]NFI, The Hague, Netherlands

Workshop Description: In 2023 ENSFI established a task force to explore the use of AI in forensic science, the opportunities it may bring and the challenges it may raise. The role of AI (in particular deep learning) in forensic investigation and evidence evaluation will only increase in the coming years. This technology provides opportunities to many subfields, but also raises concerns about the risks of misuse and. As the ENFSI AI task force, we have been working on a SWOT (strengths, weaknesses, opportunities, threats) analysis for AI in forensic science across multiple evidence types. In this workshop we will discuss this analysis with a focus on the opportunities and threats of using AI in forensic science, and give examples of current and planned use of this technology.

But we also want to hear from you! And seek your help in understanding the opportunities in your field and whether you are already using AI, or planning to? What risks do you see, or concerns do you have? Are there areas where you think AI could or should never be applied? We seek your participation in the AI and forensic science debate so as to inform the recommendations that the task force may make in the future.

02: Chemistry: Other
16:00 - 17:30 Liffey Meeting Room 3

Chemistry: Other

Sometimes Things Don’t Fit: What Do 3D-Printing, Fruit Juice, and an Illicit Drugs Producing Facility Have in Common? 16:00 - 17:30

M. Janssen[1], *J. Hulshof*[2], *M. Grutters*[3]

[1]Netherlands Forensic Institute, Microtraces and materials, The Hague, Netherlands, [2]Netherlands Forensic Institute, Illicit drugs, The Hague, Netherlands, [3]Netherlands Forensic Institute, Chemical Identification, The Hague, Netherlands

Workshop Description: In the forensic community experts often meet in highly specialized areas. When results are combined with DNA or digital evidence, we deem this an interdisciplinary approach. However, there is quite a large unaddressed intermediate field in which the chemists from different specialized expertises need to find eachother. At the Netherlands Forensic Institute (NFI) we see this challenge when for example criminals dump the trash created when producing illicit drugs. The contents of the containers will tell us which drug was produced but the containers themselves could possibly be used to connect a production facility to this dumping site. Does the illicit drugs expert however know which plastics to analyse or how to analyse these plastics? A similar thing happens with additive manufacturing (AM). 3D printing most of a firearm is a new reality. But does the firearm examiner know what the plastics can tell? Does the chemist know enough about the firearm construction? Does the chemist or CSI recognize potential investigative leads in the build of the firearm? The forensic challenges created with AM therefore are broad and span several disciplines: chemistry, firearms, toolmarks amd CSI.

In this workshop the NFI will present several investigations that span multiple classically recognized forensic disciplines. We would like to discuss with the audience how the intake of these cases is handled and how we approach reporting. We would love to hear from other institutes how similar cases are handled. The fruit juice? join us and find out why it is in the title!

06: Education and Training: Other
16:00 - 17:30 EcoCem Room

Education and Training: Other

Shedding Light on Fibre and DNA Research: Alternative Approach to Transfer and Persistence Studies 16:00 - 17:30

A. Kuffel[1], *V. Galais*[1]

[1]University of Dundee, Leverhulme Research Centre for Forensic Science, Science and Engineering, Dundee, United Kingdom

Workshop Description: This workshop is designed to tackle critical challenges in forensic science research, with a strong emphasis on the repeatability and reproducibility of experiments, as well as the importance of using rigorous scientific methods to study the transfer and persistence of evidence. Speakers from the Leverhulme Research Centre for Forensic Science (LRCFS) will share insights on how these concepts are integrated into their research, providing practical examples drawn from the study of DNA and fibre evidence.
Participants will gain practical tools and strategies for designing robust

experiments, ensuring that future research is built on solid, reproducible foundations. The session will delve into best practices for experiment design, covering key aspects such as ensuring repeatability, reproducibility, and data transparency, while also highlighting cost-effective research approaches.
Interactive elements, such as fibre counting challenges, will engage participants with real-world forensic tasks, reinforcing the workshop's core principles. Open discussions will invite participants to share their ideas and solutions to the common challenges faced in forensic research, creating a dynamic environment for knowledge exchange.

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17:45 - 18:45 Auditorium

OPENING CEREMONY

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18:45 - 19:45 Auditorium

WELCOME RECEPTION

Tuesday, May 27, 2025

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09:00 - 09:45 Auditorium

PLENARY SPEAKER 1

Plenary Talk 1 09:00 - 09:45

04: DNA and Body Fluids: Body Fluid Identification
10:00 - 11:00 Auditorium

DNA and Body Fluids: Body Fluid Identification

Advanced Rapid Identification of Vaginal Fluid with miRNA based LFA Technology 10:00 - 10:15

N. Subhashini[1]

[1]SERATEC GmbH, Research and Development, Göttingen, Germany

Abstract Body: The identification of vaginal fluid in forensic science is a crucial yet challenging task, often required in sexual assault investigations. A novel approach using miRNA-based rapid testing could significantly enhance detection capabilities. MicroRNAs (miRNAs), discovery of which recently won the 2024 Nobel Prize for their role in governing cell function, are small, stable molecules known for their tissue-specific expression patterns, even in degraded samples. Despite the promise of miRNAs, identifying specific markers for vaginal fluid remains a challenge. However, miRNAs' resilience to environmental degradation and their low sample quantity requirements make them ideal for forensic applications. This study introduces a novel lateral flow assay (LFA) based on microRNA (miRNA) markers for the rapid identification of body fluids, specifically focusing on its advantages over traditional methods and challenges of identifying the human vaginal fluid.
Unlike polymerase based amplification techniques, which requires lengthy procedures, specialized equipment, and skilled personnel, the proposed LFA minimizes the risk of contamination and allows for easy interpretation of results, making it highly suitable for on-site forensic applications. This novel technique also bypasses the need of designing primers which can typically be longer than miRNA itself leading to non-specific bindings and unspecific amplifications. Additionally, the LFA method provides very high sensitivity of 1 pmol of miRNA per sample which is crucial for application in forensic science.

A Novel Method for Blood Detection Using Fluorescent Dye 10:15 - 10:30

K. Vajpayee[1], *P. Desai*[1], *P.B. Parekh*[1], *H. Sitwala*[1], *K. Suri*[1], *H.R. Dash*[2], *R. Shukla*[1]

[1]Ahmedabad University, Biological and Life Sciences, School of Arts and Sciences, Ahmedabad, India, [2]Centurion University of Technology and Management, School of Forensic Science, Bhubaneshwar, India

Abstract Body: Detection of the body fluid present at a crime scene is essential for any forensic investigation. Amongst all the body fluids (sweat, semen, vaginal fluid, saliva, etc.,) blood is the most frequently encountered evidence at the crime scene. Currently, reagents like benzidine, ortho-toluidine, tetramethylbenzidine, phenolphthalein, leucomalachite green, luminol, and fluorescein are used to screen the presence of blood on different surfaces (porous/nonporous). Most of these tests are based on colorimetric changes owing to the nature of hemoglobin to catalyze the oxidation of chromogenic compounds. Apart from aiding the investigation, these reagents show toxic behavior (DNA damage, carcinogenic, etc.) and false-positive results. Hence, to circumvent this issue, the present study attempts to develop a state-of-art methodology for preliminary blood detection and screening using fluorescein-derived 2',7'-dichlorofluorescein di-acetate (DCFDA) dye. It is hereby proposed that the fluorescein-based dye can successfully detect blood and bloodstains aged up to 20 days. Moreover, supplemental experiments have suggested that the dye doesn't interfere with DNA integrity- causing any damage to DNA. Parallelly, no false-positive reactions have been observed as tested against similar-looking substances.

Multiplex miRNA Quantification Based on Hairpin Probe-Triggered Isothermal Amplification for Bloodstain Identification 10:30 - 10:45

W. Hu[1,2], H. Zhou[2,1], T. Ma[3], X. Liu[1,2], J. Yan[1,4]

[1]Shanxi Medical University, School of Forensic Medicine, Taiyuan, China, [2] Shanxi Key Laboratory of Forensic Medicine, Jinzhong, China, [3]Shaanxi Provincial People's Hospital, Department of Transfusion Medicine, Xi'an, China, [4]MOE Key Laboratory of Coal Environmental Pathogenicity and Prevention, Jinzhong, China

Abstract Body: Body fluid stains at crime scenes are typically characterized by trace and degraded. The origin identification can facilitate crime scenario reconstruction and perpetrator tracking. As the powerful biomarker for body fluids tracing, miRNA is shorter and more resistant to degradation, making it more suitable for forensic specimen analysis. However, either reverse transcription or PCR seriously constrain the sensitivity and specificity in current methods. In this study, a novel multiplex hairpin probe-triggered isothermal amplification (mHPIA) is first developed for miRNA quantification. Instead of reverse transcription, which generates cDNA that is too short to be amplified by loop-mediated isothermal amplification (LAMP), two hairpin probes are designed to target each intended miRNA. As annealing to complementary sequence, probes are fused by ligase, forming a dumbbell structure to trigger amplification. Besides, another molecular beacon is tailor-made and possesses free 3'-hydroxyl to serve as loop primer. The quencher-fluorophore duplex is separated by strand displacement, resulting in fluorescence excitation to monitor multiplex amplification. Based on ligation, not only both miRNA and any other fragmented RNA can be quantified by LAMP, but also target miRNA can be distinguished among homologous family members with the high specificity. Additionally, sensitivity and specificity are enhanced further by LAMP, while the carryover contamination aggravated by the enhanced sensitivity is eliminated by uracil-DNA glycosylase. As a demonstration, hsa-miR-144-3p and U6 can be simultaneously quantified

for bloodsatin identification, indicating mHPIA can serve as a promising tool for miRNA quantification in forensic practice.

Establishment of a cSNP Panel for Forensic Blood Identification in Mixed Body Fluids 10:45 - 11:00

Y. Zhao[1], *S. Hu*[1], *A. Ji*[1]

[1]Institute of Forensic Science, Ministry of Public Security (MPS), Beijing, China

Abstract Body: The analysis of body fluid stains found at criminal scenes not only requires DNA profiles, but also needs to identify the composition of stains, particularly in mixed spots, it will reduce the 'association fallacy'. Polymorphic analysis of body fluid-specific mRNA, that is the coding SNPs (cSNPs) within the mRNA transcript, sets up a direct link between the body fluid stains and the donor(s). In this study, we screened a panel including 14 cSNPs located on 4 blood-specific mRNA biomarkers (CD3G, ANK1, SPTB, GYPA), and developed a multiplex system for forensic blood identification associated donor analysis using the SnaPshot method. Particularly, one-step multiplex reverse transcription PCR strategy was applied to obtain PCR products. The sensitivity, specificity and ability of blood identification in mixed RNA extract of the multiplex system were evaluated. These results showed that the 14 cSNPs panel successfully realized blood identification, including from single-source body fluid and 2 to 4 mixed RNA components. The detection sensitivity of multiplex system reached 1ng total RNA input. Meanwhile the consistency of 14 cSNP genotypes on DNA and mRNA was also verified, the discriminatory power for blood was 0.99138.

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10:00 - 12:45
ENFSI Annual Meeting

08: Forensic Medicine and Toxicology: Forensic Medicine
10:00 - 11:00
Forensic Medicine and Toxicology: Forensic Medicine

A National Collaborative Approach to Improving Forensic Standards 10:00 - 10:30

M. Gaskell[1,2], *G. Hanford*[1]

[1]Forensic Capability Network - Dorset Police, Quality and Performance Directorate, Dorchester, United Kingdom, [2]University of Central Lancashire, Forensic & Policing, Lancashire, United Kingdom

Abstract Body: The UK Forensic Science Regulator (FSR) has set out the statutory requirement for Sexual Assault Referral Centres (SARCs) to be compliant to the FSR Code of Practice including accreditation to the international standard ISO15189 Medical Laboratories: *Requirements for Quality & Competence* by 2nd October 2025. To assist SARCs to meet this

requirement, the Forensic Capability Network (FCN) established the SARC Accreditation Network in late 2020.

This presentation aims to cover the challenges of applying an international standard intended for medical laboratories to the forensic medical examination environment of a SARC. This includes (but is not limited to):

- meeting environmental standards applied to DNA laboratories
- verification of established method for intimate and non-intimate forensic examination of victims
- a national validation exercise to demonstrate consumables used in forensic medical examinations are fit for purpose.
- Development of proficiency testing and collaborative learning exercises for peer performance review

These projects have investigated and evaluated the proportionality, necessity, and effectiveness of the ISO 15189 and FSR regulations for SARCs, ensuring that victim care remans the primary focus, enabling compliance and providing sound data to instigate changes to the SARC statutory requirements.

It also showcases the benefits to having a collaborative approach when it comes to aspects of forensics that impact on a national scale, especially when there is a constant need to be efficient with both resource and finances. It is only through the collaborative effort of this group, that SARCs now have a more defined journey to progress towards achieving compliance.

Estimating Time of Death From Smartwatch Data: First Results From an Empirical Study 10:30 - 10:45

J.P. van Zandwijk[1,2], T. Gosseling[3,4], B. Latten[5]

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Abstract Body: Determining the time of death is a critical factor in forensic death investigations. The currently most widely used method for this is rectal temperature measurement. However, this method lacks accuracy and has the limitation that it can only be applied within a restricted timeframe. Therefore, there is a need for more accurate and less time constrained alternatives.
This study explores the feasibility of using data from smartwatches for determining the time of death. To this end, we collected data from Garmin, Apple and Samsung smartwatches, worn by participants dying at a scheduled moment during a euthanasia procedure.
Analysis of experimental data (N=28) indicates that data registered by

smartwatches showed changes around the participant's death, allowing for an estimation of time of death. Although the number of variables and time granularity of registrations varied across devices, in most cases the difference between the actual time of death and the estimates derived from smartwatch data was under 30 minutes. However, for unexplained reasons, in some instances there were gaps in the data recorded by smartwatches, highlighting the need for caution when relying solely on this data for determining the time of death.
Current results show that data from smartwatches has potential to provide more accurate estimates of time of death than existing methods. As data remains stored on the device for a long period, this method can potentially extend the time range for which time of death can be estimated beyond what is achievable with temperature measurements. However, more research is indicated.

Medical Findings in Young Patients With Head Trauma: How Strong Is the Evidence for Abuse? 10:45 - 11:00

K.P. Hymel[1], M. Sjerps[2], P. Vergeer[2]

[1]Penn State, College of Medicine, Leesburg VA, United States, [2]Netherlands Forensic Institute, The Hague, Netherlands

Abstract Body: ***Background and Objective.*** Likelihood ratios (LR) are numerical measures of evidential value. Our objective was to use LRs to calculate the patient-specific evidential values of medical findings that best differentiate abusive versus non-abusive head trauma (AHT). We extend previous work [Hymel 2019,Hymel 2024] in two ways: (1) we focus on the LR instead of the posterior probability of AHT; (2) new LR-models were developed that can handle multicategory and missing observations.
Methods. We analyzed existing, uniform, prospective, de-identified data regarding 973 acutely head-injured children <3 years hospitalized for intensive care across 18 sites between 2011 and 2021; applied two different proxies for AHT and non-AHT ground truth; trained and validated LR-models that differentiate AHT versus non-AHT; and analyzed patient-specific LRs that facilitated assessment of evidential values (where LR values >1 and <1 supported hypotheses of AHT and non-AHT, respectively).
Results. The two best performing LR-models revealed evidential (LR) values for patient-specific, AHT-related medical findings that varied from modest (0.1 to 10) to relatively large (0.003 to 0.1 and 10 to 3000). A few non-AHT patients presented with misleading evidence (supporting AHT) that was moderately strong, with LRs approaching 1000.
Conclusions. The odds that a head injured child was abused can be increased or decreased by the evidential values of the child's medical findings. Physicians can use available LRs to inform their AHT-related diagnostic reasoning, opinions, and testimony.

05: Drugs: Analytical Challenges
10:00 - 10:45 Liffey Hall 2

Drugs: Analytical Challenges

Chemometric Data Analysis of GC-Solid Deposition-FTIR Spectra for Improved Differentiation of NPS Analogs 10:00 - 10:15

J. Bonetti[1], R. Kranenburg[2], S. Hokanson[1], M. Pothier[1], S. Samanipour[3], A. van Asten[3]

[1]Department of Forensic Science, Eastern Laboratory, Norfolk, United States, [2]Netherlands Police, National Unit, Driebergen, Netherlands, [3] University of Amsterdam, HIMS, Amsterdam, Netherlands

Abstract Body: The continuous introduction of NPS analogs and isomers has complicated the identification of drugs of abuse by forensic illicit drug experts. To maintain confidence in the chemical identification process, forensic illicit drug analysis laboratories have extended their analytical capability by performing GC-IR analysis in addition to regular GC-MS for challenging case work samples. It is generally accepted that with introduction of GC-IR confidence in the chemical identification is fully restored. Scientific studies regarding GC-IR analysis of psychoactive substances typically show single spectra, followed by visual assessment and library matching. But is this confidence really justified? In this study three synthetic cathinone analogs are presented that yield very similar solid-desposition IR spectra; methylone, N-ethylpentylone, and pentylone. A spectral data set was gathered for these three compounds on two different GC-sd-IR instruments. It was found that the use of different instruments (same manufacturer and model) and sample preparation protocols results in significant spectral variations that negatively affect visual assessment and library search outcomes. In addition, significant spectral shifts were observed over time for a fixed sample preparation protocol and GC-IR instrument. By using Principal Component Analysis and Mahalanobis distance calculations, spectral variations could be mapped and spectral selectivity could be objectively assessed. With optimized data pre-processing, multivariate data analysis allowed for flawless analog assignment, demonstrating that molecular spectral differences outweigh the observed instrumental and methodological variations. However, the reduced consistency of GC-IR data as compared to GC-EI-MS spectra will have practical consequences and will hamper the application of shared reference libraries.

Project NPS VeriQon – Cool Tools for Spectra Validation by Using Quantum Mechanics and Artificial Intelligence 10:15 - 10:30

T. Schoenberger[1], T. Orth[1]

[1]German Federal Criminal Police Office (Bundeskriminalamt), Forensic Science Institute - KT43, Wiesbaden, Germany

Abstract Body: With the NPS Data Hub, we operate a globally intensively used sharing platform for chemical-analytical data on new psychoactive substances (NPS) and other relevant substances in the field of drug analysis. The analytical data are usually MS, NMR, IR or Raman spectra. Every user can also enter new substances to this portal and upload analytical data in almost any format. This makes the validation of the data particularly important.
As part of the ‘NPS VeriQon’ project funded by the German Federal Ministry of Education and Research, we are working with a number of project partners to develop validation tools for the most important technologies.

These tools will be integrated into the NPS Data Hub and will run automatically as far as possible. Quantum mechanical calculations on supercomputers and various artificial intelligence approaches will be used. Intensive statistical studies have also been carried out, leading to significantly improved uncertainty estimation in MS spectrum comparisons. A novelty in the validation is the holistic approach, which combines the results of the tools for different techniques into a final assessment.
In addition, some of the tools developed will also be implemented in a separate area where they can provide valuable assistance to users in their structural elucidation workflow.

A Data-Driven Approach to the Extraction of Additional Information from GCMS Drug Samples 10:30 - 10:45

D. Coslar[1], R. Ypma[2], Z. Geradts[1,2], S. Samanipour[3]

[1]University of Amsterdam, Informatics Institute, Amsterdam, Netherlands, [2]Netherlands Forensic Institute, The Hague, Netherlands, [3]University of Amsterdam, Van 't Hoff Institute for Molecular Sciences, Amsterdam, Netherlands

Abstract Body: Each year, around 25,000 drug samples are analyzed at the Netherlands Forensic Institute (NFI) using a standard Gas Chromatography/Mass Spectrometry (GC/MS) screening. During casework, the main focus is to identify whether the sample contains an illegal substance. However, the screening reveals additional impurities, active substances and other trace compounds, which could help identify clues with respect to the sample's production, origin and transport.
During the current initial stage of the project, we have constructed an interdisciplinary data-driven approach to compound identification, which allows for autonomous sample characterization using the distribution of compounds found. This can be used to find criminologically relevant patterns in the data, without increasing the workload of analytical personnel.
We give an overview of the patterns found in the last five years of samples analyzed at the NFI. Additionally, we show that both general and case-specific patterns are in agreement with current criminological knowledge possessed by forensic drug experts and police authorities.
Overall, the work presented will allow forensic and police authorities to more easily and quickly identify criminological patterns, as well as allowing for these patterns to be uncovered autonomously, thus increasing the amount of information per case.
Moving forward, this method could be improved by expanding upon the considered (pre-)pre-cursors, impurities and active ingredients, to allow for more specific information to be uncovered. Further, increasing the compounds considered would allow for previously unsuitable samples to become analyzable as well.

12: Scenes of Crime: Forensic Archaeology and Anthropology
10:00 - 11:00 Wicklow Hall 1

Scenes of Crime: Forensic Archaeology and Anthropology

Embracing a Multidisciplinary Approach and Emerging Technologies – Forensic Excavation and Analysis of Human 10:00 - 10:30

Remains from the Former Mother and Baby Institution in Tuam, Ireland

O. Finegan[1], N. McCullagh[1], D. MacSweeney[1], J. Ward[1], C. McDermott[1], L. Walsh[1]

[1]Office of the Director of Authorised Intervention, Tuam, Galway, Ireland

Abstract Body: The Office of the Director of Authorised Intervention, Tuam (ODAIT) is an independent body established in October 2022 under the Institutional Burials Act 2022 to oversee a staged approach to the recovery and analysis of human remains from the site of the former Mother and Baby Institution in Tuam, Ireland. The main objectives of ODAIT are to restore dignity in death and where possible, in line with international standards and best practices, facilitate the forensic excavation and recovery of any human remains present at the site. Upon recovery, a multidisciplinary team of forensic specialists will make every effort, using all suitable techniques available, to: a) individualise any commingled human remains, b) identify them using a DNA-led approach, c) establish cause and circumstances of death, and d) provide a dignified place of burial. This work will push the boundaries in terms of the technical complexity of the excavation and identification process, the innovative application of new and emerging forensic technologies and the critical communication and engagement with survivors and family members to encourage their participation in the Identification Programme and honour their wishes for the reinterment of their loves ones' remains. The scientific challenges posed by this project will make it a first globally and potentially set a new paradigm for interventions of this nature. ODAIT will collaborate with Forensic Science Ireland, a range of forensic service providers, and engage with the global scientific community to achieve its goals and maximise the project's potential for success.

Forensic Archaeology and the Excavation of Infants and Children from a Unique 21st Century Context 10:30 - 10:45

N.M. McCullagh[1], O. Finegan[1], D. MacSweeney[1]

[1]Office of the Director of Authorised Intervention, Tuam, Galway, Ireland

Abstract Body: In 2016 Forensic Archaeologists in Ireland discovered commingled infant human remains in a subsurface historic sewage treatment structure at the site of a former Mother and Baby Institution in Galway, Ireland. The Institution had been in operation from 1925-1961. The infant remains were inaccessible in 2016 due to the nature of the context they are contained within. The structure is composed of 20 separate narrow chambers, the base of which are over 2.5m below the surface. Adding to the complexity, the site is now within a residential housing estate. This created such a unique context that it was not possible to recover the remains safely, and under any existing legal structure, at the time of their discovery.

In 2022 the Irish government enacted legislation that created a state agency (The Office of the Director of Authorised Intervention at Tuam - ODAIT) that is now responsible for the excavation, recovery and

identification of these remains. The Institutional Burials Act requires that the site and all work pertaining to the excavation of these remains is conducted to a forensic standard, requiring the engagement of Forensic Archaeology on a significant scale.

ODAIT and its team of specialists will begin excavating this site in 2025. The complex nature of the physical context of the site requires a unique and innovative response. This presentation will the outline the background of the site and illustrate the excavation solutions that will allow the safe forensic excavation and recovery of these infants and children's remains.

Implementation of a Large-Scale DNA Identification Program Associated With a Mass Grave at a Mother and Baby Home in Tuam, County Galway 10:45 - 11:00

K. O'Connor[1], S. Clifford[1], O. Fox[1], X. Huber[1], O. Finnegan[2]

[1]Forensic Science Ireland, DNA, Celbridge, Ireland, [2]Department of Children, Equality, Disability, Integration and Youth, Office of the Director of Authorised Intervention, Tuam, Tuam, Ireland

Abstract Body: In 2015 an investigation began after claims emerged that hundreds of babies were buried in a mass, unmarked grave near a Mother and Baby Home in Tuam, County Galway. The Mother and Baby Home operated from 1925 until 1961, and it is thought almost 800 babies may be buried on the site. In 2017 it was confirmed that a significant quantity of remains are located at the site and the Irish Government decided that a phased, forensic-standard excavation, recovery and identification of the remains should be carried out at the Tuam site, followed by respectful re-interment of remains.

Forensic Science Ireland (FSI) has been appointed to carry out the DNA profiling and act as custodian of DNA databases associated with the Tuam mass grave site. This abstract is submitted in conjunction with additional abstracts from the teams associated with the Tuam site excavation as an overview of the project as a whole. This aspect outlines the DNA profiling strategy which will be used for the Tuam site Identification Program and the challenges associated with preparing a forensic laboratory to carry out DNA profiling for a large-scale identification project.

FSI plans to use a combination of SNP, mitochondrial and YSTR profiling to carry out long-range kinship analysis for this work and will discuss the methods selected, the variables affecting our decisions and the work done to date to prepare for the commencement of the Identification Program associated with the Tuam excavation.

11: Marks, Impressions and Biometric Traces: Document, Handwriting and Signature
10:00 - 11:00 Wicklow Hall 2 (A)

Marks, Impressions and Biometric Traces: Document, Handwriting and Signature

The Quest for Automated Verification in Forensic Handwriting Examination: Current Status and Future Wishes. 10:00 - 10:15

E. van den Heuvel[1], S. Ibrahim[2]

[1]Amsterdam University of Applied Sciences, Forensic Research, Amsterdam, Netherlands, [2]ForensInk, Ottawa, Canada

Abstract Body: In this presentation, we will present an overview of previous work on computer science competitions on realistic forensic casework materials. The competitions were organized in unique collaboration between computer scientists (pattern recognition (PR) scientists) and forensic handwriting experts (FHEs). In the early years (2007-2010), we started with providing pre-conference tutorials in order to reach out to the computer scientist community to advocate the future FHEs need, which is to objectify and verify the priorly subjectively formed interpretations of comparison that lead to possibly decisive conclusions about the authorship of disputed handwriting or signatures. In successive conference years of ICDAR (International Conference on Document Analysis and Recognition; 2009; 2011; 2013; 2015; 2017), with changing compositions of a large number of authors, new test and training sets in either signatures or handwritten text were provided on Dutch, Chinese, Japenese, Bengali, Italian, and English, collected mainly by FHEs. The mayor aim of all this extensive work was to bridge the gap between recent technological developments and forensic casework because up until that point, the field of automated signature verification and writer identification did not take the real needs of FHEs into account. In these competitions, realistic FHEs questions about casework were taken at hand. Results indicated that automated methods might be able to support FHEs to objectify the strength of evidence. Another important aspect not yet emphasized is the usability and application of automatic systems in real forensic cases, which motivates to evaluate the usability of automatic systems in future competitions.

Contraband Tobacco: Implementation of a Systematic Profiling Procedure for Cigarette Packs Based on Physical and Chemical Characteristics for Forensic Intelligence Purposes 10:15 - 10:30

L. Caron[1,2], F. Crispino[1,2], C. Muehlethaler[1,2]

[1]Université du Québec à Trois-Rivières, Biochimie, Chimie, Physique et Science forensique, Trois-Rivières, Canada, [2]Groupe de recherche en Science Forensique, Trois-Rivières, Canada

Abstract Body: Tobacco smuggling in Canada is a pervasive and growing criminal issue, with significant social and economic consequences. Despite its impact, there has been limited research on tobacco smuggling to assist law enforcement in their investigations. This project aims to develop a profiling method for contraband tobacco based on the physical and chemical characteristics of the packaging. Analyzing the manufacturing features of seized cigarette packs offers a comparative framework to uncover connections in the production process through material trace examination. This will also enable a deeper analysis and understanding of the criminal dynamics surrounding the supply, production, and distribution of contraband cigarettes. It will enrich criminal and forensic intelligence and support police investigations in the fight against contraband nationwide. This project is in collaboration with different law enforcement agencies and the cigarette packs provided come from various seizures.

The physical (dimensions, folding, notches, scratches, printing, ...) and chemical characteristics (e.g. composition by FTIR, UV-Vis of paper, plastic and aluminum foil) of each component of the cigarette packaging were observed, measured and coded. The observations made include examinations to the naked eye, under a stereomicroscope with different lightings (ultraviolet, filtered light and infrared), and infrared spectrometer analysis. Multivariate statistical methods were then used to assess the similarities between the profiles and to create graphs illustrating the groupings and proximity of the contraband cigarette packs analyzed. The results are also verified with circumstantial information provided, which enables the groups obtained to be compared with the seizures.

Detection and Differentiation of "Novel" Writing Tools Using Microscopic and Chemical Methods 10:30 - 10:45

C. Polston[1], A. Alhajj Sleiman[1], M. Badet[1], H. Lescarbeault[1], J. Luisier[1], L. Nef[1], L. Marcuzzi[1], W. Mouawad[1], L. Robert[1], C. Weyermann[1]

[1]University of Lausanne, Ecole des Sciences Criminelles, Lausanne, Switzerland

Abstract Body: This study presents information intended to help examiners and experts detect the use of novel “pencils”, and enable them to differentiate these novel materials both from traditional graphite pencils and from other novel writing tools. The work discusses the results of different forensic analytical processes including visual, microscopic, and VSC examination as well as XRF, FTIR, and MALDI spectroscopy and electrical conductivity testing on marks made by traditional graphite pencils and marks made by “novel” pencils composed of metal alloys or a mixture of polymer and graphite. The aim of the work was to determine what features could assist an examiner in determining if a “novel” writing instrument had been used in lieu of a traditional graphite pencil, in differentiating the marks of a traditional graphite pencil from these other tools, and to provide the optimal process for analysis of such marks. The results show that it is possible to differentiate graphite, polymer, and metal pencils effectively using many different analytical techniques; however, the examiner must have knowledge about the existence of novel writing tools and of the characteristics which distinguish each type of pencil.

How Fast Is Fluent Handwriting? 10:45 - 11:00

T. Dziedzic[1], A. Sen Yilmaz[2], A. Szafrańska[1]

[1]Institute of Forensic Research, Forensic Handwriting and Questioned Documents Examination, Krakow, Poland, [2]Institute of Forensic Science and Legal Medicine, Istanbul University-Cerrahpasa, Istanbul, Turkey

Abstract Body: For years, Forensic Handwriting Experts (FHEs) have been evaluating the speed of writing based on qualitative line properties. The rise of technology that allows digital sampling of handwriting movement has made it possible to move toward quantitative examination of time-related characteristics.

To determine how FHEs assess fluency of writings produced at different speed, an experiment was conducted, in which 35 hybrid samples (i.e. produced with ink on a paper substrate and simultaneously digitally captured) were produced at the average velocities ranging from 3 to 65 mm/s. High resolution scans of conventional pen-and-paper representations of these samples in random order were sent to FHEs worldwide for rating as being of good, medium or poor line quality.

From 94 responses to this survey, the authors determined that for speeds below 10 mm/s, 90% of experts rated the writings as non-fluent, whereas for speeds above 60 mm/s, 80% rated them as fluent. In the intermediate range of 40-50 mm/s, experts' evaluations showed a strong correlation between speed and fluency ($p<0.0001$), with 48.7% "medium fluent" and 50.4% "fluent" ratings, indicating a near-equal split in perception. Logistic regression analysis revealed no significant relationship between experience of the experts (number of years in practice) and their ratings ($p>0.05$).

These findings, along with other interesting observations made during the research, provide objective thresholds for the evaluation of writing fluency and may have practical applications in casework, such as when questioned digitally captured signatures are to be compared with conventional pen-and-paper known samples (or vice versa).

01: Case Studies: Emerging Technologies in casework
10:00 - 11:00 Liffey Meeting Room 2

Case Studies: Emerging Technologies in casework

Integrating Generative AI into Forensic Workflows: A Case Study from the Netherlands Forensic Science Institute 10:00 - 10:30

H. Henseler[1,2], T. Meconi[3,2], A.d. Vries[2], M. Koeberg[2]

[1]University of Applied Sciences Leiden, Department of Computer Science, Leiden, Netherlands, [2]Netherlands Forensic Institute, Hansken, The Hague, Netherlands, [3]University of Groningen, Faculty of Law, Groningen, Netherlands

Abstract Body: The emergence of Large Language Models (LLMs) like ChatGPT has opened new opportunities for enhancing efficiency in work processes. However, their application in sensitive environments like forensic casework presents unique challenges. This presentation highlights findings from the Robin pilot project, initiated by the Dutch Ministry of Justice and Security, which evaluated the potential of a trusted AI assistant, based on ChatGPT-4o and hosted in a trusted-cloud environment, to support forensic experts, researchers, and operational staff.
The Netherlands Forensic Institute (NFI) participated in the pilot to explore how generative AI could be used in various workflows. Practical applications included, amongst others, summarizing police interviews by focusing on relevant information, transcribing dictated speech from crime scenes or autopsy rooms, and annotating meeting agendas with concise summaries of documents. These examples show how AI can reduce repetitive tasks, enhance preparation, and allow professionals to focus on complex investigative work.
Alongside these applications, the pilot raised critical questions about the

feasibility of adopting LLMs in forensic environments. Challenges included ensuring data privacy, addressing hallucinations, and understanding the legal and ethical implications of AI-generated outputs. Additionally, the pilot provided valuable insights into the training required when professionals begin using LLMs. Feedback sessions and interviews revealed the challenges users faced, such as effective prompt writing, understanding the limits of AI-generated outputs and ensuring data privacy.
This presentation reflects on the opportunities, challenges, and user experiences from the Robin pilot, offering a balanced perspective on the potential of LLMs to transform forensic workflows.

Bridging the Gap Between Academia and Police Casework – Supporting the Criminal Justice System for Over 10 Years 10:30 - 10:45

S. Goia[1], *C. Primeau*[1], *M.A. Williams*[1]

[1]The University of Warwick, Warwick Manufacturing Group, Coventry, United Kingdom

Abstract Body: The partnership between the forensics team at Warwick University and West Midlands Police, has aided over 350 forensic investigations since 2014, by providing micro-CT imaging and 3D laser scanning to support police casework. The *Forensic Centre for Digital Scanning and 3D Printing* benefits from five X-ray micro-CT instruments, each having different capabilities and specifications which allow for a wide variety of sample types and sizes to be scanned and analysed. The centre also benefits from multiple laser scanners which can be used, for example, in 3D crime scene scanning and reconstructions. This presentation will cover some of the casework undertaken as part of the partnership between Warwick University and West Midlands Police, through which the advantages and use of micro-CT will be highlighted. The use of high-quality 3D and 2D imaging to accentuate minute details from forensic evidence in court, acquired through the high-resolution micro-CT instrumentation available, will also be discussed. Scanning of a crime scene has seen valuable impact in blood pattern analysis, gunshot trajectories, and disproving/approving eyewitness testimony. The 3D scans of a crime scene can also serve as a digital record of the scene and interactive videos of the scene can be shown in court when evidence is presented, hence ensuring a better understanding and the engagement of the jury. Thus, this presentation aims to reflect on the casework in which the forensic centre was involved in throughout the past 10 years and the ways in which technology was used to support the Criminal Justice System.

Enhancing Forensic Services Through LIMS: Transforming Forensic Science Ireland's Support for the Irish Criminal Justice System with Automation and Advanced Analytics 10:45 - 11:00

H. McWeeney[1], *J. Davidson*[2]

[1]Forensic Science Ireland, Forensics Laboratory, Dublin, Ireland, [2] LabVantage, High Wycombe, United Kingdom

Abstract Body: Forensic Science Ireland (FSI), in partnership with LabVantage, has leveraged a Laboratory Information Management System

(LIMS) to enhance the delivery of forensic services to support the Irish Criminal Justice System. This paper presents the transformative impact of LIMS implementation across FSI's DNA, chemical, and physical evidence analysis, highlighting how it has streamlined workflows, improved data integrity, and assisted in compliance with international standards. By digitizing processes and integrating various forensic disciplines, LIMS has enabled FSI to efficiently manage case data, reduce turnaround times, and enhance the quality and traceability of forensic results.

Moreover, this paper explores the evolving landscape of forensic science and discusses how emerging analytics and LIMS capabilities will further advance FSI's service offerings. The integration of predictive analytics, automation, and enhanced data visualization will enable FSI to better anticipate case demands, optimize resource allocation, and provide deeper insights into forensic evidence and trends that are emerging. Through use cases and case studies we will explore future strategies to unify stakeholders - law enforcement, medical examiners, forensic supervisors, and lab managers—through a comprehensive system that eliminates data inconsistencies, tracks the chain of custody, and ensures real-time access to relevant information.

07: Forensic Management and Quality Systems: Quality Systems and Accreditation
10:00 - 11:00 Liffey Meeting Room 3

Forensic Management and Quality Systems: Quality Systems and Accreditation

The ISO 21043 Forensic Sciences Standard: A Major Opportunity to Move Forensic Interpretation and Reporting Forward 10:00 - 10:30

C.E. Berger[1,2]

[1]Leiden University, Faculty of Law, Leiden, Netherlands, [2]Netherlands Forensic Institute, Principal scientists, The Hague, Netherlands

Abstract Body: Just before the EAFS2025 conference, the new *ISO 21043 Forensic sciences* standard came out.
It is the product of 7 years of hard work, the consensus of countries worldwide, and the very first really forensic standard.
In this talk we will mainly discuss Parts 4 and 5 of the standard: Interpretation and Reporting.
The ISO 21043 standard structures these essentially forensic parts of the forensic process, offering guidance and requirements, but also plenty of flexibility to implement it in practice.
The author of this talk was involved in the development of these parts from the very beginning, was the lead editor for Part 4 (Interpretation), and drafted the initial document.
You will get to hear the inside story behind the development of the standard and a good understanding of what it really means.
The ISO 21043 Forensic sciences standard offers a major opportunity to move forensic science forward.

Methods Validation App (MVA): A Robust and User-Friendly Software for the Validation and Accreditation of Analytical Methods 10:30 - 10:45

G. Solarino[1,2], *M. Vincenti*[1], *E. Alladio*[1,2]

[1]University of Turin, Chemistry, Turin, Italy, [2]DataBloom, Turin, Italy

Abstract Body: Methods Validation App (MVA) is a new application addressing the growing demand for efficient and reliable methods validation workflow in regulated laboratories. Its development, leveraging Python's versatility and robust libraries for data handling and statistical analysis, offers an accessible, user-friendly interface for analysts in forensic sciences and other disciplines requiring stringent analytical reliability. The intuitive design of MVA eliminates the steep learning curve associated with many other statistical tools, making it accessible even for non-specialist users. The development of MVA aligns with the technological evolution of analytical techniques, ensuring that laboratories can validate their methods efficiently, reliably, and in compliance with regulatory requirements. By automating critical aspects of method validation (i.e., calibration, limit of detection, precision, accuracy), the tool mitigates the risks associated with human error, standardizes validation protocol, and accelerates the evaluation process. Its applications in forensic sciences highlight its collective relevance, where analytical rigor directly affects legal and social outcomes. Beyond forensic use, MVA holds potential for broader adoption in fields such as pharmaceuticals, environmental testing, and food safety, where validated analytical methods are mandatory.
In summary, MVA is a tool that modernizes method validation by integrating advanced statistical capabilities within an accessible platform, significantly enhancing productivity, ensuring the reliability of analytical outcomes, promoting accessibility and adoption by a wide audience, including non-experts, in the field of analytical methods validation.

Forensic Advisors: Transitioning From Ad-Hoc Practices to a Standardized ISO 9001-Certified Customer Service Model 10:45 - 11:00

T. De Baere[1], K. Lallemand[2], L. George[2]

[1]National Institute of Criminalistics and Criminology, Quality, Brussels, Belgium, [2]National Institute of Criminalistics and Criminology, Forensic Advice, Brussels, Belgium

Abstract Body:
In 2010, The National Institute of Criminalistics and Criminology (NICC) in Belgium introduced the role of a forensic advisor, a generalist providing tailored forensic advise to magistrates and police. Beyond their scientific background, forensic advisors are skilled communicators, coordinators of multiple inputs and responsive to specific needs of their clients.
While forensic laboratories are typically accredited under ISO17025 and provide lab results, the role of the forensic advisor is distinct, focusing more on service provision. Therefore, ISO9001 is a useful quality management system for client-oriented service delivery.
Over the past two years, significant steps were made toward achieving ISO9001 certification for the forensic advice department at the NICC. This effort included process visualization of their key tasks, harmonization between different approaches into procedures and standardized output templates to ensure consistency.
Additionally, all other aspects of quality management were implemented,

ranging from structured training, non-conformity registration and handling, risk-based thinking to mitigate potential errors. In order to ensure customer-centric approach, targeted surveys were set up to identify and address their specific needs and expectations.
These initiatives, aligned with the general methods and procedures applicable of the ISO17025-accredited forensic institute, led to an ISO9001-certified service ensuring a customer-centric approach, providing reliable, standardized and quality controlled outputs that meet the expectations of judicial stakeholders while maintaining a forensic-oriented approach.

04: DNA and Body Fluids: DNA Interpretation
11:00 - 11:45 Auditorium

Poster Session Tuesday - DNA and Body Fluids: DNA Interpretation

Cell Free DNA and miRNA Analysis by Quantitative Real-Time Polymerase Chain Reaction in Postmortem Interval Determination 11:00 - 11:00

D. Yavuz Kilicaslan[1], E. Emiral[2], N.L. Satiroglu- Tufan[2,3]

[1]Gendarmerie and Coast Guard Academy, Security Sciences, Ankara, Turkey, [2]Ankara University School of Medicine, Forensic Medicine, Ankara, Turkey, [3]Ankara University Institute of Forensic Sciences, Forensic Genetics, Ankara, Turkey

Abstract Body: The time elapsed after death is known as the postmortem interval (PMI). After death, the body undergoes changes such as algor mortis, rigor mortis, livor mortis, and putrefaction. In forensic medicine, PMI is traditionally determined using standard methods and forensic entomology, both of which can be affected by environmental conditions. Recently, genetic materials, which are less influenced by the environment, have gained attention in PMI studies. Cell-free DNA (cfDNA) comprises short DNA fragments released into the bloodstream due to cell necrosis and apoptosis. This study quantitatively analyzed cfDNA and specific microRNAs (miRNAs) — miR-122, miR-133, miR-1, miR-16, and let-7e — in serum samples from rats at various time intervals to assess their correlation with PMI. The results were analyzed using Ct, ΔCt, ΔΔCt, and fold change methods. Statistically, miR-16 and miR-122 had lower ΔCt values at all time points. miR-16 showed a lower ΔΔCt average at 24 and 48 hours and the highest fold change at 24 hours. Reference genes GAPDH and ACTB declined over time, with higher averages at 0, 6, and 12 hours compared to 24 and 48 hours. This research is the first to quantitatively explore cfDNA's potential role in PMI estimation.

Chemometric Methods for Classifying DNA Profiles in Forensic Genetics 11:00 - 11:00

C. Scagliarini[1,2], T. Neocleous[3], S. Cisana[4], M. Omedei[4], P. Garofano[4], E. Alladio[1,2]

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Abstract Body: Assessing whether a DNA sample is suitable for forensic analysis is a fundamental challenge in forensic genetics, as it determines whether further investigation is viable and worthwhile. This study focuses on single contributor DNA profiles, classifying them as complete or partial to evaluate their potential for subsequent analysis. The profiles were obtained through standard forensic workflows, including extraction, quantification, amplification, and profiling using the PowerPlex® Fusion 6C system. The final dataset comprises peak height ratios (PHR) for all STR markers in the kit and degradation indices, which are critical in determining DNA profile completeness.
Advanced chemometric methods were employed to address the dataset's complexity, particularly its significant class imbalance. A downsampled training set was used, and two different techniques were tested for variable selection: stepwise logistic regression based on Akaike Information Criterion (AIC) and penalized logistic regression (LASSO, Least Absolute Shrinkage, and Selection Operator) with cross-validation. These approaches pinpointed critical predictors, such as degradation indices and specific STR markers, as highly relevant for classification. By refining classification thresholds, the specificity for the minority class was enhanced, showcasing the flexibility of chemometric techniques in tackling forensic challenges. This work highlights the potential of statistical and chemometric approaches in forensic genetics, offering a robust and objective framework for determining DNA sample suitability. This study provides a foundation for reliable DNA profile interpretation and improved forensic workflow by leveraging these advanced modeling techniques.

Poster Session 1 (Multiple Topics): All except 10
11:00 - 11:45 Auditorium

Poster Session Tuesday

01: Case Studies: Emerging Technologies in casework
11:00 - 11:45 Auditorium

Poster Session Tuesday - Case Studies: Emerging Technologies in casework

A new Age of Anatomical Plant Identification 11:00 - 11:00

V. Haag[1], S. Helmling[2], T. Lewandrowski[3], K. Dremel[4], J. Stebani[5], A. Olbrich[3], V. Zemke[3], S. Zabler[6], G. Koch[7]

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Abstract Body: **Abstract:**
In the age of the optimization of digitally based examination methods, the

analysis of structural plant anatomy is becoming increasingly important for forensics. Especially when the chemotaxonomic or genetic signature is altered by processing the material or can no longer be analyzed due to decomposition and alternative identification methods are no longer applicable. This has led to an unexpected renaissance of traditional plant anatomy despite the increased demand for new methods driven by the rapid development of digital microscopy [1;2;3;9;10].

In this presentation, applied fields of present-day anatomical examination methods and sample preparation will be presented. These include the established paper and fiber analysis [5;6] and 3D-reflected-light-microscopy used at the Thünen Institute of Wood Research in Hamburg, which are routinely applied at the Thünen Center of Competence on the Origin of Timber. Further, anatomical characterizations of organic structures of various NTFPs from the current study “Anatomical investigation of residual NTFPs (Non-Timber Forest Products/Shells and Nuts)” are illustrated. Finally, the current diversification of products on the international market and the most promising anatomical approaches based on machine learning and combined volumetric µ- and nano-CT examination [4;8], are presented which still have potential for further development.

01: Case Studies: Other
11:00 - 11:45 Auditorium

Poster Session Tuesday - Case Studies: Other

Multiple Gunshot Wounds in a Situs Inversus Decedent (Kartagener Syndrome): Determination of Bullet Trajectories Through Chest and Abdominal Viscera 11:00 - 11:00

W. Gunther[1,1]

[1]Office of the Chief Medical Examiner, Tidewater District, Norfolk, United States

Abstract Body: Forensic autopsy on decedents with multiple gunshot wounds requires determination of the trajectory of fire of each projectile that traverses the body. Determining gunshot wound paths from entrance to exit, or from entrance to retained bullet, increases in complexity with every additional gunshot wound, in cases of multiple overlapping injuries. Right-to-left or left-to-right orientation is an important component of the trajectory of fire. Torso gunshot wounds with right-to-left orientation are expected to traverse right-sided organs, midline organs, and left-sided organs in that order. Trajectories were determined in a decedent with 26 gunshot wounds, 8 of them involving the torso, who had previously undiagnosed situs inversus, presumed to be due to primary ciliary dyskinesia (Kartagener syndrome).

A 33-year-old man without known medical history was found dead in an apartment building parking lot after shots were fired. Adjacent vehicles had bullet perforations. Police identified 48 cartridge casings on the scene, including 9 mm, .45 caliber, and .40 caliber handgun casings, and 0.762x39 mm rifle casings.

Pre-autopsy radiography (plain films) identified 11 intact bullets, with

innumerable bone and metal fragments. The heart lay on the right side of the chest, and the liver on the left side. Autopsy documented situs inversus, and 8 out of 26 penetrating and perforating torso gunshot wounds that injured the left lung, left kidney, and spleen on the right side of the body, and the cecum, right lung, and right hemidiaphragm on the left side of the body. Trajectories were successfully determined for all the gunshot wounds.

Elder Abuse: A Descriptive Study in the Forensic Medicine Department of Sidi Bel Abbès 11:00 - 11:00

M. Djilali Merzoug[1], *M.A. Boumelik*[1]

[1]Djillali Lyabes, Medicine, Sidi Bel Abbès, Algeria

Abstract Body: This descriptive, cross-sectional study was conducted over a 3-month period (May, June, and July 2022) in the Forensic Medicine Department of Sidi Bel Abbès, Algeria. The study took place during a time of significant social unrest, a factor that may have contributed to increased tension and family conflicts.
A total of 65 elderly victims of abuse, aged between 65 and 85 years, were examined. All cases involved intra-family violence, highlighting the disturbing prevalence of abuse within domestic settings. The victims presented with various physical injuries, including bruises, fractures, and lacerations, most of which were consistent with intentional acts of violence. The findings underscore the vulnerability of elderly individuals, particularly during periods of societal hardship, and the critical role that forensic medicine plays in documenting and addressing these cases. The study also reveals that intra-family violence remains a hidden yet pressing issue in this context, necessitating both medical and social interventions.
These results emphasize the urgent need for increased awareness and preventive measures to protect the elderly from abuse. It is essential to strengthen social support systems and promote public education to address the root causes of intra-family violence. Furthermore, collaboration between healthcare providers, social workers, and legal authorities is crucial to ensure a comprehensive approach to safeguarding this vulnerable population.
This study sheds light on the often-overlooked issue of elder abuse in Algeria, urging stakeholders to take actionable steps toward reducing its prevalence and impact

Challenges in Linking Chlamydia trachomatis Infection to Alleged Sexual Assault: A Case Study 11:00 - 11:00

J. Neto[1], *M. Lopes*[1], *I. Abundância*[1], *M.J. Soares*[1], *P. Marcelino*[1], *M. Cura*[1], *I. Dias*[1]

[1]Instituto de Medicina Legal Ciencias Forenses IP, CLínica Forense, Lisboa, Portugal

Abstract Body:

Background: The detection of sexually transmitted infections (STIs) in cases of alleged sexual assault presents unique challenges. *Chlamydia*

trachomatis (*C. trachomatis*), a common STI, is particularly problematic as serological results alone cannot confirm the timing or route of transmission, complicating forensic conclusions.

Case Report: A 13-year-old female reported an alleged sexual assault involving anal penetration with condom use in early 2023. Six months later, serological tests revealed positive IgG antibodies for *C. trachomatis* (56.6 RU/ml) and negative IgM (0.7 Index), indicating prior exposure. A forensic examination conducted two months after the serology found no evidence of recent anogenital trauma. Birth records were unavailable, precluding investigation into possible vertical transmission during delivery. Expert consultation recommended testing for *Chlamydia pneumoniae* and *C. psittaci* to evaluate potential cross-reactivity as an alternative explanation.

Discussion: The presence of IgG antibodies suggests past exposure to *C. trachomatis*, but it does not establish when or how transmission occurred. Vertical transmission at birth, unreported sexual contact, or nonsexual transmission remain possible. Cross-reactivity with *C. pneumoniae* or *C. psittaci*, which cause respiratory infections, could also explain the serological findings. The lack of clinical records and reliance on serology underscores the diagnostic limitations in such cases.

Conclusion: This case illustrates the complexity of linking STIs to alleged sexual assaults. Comprehensive diagnostics, including detailed histories and targeted testing, are crucial for accurate evaluations. Interdisciplinary collaboration is essential to balance medical findings with forensic evidence, ensuring robust and just conclusions

08: Forensic Medicine and Toxicology: Forensic Medicine
11:00 - 11:45 Auditorium

Poster Session Tuesday - Forensic Medicine and Toxicology: Forensic Medicine

Use of Luminol and Ultraviolet Fluorescence Methods for Estimation of Time of Death from Bone Tissue 11:00 - 11:00

I. Sam[1], *O. Unluturk*[2], *N. Arican*[3]

[1]The Council of Forensic Medicine, Amasya Branch Office, Forensic Medicine, Amasya, Turkey, [2]The Council of Forensic Medicine, Morgue Specialization Department, Bone and Dental Examination Branch, Istanbul, Turkey, [3]Istanbul University, Forensic Medicine, Istanbul, Turkey

Abstract Body: **Objective:** Morphological assessments to determine time of death from bones are not always accurate due to many factors such as the presence of trauma, burial method or environmental factor, as well as long postmortem intervals. This has created a need for new methods that are analytical, repeatable, cost-effective and easy to implement.

Method: Bone sections obtained from the cases with known time-of-death sent to the Council of Forensic Medicine, were examined with 365-nm ultraviolet light. Areal extent of the blue fluorescent surface was analyzed using Adobe Photoshop software. Afterwards, bone powders were formed from the bones and chemiluminescence was measured with luminol solution using a luminometer.

Results: There was no statistically significant correlation between chemiluminescence values measured by luminometer and any PMI range. In the evaluation of UV fluorescence, cases with PMI between 0-10 years were found to be statistically significant compared to other PMI groups. In the comparison of cases with PMI <30 years and >30 years, a significant correlation with UV fluorescence was found within the <30 years group. There was a negative correlation between areal extent of blue fluorescent surface and time of death

Conclusion: It has been observed that chemiluminescence can be produced from bones using luminol, but the results lack reliability because of the significant impact of environmental factors. On the other hand, the UV fluorescence method can be useful in estimating time of death in cases with PMI <30 years; however using this method alone is still not sufficient.

Evaluation of Hanging Deaths in Childhood: An Autopsy Study 11:00 - 11:00

C. Kücük[1], H.i. Aydogdu[2], H. Efil[3], M.N. Arslan[3]

[1]The Ministry Of Justice Council Of Forensic Medicine, Denizli, Turkey, [2] Giresun Universty Faculty of Medicine, Forensic Medicine, Giresun, Turkey, [3]The Ministry Of Justice Council Of Forensic Medicine, İstanbul, Turkey

Abstract Body: **Introduction:** Hanging is an event that occurs through the force of the body's own weight, with a rope or other ligature fixed to the neck, above the head. Hanging is an infrequent mechanism of injury, with an overall incidence of less than 1% of trauma cases. Of these, children account for approximately 10%.
The aim of this study is to examine autopsy findings in children who have died from hanging, a rare cause of death in childhood.
Materials and Methods: Reports of pediatric cases sent to our center for autopsy between 01/01/2012 and 31/12/2021, to determine the exact cause of death, were retrospectively evaluated in an electronic format.
Results: A total of 162 pediatric cases were included in the study. Of these, 113(69.8%) were male. The majority of deaths occurred at home (57.4%). Upon examining the sternocleidomastoid muscle, no findings were observed in the muscle body of 131(80.9%) cases. In the hyoid bone, fractures were detected in the right horn in 28 cases, the left horn in 22 cases, and bilaterally in 14 cases. Regarding the thyroid cartilage, fractures were found on the right side in 6 cases, on the left side in 10 cases, and bilaterally in 10 cases.
Conclusion: The majority of hanging deaths are suicides, though they can occasionally be accidental or homicidal. The location and frequency of traumatic lesions in pediatric hanging cases are noteworthy. This study is one of the largest autopsy studies focused solely on hanging in the pediatric age group.

Photon Counting CT in Forensic Radiology: First Experience 11:00 - 11:00

G. Crombag[1,2], N. Peters[1], J. Nobel[1,2], J. Wildberger[1], A.A. Postma[1,3]

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Abstract Body: *Objectives*
To explore to potential role of photon counting computed tomography (CT) in the field of forensic and post-mortem imaging. This newly introduced scanning technique not only benefits from improved spatial resolution with less noise, but also enables material differentiation based on spectral information (for example potential bone marrow edema).
Methods
Several forensic cases have been imaged on a first generation photon counting CT (Naeotom Alpha, Siemens Healthineers). Non-contrast enhanced images were acquired and reconstructed with various soft and hard kernels for different radiological assessment.
Results
A pictorial overview of several cases demonstrating the different advantages of implementing photon counting CT in forensic and post-mortem imaging and their radiological interpretation.
Conclusion
This study demonstrates case examples of the additional benefit of photon counting CT in forensic and post-mortem imaging.

Evaluation of Point-of-Care Testing for Blood-Borne Infections in Forensic Autopsy Cases 11:00 - 11:00

G.E. Kim[1], D.Y. Lee[1], E.-B. Jung[1], M.-Y. Kim[1]

[1]Sungkyunkwan University School of Medicine, Department of Anatomy and Cell Biology, Laboratory of Forensic Medicine, Suwon-si, Korea, Republic of

Abstract Body: Unlike clinical patients, most autopsy cases proceed without knowing the medical history of the deceased, increasing the risk of blood-borne infections to autopsy personnel and delaying response times to exposure incidents. To address these issues, we assessed the utility of point-of-care testing (POCT) kits for detecting these infections in postmortem specimens by comparing their results with qPCR results for each infectious agent. Four POCT kits targeting HIV, HBV, and HCV infections were applied to 217 autopsies at the Seoul National University Medical Examiner's Office from 2019 to 2024. Among them, 26 (12.0%) were positive for at least one kit: two (0.9%) for anti-HIV, four (1.8%) for HBsAg, six (2.8%) for anti-HBs, and five (2.3%) for anti-HCV. In qPCR, HIV was detected in two cases (0.9%), HBV in four (1.8%), and HCV in three (1.4%). The corresponding concordances between POCT and qPCR were high for all infections (HIV 98.2%, HBV 99.1%, HCV 99.1%; $p < 0.05$, respectively). Compared with qPCR results, all POCT kits showed high specificity (>99%), but sensitivity varied (HIV 50.0%, HBsAg 75.0%, HCV 100%). POCT results were available within 20 minutes, suggesting their potential as a rapid screening tool for infection risk in forensic settings. This study confirms the performance of POCT in autopsy specimens and supports its implementation as an infection screening tool prior to autopsy to protect personnel. However, due to the low prevalence of each infection, further studies with larger sample sizes are needed.

Suspicious Death in a Minor: A Forensic Analysis and Associated Circumstances 11:00 - 11:00

V. Petre-Ciudin[1], C. Scripcaru[1]

[1]Institute of Forensic Medicine, Forensic Medicine, Iasi, Romania

Abstract Body: **Introduction:** We present a case of a minor who died under suspicious circumstances. The aim of this study was to investigate the cause of death and to assess any evidence of violence, considering the fact that the prosecutor and the criminalist suspected the father for murder, and the external examination of the cephalic extremity could confirm this.

Methods: A complete forensic examination was performed, including external and internal examination of the body, as well as complementary examinations (toxicological, histopathological). Clinical data, witness statements, and the crime scene report were also analyzed.
Results: The forensic examination revealed multiple external injuries to the face, consistent with acts of violence, and signs of asphyxia but not regarding the reasons as the prosecutor and the criminalist were thinking, but due to aspiration of gastric contents. Toxicological analyses excluded the presence of toxic substances in the body. The histopathological examination confirmed the presence of interstitial pneumonia and showed lesions compatible with asphyxia.
Conclusions: The cause of death was determined to be acute respiratory failure, a consequence of mechanical asphyxia due to aspiration of gastric contents, on a background of interstitial pneumonia. The external injuries, although significant, did not directly cause death. The case highlights the importance of a thorough forensic evaluation in such situations to differentiate between traumatic and pathological events, especially that the father was convicted until the report was finished.

Head Gunshot Wound with Pressed Barrel: Specific Aspects of Identifying Additional Firing Factors - A Correlative Medico-Legal and Criminalistic Analysis 11:00 - 11:00

B. Mălinescu[1,2], V. Iftenie[3,4], L. Matei[5], C. Trandafir[5], V. Dobârceanu[6]

[1]Romanian American University, Faculty of Law, Bucharest, Romania, [2]Ilfov Medico-Legal Service, Head of Ilfov Medico-Legal Service, Bucharest, Romania, [3]"Dimitrie Cantemir" Christian University, Faculty of Law, Bucharest, Romania, [4]"Mina Minovici" National Institute of Legal Medicine, Forensic Pathology, Bucharest, Romania, [5]"Mina Minovici" National Institute of Legal Medicine, Serology and Biocriminalistics, Bucharest, Romania, [6]The General Inspectorate of Romanian Police - National Forensic Institute, Physical-Chemical Expertise Service, Bucharest, Romania

Abstract Body: The authors address a series of specific, atypical aspects regarding head gunshot wounds with the barrel pressed against the head, focusing on the correlation between the morphology of head gunshot wounds found during autopsy and the forensic identification of additional firing factors.
Theoretical aspects of forensic pathology concerning head gunshot wounds are presented, as well as forensic theory on laboratory methods used to

identify additional firing factors and gunshot residues on human tissue fragments collected at autopsy.
To illustrate the atypical findings that may arise in practice with head gunshot wounds from a pressed barrel, the authors present a series of five cases (four suicides and one homicide) from the archives of the National Institute of Legal Medicine “Mina Minovici” in Bucharest and the Ilfov Medico-Legal Service, in Romania. In these cases, it was macroscopically evident during autopsy that there were clear, undeniable criteria allowing for the definite determination of the bullet's entry and exit wounds. However, laboratory bioforensic methods used to identify additional firing factors produced results that were exactly reversed: additional firing factors and gunshot residues were found at the exit wound, not at the entry wound.
This phenomenon is scientifically explainable, as in head gunshots with a pressed barrel, the additional firing factors enter the wound channel created by the bullet and, as the bullet exits after a relatively short trajectory, they "wipe off" on the edges of the exit wound. This is where they are found through specific laboratory identification methods.

Effects of Antemortem Drug Administration on Histopathological and Macroscopic Findings of Liver at Postmortem 96th Hour 11:00 - 11:00

A. AKREP[1], G. ERSOY[1], F. YILDIRIM[2], Ş. KILIÇ[3], N.G. İYİGÜN[4]

[1]Istanbul University –Cerrahpasa, Institute of Forensic Sciences and Legal Medicine, Department of Medical Sciences, Istanbul, Turkey, [2]Istanbul University-Cerrahpasa, Faculty of Veterinary Medicine, Department of Pathology, Istanbul, Turkey, [3]Istanbul University-Cerrahpasa, Institute of Nanotechnology and Biotechnology, Department of Biotechnology, Istanbul, Turkey, [4]Istanbul University-Cerrahpasa, Faculty of Veterinary Medicine, Istanbul, Turkey

Abstract Body: **Background and Aim:** Understanding factors affecting postmortem tissue decomposition is critical for improving time of death estimation in forensic medicine. Antemortem drug treatments may potentially alter decomposition rates and patterns, yet their effects remain underexplored. This study aims to evaluate the impact of antibiotic (amoxicillin-clavulanic acid) and cytotoxic drug (methotrexate) administration on decomposition at late postmortem period.
Methods: Twelve Wistar Albino rats (420±10 g) were divided into three groups: antibiotic (amoxicillin-clavulanic acid,145 mg/kg), cytotoxic (methotrexate, 20 mg/kg), and control. The cytotoxic drug was administered intraperitoneally, while the antibiotic was given subcutaneously, both for three consecutive days before sacrifice.Postmortem storage was conducted under controlled indoor conditions (constant humidity, light, and temperature) and outdoor environmental exposure in ventilated cages. Morphological assessments included weight changes, abdominal circumference, rigor mortis, discoloration, and bloating. Histopathological analysis of hematoxylin-eosin stained sections of liver tissue focused on cytoplasmic integrity, nuclear integrity, and nuclear vacuolation.
Results: Kruskal-Wallis analysis revealed significant differences in nuclear count ($p = 0.024$) and cytoplasmic integrity ($p = 0.047$) across drug groups. Pairwise comparisons demonstrated significantly better preservation in the antibiotic group compared to the control ($p = 0.044$).

Percentage of vacuolated nucleus values showed no significant differences ($p = 0.252$). Outdoor storage conditions accelerated decomposition in all groups.
Conclusions: Antemortem antibiotic treatment effectively preserves nuclear and cytoplasmic integrity suggesting slower rate of postmortem decomposition.This study provides critical insights for forensic medicine, highlighting the potential of drug treatments to influence postmortem interval estimation and offering a foundation for future methodological advancements.

Fatal Choking in a Child with Juvenile Myasthenia Gravis Triggered by Probable COVID-19 Infection 11:00 - 11:00

M.E. Smith[1], *G. Gowitt*[1]

[1]DeKalb County Medical Examiner's Office, Forensic Medicine Associates, Inc, Decatur, Georgia, United States

Abstract Body: Juvenile myasthenia gravis (JMG) is an autoimmune disorder characterized by weakness and rapid fatigue of voluntary muscles, often presenting with ocular symptoms. However, involvement of bulbar muscles, those responsible for swallowing, speaking, and chewing, can lead to dysphagia and increased choking risk especially during myasthenic flares. While the risk for aspiration is documented, fatal choking cases in JMG patients have not been reported.

We report the case of a 2-year-old girl with JMG who was found unresponsive after consuming gelatin. Emergency services found her not breathing and without a pulse, with gelatinous red material obstructing her airway. They removed the obstruction, but she passed away at the hospital despite continued life-saving efforts. Autopsy revealed gelatinous material in the stomach consistent with her last meal and a positive SARS-CoV-2 (COVID-19) test. Histology showed pulmonary congestion. The rest of the autopsy was unremarkable.

Infections are known triggers for myasthenic flares due to immune system activation. COVID-19 has been reported to precipitate flares in both adults and children. In this patient, COVID-19 likely triggered a myasthenic flare, leading to rapid bulbar muscle fatigue and choking. To our knowledge, this is the first reported fatality due to choking in a patient with JMG.

This case highlights the importance for forensic pathologists to consider underlying neuromuscular disorders in pediatric choking deaths. Vigilant monitoring of swallowing difficulties in children with JMG is critical, especially during common viral infections. Increased awareness among caregivers and healthcare professionals is essential to prevent potentially devastating outcomes in this vulnerable population.

Evaluation of Facial Soft Tissue Thickness by Magnetic Resonance Imaging of Individuals Under the Age of 18 in Turkish Society 11:00 - 11:00

Z. Arslan[1], *G. Canturk*[2]

[1]Institute of Forensic Medicine, Ministry of Justice, Mardin, Mardin, Turkey, [2]Ankara University, Forensic Medicine Department, Ankara, Turkey

Abstract Body: Facial soft tissue thickness (FSTT) is a vital dataset for various forensic and anthropological fields, particularly in reconstructing human faces for medico-legal purposes, education, and scientific research. While there are multiple population-specific FSTT studies for adult and pediatric groups, no database has been established for Turkish children. This absence presents challenges in forensic contexts in Turkey, where anatomical facial approximations for children are necessary. The lack of research inhibits comparative studies, especially when comparative data like DNA or dental records are not available. This study aims to address the gap by developing a comprehensive FSTT database for Turkish children using radiological imaging techniques. Retrospective magnetic resonance imaging (MRI) scans of the head and neck from Ankara University's Pediatric Radiology Department, collected from 2010 to 2022, included 300 healthy Turkish children aged 3-18. The children were classified by sex, body mass index (BMI), and age groups (3-8, 9-14, and 15-18 years). Eleven cranial landmarks on the mid-facial axis were selected to ensure reliability. Descriptive statistics were calculated using mean, standard deviation, and percentile distributions, employing independent samples t-test, one-way ANOVA, and linear regression analysis with a significance level of $p < 0.05$ via SPSS (version 26.0). To reduce inter-observer variability, intra-observer reliability was established with intraclass correlation coefficients (ICCs). This research represents a significant initial step for forensic applications and lays the groundwork for more extensive studies on the FSTT of Turkish children.

Identification of Undeclared Pharmacologically Active Substances in Illegally Traded and Falsified Medicinal Products 11:00 - 11:00

A. Blazewicz[1], *M. Poplawska*[1], *B. Daniszewska*[1], *K. Piorunska*[1], *E. Bednarek*[1], *J. Sitkowski*[1], *A. Mocarska*[1], *P. Chmielewska*[1], *P. Olzak*[1], *P. Rudnicki-Velasquez*[1], *A. Sienko*[1], *S. Przygocka*[1], *M. Karynski*[1]

[1]National Medicines Institute, Falsified Medicines and Medical Devices Department, Warsaw, Poland

Abstract Body: The availability of illegally sold medicines has become a challenge in recent decades. For many years, falsified medicines have been traded worldwide; however, recently, this has become increasingly easier owing to the increased availability of medicines and open channels of trade, including online sales. In addition to drug trafficking, pharmaceutical crime is of interest to organized criminal groups, and many factors contribute to the falsification of medicines. It is generally stated that around 1% of the medicines in Europe are falsified, and over 50% of medical products sold through websites other than established online pharmacies can be classified as falsified medical products. The World Health Organization distinguishes between three categories of poor-quality medical products: substandard, unregistered/unlicensed, and falsified. The most often falsified medicines are drugs related to life-style, such as: drugs used in erectile dysfunction, slimming agents, anabolic-androgenic steroids and psychoactive substances. The necessity of identifying unknown and undeclared substances in suspected products requires the constant development of techniques used for analytical research in forensic or control laboratories to perform analyses for public authority needs. The Polish Official Medicines Control Laboratory, upon request by police,

customs, or other enforcement groups, regularly tests seized products submitted to the laboratory using accredited methods such as LC-QTOF-MS/MS, FTIR-ATR, NMR and XRPD. The illicit medicines are of poor quality; they may be substituted, adulterated, or contain no active ingredients. Our results indicate that the high prevalence of illegal and falsified medicines is dangerous and can be considered a potential threat to consumer health.

Infant Head Injury by Shaking Trauma: Comparing the Kinematics of Shaking a 1-Year-Old vs. 6-Week-Old Surrogate 11:00 - 11:00

K. Hutchinson[1], *A.J. Loeve*[1,2]

[1]Delft University of Technology, BioMechanical Engineering, Delft, Netherlands, [2]Co van Ledden Hulsebosch - Center for Forensic Science and Medicine, Amsterdam, Netherlands

Abstract Body: Due to violent shaking, annually 14-41 per 100.000 infants get mildly to lethally injured or severely disabled. The incidence is highest in the first few months and diminishes with age. Especially mortality is highest in months 1 to 4. However, some of the injuries are also seen in non-abusive cases. Discerning accidents from violence is crucial: misjudgment may leave vulnerable infants with abusive caretakers or falsely convict innocent loving ones.
Various animal, computational and physical models have been used to study the mechanisms of inflicted head injury by shaking trauma (IHI-ST). However, to the best of our knowledge, these all focused on very young and hence lightweight and small infants.
The goal of the current study was to quantify and compare the kinematics of violently shaking smaller versus larger infants. This was investigated by having two instrumented test-dummies representing a 6-week-old and 1-year old child shaken by 33 and 40 participants, respectively, while recording the kinematics of the dummies' heads and torsos. Participants were instructed to shake the dummies as hard as possible (primary goal), and to keep that up for as long as possible (secondary goal).
Participants could shake the 6-week-old surrogate more fiercely, with particularly peak rotational accelerations of the head being much higher than in the 1-year-old surrogate. Since it has been hypothesized that rotational motion of the head may result in some of the main injury mechanisms in shaking, these results suggest that shaking a smaller child more easily produces loads that cause IHI-ST.

Ten years of the Dutch Expertise Centre for Child Abuse: update of descriptive data from 2019 to 2024 11:00 - 11:00

N. Onkenhout[1], *R. van Rijn*[2], *E. van de Putte*[3]

[1]Dutch Expertise Centre for Child Abuse / University of Utrecht, Utrecht, Netherlands, [2]Academic Medical Center Amsterdam, Department of Radiology and Nuclear Medicine, Amsterdam, Netherlands, [3]University Medical Center Utrecht, General Pediatrics, Utrecht, Netherlands

Abstract Body: The Dutch Expertise Centre for Child Abuse (DECCA) was founded in 2014 and offers a combination of paediatric and forensic expertise to advise doctors in cases of suspected child abuse. The DECCA

has played an important part in the Dutch child protection system and has been included in the Dutch guideline for domestic violence and child abuse of the Royal Dutch Medical Association. In 2019, a study about the first 4 years of DECCA was published by van Rijn et al. This update aims to present data and activities of DECCA from 2019 to 2024. We present cross-sectional data prospectively collected. The study will include analyses of demographics, regional distribution, types of injuries, and outcomes of cases. Between January 1st 2019 and October 31st 2024, DECCA received a total of 1700 requests for advice about cases of potential child abuse. The number of requests for advice has continued to increase over the years. This emphasizes the continued need for multidisciplinary approaches in child protection. In 55% of DECCA cases, the medical findings provided evidential strength toward non-accidental causes over other causes, whereas in 31% they pointed toward another cause such as accidental trauma or illness. The evidential strength of the medical findings and recommendations for further diagnostics are provided in a DECCA report. This can help doctors in their decision-making process to report their suspicion of child abuse, take safeguarding measures, investigate further, or discard their suspicion.

Fatal Hemoperitoneum as a Rare Complication of Methamphetamine Use: A Case Report 11:00 - 11:00

A. Kwok[1], M. Smith[2,3], G. Gowitt[2,3], M.E. Smith[2,3]

[1]Wayne State University, Pharmacy and health sciences, Detroit, United States, [2]DeKalb County Medical Examiner's Office, Decatur, United States, [3]Forensic Medicine Associates, Inc, Decatur, United States

Abstract Body: Methamphetamine abuse is widespread in the United States, and understanding its pathophysiology is crucial in forensic medicine, as it is a stimulant drug known to raise blood pressure, cause vasoconstriction, and potentially result in fatal outcomes. Reported complications include agitation, cardiac arrhythmias, intracerebral hemorrhage, and bowel ischemia, among others. We report the case of a 37-year-old male who died from methamphetamine intoxication and complications of chronic intravenous drug use. He presented to the emergency department with abdominal pain, nausea, and vomiting but left against medical advice without receiving treatment. Later that evening, he requested emergency medical services but went into cardiac arrest while en route to the hospital, passing away despite resuscitative efforts. Autopsy revealed significant findings, including massive hemoperitoneum, mesenteric hemorrhage, small bowel ischemia, and subacute infective endocarditis affecting the mitral and aortic valves. Postmortem toxicology showed elevated methamphetamine and amphetamine levels. In this case, methamphetamine-induced vasoconstriction likely caused bowel ischemia, progressing to necrosis of mesenteric vessels and resulting in massive hemoperitoneum. Additionally, his chronic intravenous drug use likely predisposed him to infective endocarditis, leading to destruction of the mitral valve, impairing his heart function and contributing to his death. This case highlights a rare and previously unreported fatal complication of methamphetamine use, namely, small bowel ischemia leading to massive hemoperitoneum. It expands the documented autopsy findings associated with the systemic effects of methamphetamine and provides valuable insights for healthcare professionals and forensic pathologists.

Establishing a Skeletal Atlas of Elder Abuse: Comparative Lessons in 'Science Supporting Justice' From a Longitudinal Study in the United States 11:00 - 11:00

K. Bolhofner[1], J. Harris[1], K. Gary[2], L. Fulginiti[3], J. Buikstra[4]

[1]Arizona State University, School of Interdisciplinary Forensics, Glendale, United States, [2]Arizona State University, School of Computing and Augmented Intelligence, Mesa, United States, [3]Maricopa County Office of the Medical Examiner, Phoenix, United States, [4]Arizona State University, School of Human Evolution and Social Change, Tempe, United States

Abstract Body: In the United States, it is estimated that 10% of adults aged 65+ will experience some form of abuse annually[1]. In the United Kingdom, a recent study found that 22% of residents 65+ surveyed had experience of abuse or knew a person who had been abused[2]. Physical abuse represents a severe manifestation of this trend, yet is difficult to prove[3]. Skeletal expressions of abuse offer key indications of inflicted and untreated injuries, but are masked by assignation to accidental falls. Funded by the National Institute of Justice, our research aims to produce a standard for the diagnosis of elder abuse in the skeletal system[4]. We have identified a significant difference in skeletal patterns of injury between those individuals involved in accidental falls and those for whom abuse/neglect is suspected[5], as well as differences in fracture patterning in non-ambulating individuals in both categories[6]. We also examined differences in osteoporosis between these categories and found a disproportionately high frequency of osteoporosis among individuals sustaining fractures in accidental falls[7]. Finally, we have examined age and sex as potential predictor variables[8]. Results from this ongoing study represent an extensive effort to develop and improve diagnostic criteria for the establishment of a 3D skeletal atlas of elder abuse and a digital tool for diagnostic aid[9]. Here, we present the results of our analyses specifically in reference to and in support of the work being carried out in the UK and Europe on the topic of physical elder abuse[10] to augment international scientific support of justice.

Looking Back on a Murder Might Turn It Into an Accident. 11:00 - 11:00

I. Dias[1], I. Abundância[1], C. dos Santos[1,2], J. Guerreiro[3], G. Castanheira[1], S. Andrade[1]

[1]South Branch of National Institute of Legal Medicine and Forensic Sciences., Lisbon, Portugal, [2]Lisbon School of Medicine, Lisbon, Portugal, [3] Portuguese Criminal Investigation Police (PCIP), Lisbon, Portugal

Abstract Body: In Forensic Pathology, hyoid bone fractures are usually a red flag for compressive forces applied to the neck. This fracture is common in mechanical asphyxia, such as ligature strangulation and manual strangulation, but it can also be detected in charred bodies, and victims of car or bicycle accidents.
The case concerns a woman found in cardiorespiratory arrest in her kitchen floor, declared dead at the scene. At the Legal Medicine Department, an external examination was performed, with the forensic pathologist noticing bruising around the neck. The Police were informed and began an

investigation, and a forensic autopsy was performed. The victim lived in an apartment on the 3rd floor, the door was locked and there were no missing items.
The cause of death was asphyxia by external compression of the neck (with unilateral fracture of the hyoid bone), with homicide being the manner of death. A 2-year investigation was unable to provide a suspect.
During the internship of a forensic pathologist resident at PCIP, the case was revisited and, for the first time, all the information was analysed. The cold case was presented once again to the forensic pathologist, who changed the manner of death in face of new circumstantial evidence.
The authors´ aim is to highlight the importance of coordination between police investigation and the forensic pathologists' findings, and the need to have the upmost complete information of scene, first responders' testimonies, and investigation performed by the police for a better practice of each of the intervenients.

Amnesia in Sexual Assault: A One-Year Study 11:00 - 11:00

I. Dias[1], I. Abundância[1], Z. Argyropoulou[1], C. dos Santos[1,2], S. Andrade[1]

[1]South Branch of National Institute of Legal Medicine and Forensic Sciences., Lisbon, Portugal, [2]Lisbon School of Medicine, Lisbon, Portugal

Abstract Body: Drugs like benzodiazepines, Z-drugs, antihistamines, gammahydroxybutyric acid, amongst others are frequently used in Drug Facilitated Sexual Assault (DFSA). Often, these drugs are hidden in drinks, and they can cause retrograde or antegrade amnesia, with consequent delay on the report of the crime. These drugs have a short half-live, and by the time the police are informed of the crime, the drug or its metabolites can no longer be traced within the body.
The choice of the biological matrix (blood, urine or hair) to be sampled and processed takes into account the presumed time since its consumption.
The authors´ aim is to determine the number of sexual assault exams, in the South Branch of the National Institute of Legal Medicine and Forensic Sciences, where the victim claimed to have amnesia for the event, and characterize these victims in terms of sex, age, biological sample used for toxicological investigation, and the presence of drugs and/or ethanol (willingly consumed or not).
Establishing these parameters may allow us to understand which population is affected by DFSA, increase awareness about these crime, and reflect upon the timing and use of biological matrices for toxicological exams, as well as implementing new approaches and matrices, that may be more sensitive to determine a single consumption of these substances during a sexual assault.

Hymen Ruptures After Sexual Abuse 11:00 - 11:00

I. Troice-Neilande[1,2]

[1]State Center for Forensic Medical Examination of the Republic of Latvia, Jelgava, Latvia, [2]State Center for Forensic Medical Examination of the Republic of Latvia, JelgavaLa, Latvia

Abstract Body: **Background.** For long time people believe that "virginity"

is associated with the hymen integrity and - girls without ruptured hymen can't be sexually active. But there is evidence that hymen doesn't tear at any sexual intercourse for females in different age, not only adult women.
Aim. The aim of the current study was to investigates the incidence of hymen rupture after alleged sexual abuse in year 2023.
Methods. Studied population is women who reported rape to police form different part in Latvia, which were further examined in State Centre for Forensic Medical Examination in 2023. D
Results. A total cases of 93 were included in this research and the ages of females ranges from 13 to 68 years. In three cases - no data about the condition of the hymen were reported, but in one of these cases a sample was taken for the determination of spermatozoa. In three cases fresh ruptures of hymen were found, without presence of spermatozoa. In 33 cases -old ruptures of hymen were reported, and in 40 cases the integrity of the hymen was reported. Of these 33 cases with old tears of hymen were reported, 13 cases events were from few months to years behind. In five cases of those, 40 the presence of spermatozoa were reported.
Conclusion. Almost in half of women included in this research the integrity of hymen was reported.

Validation of Forensic Cleaning Processes Within Sexual Assault Referral Centres (SARCs) 11:00 - 11:00

G. Hanford[1], *M. Gaskell*[1]

[1]Forensic Capability Network, Quality and Performance Directorate, Dorchester, United Kingdom

Abstract Body: The Forensic Science Regulator (FSR) requires all SARCs to be FSR Code compliant by 2nd October 2025. Part of meeting compliance is to ensure the efficacy of DNA decontamination within a forensic clean environment. The cleaning processes are long established but have never been assessed for their ability to remove known amounts of DNA within the SARC facilities.

6 cleaning reagents commonly used within UK SARCs and Forensic Service Providers were assessed in this validation study: Chemgene HLD_4H, Virkon, Microsol, Selgiene, Virusolve and Presept. These were evaluated for their DNA decontamination capability of dried on body fluid stains deposited on typical surfaces found in a forensic examination room. The level of any residual DNA was assessed against an environmental monitoring indicator for DNA cleanliness. The mechanism of cleaning action was also explored to ensure not only assurance of current processes and products, but potential improvements to existing techniques could be realised.

This study showed a spectrum of decontamination resilience depending on the combination of body fluid and surface material, with dried semen on vinyl proving the most challenging. Bleach-based reagent Presept gave was the best performer in all areas, with non-bleach products Virkon and Selgiene also performing well. Generally, adding a cleaning cycle using the manufacturers' recommended concentrations with a 30 second contact time between, allowed all 6 products to perform to an acceptable standard.

SARCs are now able to base their forensic cleaning on this national study, saving resource and money by needing to conduct local verification only.

Lightening deaths – Autopsy challenges and Diagnosis 11:00 - 11:00

J. Yadav[1], *R. Chandela*[1], *A. Keche*[1], *S. Moirangthem*[1]

[1]ALL INDIA INSTITUTE OF MEDICAL SCIENCES BHOPAL, Department of Forensic Medicine & Toxicology, Bhopal, India

Abstract Body: Lightening deaths are common natural catastrophe commonly seen in tropical countries of southwest Asia and Africa. In 20-21, 35.8 % of 8060 deaths from natural forces were caused by lightening in India (NCRB data)
Even though diagnosing cause of death as lightening is essential for compensation claims but at the same time poses a diagnostic challenge to autopsy pathologist especially when pathognomonic features of lightening like filigree burns, slitting of clothes etc. are not present. In such cases assigning cause of death due to lightening is often the diagnosis of exclusion. This becomes even more challenging if eye witness and adequate history is not present
3 cases of lightening with different presentations including a delayed death during autopsy are discussed where different approaches were adopted in assigning the cause of death as lightening. The composite approach in dealing with lightening cases is being discussed

Comparative Analysis of Postmortem Computed Tomography and Conventional Autopsy in Road Traffic Accident Cases 11:00 - 11:00

D.A.P.S. chauhan[1]

[1]AIIMS, New Delhi, Department of forensic medicine and toxicology, NEW DELHI, India

Abstract Body: **Background:-** Post-mortem imaging or virtual autopsy is a advancing field of post-mortem investigations of trauma victims. In this study we are depicting the feasibility of complementation or replacement of conventional autopsy by post-mortem imaging in road traffic accident cases.

Method:

Radiological Examination**:**
Computed Tomographic of whole body will be performed before starting the traditional autopsy dissection by using 16 slice multidetector row CT scanner (Canon Medical Systems Aquilion Lightining TSX-035A). Image acquisition will be performed on a volumetric spiral scanning with detector collimation of 0.5 mm. post-processing of the images obtained wiil be performed using standardized formats.

Traditional Post-mortem examination**;**
Traditional autopsy procedure i.e., Gross external examination of the dead body followed by internal examination of various structures and organs after dissection will be noted.

Conclusion: PMCT proved to be a sensitive tool for detecting underlying internal injuries like fractures and ruling out the exact cause of death. In

this case, PMCT was able to pick minute internal fractures in addition to conventional autopsy findings, giving more evidentiary value for documentation of injuries pattern and also helping in targeted area dissection of the body without much mutilation for dignified management of the dead. Also in treated cases of RTA conventional autopsy can be avoided as PMCT is sufficient to find out the injury pattern and to give the Cause of death.

Conflict of interest: None

Validation of Consumables Used in the Recovery of DNA Evidence Within Sexual Assault Referral Centres (SARCs) 11:00 - 11:00

M. Gaskell[1,2]

[1]Forensic Capability Network - Dorset Police, Quality and Performance Directorate, Dorchester, United Kingdom, [2]University of Central Lancashire, Forensic & Policing, Lancashire, United Kingdom

Abstract Body: Any contamination in the DNA evidential chain could compromise the integrity of the samples and diminish the value and reliability of the forensic evidence. Anticontamination measures are in place to mitigate any risk and prior to this study, there was no evidential basis to demonstrate that the measures employed within the manufacture, treatment, transport and storage of forensic grade DNA consumables were fit for purpose.

treatment of solid consumables with Ethylene Oxide (EtO).

This validation study involved all 54 SARCs within England and Wales and aimed to provide assurance with supporting data that the national provision of DNA consumables is fit for purpose and remain so until point of use. This would also provide evidence questioning the need to complete routine DNA batch testing of EtO treated consumables upon receipt.

276 consumable items of 19 different types from 114 different lots/batches were assessed, manufactured and supplied up to 2 years prior to submission to the study. Using an accredited DNA 17 NGM analytical process, results from these items were compared against acceptance criteria which at the time was stipulated in FSR-C-108 *DNA Analysis*.

100% of the forensic DNA grade consumables passed the acceptance criteria indicating that using current

supplier processes, transport and SARC anticontamination measures, the consumables remain fit for purpose

until point of use and provides justification to negate batch acceptance testing of these types of consumables.

A Retrospective Analysis of Fatal Ground-Level Falls and Falls From a Height 11:00 - 11:00

L. Chonyera[1], *C. Mole*[1]

[1]University of Cape Town, Forensic Medicine and Toxicology, Cape Town, South Africa

Abstract Body: Falls have been identified as the world's second leading cause of accidental deaths, making them a public health concern. Depending on the manner and height at which a fall occurs, distinct injury patterns emerge, which may be relevant in determining the circumstances resulting in death. This study sought to identify and compare the demographic characteristics, prevalence, and injury patterns associated with ground level falls and falls from a height. A five-year (1 January 2014 - 31 December 2018) retrospective review of fatal fall cases investigated at Salt River mortuary in Cape Town was conducted. The fall height, impacting surface and victim demographics were assessed to determine the patterns and prevalence of injuries. There were 360 fall fatalities during this period, corresponding to a fall prevalence of 3.72/ 100 000 population. Ground level falls were prevalent among the elderly while younger individuals were more likely to be involved in falls from a height (>1m). Sex was also significantly associated with fall height. Accidental falls were more common (87%), and no association was found between the alleged manner of death

and sex. Skeletally, an association was observed between injuries sustained and fall heights. A higher frequency of femur fractures was observed in ground level falls while the head, chest and pelvis were affected in high-level falls. The results of this study contribute to the growing body of knowledge on fall related injuries and help the medico-legal community identify and explain injuries caused by falls.

Sexual Abuse With Digital Penetration – What Can Be Found? 11:00 - 11:00

M. Soares[1], I. Abundância[1], I. Dias[1], V. Rodrigues[1], P. Marcelino[1], J. Neto[1], S. Andrade[1], M. Heitor[1], J. Albuquerque[1], C. Gomes[1]

[1]Instituto Nacional de Medicina Legal, Forensic Clinic and Pathology, Lisboa, Portugal

Abstract Body: Sexual examinations conducted under Criminal Law at INMLCF Police Stations follow specific protocols based on the elapsed time since the incident and the type of assault. This study focuses on cases involving digital penetration without penile involvement, often undervalued in sexual assault evaluations.
A review was performed of urgent sexual examinations recorded on the MedLeg® platform from 2016 to 2023. The analysis included cases involving finger penetration or manipulation of the anogenital region, excluding those with concomitant penile penetration. A sample of 40 cases formed the study's basis, with 31 undergoing Genetics and Forensic Biology examinations. Ten cases were excluded due to case closure or complaint withdrawal.
Of the 40 examinees, 14 presented recent genital injuries. Common findings included vulvar erythema (5 cases), vulvar or hymenial lacerations (4 cases), and abrasion of the navicular fossa (3 cases). Genetic material was collected in 31 cases, with potential aggressor DNA profiles identified in 13. These results came from swabs of skin (1 case), victims' underwear (5 cases), and vulvar swabs (7 cases).
The study underscores the importance of swabbing areas of digital contact and victims' clothing, as aggressors frequently manipulate these regions. Findings emphasize that digital penetration can cause observable injuries and yield critical genetic evidence, reinforcing the need to prioritize such examinations in forensic assessments.
This work highlights the value of thorough examination and sample collection in cases of digital sexual assault to ensure comprehensive medico-legal documentation and support for justice.

Photogrammetry in the Autopsy Room: Can a Simplified Workflow Maintain Quality? 11:00 - 11:00

M. Pietrzak[1], A. Petaros[2]

[1]Swedish National Board of Forensic Medicine, Gothenburg, Sweden, [2] Swedish National Board of Forensic Medicine, Linköping, Sweden

Abstract Body: Photogrammetry is a widely used three-dimensional visualization method in forensic science, providing high-quality evidence for legal proceedings. It enables the accurate reproduction of reality in virtual space using 2D photographs from standard handheld cameras.

Photographs should follow an established workflow that accounts for several factors, such as the number of photographs, adequate photo overlap, and proper lighting conditions.

However, this workflow is not always feasible to implement at forensic institutes due to legal regulations regarding autopsy procedures, as well as financial, time, and human resource limitations.

The goal of this study was to investigate the possibility of using photographs routinely taken during autopsies to create photogrammetry models of sufficient quality for presenting body injuries. This was done by compiling a list of simple instructions for autopsy photodocumentation, considering factors that would facilitate the subsequent creation of models.

The utility of these instructions was tested by comparing models created using autopsy photographs without prior instructions to those created using photographs taken according to the simple instructions. These were then compared to models of the same regions created with photographs taken specifically for photogrammetry. The quality of the models in each group, compared to the control group, was evaluated by forensic pathologists and residents in forensic medicine. The poster will present the results of the evaluation and the challenges associated with each model set.

Using only photographs taken during routine autopsies is believed to reduce financial, time, and human resource costs, making it possible to implement this approach at any forensic institute.

A Retrospective Study of Nipple Swabs: Looking Forward on the Need to Change Practices 11:00 - 11:00

S. Andrade[1], *I. Dias*[1], *I. Abundância*[1], *Z. Argyropoulou*[1], *C. Silva*[1]

[1]South Branch of National Institute of Legal Medicine and Forensic Sciences., Lisbon, Portugal

Abstract Body: In Portugal, sexual assault victims are subjected to a medical-legal examination aimed at collecting and preserving biological evidence of the incident . The collection of biological samples is performed according to the time that has elapsed since the alleged sexual assault, with periods varying between 6 and 72 hours post-incident.
According to usual practices, skin swabs are generally taken when there is a suspected lesion, such as a bite or a hickey , being overlooked for sample collection when the victim has displayed destructive behavior like taking a bath.
However, in sexual assaults where opportunistic swabs from the skin of the nipples are collected, the results for the presence of DNA from the assailant are surprisingly positive after the expected time frame. In this study, we intend to carry out a retrospective analysis of the last 5 years of all nipple swabs performed and the time that has elapsed since the assault and medical observation , as well as the destructive behavior displayed by the victim, in order to reassess the need for extending the time frame for collections.

09: Interpretation: Evidence Evaluation
11:00 - 11:45 Auditorium

Poster Session Tuesday - Interpretation: Evidence Evaluation

Colorimetric Study of Cremated Teeth as a Diagnostic Tool to Aid in Forensic Dental Identification 11:00 - 11:00

E. Nuzzolese[1], *G. Di Vella*[1]

[1]University of Turin, Human Identification and Forensic Odontology Laboratory (LIPOF), Turin, Italy

Abstract Body: Teeth are among the most resilient tissues in the human body, making them valuable for forensic odontologists analyzing burnt, decomposed, and skeletonized remains. This research aims to examine colorimetric changes in dental crowns subjected to high temperatures and to develop a reproducible forensic cataloging method. Sixty-three human teeth, extracted for therapeutic reasons with Ethics Committee approval, were divided into three groups. Each group was subjected to three temperature ranges—400°C (752°F), 700°C (1292°F), and 1000°C (1832°F)—for 20 and 60 minutes in a laboratory furnace.
The teeth were analyzed using a dental spectrophotometer to obtain colorimetric data from the enamel, which was then converted into RGB values. The predominant colors were selected to create averages reflecting color changes based on temperature. Teeth exposed to 400°C for 20 minutes exhibited dark gray coloration; those at 700°C showed increased brightness with beige-blue tones; and teeth at 1000°C revealed increasingly lighter tones with pink reflections. For the 60-minute exposure, a general increase in brightness was noted, complicating differentiation, except for the 400°C group, which displayed light blue-gray tones.
The study confirms existing literature linking colorimetric shifts in cremated teeth to peak temperatures and offers a new standardized colorimetric scale to aid in human identification of incinerated human remains.

Multinational Classification of Dental Resin Composites for Forensic Purposes 11:00 - 11:00

D. Bosio[1], *M. Putzu*[1], *G. Di Vella*[2], *E. Nuzzolese*[2]

[1]Città della Salute e della Scienza di Torino, Turin, Italy, [2]University of Turin, Human Identification and Forensic Odontology Laboratory (LIPOF), Turin, Italy

Abstract Body: The identification of human remains relies on the collection and comparison of primary and secondary identifiers. When teeth and jaws are present, dental data can be pivotal in the identification process, both for the initial reconstruction of the biological profile and for the definitive identification, in conjunction with fingerprints and DNA comparison.
In dental autopsies, forensic odontologists record the odontogram of unidentified human remains, describing the presence, color, and type of restorations. Dental materials can be found and, in addition to a macroscopic description, can be subjected to various analyses to identify their composition and, potentially, the manufacturer.

Therefore, a multinational database was generated by collecting dental resin composites from various countries, including Australia, Brazil, China, Germany, Japan, Italy, Luxemburg, Korea, and Switzerland, using scanning electron microscopy with energy-dispersive X-ray spectroscopy (SEM/EDS) and X-ray fluorescence (XRF). This approach obtained an archive of magnified images (2,000x, 5,000x, 10,000x), spectra, and information for each brand.
The advantage of the database is the possibility to compare an unknown spectrum and composition of a dental resin specimen with those stored in the database with known samples from various nationalities. Although several brands of dental materials are used worldwide and do not offer any specific information on the possible nationality, there are other dental materials that are country or continent-specific, like the ones examined, thus allowing possible geographical localization.
The multinational-generated database is constantly updated with dental composites from other nationalities and is a library available to all forensic odontologists upon request.

The Impact of Music Education and Retention Interval on Earwitness Accuracy: A Study 11:00 - 11:00

P. Woldan[1]

[1]Jagiellonian University, Department of Forensic Science, Krakow, Poland

Abstract Body: Voice identification parades are a rare form of identification procedures, used when a witness hears but does not see the perpetrator. Conducting a voice parade is challenging, and the accuracy of earwitness evidence is influenced by various factors, such as hearing ability and retention interval. Research generally suggests that earwitnesses have a low ability to accurately identify voices, regardless of the factors studied.

The Author conducted a study that examines the performance of music-educated and non-music-educated participants, aged 15–22, in a voice line-up experiment over one-week and two-week retention intervals. A total of 129 participants were divided into four groups: music-educated (one-week, n = 29; two-week, n = 26) and non-music-educated (one-week, n = 41; two-week, n = 33). Participants first listened to a recording of the perpetrator's voice from a simulated "crime scene." After the designated retention interval, they were presented with recordings of six voices, including the perpetrator's, reciting crime scene lines and a short book passage. The voices from the parade were selected from 20 in total during the pre-eliminary procedure.

The results have revealed no statistically significant difference between music-educated and non-music-educated participants. While retention interval showed no significant impact on accuracy, the difference approached statistical significance. Accuracy scores averaged 47.1% after a one-week retention interval and 30.5% after two weeks. These findings suggest that earwitness evidence is not a reliable form of identification, even if the person has special ability (like music education).

Human Identification Methods in Disaster Victim Identification: 11:00 - 11:00

From Remains to Identity

I. Gouveia Abundância[1], *I. Dias*[1], *O. Saychuk*[1]

[1]Southern Branch of the National Institute of Legal Medicine and Forensic Sciences, Forensic Clinical and Pathology Department, Lisbon, Portugal

Abstract Body: **Introduction**
Disaster victim identification (DVI) is a critical aspect of forensic science, particularly in large-scale catastrophes where numerous victims require accurate identification. Methods used must be reliable and ethically appropriate to provide closure for families and fulfill legal obligations. The authors intend to review the primary human identification techniques applied in DVI, emphasizing their efficacy and limitations.
Methodology
Bibliographical research of scientific publications and international forensic guidelines, with focus placed on three core identification methods: fingerprint analysis, dental identification and DNA profiling. Secondary methods, such as anthropological assessment and personal effects analysis, were also considered.
Discussion
Fingerprint analysis remains one of the most rapid and cost-effective methods, but its applicability is limited by the condition of the human remains. Dental identification is highly reliable due to the durability of dental structures, especially in cases involving high levels of cadaveric destruction. DNA offers high accuracy even in fragmented or degraded remains, however, it requires specialized facilities and can be time-consuming. The integration of multiple methods ensures a robust and systematic approach. Challenges include logistical constraints, sample contamination, and the ethical management of personal data. Advances in technology, such as rapid DNA sequencing and digital dental records, are enhancing identification efforts.
Conclusions
Effective DVI relies on a multidisciplinary approach, combining traditional forensic techniques with emerging technologies. Continuous refinement of protocols and collaboration between forensic experts are essential to improve accuracy and efficiency in human identification. Future research should focus on optimizing resource allocation and developing portable identification tools for field use.

Fiction with Potential Repercussions: An Update on the CSI Effect 11:00 - 11:00

M. Corbett[1], *V. Stinson*[1]

[1]Saint Mary's University, Psychology, Halifax, Canada

Abstract Body: The present paper explores the nuanced impact of the CSI Effect on jurors and the legal system, as informed by a review of recent literature and empirical studies. Originating from the popular crime drama "CSI," the CSI Effect refers to the way televised portrayals of forensic science shape jurors' expectations and understanding of evidence in courtroom settings. Following the foundational work of Smith, Stinson, and Patry (2011), a growing body of research reveals mixed findings, with some studies indicating no direct influence on verdicts, while others highlight

increased expectations for forensic evidence—particularly the Strong Prosecutor Effect. Additionally, public perceptions revealed through surveys demonstrate a tendency to overestimate the reliability of forensic evidence when influenced by crime media. The implications of these findings suggest that jurors' misconceptions about forensic science can lead to challenges for both prosecution and defence, affecting trial outcomes. By shedding light on the disparity between dramatic portrayals and actual forensic practices, this paper aims to foster awareness among legal professionals and promote informed deliberations within jury trials.

02: Chemistry: Gunshot Residue (GSR)
11:00 - 11:45 Auditorium

Poster Session Tuesday - Chemistry: Gunshot Residue (GSR)

Technological Advances for Studying the Behavior of Organic and Inorganic Gunshot Residues and Implementing Cost-Effective Solutions 11:00 - 11:00

L. Thomas[1], K. Dalzell[1], T. Ledergerber[2], L. Arroyo[1,2], T. Trejos[1,2]

[1]West Virginia University, Department of Forensic and Investigative Science, Morgantown, United States, [2]West Virginia University, C. Eugene Bennett Department of Chemistry, Morgantown, United States

Abstract Body: As gun violence continues to escalate, the rise in criminal activity negatively impacts crime laboratories' turnaround times and contributes to significant backlogs. [1,2] To alleviate the pressures on investigative agencies, there is a strong demand for solutions that enhance the cost-effectiveness, timeliness, and resource efficiency of processing gunshot residue (GSR) evidence. However, due to complex deposition, transfer, and persistence processes, GSR presents challenges for forensic laboratories to analyze and for investigators and fact finders to interpret. This study aims to narrow the knowledge gaps in this field by using novel technology to uncover and detect inorganic and organic gunshot residue (IGSR and OGSR) at the scene and laboratory.
Through laser sheet scattering, high-speed videography, and aerodynamic particle counters, GSR's movement and deposition patterns have been visualized in indoor and outdoor environments. This enables a comprehensive assessment of the risks associated with GSR exposure to bystanders during shooting incidents, which can be applied to real-world scenarios. In conjunction with these advanced tools, we have built the capacity to detect trace amounts of inorganic and organic GSR with unparalleled accuracy using screening methods. [3,4]
Performance rates of two screening techniques—Laser-Induced Breakdown Spectroscopy (LIBS) and electrochemistry— are evaluated in benchtop and portable systems through a dataset of nearly 4000 specimens, including hands of shooters, non-shooters, bystanders, target substrates (fabric, wool, drywall, vehicles, windows), and mock arrests . [5] With the capability to be deployed at crime scenes, these techniques allow advanced triage and signify significant advancements in efficiency for firearm-related investigations.

Evaluation of Gunshot Particles (GSR) Using Likelihood Ratio – A Bayesian Model in Process 11:00 - 11:00

L. Jaeger[1], M. Larsson[1], J. Malmborg[1], A. Nordgaard[1]

[1]National Forensic Centre (NFC), Linköping, Sweden

Abstract Body: We present a comprehensive dataset derived from previously published studies concerning the transfer, persistence, contamination, and background prevalence of gunshot residues (GSR). Such data are crucial for the accurate evaluation of GSR evidence in forensic investigations.
Our study includes the distribution of GSR observed on the hands of approximately 1,900 individuals from the general public, 1,000 police officers, as well as from surfaces within approximately 310 police vehicles and 220 police facilities. The distribution of these observations has been modelled using a generalised Pareto distribution.
To estimate GSR transfer, data were collected from 79 simulated arrest scenarios. Samples were taken from the hands of the arresting officers and the previously uncontaminated "suspects". The resulting data were modelled using a Beta distribution for the probability distribution of transfer percentage.
Additionally, the half-life of GSR on hands was estimated from 62 time-series datasets by fitting an exponential first-order decay model.
A Bayesian network is being developed to integrate the compiled data and assess the probabilities of different scenarios contributing to the detection of GSR on a suspect's hands. The network utilises the compiled dataset to estimate the conditional probability tables (CPTs), providing a structured framework for probabilistic reasoning.
The poster will detail the design of the Bayesian network, including its structure, variables, and relationships, as well as the methodology used to populate the CPTs. This approach enables a comprehensive evaluation of GSR evidence by combining various factors, such as transfer, persistence, contamination, and background prevalence, into a coherent probabilistic model.

Rethinking Forensic Research for Increased Impact in Gunshot Residue Practice 11:00 - 11:15

C. Weyermann[1], S. Charles[2], V. Redouté Minzière[1], T. Tilborg[1], K. Chana[3], H. Menard[4], B. Nys[2], R. Schumacher[5]

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Abstract Body: Scanning electron microscopy coupled with energy dispersive X-ray spectroscopy (SEM-EDS) has been the “gold standard” technique for the analysis of inorganic gunshot residue (GSR) particles for more than 40 years. Since then, new techniques and significant innovations are still struggling to find their way into routine GSR examination, despite the amount of research being conducted and published on the subject. The aim of this work was to investigate the persistent gap between research and practice in the field of GSR through a literature review, a survey of GSR

examination (responses were received from 45 experts) and a round table organised at the annual meeting of the European Network of Forensic Science Institutes Firearms / GSR Working Group in Brussels in 2023. The literature review showed that approx. 42% of the relevant publications on GSR focus on the development of novel methods, while 26% address GSR persistence, prevalence and interpretation. Survey responses confirmed that residues are mainly collected from hands with carbon stubs and analysed by SEM-EDS. 90% of respondents work in accredited laboratories and 95% have little time for research outside their routine duties. There is widespread support among experts for the collection of more forensic data on persistence, prevalence and secondary transfer to support interpretation, which is evolving from source to activity inference. The discussion will focus on the difficulties identified by practitioners and researchers and how the barriers might be overcome.

Analysis of the Spatial Distribution of Gunshot Residue (GSR) Upon Impact Resulting From the Discharge of a 9 mm Luger Firearm at Variable Distances 11:15 - 11:15

C. Côte[1], *L. Montagna*[1], *F. Bresson*[1], *P. Bakis*[1], *C. Sainte*[2]

[1]Service National de Police Scientifique / Laboratoire de Police Scientifique de Marseille - LPS13, Weapons and Ammunitions Division, Marseille, France, [2]Service National de Police Scientifique / Laboratoire de Police Scientifique de Marseille - LPS13, Marseille, France

Abstract Body: Gunshot residue (GSR) analysis is crucial in forensic investigations to link suspects to firearms and estimate firing distances, often providing critical evidence in criminal cases. This study investigates the spatial distribution of GSR (SGSR) around bullet holes with the aim of developing a predictive model for more accurate firing distance estimation.

A series of controlled test shots were fired from a 9 mm Luger Glock 17 handgun at cotton targets positioned at varying distances (0-5 meters). High-speed videography (Photron SA5HV) captured the dynamic SGSR formation upon bullet impact, providing a detailed visual record of GSR dispersion. Following each shot, GSR samples were meticulously collected at the bullet hole edge, 5cm, and 10cm away using carbon adhesive stubs. These samples were then analysed using scanning electron microscopy coupled with energy-dispersive X-ray spectrometry (SEM-EDS) to identify and quantify GSR particles.

Analysis of the high-speed video and SEM-EDS data revealed a clear correlation between firing distance and SGSR. GSR concentration consistently decreased as the distance between the firearm and the target increased, with a higher density of particles observed closer to the impact point. Furthermore, a distribution factor (K) was calculated by comparing the number of GSR particles identified at the impact point with those found at 5cm and 10cm. This factor showed a correlation with increasing firing distance. The distribution factor, offers a potential tool for more objective firing distance estimation in forensic investigations by SEM-EDS.

This project has been supported by the *Innov'PTS23* call for projects.

Forensic Comparison of Various Gunshot Residues on Textile 11:15 - 11:15

Fabrics by Fourier-Transform IR Microscope Coupled With Classification Modelling

H. Rashed[1], *N. Ahli*[1], *A. Aljanaahi*[1], *R. alblooshi*[1], *I. albastaki*[1], *A. Askar*[1], *M. Ahli*[1]

[1]Dubai Police GHQ, General Dept. of Forensic Science and Criminology, Dubai, United Arab Emirates, United Arab Emirates

Abstract Body: Gunshot residue (GSR) is one of the important types of trace evidence found at crime scenes. It can be used forensically to solve incidents related to firearms discharge. GSR is a formulation of inorganic and organic compounds formed as a debris cloud from the gases and pressure created by the inner mechanical parts of the gun during ammunition discharge. The GSR particles found in crime scenes are crucial as they provide a link between the suspect and the crime, especially if the residue is found on the body or clothing. The unique aspect of organic GSR is the chemical composition of the ammunition, which includes different roles such as fuel, flash inhibitor, plasticizer, and stabilizer. Microscopic ATR-FTIR provides beneficial information about GSR particles visually and chemically without lifting the particles from the fabric surface in a non-destructive way. Six different ammunition sources and calibres, along with five different substrate materials, were used to collect GSR. The results show that ATR-FTIR vibrations provide the EC and MC stabilizers' transmittance differences for all GSR and unfired particles. Moreover, it provides a difference in the "fingerprint" spectrum region between all particles. Additionally, the microscope provides morphology information about the particle from the colour and shape. The binary and multiclass random forest classification models for FTIR data used here achieved 100% accuracy, sensitivity, and specificity. This method is non-destructive, rapid, and efficient, as it doesn't require the removal or lifting of GSR particles from the fabrics.

02: Chemistry: Gunshot Residue (GSR)
11:00 - 11:45 Auditorium

Poster Session Tuesday - Chemistry: Paint and Glass

From Fragments to Patterns: Mining Glass Data from 5 Years of Reports 11:00 - 11:00

P. Zoon[1], *M. Janssen*[1]

[1]Netherlands Forensic Institute, Microtraces & Materials Group, The Hague, Netherlands

Abstract Body: For the evaluation of forensic glass examinations at the activity level information it is important to have data on the prevalence of glass fragments. The majority of the published studies is several years old and analysis of the recovered glass fragments is done with refractive index measurements. Refractive index measurements (without added elemental analysis) have a poor discriminating strength for modern (float) glasses. It is unclear if similar numbers of fragments per glass source group are found when a highly discriminating technique like laser ablation inductively

coupled mass spectrometry (LA-ICPMS) is used to analyse the glass fragments.
This poster presents the results of datamining 5 years worth of forensic glass reports at the NFI. In total, data of more than 250 reports containing over 750 unique exhibits was extracted and analysed with Python scripts. The number of glass fragments present on various items are categorised per item type (e.g. shoes, pants, jackets etc.) and the proportion of finding one or more glass fragments that match with reference glass are presented for each category. The trace elemental composition, as determined by LA-ICPMS, of each fragment is used to determine the distribution of glass source groups per item category as wells as how many fragments are present per source group.

03: Digital Evidence: Artificial Intelligence
11:00 - 11:45 Auditorium

Poster Session Tuesday - Digital Evidence: Artificial Intelligence

Skeleton ID C-Rank: 3D Methodology for Frontal Sinus-based Human Identification. 11:00 - 11:00

A.D. Villegas Yeguas[1,2], A. Manzanares[2], V. Martinez-Garcia[2,3], G. R-Garcia[2], M.A. Guativonza[3,4], S. de Luca[2], E. Bermejo[2,5], A. Valsecchi[2,5], O. Ibáñez[6]

[1]University of Granada, Department of Computer Science and Artificial Intelligence, Granada, Spain, [2]Panacea Cooperative Research S. Coop, Ponferrada, Spain, [3]University of Granada, Department of Legal Medicine, Toxicology and Physical Anthropology, Granada, Spain, [4]University of A Coruna, Faculty of Computer Science, La Coruña, Spain, [5]Andalusian Research Institute in Data Science and Computational Intelligence, Granada, Spain, [6]Faculty of Computer Science, CITIC, Universidade da Coruña, A Coruña, Spain

Abstract Body:

The distinctive morphology of the frontal sinuses makes them a valuable tool in forensic anthropology for human identification purposes. This anatomical structure has been widely studied using both 2D and 3D images as they are easily visualized using radiology (X-Rays, Computed Tomographies and Magnetic Resonance Imaging). The images obtained by these methods are used in human identification by, manually, comparing the different shape and size of the frontal sinuses in ante-mortem (AM) and post-mortem (PM) images.
In this work we propose a novel technology to make the superimposition and posterior analysis of multiple cases simpler and faster. Using different computer vision techniques (feature and intensity-based image registration), we have developed two different methods to automatically compare the morphology of AM and PM images to rank the cases by similarity, thus making the search of a match between the AM and PM cases more efficient. We also developed a segmentation protocol in order to standardize the data acquisition process to obtain the 3D models needed to make the comparison from medical images and studied the intra-subject variability.
A preliminary study served us to validate the tool and the protocols. Different forensic anthropology practitioners with different expertise levels

followed the protocol to segment and process the data while attempting to identify multiple cases using the software. In this work we will present the promising results achieved in our study, as well as the viability of the proposed methodology for comparing any kind of anatomical structure using 3D medical images.

Evaluating Large Language Models for Crime Text Processing: A Comparative Study of AI tools vs Human Analysts 11:00 - 11:00

N. Stomp[1], T. Kuznecova[1], S. Bhandari[2]

[1]Saxion University of Applied Sciences, Technologies for Criminal Investigations (TCI), Enschede, Netherlands, [2]University of Twente, Data Management and Biometrics (DMB), Enschede, Netherlands

Abstract Body:
Extracting and structuring information from text opens new possibilities for crime research by enabling techniques such as machine learning, pattern discovery or scenario reconstruction. However, manual transformation of text is labor-intensive and may become unmanageable as data volume grows. The rise of AI tools based on Large Language Models (LLM) has led to new opportunities for automating text processing tasks across various domains. Nonetheless, suitability of such tools in fields like crime research still requires careful evaluation of limitations and risks due to high demands for accuracy and consistency in such sensitive or high-risk applications. This study investigates how LLMs can assist in processing and structuring crime-related text data, while comparing their performance to human analysts. After pre-selecting three LLMs – ChatGPT, Gemini and Perplexity – a series of experiments were conducted using 45 open-source articles on 9 homicide cases in the Netherlands. Both LLMs and human analysts extracted, aggregated, and relabeled data based on predefined variables to create structured datasets. These results were then evaluated for accuracy and formatting consistency using a human-produced dataset as a benchmark, while also comparing all tested LLMs to each other.
Results highlight the significant potential of using LLMs for efficient processing of crime-themed texts, while also pinpointing areas for improvement, including formatting inconsistencies and difficulties with interpretation of complex semantics such as the motive behind a crime. With each LLM showing its own strengths and weaknesses, training a custom tool version specifically on crime-related data could be a significant step forward.

From Speech To Report: Tailoring Machine Learning-Powered Speech-to-Text for the Forensic Autopsy Report 11:00 - 11:00

S. Erdogan[1], S. Toklu[2], N. Canturk[1]

[1]Ankara University, Institute of Forensic Sciences, Department of Criminalistics, Ankara, Turkey, [2]Gazi University Faculty of Technology, Department of Computer Engineering, Ankara, Turkey

Abstract Body: Forensic autopsy is a crucial post-mortem examination carried out for medical and legal purposes, typically mandated by authorities in cases of sudden or unexplained death. It encompasses unnatural deaths, suspicious circumstances, and incidents related to medical negligence. This thesis focuses on enhancing the efficiency of forensic autopsies through technology, specifically proposing the development of a software application that uses speech-to-text transcription technology. This application aims to transcribe the spoken words of forensic experts during the autopsy process, subsequently employing machine learning and natural language processing techniques to generate comprehensive forensic autopsy reports. The project's objective is to automate the writing of forensic autopsy reports by streamlining the speech-to-text transcription process. This method is intended to facilitate forensic investigations by improving workflows and saving time for forensic experts. In experiments, the effectiveness of independently using the FastText and BERT models, as well as their combined application, was evaluated using the Word Error Rate (WER) criterion. The WER of the forensic autopsy audio transcription was initially found to be 34%. However, this rate dropped to 22% when the FastText and BERT models were applied together, reflecting an approximately 35% improvement in accuracy. The findings highlight the effectiveness of speech-to-text technology and machine learning models in producing forensic autopsy reports, demonstrating the value of a hybrid model in enhancing performance.

From Trash to Treasure: Enriching Evidence with AI-based Carving in Digital Forensics 11:00 - 11:00

M. Mueller[1], T. Fischer[1], T. Wirth[2], A. Guzhov[2], L. Howes[3], D. Ospelt[3]

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Abstract Body: Identifying evidence in cybersecurity and digital crime investigations is a crucial task in Digital Forensics. In many cases, relevant data might be inaccessible due to hidden, deleted or overwritten files, requiring the application of advanced algorithms to recover the information. File carving is one such technique, which reconstructs lost files based on their internal structure without relying on file system metadata. Recently, Artificial Intelligence (AI) has emerged as a promising method to significantly increase the performance and quality of data recovery methods. In this work, we introduce an AI-driven method to improve the file carving process, particularly for reconstructing fragmented files that classical carving techniques fail to recover. Our approach focuses on image file formats, establishing a pipeline from reading byte-level data to decoding images. First, we identify the file type for each sector in the non-allocated space. Next, we cluster related fragments for each file type to form groups corresponding to individual files. Finally, the fragments within each group are ordered and decoded to recover a complete image file. This poster presents our state-of-the-art AI-based algorithm for file carving and data recovery, detailing its technical aspects and results from recovery studies using real-world cases. We compare the performance of our method with classical carving techniques, highlighting the significant advantages it offers for law enforcement agencies in terms of recovery accuracy and

efficiency.

AI in Forensic Science: Navigating the Frontier of Forensic Innovation and Ethical Implementation 11:00 - 11:00

N. Jones[1]

[1]RTI International, Center for Forensic Science Advancement and Application, Research Triangle Park, United States

Abstract Body: Establishing guidelines for the responsible use of AI across the justice system has become increasingly important. AI offers opportunities to improve forensic workflows and evidence analysis methods but presents a need for responsible AI usage to mitigate risks; and an urgency to establish best practices given rapid AI advancements. Current AI applications in forensics primarily focus on supervised machine learning for pattern detection, evidence classification, and characterization, with emerging research exploring the potential of multimodal and generative AI.

While AI integration in investigations can potentially maximize limited resources, its deployment in forensic science and law enforcement has been somewhat random, occurring in a low-information environment. The scarcity of standards for effective AI implementation has led to adoption driven primarily by commercial products targeted at investigative use.

AI's use in criminal justice raises concerns about potential bias, civil liberties protection, transparency, public trust, and due process. As AI adoption expands, establishing clear guidelines, conducting rigorous evaluations, and fostering multi-stakeholder engagement is crucial.

This presentation will explore:

1. Current AI research and applications in forensics
2. Specific use cases for AI in forensic applications
3. Technical, operational, and societal considerations for AI implementation
4. Validation and evaluation of AI for investigative purposes
5. Current minimum and best practices for adopting safety- and rights-impacting AI technologies

The goal is to provide a comprehensive overview of AI's role in forensic science and its responsible implementation in the justice system.

Comparison of Machine Learning and Artificial Intelligence for the Detection of Writing Ownership and Authenticity in Terms of Numerical Data 11:00 - 11:00

E.B. Aytuglu[1]*, D. Salkım İşlek*[1]*, E. Kiriş*[1]*, E. Kose*[1]

[1]Istanbul University-Cerrahpasa Institute of Forensic Sciences and Legal Medicine, Department of Science, Istanbul, Turkey

Abstract Body: Signature authenticity detection in forensic sciences is of

great importance, especially in a digitalized world. Modern image processing and machine learning methods have the potential to make significant contributions to signature authenticity detection. While image processing techniques can extract detailed features of signatures, machine learning algorithms are used for authenticity detection by analyzing these data. This study was carried out in 3 stages. In the first stage, image processing methods, color space transformations, and noise reduction algorithms were used. In the second phase, an image processing algorithm was developed to convert the signatures into digital data. This algorithm includes feature extraction from the images and calculation of the momentum of the images. The extraction of features in the image is based on the geometric shapes of the signature. To increase the precision and accuracy of the momentum calculation, the images were divided into unit squares. In the third stage, the obtained numerical data were analyzed with classification and clustering machine learning algorithms, and the similarity rate was calculated as a percentage. Thus, it is aimed to transition from subjectivity to objectivity by enabling faster, more accurate, and reliable numerical results in forensic sciences with modern software technologies.

04: DNA and Body Fluids: Body Fluid Identification
11:00 - 11:45 Auditorium

Poster Session Tuesday - DNA and Body Fluids: Body Fluid Identification

Chemometric Analysis of Hyperspectral Imaging for the Differentiation and Identification of Biological Fluids 11:00 - 11:00

A. Mazzoleni[1,2], E. Alladio[1,2], P. Oliveri[3], E. Catelli[4], M. Occhipinti[5], A. Tocchio[5], S. Prati[4], P. Garofano[6], G. Sciutto[4]

[1]University of Turin, Chemistry, Turin, Italy, [2]Databloom, Turin, Italy, [3] University of Genoa, Pharmacy, Genoa, Italy, [4]University of Bologna, Chemistry, Bologna, Italy, [5]XGLab SRL – Bruker Nano Analytics, Milan, Italy, [6]Centro Regionale Antidoping “A. Bertinaria”, Orbassano, Italy

Abstract Body: Identifying and analyzing biological fluids in forensic investigations face challenges due to complex sample matrices and degradation. Traditional techniques, such as forensic alternate light sources, often struggle under these conditions. Novel methods are being developed for the selective, non-destructive detection of latent biological traces to address this challenge. This study evaluates the potential of a cutting-edge multiblock platform (IRIS, XGLab SRL – Bruker Nano Analytics, Milan, Italy) for identifying and characterizing dehydrated biological fluids. The IRIS system simultaneously acquires data from three spectroscopies: X-ray fluorescence (XRF, 1-40 keV), visible and near-infrared (VNIR, 380–1100 nm), and short-wave infrared reflectance (SWIR, 1100–2500 nm). Fluids such as blood, urine, semen, and saliva were applied to wood specimens and analyzed over time by using a chemometric approach.
The study had two main goals: (i) to detect and localize biological fluids on the substrate and (ii) to differentiate between various biological traces accurately. Principal Component Analysis (PCA) and Multivariate Curve Resolution - Alternating Least Squares (MCR-ALS) were applied to individual data blocks and combined in a Data Fusion approach. These strategies effectively resolved overlapping signals, analyzed 3D data, and correlated elemental and spectral information.
Results demonstrated the sensitivity and specificity of the method for

highlighting and distinguishing biological fluids on wood. Future work will expand the sample set and refine multivariate discrimination models for broader forensic applications.

Enhancing Bloodstain Visibility on Dark Surfaces: Specificity and Sensitivity of Infrared Photography for Detecting Bloodstains 11:00 - 11:00

A. Davidson[1], C. Ellis[1], J. Lewis[1]

[1]Cellmark forensic services, chorley, United Kingdom

Abstract Body: Traditional methods for blood searching are time-consuming, particularly on dark surfaces. Previous studies have assessed the ability of using infrared radiation (IR) for the detection of bloodstains. IR is an energy form with wavelengths between 780nm—1mm, so isn't visible to the naked eye. Blood absorbs IR light allowing for greater detection when the background reflects IR. Studies using IR show variations in the detection limit of water and blood dilutions, from 1:10 to 1:100. It has also been noted in previous work that transfer stains were more problematic than spatter stains and the surface type affects the visibility of bloodstains under IR due to absorption/reflection properties of the surface material. The specificity and sensitivity of the technique was investigated to establish whether near infrared photography using the Canon XA60 camcorder is suitable for documentation, visual searching, and pattern enhancement of bloodstains under different conditions and variables. With the overall goal to reduce examination time using a non-invasive technique, without compromising the quality of results.

Sperm Detection AI Implementation Into Routine Casework in Estonia 11:00 - 11:00

S. Erg[1], M. Sadam[1], K. Karise[1], L. Kärgenberg[1], E. Toover[1], J. Sinisalu[1], K. Lehis[1], A. Tiidla[1]

[1]Estonian Forensic Science Institute, Tartu, Estonia

Abstract Body: AI assisted microscopy for searching sperm cells in forensic trace samples was validated and accredited for casework use in the Estonian Forensic Science Institute.

Automated scanning with object detection and scoring system by MetaSystems, including software Metafer (Sperm Finder packet, deep neural network based artificial intelligence) was tested for mock and routine samples. Validated parameters included concordance, sensitivity, robustness, precision (repeatability, reproducibility), contamination, traceability). In addition, variations of microscopy slide preparation methods were tested.

All the tested parameters of the system were found to be suitable for working with forensic samples, with clear improvement in sensitivity of the analysis – especially in samples containing low number of sperm cells.

The Development of Proficiency Tests for Sexual Assault Referral Centres (SARCs) 11:00 - 11:00

R. Hamid[1]

[1]Home Office, Forensic Information Database Services, Solihull, United Kingdom

Abstract Body: There are 54 SARCs in England and Wales which undertake forensic examination of victims of sexual offences; this includes the taking of DNA samples from the victim. From 2nd October 2025, the DNA sampling activities undertaken by SARCs need to be compliant with the Forensic Science Regulator's (FSR) Code and accredited to international standard ISO 15189 – which includes taking part in a proficiency test (PT). This poster will take you through the development of a world leading new PT scheme, utilising anatomical models and vinyl material to mimic skin, to provide support to SARCs with compliance with the FSR code.

The Effect of Luminol on Blood Presumptive Testing 11:00 - 11:00

M. Nõmm[1], *R. Järving*[1], *L. Adamson*[1], *M. Sadam*[1]

[1]Estonian Forensic Science Institute, DNA Department, Tallinn, Estonia

Abstract Body: Blood is the most frequently found evidence at the crime scene in case of violent crimes like murder, rape, and assaults. To hide evidence, perpetrators can wash bloodstains, making them invisible to the naked eye. Luminol based solution is an effective presumptive reagent for detecting latent blood at the crime scene and its chemiluminescent property has been used in forensic science for over 50 years to detect and photograph bloodstains.-
From all the luminol commercial products, that are widely available, Estonian regional police agencies have decided to use Lumiscene (Loci Forensics B.V.). For this reason, Lumiscene was chosen for this study. In addition, Lumicene Ultra (Loci Forensics B.V.), a more concentrated and therefore more sensitive version of the regular Lumiscene, was tested. Dilution series of blood stains were made on commonly used fabric. The stains were treated with Lumiscene and Lumicene Ultra solutions, and then left to dry. Presumptive test Tetrabase for blood and presumptive tests Hexagon Obti (Human Gesellschaft für Biochemica und Diagnostica mbH), Bluestar Obti (Bluestar®) and HemDirect (Seratec®) for human blood were carried out to see if luminol treatment influences the test results. DNA samples for testing were taken on different time points – on the first week, and after one, two, three and five months after luminol treatment.
The results of the study will be described and a conclusion on the effect of luminol on blood presumptive tests will be reported.

The Effect of Different Water Types on the Detection of Bloodstains Using the Forenscope® 11:00 - 11:00

S. Waldron[1], *A. Brennan*[1]

[1]Atlantic Technological University, Life Sciences, Sligo, Ireland

Abstract Body: Blood found at the scene of a crime can be crucial

evidence particularly in violent criminal cases. Moreover, as bloodstains form in predictable patterns, the analysis of these patterns can assist investigators in both the reconstruction of the crime and evaluation or corroboration of witness statements. However, when bloodstains are found on dark-coloured or highly patterned material, it can be difficult for investigators to discern any blood patterns present.

Infrared has previously been shown to be readily absorbed by bloodstains and is the most effective region on the electromagnetic spectrum for distinguishing bloodstains on dark backgrounds. This introduces the need for an alternate lighting system that exploits this characteristic and can easily capture images of any bloodstains or patterns present. The Forenscope® multispectral forensic tablet is one such system.

In many instances, evidence is recovered from bodies of water such as rivers or the sea, usually having been discarded by the perpetrator attempting to conceal a crime. There is a gap in the existing knowledge of the effects of different water types on the detection of bloodstains using infrared light. This study investigates how being submerged in salt water, fresh water, and distilled water for a given duration of time affects the detection of bloodstains using the Forenscope® for the purpose of blood pattern analysis.

A Simplified Laboratory Process for mRNA Detection for the Identification of Body Fluids 11:00 - 11:00

J. Thomson[1], D. Moore[1], S. Doole[2], C. Hargreaves[3], Z. Subhani[1]

[1]Eurofins Forensic Services, Feltham, United Kingdom, [2]Eurofins Forensic Services, Wakefield, United Kingdom, [3]Eurofins Forensic Services, Tamworth, United Kingdom

Abstract Body: In recent years, tests to detect mRNA transcripts specific to forensically relevant body fluids have become established as a method for body fluid identification. One of the limitations often encountered with such mRNA processing for body fluid identification is the complexity that it introduces into the standard DNA processing line. Here we present a novel streamlined process for mRNA detection by incorporating a total nucleic acid extraction process resulting in a single DNA/RNA extract suitable for both DNA STR analysis and mRNA detection. Furthermore, mRNA assays have been designed to address specific, casework-relevant attribution questions that are most commonly encountered in crime stain reporting. This allows for simplified mRNA target sets to be used that use one-step RT-qPCR for detection and which can be easily incorporated into a routine forensic DNA workflow. These assays are mRNA-specific and therefore do not amplify genomic DNA. Here we present the first of our targeted assays for vaginal material and saliva, including validation data and discuss the benefits and limitations encountered.

Assessing the Reliability of Expired Immunochromatographic Tests for Blood Detection 11:00 - 11:00

A. Barbaro[1], A. La Marca[1]

[1]SIMEF, Reggio Calabria, Italy

Abstract Body: Biological fluids are commonly present at crime scenes, and their identification is crucial in criminal investigations. Over the years, various presumptive and confirmatory methods—chemical, enzymatic, spectroscopic, and more—have been developed to detect human biological materials. Among them, commercial immunochromatographic strip tests, which rely on antibody-antigen interactions, are widely used as confirmatory tests for blood, saliva, and semen due to their reliability and ease of use.
This study evaluates the performance of expired commercial immunochromatographic tests for blood detection—specifically those that expired 6, 12, 24 and 36 months ago—stored according to the manufacturer's guidelines. The goal is to determine if these expired tests still yield accurate results. Blood samples were collected from a female volunteer, following SIMEF internal procedures and informed consent. Various dilutions (1:100, 1:500, 1:1000) were prepared using the kit's buffer. According to the manufacturer's instructions, three drops of each dilution were applied to the expired test cassettes. Band intensities were assessed to compare samples qualitatively, not quantitatively. Non-expired tests were also used to provide a baseline for comparison.
While forensic labs conduct hundreds of tests, manufacturers generally advise against using expired reagents, often without detailing how expiration dates are determined. However, it is widely understood in the scientific community that expired products, when stored correctly and with minimal risk of degradation, can still be effective. The results of this study support this notion, suggesting that expired tests can deliver reliable outcomes, offering a valuable reference for forensic laboratories.

Detection of Saliva Using RT-LAMP Integrated with CRISPR-Cas and LFA: A Preliminary Study 11:00 - 11:00

C.W. Su[1], Y.S. Lin[1], H.M. Hsieh[2]

[1]Criminal Investigation Bureau, Taipei, Taiwan, China , [2]Central Police University, Department of Forensic Science, Taoyuan, Taiwan, China

Abstract Body: In forensic investigations, accurately identifying DNA profiles and body fluid types from biological samples is crucial. Saliva, commonly found at crime scenes, serves as a significant source of evidence, particularly in sexual assault cases. Traditional methods for saliva identification, such as radial diffusion and colorimetric tests, often lack sensitivity and specificity. However, contemporary techniques like the Phadebas® test for amylase detection and various immunoassays have improved sensitivity.
Recent advancements in biotechnology have led to the development of isothermal amplification methods, including Loop-mediated Isothermal Amplification (LAMP) and Recombinase Polymerase Amplification (RPA), which provide rapid and specific results without the complexities of traditional PCR. These methods can also be integrated with Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) technology to enhance detection capabilities for saliva-specific markers.
This study presents a novel approach that combines reverse transcription with LAMP, CRISPR, and Lateral Flow Assay (LFA) for saliva identification using FDCSP as a specific marker. The specificity was evaluated using 7 peripheral blood samples, 4 semen samples, 7 saliva samples, 5 vaginal

fluid samples, and 6 menstrual blood samples. Repeatability was tested with three replicates over three different days to assess reproducibility. Sensitivity tests involved duplicates from three individuals, from which two-fold serial dilutions (from 2^1 to 2^{13}) were performed.
The results indicate that this integrated model significantly enhances both sensitivity and specificity for saliva detection, making it a valuable tool for forensic analysis. These advancements underscore the importance of continuous innovation in forensic science to improve evidence analysis efficiency and support investigative efforts.

Construction of an Eight-Plex Microbial Markers Fluorescence Multiplex Identification System for Identifying Saliva and Vaginal Fluid 11:00 - 11:00

S. Hu[1], Y. Zhao[1], L. Zheng[2], Q. Sun[1], S. Guo[2], A. Ji[1], J. Ye[1], W. Chen[2]

[1]Institute of Forensic Science of China, Beijing, China, [2]Huazhong Agricultural University, Wuhan, China

Abstract Body: **Objective** The aim of this study was to establish an eight-plex fluorescent complex system for identifying saliva and vaginal fluid based on microbial markers. **Methods** The specific microbial markers in saliva and vaginal fluid were screened based on specificity and abundance through the investigation of the literature. Stain samples of saliva, vaginal fluid were prepared, and total DNA was extracted. The multiple microbial markers fluorescence identification system was constructed by capillary electrophoresis, and the body fluid stain samples were used to test the specificity and sensitivity of the system. **Results** In this study, five salivary microbial markers (*Neisseria subflava, Veillonella atypica, Streptococcus salivarius, Streptococcus oralis, Porphyromonas catoniae*), and three vaginal fluid microbial markers (*Lactobacillus crispatus, Lactobacillus gasseri, Bifidobacterium breve*) were screened. An eight-plex microbial markers fluorescence multiplex identification system was constructed by capillary electrophoresis technology, and the specificity of the system were verified using 140 samples. The test results showed that microbial marker specificity of saliva and vaginal fluid is good. The detection sensitivity of saliva was 0.065 ng of total DNA, and that of vaginal fluid was 0.125 ng of total DNA. The total DNA extracted during the process of this system can simultaneously meet the needs of forensic short tandem repeat sequence typing. **Conclusion** The eight-plex microbial markers fluorescence multiplex identification system can identify saliva and vaginal fluid effectively and provide a new method for body fluid stain identification at crime scene.

Evaluating Bloodstain Persistence on Textiles in Soil: Effects of Fabric Type and Burial Duration 11:00 - 11:00

A. Amankwaa[1], C. Russell[1]

[1]Northumbria University, Applied Sciences, Newcastle upon Tyne, United Kingdom

Abstract Body: This study investigated how soil burial impacts the persistence and detection of bloodstains on cotton, polyester, and wool

fabrics over 9 weeks. Environmental factors often compromise blood evidence. Understanding the persistence and detection of bloodstains on different materials and in different environments can enhance forensic analysis by providing insights into development of appropriate examination strategies, the prioritisation of exhibits for DNA analysis, storage of exhibits, interpretation of test results, and the evaluation of evidence. Bloodstained fabric samples were buried in topsoil and evaluated weekly using the Leucomalachite Green (LMG) test, rated on a scale from 1 to 5 for colour intensity. Surface-level fabrics were compared to buried fabrics to assess burial effects on persistence of bloodstains and performance of the LMG test. Bloodstains on fabrics showed significant degradation over a 9-week burial period, with wool being the most persistent, followed by polyester and cotton. Statistical tests revealed significant differences in colour intensity scores by fabric type and burial duration. These findings are vital as it showed that the LMG test is not robust in detecting aged bloodstains from buried cotton and polyester textiles. Further, in combination with other blood markers (such as DNA or RNA), the persistence pattern observed using the LMG test could potentially inform the estimation of time since deposition of stains. Understanding how burial conditions affect bloodstain persistence can also inform best practices for the prioritisation of buried exhibits for DNA analysis and storage of recovered buried clothing, thereby preserving forensic evidence.

11: Marks, Impressions and Biometric Traces: Document, Handwriting and Signature
11:00 - 11:45 Auditorium

Poster Session Tuesday - Marks, Impressions and Biometric Traces: Document, Handwriting and Signature

Support System for Document Analysis Through Detection and Recognition of Handwritten Documents 11:00 - 11:00

E. Bermejo[1,2], *A. Manzanares*[1]

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Abstract Body:

Forensic handwriting analysis relies on identifying structural variations in letter formation and connecting strokes to distinguish between writers. These characteristics, including variations in slant, fluency, pressure or size, are shaped by individual motor habits and represent distinctive styles unique to each writer. Advances in technology, particularly in the fields of image processing and artificial intelligence, have opened new avenues for automating and enhancing the process of handwriting analysis, offering powerful tools to complement traditional forensic practices.

This work presents an analytical tool to assist examiners in the task of evaluating letter formation and structural differences in handwritten text. The methodology focuses on segmenting letters, identifying connecting strokes and measuring slant angles using advanced automatic techniques applied to scanned text. Additionally, the proposed system integrates text recognition capabilities, allowing for rapid comparison between two

documents by correlating the isolated elements with their textual content.

Our contribution will be supported by a practical demonstration, tested on the IAM and CVL datasets for handwritten text identification, involving study cases requiring the analysis of mixed writing styles involving lower/upper-cases, disconnected, and cursive styles.

The proposed methodology not only enhances the efficiency of handwriting analysis but also serves as a bridge between traditional forensic expertise and emerging technologies. To this end, the tool is designed to be intuitive and seamlessly integrate with existing workflows, facilitating the query of words and letters while easing the process of identifying similarities across corresponding documents.

Using Handwriting and Linguistics in the Detection of Deception: A Multimodal Approach to Statement Analysis 11:00 - 11:00

H.H. Harralson[1], *L.S. Miller*[1], *H.-L. Teulings*[2]

[1]East Tennessee State University, Department of Criminal Justice & Criminology, Johnson City, Tennessee, United States, [2]NeuroScript LLC, Tempe, Arizona, United States

Abstract Body: Linguistical techniques are used in the analysis of statements for the detection of deception. Liars experience increased cognitive load which is expressed in language through decreased complexity regarding details, shift in pronouns, increased use of negative emotion words, and other factors. Correspondingly, handwriting exhibits variance under cognitive stress which can result in changes in spatial-temporal handwriting features. Both handwriting and linguistics are language-based and both are affected by cognitive load.

In this exploratory study, 12 college students provided truthful and deceptive handwritten statements about the same event. The handwriting specimens were compared and examined by reviewers for linguistical and handwriting factors. The reviewers were instructed to determine which handwritten statement was true and which was deceptive. Both linguistic and handwriting factors were provided as support by the reviewers. The evaluation of both handwriting and linguistics offered increased support in determining which statement was deceptive than using either technique alone.

The multimodal analysis of linguistic factors and handwriting variance has the potential to increase reliability of lie detection compared to analyzing only linguistic factors. These two techniques are synergistic when handwritten evidential statements are collected because the linguistic information will be inherently present. The goal of our study is to make researchers and investigators aware of the latent information that is in handwritten statements and the importance of exact transcriptions.

Applying a Multimodal Approach in the Analysis of Historical Documents: Investigating Medieval Irish Manuscripts Using 11:00 - 11:00

Palaeography and Forensic Document Examination

P. Fraundorfer[1], *H.H. Harralson*[2]

[1]Trinity College, Department of History, Dublin, Ireland, [2]East Tennessee State University, Department of Criminal Justice & Criminology, Johnson City, Tennessee, United States

Abstract Body: The interface of palaeographic analysis and forensic document examination (FDE) techniques is beneficial in the investigation of historical documents. There is considerable fraud in historical documents, autographs, and artwork that makes the area relevant for analysis by FDEs. Historical documents are reviewed by university experts, historians, and conservators who may not have knowledge about FDE methods. Alternatively, FDEs who encounter historical documents may not have the scholarly background and experience of palaeographers in the examination of older writing styles or languages or are limited by the availability of comparative evidence. An integration of analytical methods used by palaeographers and FDEs would aid in the analysis of historical documents.

A multimodal approach to the study of Irish manuscripts from the 9th century was taken when analysing the so-called Reichenau Schoolbook (St. Paul im Lavanttal Cod. 86b1). Since it was first analysed in the 19th century, it was generally assumed that the Reichenau Schoolbook was written by one Irish itinerant monk. Through a combination of FDE techniques and traditional palaeographic analysis, traces of a second scribal hand were identified, which could be traced back to other Irish manuscripts from this period. The path of the scribe and the manuscript can now be reconstructed through a multimodal approach using manuscript analysis, palaeography, content, document examination, and codicological information. The combined use of these techniques is illustrated in this case study, which analyses a group of medieval Irish manuscripts from the 9th century written by very similar-looking scribal hands, the so-called Reichenau Group.

An AI-Powered Font Identification Tool for Questioned Documents Examination 11:00 - 11:00

S. Ng[1], *C.Y. Yang*[1], *J. Tan*[1], *C.C. Lim*[1]

[1]Home Team Science and Technology Agency, Forensics CoE, Singapore, Singapore

Abstract Body: Font identification plays an important role in forensic document examination, as illustrated by its relevance in cases like the 2016 Panama Papers investigation. However, current font identification methods in forensic practice often involve time-consuming processes and face limitations. We present an in-house AI-powered tool aimed at enhancing the process of forensic font identification. Our in-house method operates locally, ensuring the security of sensitive materials and enabling further customisation for forensic needs.

Using deep learning techniques, our preliminary model shows promising results: 70% top-1 accuracy, 84% top-3 accuracy, and 89% top-5 accuracy

in classifying 100 fonts. These figures suggest potential for improving efficiency and accuracy in forensic document authentication and forgery detection.

While further development is required, particularly in expanding and improving performance on a wider range of samples and fonts, this work provides a foundation for AI-assisted forensic font identification. By exploring the integration of AI technology with traditional forensic methods, we aim to contribute to the advancement of forensic document examination practices, potentially enhancing the capabilities of forensic document examiners.

The Effect of Printer Use on Toner Residue Distribution: Implications for Questioned Document Analysis 11:00 - 11:00

A. Sen Yilmaz[1], G. Basar[1], O. Genc Sutlu[1], A. Gelir[2], F. Asicioglu[1]

[1]Istanbul University-Cerrahpasa, Forensic Science and Legal Medicine, Istanbul, Turkey, [2]Istanbul Technical University, Physics Engineering, Istanbul, Turkey

Abstract Body: Printers can leave toner particle residues on paper outputs, depending on the printer's brand and frequency of use. Previous studies have explored the distribution of these toner residues on documents, particularly about signed before-printing documents, and showed toner particle distribution on the signed area gives the idea for printing and signing sequence. However, the amount of toner contamination and whether the distribution of particles on the front and back surfaces of the paper is consistent has not been thoroughly examined. This study aimed to determine whether the distribution of toner particles was characteristic and whether toner particle contamination levels on the back surface of a document were similar to those on the front. Blank paper samples were passed through 22 distinct printers with dissimilar uses, and toner residues were counted in 25 different parts of the paper using small circles with a 1 cm radius, on both the front and back surfaces of the paper. The number of toner particles in each circle was counted using the ImageJ program. The results showed that the distribution of particles on both surfaces was random, with a higher number of particles found on the front surface compared to the back. These findings suggest that toner particle contamination may not be uniform across both surfaces of a document and that the presence of particles is influenced by printer usage frequency. This study contributes to understanding the nature of toner distribution, which could have implications on print-based questioned documents for forensic document analysis.

11: Marks, Impressions and Biometric Traces: Speaker Recognition and Authorship Analysis
11:00 - 11:45 Auditorium

Poster Session Tuesday - Marks, Impressions and Biometric Traces: Speaker Recognition and Authorship Analysis

The Effects of Voice Disguise, Made by Raising or Lowering Fundamental Frequency, on Other Formant Frequencies 11:00 - 11:00

M. Davulcu[1]

[1]Gendarmerie Forensic Department /Türkiye, Audio And Speech Analysis Unit, Ankara, Turkey

Abstract Body: Voices, which are deliberately tried to be changed during the speech in order to hide their identities by the speakers, are increasingly being the subject of forensic investigations. Although voice disguise can be done in different ways, one of the simplest method is to change the fundamental frequency, that is, to make the sound low pitch or high pitch. In this study, in which F0, F1, F2, F3 and F4 parameters of normal and disguised recordings of 15 female and 15 male speakers were evaluated, it was aimed to find out which acoustic properties changed and which remained consistent in order to help detect disguised voices. For features affected by voice disguise, the goal is to determine whether these changes are systematic, whether the same change always occurs for a given change condition.

Corpus-based Analysis of Authorial Stance in 21 Genuine Turkish Suicide Notes 11:00 - 11:00

K. Ceyhan[1], B. Ayyıldız[2], N. Canturk[1]

[1]Ankara University Institute of Forensic Sciences, Department of Criminalistics, Ankara, Turkey, [2]Ankara University Faculty of Language, History and Geography, Department of Western Languages and Literatures, Ankara, Turkey

Abstract Body: Authorial stance is an apparatus used in the interpretation of the data and ascribing significance to feelings, statements, and declarations. The study of authorial stance, which is engraved within suicide notes with optimism and pessimism indicators, makes the observation of cognitive processes and the social structure of suicide possible and helps in the detection of forged suicide notes. The aim of this study is to observe the cognitive processes applied to Turkish suicide notes via the analysis of stance indicators present. In the study, a corpus-based analysis of stance indicators in 21 (15 written by males and 6 by females) genuine open-source Turkish suicide letters that were written between the years 2017 and 2024 was made. The frequency analysis was made using the AntConc corpus analysis toolkit. The statistical and contextual analysis employed on the corpus displayed the most frequently used Turkish content words and phrases in suicide letters. The statistical analysis of the corpus showed that suicide victims have a tendency to use stance indicators that connote “love”, “freedom of will”, “regret”, and “blame”. It was also observed in the contextual analysis that varying semantic uses of the indicators alter the stance in terms of optimism and pessimism. Consequently, the analysis of stance indicators can be enlightening in the cognitive processes involved with suicide and in differentiating forged and genuine suicide notes. Observing the language of suicide in light of these indicators can produce new solutions in understanding the concept of suicide and taking protective measures.

The Effects of Audio Conversions on Voice Similarity Scores 11:00 - 11:00

L. Tavi[1], T. Loikkanen[1]

[1]Forensic Laboratory of National Bureau of Investigation, Vantaa, Finland

Abstract Body: In forensic voice comparisons, it is crucial to assess various technical and other qualitative characteristics of investigated audio recordings. In addition to telephone recordings, case material nowadays contains audio recordings from different social media platforms, or instant message services. Audio recordings may have variable, possibly converted codecs, such as lossy AAC and OPUS. Even though speech in such recordings may be perceived as relatively high quality by human listeners, dissimilar codecs and other technical differences between the questioned audio and the reference material can have a negative effect on voice comparison algorithms, yielding to misleading results. Furthermore, audio recordings from real-life scenarios often contain undesirable background speech, which may also have unpredictable effect on the results.

In this presentation, we will demonstrate the effects of different codecs and other technical issues on voice similarity scores using state-of the-art speaker embeddings. Additionally, we discuss the effects of background speech on the scores.

12: Scenes of Crime: Forensic Archaeology and Anthropology
11:00 - 11:45 Auditorium

Poster Session Tuesday - Scenes of Crime: Forensic Archaeology and Anthropology

The Suitability of Using Pigs as Human Proxies in the Geophysical Detection of Clandestine Graves 11:00 - 11:00

V. Berezowski[1,2], I. Moffat[3], D. Seckiner[4], I. Crebert[2], J. Ellis[2], X. Mallett[2]

[1]Deakin University, School of Life and Environmental Sciences, Waurn Ponds, Australia, [2]University of Newcastle, School of Law and Justice, Newcastle, Australia, [3]Flinders University, Archaeology, Adelaide, Australia, [4]University of New South Wales, School of Biomedical Sciences, Kensington, Australia

Abstract Body: In many forensic science disciplines, pigs are often used as a proxy for human remains. This is due to their anatomical and physiological similarities, as well as being more readily available. However, previous research has found that pigs are not adequate analogues for human remains, especially when looking at decomposition rates and the post-mortem interval. Very few researchers have investigated the use of pig cadavers in place of human donors in the geophysical detection of clandestine graves, and as such, the aim of this research was to compare the geophysical responses of pig cadaver and human donor graves in order to determine if pigs can be used as adequate human proxies under Australian field conditions. To do this, two geophysical techniques, ground penetrating radar (GPR) and electrical resistivity tomography (ERT), were used to survey both single and multiple pig cadaver and human donor graves. Upon comparison of the geophysical responses, it was found that, under Australian field conditions, both GPR and ERT were successfully able to visualize the graves with no obvious differences. The similarity between

the responses could indicate that the geophysical techniques are detecting the grave-related disturbances instead of the grave contents. These encouraging results indicate that studies may be easily replicated in other soil and climate conditions, without being constrained by the highly restricted access to human donors. Ultimately, the results of this study can benefit law enforcement with homicide cases involving graves and can provide answers to the families with missing loved ones.

A Study to Investigate Search and Rescue Dogs' Ability to Detect Humans Using Teeth in a Variety of Environments 11:00 - 11:00

T. Benny[1], *D.M. Davis*[2], *R. Morris*[3]

[1]University College Dublin, School of Veterinary Medicine, Dublin 4, Ireland, [2]University College Dublin, School of Medicine, Dublin 4, Ireland, [3]Wexford K-9 Search and Rescue, Adamstown, Enniscorthy, Wexford, Ireland

Abstract Body: Canine olfaction is a remarkable sensory system that has been applied in various domains including search and rescue (SAR) operations [1]. This study aimed to evaluate the performance of two SAR dogs in locating human teeth in different environments with the aid of 3 distinct experimental designs.

For the main experiment, we used a stainless-steel probe bar marked with intervals of 3 cm, 6 cm, and 9 cm to dig varying depths. A vial containing a tooth was placed inside the holes, and nine trials were conducted for each dog across the three depths and materials: soil, grass, and sand. Dog-handler pairs searched designated areas and dogs were rewarded upon successful detection. The search process was video recorded for subsequent analysis and measurement of detection efficacy.

The study findings confirm that human teeth are a viable scent source for SAR dogs. Mean detection times indicated that greater depths generally led to increased detection times, a finding consistent with previous canine olfactory research [2]. Certain anomalies, particularly in grass trials, may warrant further investigation.

This study contributed to the growing body of literature on canine olfactory detection, providing valuable insights into the effects of depth and material on detection time. The findings have practical implications for refining training and deployment strategies.

Further research may involve a larger sample size, various dog breeds, different odorous substances, controls, and broader environmental conditions which may yield a more comprehensive understanding of the multifaceted nature of canine olfaction.

05: Drugs: Analytical Challenges
11:00 - 11:45 Auditorium

Poster Session Tuesday - Drugs: Analytical Challenges

Rapid Immunoassay Test Strips for Synthetic Cannabinoids 11:00 - 11:00

Á. Maclennan[1], *K. Ceniccola-Campos*[1]

[1]University of Strathclyde, Chemistry, Glasgow, United Kingdom

Abstract Body: Synthetic cannabinoids (SC) are a growing class of laboratory-manufactured substances chemically similar to Δ9-tetrahydrocannabinol (THC), the principal psychoactive compound found in cannabis. Despite their fast-acting ability to bind to the same CB1 and CB2 receptors, SC often elicit wildly varying and differing effects from cannabis including acute kidney damage, seizures, and psychosis. Since their widespread appearance on the drug market in the mid-2000s, SC have been and continue to be identified as a public health threat due to their unknown toxicities and potential to cause harm. Immunoassay test strips offer a simple and convenient means of detection by providing a non-invasive, rapid test with easily interpreted results. While they have been traditionally employed for human urine, the test strips used in this study have been repurposed to identify the presence of SC in street samples of plant material. Although test strips are an easily-accessed method of drug detection they often result in false positives and negatives due to drug potency and detection cut-off levels. One of the main challenges associated with presumptive testing is the rapidity at which these structures and availability change within the drug market. This proof-of-concept study aims to repurpose K2-specific immunoassay test strips to identify the presence of SC in herbal spice street samples, thereby offering a reliable testing indicator and presumptive detection method.

Non-Destructive Drug Analysis of E-Liquids 11:00 - 11:00

A. Rexander[1], *F. Nissmo*[1], *H. Albertsson*[2]

[1]Swedish Police Authority, National Forensic Centre (NFC), Drug Analysis Unit, Linköping, Sweden, [2]Swedish Police Authority, National Forensic Centre (NFC), Chemistry and Technology Unit, Linköping, Sweden

Abstract Body: Analysis of cannabinoids within E-cigarettes is commonly performed by LC-MS at NFC. The devices typically consist of a battery, a coil and the liquid. The process of removing the liquid from these devices is time consuming and requires bending and breaking the cartridges which can jeopardize personal safety in the lab. In those cases where a large number of seized E-cigarettes need to be sampled, a non-destructive method to establish the homogeneity of the population is essential for efficient case-handling.
NFC has developed an analysis strategy to examine the E-liquid with Raman spectroscopy without opening the devices. Analysis is performed through the transparent window on the cartridge using a Raman microscope. A spectrum of the liquid contents can be obtained within a few minutes. Theoretical studies and detailed analysis of the Raman shifts for the different functional groups of Δ^9-tetrahydrocannabinol (THC) has previously been described in the scientific literature. This information in combination with Raman shifts for terpenes, solvents and flavours (often present in E-liquids) make it possible to use statistical models to evaluate the homogeneity of a seizure and thereby group different types of the E-cigarettes arising within the same seizure. Results for a number of brands and models of E-cigarettes are presented in this preliminary study.

Semi-Synthetic Cannabinoids – A Quagmire of Rapidly Emerging Substances, Complicated Matrices, and Sampling Issues 11:00 - 11:00

J. Wallgren[1], *C. Strandqvist*[1], *P. Borgsjö*[1], *R. Waldebring*[1], *S. Dunne*[1]

[1]Swedish Police Authority, National Forensic Centre (NFC), Drug Analysis Unit, Linköping, Sweden

Abstract Body: In recent times a new category of substances dubbed “Semi-synthetic Cannabinoids” has emerged and is rapidly growing. This new category consists of compounds that are structurally similar to THC unlike previous synthetic cannabinoids such as JWH-018 and 5F-EDMB-PICA. The category includes cannabinoids such HHC and HHC-acetate, which can be synthesized from CBD derived from industrial hemp. Additionally, it includes analogues to THC that have alkyl side chains with different lengths such as THCH and THCP. THCH and THCP have been identified as natural compounds in cannabis, albeit only in trace amounts. This serves as an indication that the origin of THCH and THCP in seized drug material likely originates from synthesis rather than from extraction of plant material.

The rapid rate at which new semi-synthetic cannabinoids enter the market has created a situation where their impending scheduling lags behind. Furthermore, the preferred matrices of these compounds are seemingly plant material, e-liquids and edibles. This combination has resulted in the emergence of physical stores selling products containing for the time being legal cannabinoids. Additionally, the innocuous forms, colorful packaging and marketing make the products attractive, particularly to young people.

From the perspective of forensic chemists there are a plethora of problems pertaining to these products. Such as the extraction process of edibles, the sampling of e-cigarettes, the acquiring of reference materials and potential stability issues with the cannabinoids. NFC has developed a flexible strategy to be able to respond to the evolving range of products containing semi-synthetic cannabinoids.

Decoding Designer Drugs: Linking Structural Variations to Electrochemical Profiles 11:00 - 11:00

J. Mazurków[1], *K. De Wael*[1]

[1]University of Antwerp, Department of Bioscience Engineering, Antwerpen, Belgium

Abstract Body: Designer benzodiazepines (BZDs) are a significant and growing challenge in forensics due to their widespread abuse and the ability of manufacturers to evade international regulations by synthesizing structural analogues not explicitly listed as controlled substances. These analogues often retain potent pharmacological effects while remaining undetected by conventional analytical methods. Developing rapid, cost-effective, and reliable approach to identify and classify these compounds is crucial for modern forensic analysis.
This research investigates the utility of electrochemical profiling to decode structural variations among designer benzodiazepines. Voltammetric studies of diverse BZD analogues were performed across a range of pH

values, revealing distinct electrochemical behaviors influenced by the molecular structures. Chemometric techniques were employed to process the resulting electrochemical data, correlating specific structural features with observed voltammetric patterns. A custom software platform was developed to enable the classification of newly encountered BZDs based on their electrochemical fingerprints. This system not only groups unknown compounds into established BZD families but also evaluates the potential to propose structures of unknown analogues. The integration of electrochemical profiling with chemometrics offers a promising approach for tackling the challenges posed by designer drugs, providing a rapid and adaptable method to enhance forensic detection and classification.

Minor Components in Cannabinoid Preparations 11:00 - 11:00

S. Kirk[1], *R. Kennedy*[1]

[1]Forensic Science Ireland, Celbridge, Ireland

Abstract Body: On the back of the ever-updating cannabis and THC drugs laws which vary from nation to nation, the landscape of both commercial and illicit cannabis products has exploded with a variety of new preparations.
In addition to the traditional plant material and resin, products such as oils, 'vape' pens, honeycomb 'shatter', and edible products including jellies and chocolates are available. Whilst some products are made using THC extracts, others contain synthetic cannabinoids, man-made compounds that mimic the psychoactive effects of THC. Products may also contain semi-synthetic cannabinoids such as hexahydrocannabinol (HHC), which has recently shown an increase in popularity.
GCMS analysis of cannabis products can reveal traces of minor cannabinoids that tell a story as to how each item may have been produced. On the other hand, the presence of certain compounds can raise more questions than answers. In this poster, multiple case studies illustrate the increasing complexity of the world of cannabinoids, both naturally-occurring and synthetic.

- Δ^8-THC products (resin and 'distillate') were found to contain quantities of $\Delta^{4(8)}$-iso-THC. This is an intermediate compound which could indicate the synthesis via Δ^9-THC from cannabidiol.
- Tetrahydrocannabidiol (H4CBD) electronic cigarettes were found to contain traces of cannabinoid acetate compounds. While the origins of these compounds is unclear, some possible causes of acetylation of cannabinoids are investigated.

Development of a Semi-Quantitation Screening Method for Rapid Determination of Low-Level Cocaine Concentrations in Casework Using a Weighed Qualitative Sample 11:00 - 11:00

K.J. Flanagan[1], *S. Killoran*[1], *S. Hanniffy*[1], *R. Fagan*[1], *L. Speranza*[1]

[1]Forensic Science Ireland, Chemical Analysis Division, Celbridge, Ireland

Abstract Body: Cocaine is one of Irelands most abused substances, which is often presented with widely varying purity levels. This variability raises critical questions - is a sample adulterated cocaine or adulterated *with* cocaine? Low-level cocaine concentrations appear semi-regularly in casework samples, requiring operators to determine whether the trace results are reflective of the overall sample. Advancement in analytical instrumentation (in particular, increased sensitivity) has heightened the need for effective screening methods to address these challenges.
The purpose of this project is to demonstrate a rapid and reliable method to apply a semi-quantification value to low-level cocaine samples, without the need to resort to secondary techniques or quantification analysis, for which these types of samples may not be suited. This approach is designed to provide operators with increased assurance in qualitative results, ensuring a straightforward application across various case scenarios.
To carry out this method, a weighed qualitative sample that is diluted with a consistent volume of solvent and then run on a GS-MS instrument. The resulting peak area is then compared to a calibration curve that has been established through-out this project, using both HPLC quantitative data and GC-MS weighed qualitative data. The resulting figure is an accurate estimation of the cocaine content of a sample that is obtained in a time effective manner without requiring further processing.
In conclusion, this methodology equips operators with a robust tool for addressing the increasing prevalence of trace-level cocaine detections, thus facilitating confident decision-making in forensic and analytical contexts.

05: Drugs: Other
11:00 - 11:45 Auditorium

Poster Session Tuesday - Drugs: Other

Validation of the Qualitative Analysis Method for the Three Most-Common Amphetamine-Type Stimulants Using GC-MS 11:00 - 11:00

Ç.U. Kacargil[1]

[1]Gendarmerie Forensic Department, Chemical Examinations Section, Ankara, Turkey

Abstract Body: Forensic chemistry laboratories that perform drug examinations should prepare expertise reports that contain clear results free from subjectivity. Therefore, laboratories that perform forensic chemical examinations should validate their methods in line with respected validation guides, no matter how simple or general the analysis they perform is. Today, it is among the duties of laboratories to ensure that the analyses are carried out under the determined standards and to show that the same results can be produced under the same conditions. Moreover, within the possibilities and needs, these validation studies should be certified by independent accreditation institutions to record the reliability of the method used and the results achieved.
Our laboratory has been successfully carrying out the detection and analysis of amphetamine-type stimulants for years. In the examination requests submitted to our laboratory, mostly Amphetamine, Methamphetamine, and MDMA have been encountered.

The aim of our study is to validate our method based on the national and international guidelines published in this field, in order to provide objective evidence and to prove that the GC-MS method, which is currently being applied in our laboratory, is suitable for the purpose and shows the required performance. Eventually, it is aimed that this method be supervised and accredited by authorized institutions.
With this study, the qualitative analysis method of three amphetamine-type stimulants that we composed for GC-MS, was validated, and obtained results showed that our method is fit for purpose, sensitive, reliable, selective, and robust. Thus, the preliminary preparation for accreditation studies has been completed.

Quantitation of Delta-9-Tetrahydrocannabinol With a Gas Chromatograph Equipped With Flame Ionization Detection (GC-FID) Using Hydrogen as Carrier Gas 11:00 - 11:00

K. Andersson[1]

[1]Swedish Police Authoity, National Forensic Center (NFC), Drug Analysis Unit, Linköping, Sweden

Abstract Body: At the NFC in Linkoping, Sweden samples in over 50 000 drug cases have been analyzed during 2024. The most commonly identified illicit compound was delta 9-tetrahydrocannabinol (THC), the active substance in marijuana and cannabis resin. Quite often the judicial system is interested in the concentration of THC in the confiscated plant material. At present, the concentration of THC is measured with a gas chromatograph equipped with a flame ionization detector (GC-FID). During 2024, approximately 200 cases containing delta-9-tetrahydrocannabinol were quantified with the GC-FID system using helium as carrier gas with a total run time of five minutes per analysis. Recently a new gas chromatograph (Trace 1600 from Thermo Scientific) was purchased, together with a hydrogen generator. The idea was to replace helium with hydrogen as carrier gas, since the price of helium has increased rapidly over recent years. Values of the relative standard deviations (RSD %) for THC concentration and THC retention time both within and between days (repeatability and intermediate precision) will be presented in this poster for the hydrogen carrier gas system, as well as the detection and the reporting limits for the new method. In addition, comparison of reported THC concentrations when analyzing 30 case work samples with the old and new GC-FID methods will also be given.

Drug Sniffer – Characterization of the Smell of Drugs 11:00 - 11:00

C. Martin[1,2], *C. Diederich*[2], *F. Verheggen*[1]

[1]Uliege, Gembloux, Belgium, [2]Unamur, Namur, Belgium

Abstract Body: Ecstasy, cocaine, marijuana ... the diversity of available drugs is impressive. Each specific synthetic drug can be prepared following various procedures and involving a multitude of additives, resulting in an even more diverse final chemical composition. As a consequence, the smell associated to each of these illicit products is very likely to vary, making their identification by drug detection dogs difficult. In addition, new illicit

substances are discovered every year.
In this research, we characterized and compared the volatilomes of different natural and synthetic drugs provided by the Belgian federal police. Volatiles released in the headspace of these products were sampled on thermo desorption tubes (Tenax TA/carbograph) under a dynamic air flow. Tubes were then analysed on a gas chromatograph coupled with a mass spectrometer. Differences of volatilome were highlighted through a predictive analysis (PLSDA).
We found the smell of natural drugs (i.e. marijuana) to strongly differ from synthetic drugs. Purity and synthesis method of the drug were strongly impacting a drug's volatile profile. However, we were able to identify molecules that are common among different drug families.
These results should ease the training and enhance the performance of drug detection dogs. We discuss their potential for the development of analytical methods (e.g. electronic nose) that would target specific drug volatile compounds for an improved detection technique.

TBA 11:00 - 11:00

Investigating Both the Visual Appearance and Ability to Analytically Detect Compounds Following Simulated "Spiking" of Different Beverages With a Range of Drugs 11:00 - 11:00

L. Moynihan[1], S. Killoran[1], B. Gibson[1], K. Murtagh[1]

[1]Forensic Science Ireland, Celbridge, Co. Kildare, Ireland

Abstract Body: Drink spiking involving the covert administration of a drug or alcohol into an individual's drink without their knowledge or permission is reportedly a widespread issue and the subject of much media attention. The purpose of spiking may be to incapacitate a person for the purpose of sexual assault, assault, robbery or other criminal activity.
The Drugs and Toxicology Sections at Forensic Science Ireland collaborated to identify a panel of drugs (including alcohol) typically associated with drug facilitated sexual assault, chem-sex, club drugs and commonly encountered prescription drugs.
Each drug (sourced in its typical presentation of either liquid, powder or tablet) was added to a selection of beverages of different known alcohol concentrations, alcohol type, colour/opacity and effervescence.
Following addition of the "spiking" compound, the beverages were photographed and the liquid was analysed for both alcohol ABV% (HS-GC-FID) and drug presence (GC-MS).
This poster will display examples of the visual presentation of different beverages that have been spiked with a range of compounds, along with the analytical results obtained for both alcohol and drug content.

06: Education and Training: Other
11:00 - 11:45 Auditorium

Poster Session Tuesday - Education and Training: Other

Using Memes for Reflection and Expression of Emotion in the Forensic Sciences 11:00 - 11:00

H. Tidy[1], C. Mullen[2], F. Carlysle-Davies[3], R. Croxton[4], R. Bolton-King[5], L. Nichols-Drew[6], K. Moran[7], P. Monachello[8], G. Williams[9]

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Abstract Body: Meme-making provides an excellent vehicle for reflection and expression of emotion within the forensic sciences. This presentation focuses on two aspects where memes as a classroom activity have been instrumental as a learning and teaching aide. The first being where meme-making was used as a vehicle to allow students to reflect on, and absorb, lecture information. Participants were asked to create a meme which summarised what they had learnt during the session, this allowed students to express their creativity alongside reflecting on the taught session. This process ultimately led to better retention of fact as well as a more inclusive and varied learning environment.

The second example focuses on the use of memes as an expression of emotion allowing students to express how they feel about their courtroom assessment, an essential part of any forensic science undergraduate degree programme. This assessment is known to be one that students find difficult with heightened anxiety and other emotions at play. This research allowed students to express how they felt about this assessment in a visual nature allowing educators an insight into what causes the student anxiety as well as other emotions associated with the assessment.

In both these examples, memes were also shared across the student group which further allowed peer bonding and enhancement of the learning environment. This presentation will allow participants an opportunity to make and share their own meme to see the technique in action.

Smart Photogrammetry Effectiveness in Forensic Science for Small, Medium, Big Items, and Crime Scene: From Educational Environment to Professional Applications 11:00 - 11:00

A. Melinato[1], C. Casha[2], F.S. Auricino[1], D. Debattista[2]

[1]European Forensic Institute, Applied Sciences, San Gwann, Malta, [2]Malta Police Forensic Science Laboratory, Floriana, Malta

Abstract Body: The Covid-19 pandemic has boosted an evolution in the educational methods, especially in the higher education sector, becoming an opportunity to enhance technological and methodological advancements. The distance learning education has been growing over time, but the need to open also to practical teaching was overlooked. The pandemic has greatly restricted access to laboratories and classrooms for practical activities. At the same time, it was necessary to provide students with this important part of their learning experience. As a result, new digital teaching platforms and immersive technologies have been rapidly

integrated in the educational environment, and been developed for the educational setting. Virtual reality currently serves as a crucial immersive technology to train students and professionals to effectively operate in different scenarios such as crime scenes. Usually, the virtual environment is generated through a scanning process based on sophisticated photographic or laser scanners. Can a student or a professional easily create their own 3D models of evidence and/or environments to visit virtually after the practical session?

A Study to Investigate Search and Rescue Dogs' Ability to Detect Human Teeth in Various Environmental Settings to Establish Odour Travel 11:00 - 11:00

E. Dillon[1], M. Davis[2], R. Morris[3]

[1]University College Dublin, School of Medicine, Dublin, Ireland, [2]University College Dublin, School of Diagnostic Imaging, School of Medicine and Medical Science, Dublin, Ireland, [3]Wexford K-9 Search and Rescue, Wexford, Ireland

Abstract Body: It has been well documented that search and rescue(SAR) dogs play a valuable role in locating missing persons . They are well adapted to this role owing to their ability to detect a variety of human scents. The purpose of this study was to explore SAR dogs' ability to detect human teeth in different environmental conditions.
This study took place over several weeks during which time Dog A and B ; five-year old male and two-year old female springer spaniel detected samples with human teeth scent. The samples used were a mix of 4cm pieces of A4 paper which had been left in a glass jar with an avulsed child's tooth for up to three days and full tooth samples. The samples were handled with gloves and placed in different locations, including grass fields and woodland. Weather conditions, including wind speed and air temperature, were measured and the dogs' behaviour was observed during scent detection.
It was observed that both dogs had the ability to detect the human teeth scent in various environmental conditions. Wind speed appeared to have the greatest influence on their detection ability. Longer grass appeared to decrease the length of odour travel while a rapid increase in wind speed increased the distance of odour travel.
The observations made in this study have importance for the future work of SAR dogs. This study indicates that odour travel changes in different environmental settings however further research is required to understand the full effect of these environmental conditions.

Immersive engagement with Forensic Science: The Great Gallery Heist Workshop 11:00 - 11:00

J. Loftus[1], A. Clarkin[2], W. Byrne[2], E. Liddy[2], C. May[1], R. Dunwoody[1], S. Soper Ní Chafraidh[1], S. Fleming[1], A. Izquierdo[1], A. Browne[1], K. Connick[1]

[1]Forensic Science Ireland, Celbridge, Ireland, [2]AG2, Bray, Ireland

Abstract Body: Forensic Science Ireland, in partnership with AG2, have

developed an innovative education and outreach programme for all ages and abilities aimed at sparking interest in forensic science. The Great Gallery Heist Workshop is an immersive and educational experience that puts participants in the role of forensic investigators solving a high-stakes art theft.
The workshop is module-based, allowing interactive learning in evidence types such as fingerprints, chemical unknowns, fibres, footwear, questioned documents and DNA. Using forensic techniques tailored for age-appropriate and accessible engagement, the workshop fosters critical thinking, teamwork, and problem-solving skills.
The project also includes custom case files, worksheets and certificates of completion for each participant, along with a unique custom-designed "art gallery" display scene that is easy to transport and assemble, creating an immersive environment for the workshop.
Through this initiative, we aim to not only educate but inspire the next generation of forensic scientists, bridging the gap between forensic science and the public.
Preliminary results from pilot sessions have provided positive feedback with opportunities for adaptions and improvements to the workshop. This presentation will share insights into the workshop's design, future developments of the project and a working demonstration of The Great Gallery Heist.

07: Forensic Management and Quality Systems: Management of Organisational Change
11:00 - 11:45 Auditorium

Poster Session Tuesday - Forensic Management and Quality Systems: Management of Organisational Change

The Indian Criminal Justice System and the Need for a DNA Database: A Public Survey of Indian Attitudes Towards the Effectiveness of Forensic DNA Databases 11:00 - 11:00

K. Gupta[1], C. Behera[2], K. Aggarwal[1]

[1]All India Institute of Medical Sciences, Forensic Medicine and Toxicology, New Delhi, India, [2]All India Institute of Medical Sciences, New Delhi, Forensic Medicine and Toxicology, New Delhi, India

Abstract Body: The integration of forensic DNA databases into India's criminal justice system has the potential to revolutionize crime investigation, victim identification, and justice delivery. However, concerns about privacy, ethical challenges, and public perception have delayed their implementation. This study examines public attitudes toward forensic DNA databases in India, focusing on their perceived utility, ethical implications, and related concerns. The findings are analyzed in the context of the Criminal Procedure (Identification) Act, 2022, which authorizes the collection and storage of biometric and biological data, including DNA, for criminal investigations.
The study reveals widespread recognition of the benefits of DNA databases in enhancing investigative efficiency, solving crimes, and reducing judicial delays. Despite this, significant apprehensions remain regarding data privacy, the potential misuse of genetic information, and the risk of discrimination in India’s diverse socio-cultural context. Concerns about the indefinite storage of DNA data and inadequate safeguards to prevent abuse

were frequently raised. Additionally, gaps in public understanding of DNA technology and its applications highlight the need for awareness and education initiatives.
This research underscores the urgent need for a robust regulatory framework that prioritizes privacy protections, restricts data use to specific cases, and incorporates effective oversight mechanisms. Public trust can be built through transparent policies and education campaigns that dispel misconceptions about DNA technology. Aligning legislative measures like the Criminal Procedure (Identification) Act, 2022, with international best practices and public expectations will be essential for the ethical and effective integration of DNA databases into India’s justice system.

07: Forensic Management and Quality Systems: Other
11:00 - 11:45 Auditorium

Poster Session Tuesday - Forensic Management and Quality Systems: Other

Collaboration at the European Level: Enhancing a Forensic Advisory Network 11:00 - 11:00

Y. van Duin[1], *I. O'Sullivan*[1]

[1]Netherlands Forensic Institute, Executive Services, The Hague, Netherlands

Abstract Body: In the dynamic and rapidly evolving landscape of forensic science, effective collaboration is crucial for advancing forensic advisory practices and improving the overall forensic chain. This poster presents our initiatives focused on establishing a network among forensic advisors and laboratories across Europe. By fostering strategic partnerships, we aim to enhance knowledge sharing and broaden professional networks, ultimately contributing to the effectiveness and reliability of forensic services.

We explore collaboration opportunities within the framework of the European Network of Forensic Science Institutes (ENFSI), emphasizing the importance of shared expertise and experience in addressing complex forensic challenges. Our goal is to create a supportive environment where forensic advisors can easily connect to, and exchange knowledge and ideas to help improve the whole forensic process. This poster presents our initiative to establish a robust network of forensic advisors across Europe, even though forensic advice is organized differently by country. The search for connection is most important.

Our poster presentation highlights the importance of building this European network, whether or not through ENFSI, showcasing how it can strengthen the advisory capacity within forensic science and improve overall outcomes in the forensic chain. We invite colleagues to engage with us in this initiative and help shape a collaborative future for forensic advisory practices in Europe.

Meeting the Demand for Rapid Results 11:00 - 11:00

Å. Jufvas[1], *L. Jaeger*[1], *H. Lyth*[1]

[1]National Forensic Centre, Linköping, Sweden

Abstract Body: A brutal serial rapist or an escalating gang related conflict with ruthless retaliations – these are just two examples of when rapid answers from the laboratory can be crucial for life or death.
In the normal flow of casework backlogs are inevitable. To be able to respond to the increased demand for rapid results in Sweden the National Forensic Centre have developed an “emergency process” together with the National Operations Department. This process is divided into two lanes; the acute cases (results within a few hours) and the prioritized cases (results within 3-4 days).
Only a few different types of analyses on a very limited number of materials are allowed in the emergency process. Recommended analyses have a high success rate, since the focus is to be able to *deliver a name* to the investigation, rather than the most solid evidence in court. The most commonly requested analyses in the acute and prioritized cases are DNA, fingerprints, face recognition and gun-traces.
There are a number of criteria that have to be fulfilled in order to get the case approved for the emergency process. For example, no idea about who the perpetrator is and an ongoing risk for death or serious injury.
In 2024 we handled 35 acute and more than 300 prioritized analyses. Feedback from investigators is that several of the rapid results from the laboratory have directly saved the lives of potential victims.

Occupational Risks in Forensic Practice: Protecting Forensic Professionals 11:00 - 11:00

I. Gouveia Abundância[1], *A. Pinela*[2], *M.J. Soares*[1], *O. Saychuk*[1]

[1]Southern Branch of the National Institute of Legal Medicine and Forensic Sciences, Forensic Clinical and Pathology Department, Lisbon, Portugal, [2] Amadora/Sintra Local Health Unit, Occupational Health Department, Amadora, Portugal

Abstract Body: **Introduction**
Forensic professionals (FP) are faced with unique and complex occupational risks, with an impact on their physical and mental health. As a specialized group, due to the peculiar nature of their activity, these professionals should have guaranteed health promotion and surveillance, depending on their work exposure. The authors aim to highlight the main existing occupational risks and provide recommendations to ensure FP occupacional health and safety.

Methodology
Bibliographical research of scientific publications and guidelines from international regulatory organizations.

Discussion
FP are particularly vulnerable to a range of biological, chemical, physical and psychological risks, such as: exposure to pathogens; contact with toxic chemicals; physical overload resulting from the handling of material and corpses; and psychosocial risks associated with the pressure and stress resulting from continuous exposure to traumatic scenarios and violent death. The inadequate use of personal protective equipment (PPE) and the lack of training of professionals regarding prevention measures are aspects that contribute to the worsening of the vulnerability of these workers.

Conclusion
Due to the specificity of forensic practice, it is important for FP to be aware of all occupational challenges faced in their workplace. It is crucial that preventive and monitoring measures adapted to this group are implemented, with a special focus on the adequate supply of PPE, robust biosafety training and psychological support. It is essencial to assess and mitigate the risks to which FP are exposed, through the development and implementation of specialized protocols, which are fundamental to ensuring a safe and healthy working environment.

Be-ForIntel: Building the foundations of a Forensic Intelligence tool in Belgium 11:00 - 11:00

B. Renard[1], C. Stappers[1], M. Mauquoy[1], F. Gason[1], D. Harvey[2], K. Kumar[2], C. Vandeviver[2], T. Vander Beken[2], O. Ribaux[3]

[1]National Institute of Criminalistics and Criminology (INCC), Brussels, Belgium, [2]Ghent University, IRCP, Ghent, Belgium, [3]Université de Lausanne, Faculty of Law, Criminal Justice and Public Administration, Lausanne, Switzerland

Abstract Body: The use of forensic data is well-established in Belgian criminal investigations, aiding in solving and preventing crimes. Traditionally, this data is used as evidence in court on a case-by-case basis. However, forensic intelligence offers the potential for broader application. The Be-ForIntel project aims to explore how forensic intelligence can be implemented in Belgium, focusing on three main objectives. First, it seeks to map the organizations and institutions that generate forensic data in Belgium. This involves identifying the fundamental conditions (rules, laws, techniques, etc.) necessary for implementing a forensic intelligence tool. By doing so, all forensic data in Belgium can be cataloged to understand how it can be managed within a forensic intelligence system. This practical, bottom-up approach aims to identify opportunities and challenges in developing such a tool.
The second objective is to assess the feasibility and added value of a forensic intelligence approach in Belgium. This involves combining police-recorded crime data with forensic data to evaluate the benefits through network and statistical analyses. A legal study and semi-structured interviews will be conducted to support this feasibility assessment.
Finally, the third objective is to translate the findings from the first two objectives into clear guidelines for practitioners, including magistrates, police officers, forensic experts, and legislators. These guidelines will provide a roadmap for the practical implementation of forensic intelligence projects in Belgium.

Behind the Scenes: A History of Case Intake Services in Ireland and the Transition to Digitalization 11:00 - 11:00

E. Heneghan[1], C. Jones[1], J. Doyle[1], M. Lee-Gorman[1]

[1]Forensic Science Ireland, Celbridge, Co. Kildare, Ireland

Abstract Body: This poster provides an overview of the establishment and

evolution of forensic services in Ireland, starting with the creation of Forensic Science Ireland (FSI) in 1975. It outlines key milestones in case intake protocols that have shaped the efficiency of FSI's operations. Initially, cases were recorded manually in logbooks, a method that, while essential, was time-consuming and prone to errors, disrupting laboratory workflows.
A significant advancement occurred between 2008 and 2015 with the introduction of a basic case management system hosted on Lotus Notes, which enhanced evidence tracking. The further integration of the LabVantage Laboratory Information Management System (LIMS) and barcoding technology further streamlined evidence handling, improving both accuracy and efficiency.
The poster also highlights a key development in case intake: the implementation of an appointment system for An Garda Síochána to deliver cases. This system allowed staff to better organize workflows, prioritize urgent cases, and ensure a more streamlined intake process.
By analysing archival records dating back over 50 years to 1975 and internal policy documents, this overview traces the adoption of technological innovations and procedural reforms at FSI. It underscores how these advancements have helped the lab meet the growing demands for accuracy, reliability, and efficiency in forensic casework, from evidence submission and storage to preservation.
In conclusion, this poster contributes to a deeper understanding of the vital service provided by CIS and the continual changes endorsed by staff to ensure best practice within Forensic Science Ireland.

Science Supporting Justice: The Role of Case Intake Services in Forensic Science Ireland – The trends, patterns and life cycle of exhibits through the laboratory. 11:00 - 11:00

G. O'Daly[1], *E. Devitt*[1], *L. McDonnell*[1], *T. Linnie*[1]

[1]Forensic Science Ireland, Backweston, Ireland

Abstract Body: Case Intake Services are the team with responsibility for taking in all exhibits into Forensic Science Ireland. The team plays a central role acting as the crossing point between the stakeholders, customers and clients of FSI and the analysts and scientists within the laboratory.

CIS are the first team engaging with exhibits coming in for analysis and it is part of their role to ensure all exhibits submitted are done so in adherence to FSI's intake policies and operating procedures. They check the appropriate packaging is used, all exhibits are safe to be handled by FSI Staff and that they are stored in a Secure Location.

CIS have continuous interactions with all exhibits that come into the lab from submission, storage, internal transfer, packaging and return. This is recorded using the labs Laboratory Information Management System. This allows FSI staff to provide Chain of Continuity statements for the courts. It is therefore possible to establish the trends and patterns of exhibit intake and movement.

The poster will serve to inform EAFS delegates who CIS are and what they do, highlighting the role this administrative team play towards FSI'S mission of Science Supporting Justice. It will depict the life cycle of exhibits

as they move through the laboratory from the time of submission to the point of return. Finally it will illustrate the volume and type of exhibits by discipline handled by CIS, including Drugs, DNA, Fingerprints, Chemistry and Physical Analysis over the course of the last few years.

07: Forensic Management and Quality Systems: Quality Systems and Accreditation
11:00 - 11:45 Auditorium

Poster Session Tuesday - Forensic Management and Quality Systems: Quality Systems and Accreditation

International Survey on Verification Practices in Forensic Firearm and Toolmark Examination: Assessing Current Methods and Expert Perspectives 11:00 - 11:00

A. Almazrouei[1], C. Roux[1], S. Chadwick[1], M. de la Hunty[1]

[1]University of Technology Sydney, Centre for Forensic Science, Sydney, Australia

Abstract Body: *Objective:* Verification in firearm and toolmark examination is a critical quality assurance measure designed to confirm the accuracy of initial examinations. However, limited empirical data exists regarding current verification practices across laboratories. This study investigated current verification practices aiming to establish baseline data and identify opportunities for procedural standardization.

Method: An international survey of verification practices in forensic firearm and toolmark examination laboratories was distributed and analysed. A total of 86 complete responses were collected from 109 initiated surveys. Participants included forensic firearm/toolmark examiners (64.8%) and laboratory managers/supervisors (26.1%) from diverse geographical locations, primarily Europe (43.0%) and North America (34.9%).

Results: The majority of laboratories (96.5%) implement different methods of casework review procedures, with 68.7% implementing verification as a complete re-examination of comparisons. Open verification (53.8%) was more common than partially blind (41.3%) or blind verification (25.0%). Most laboratories (91.0%) maintain comprehensive documentation of verification procedures. Disagreements between examiners were rare, with 78.8% reporting disagreements in less than 25% of cases. Resolution primarily occurred through consensus building (77.5%) and re-examination (58.8%). Practitioners strongly supported verification's effectiveness in error detection (median=1, average=4.51) and bias minimization (median=1, average=4.41), while acknowledging practical challenges in implementing blind verification.

Conclusion: The findings indicate widespread implementation of verification procedures with varying approaches across laboratories. While practitioners strongly support verification's role in quality assurance, practical constraints influence the adoption of blind verification. These results suggest the need for standardized protocols that balance rigorous quality assurance with operational feasibility.

Assignment Types at the Swedish National Forensic Centre 11:00 - 11:00

J. Malmborg[1], K. Andersson-Bahlmann[1], A. Nordgaard[1]

[1]Swedish National Forensic Centre (NFC), Linköping, Sweden

Abstract Body: Effective communication of forensic evidence requires fact-finders to comprehend the significance of forensic evidence within its context. Harmonized forensic reporting across various forensic disciplines is desirable to maintain clarity and consistency. Nonetheless, forensic tasks vary widely, and not all can conform to a single framework for evaluation and reporting.
When a harmonized scale of conclusions was adopted by the National Forensic Centre (NFC) in 2004 most forensic disciplines were encouraged to align their reporting accordingly. Over time, this model has evolved, leading to five broad categories of forensic assignments. The reporting templates of our laboratory are now instead harmonised within each assignment type, enhancing the interpretability of forensic conclusions across diverse cases, while still making it possible to select a relevant assignment type for the question at hand.
This poster will detail the five assignment types: (1) *Descriptive/Preparative*, providing a purely descriptive account of findings, or prepare for subsequent evaluation of findings by someone else; (2) *Source Level Interpretation*, offering evaluative conclusions regarding source attribution; (3) *Activity Level Interpretation*, assessing likelihoods of human actions that may have caused a trace; (4) *Classification*, using criteria or evaluative judgment to assign an item to a category; and (5) *Investigative*, addressing broad questions about what happened at a crime scene.

A flowchart on the poster will illustrate the selection process for assignment types based on the forensic question, along with the reporting formats used at our laboratory.

Close to the Source: A Practical and Standardised Approach to Successful Validation for Fingermark Development Techniques 11:00 - 11:00

S. Doherty[1], *N. Ó Claonadh*[1], *E. Walsh*[1], *B. Gaynor*[1]

[1]Forensic Science Ireland, Dublin, Ireland

Abstract Body: Since 2019, the Fingermark Visualisation Laboratory (FVL) at Forensic Science Ireland has successfully validated, and accredited eight distinct Fingermark development and visualisation methodologies, ranging from: wet chemical development techniques, multiple step metal deposition procedures, and visualisation using novel light sources. A standardised approach was utilised to ensure the methods reflected the broad range of surface types encountered in casework to ensure a fit for purpose method. Thirteen key criteria are required to be met within these validation plans in line with accredited quality policy of Forensic Science Ireland. Here we outline the standardised methodology used in the FVL that, to date, has led to the successful accreditation of eight novel methods with zero negative findings at audit.

Enhancing Competency Management in the Fingerprint Visualisation Lab 11:00 - 11:00

E.J. Walsh[1], *S. Doherty*[1], *B. Gaynor*[1]

[1]Forensic Science Ireland, Fingerprint Section, Celbridge, Ireland

Abstract Body: The fingerprints team of Forensic Science Ireland is one of the few worldwide, where staff will carry out and maintain competencies across fingermark visualisation, development, enhancement and comparison. Staff routinely rotate between these duties and as a result, maintaining competencies across the 17 accredited techniques used for development and enhancement can be challenging.
Previously, test cases were created on an ad hoc basis by individual staff to regain or maintain proficiency in infrequently used processes. However, this method lacked traceability, quality assurance and uniformity.
The newly developed procedure addresses these issues by introducing a pre-prepared range of labelled test exhibits. When these test exhibits are used, the results are recorded digitally, creating a fully traceable and reliable record of competency assessments. Here we highlight a relatively simple change in procedure which results in more robust and reliable quality assurance.

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11:00 - 11:45 Liffey Meeting Room 2

MORNING COFFEE BREAK AND POSTER SESSION 1

04: DNA and Body Fluids: Body Fluid Identification
11:45 - 12:45 Auditorium

DNA and Body Fluids: Body Fluid Identification

Identification of Body Fluid Sources Based on Microbiome Antibiotic Resistance Genes Using High-throughput qPCR 11:45 - 12:00

J. Yan[1,2], *D. Yu*[1,3], *J. Zhang*[1,3]

[1]School of Forensic Medicine, Shanxi Medical University, Taiyuan, China, [2] MOE Key Laboratory of Coal Environmental Pathogenicity and Prevention, Jinzhong, China, [3]Shanxi Key Laboratory of Forensic Medicine, Jinzhong, China

Abstract Body: Identifying the origin of body fluids is a critical in forensic investigation. Recently, microbiome was considered as a potential tool for body fluid identification. However, high-throughput sequencing data is challenging to analyze and complicated. Studies have found that antibiotic resistance genes (ARGs) of microbiome varied in the human body part. To date, no studies inferred the sources of body fluids based on ARGs. Therefore, we attempted to use ARGs as a tool to identify body fluids. We assessed the diversity of 65 ARGs in blood, semen, saliva, vaginal secretions (VS), nasal secretions (NS), and fecal samples using high-throughput qPCR. The results showed that ARGs were more diverse in fecal samples, which was significantly higher than other sample types. PCoA showed that the samples clustered according to their type. We constructed a random forest classification model based on these 65 ARGs with a

prediction accuracy of 92.68%. Subsequently, we constructed prediction models for the top 40, 20, and 10 ARGs after sorting genes with the highest important features. The prediction accuracies were 90.24%, 87.80%, and 85.36%, respectively. Notably, when only the top 10 important characterized ARGs were used to construct models for saliva, semen and VS samples, the prediction accuracy reached 100.00%. Our results suggest that ARGs are promising markers for forensic body fluid identification.

Progress Towards the Application of Flow Cytometry-Based Methodologies for the Identification and Isolation of Epithelial Cells in the Context of Forensic Science 12:00 - 12:15

I. Somers[1], *G. Best*[2], *D. Taylor*[3], *R. A.H. van Oorschot*[4,5], *M. Goray*[1]

[1]Flinders University, College of Science and Engineering, Adelaide, Australia, [2]Flinders Health and Medical Research Institute, Flinders University Flow Cytometry Facility, Adelaide, Australia, [3]Forensic Science South Australia, Adelaide, Australia, [4]Victoria Police Forensic Services Department, Office of the Chief Forensic Scientist, Melbourne, Australia, [5]La Trobe University, School of Agriculture, Biomedicine and Environment, Melbourne, Australia

Abstract Body: The ability to link a DNA profile to a source of biological material has significant implications in forensic investigations and judicial considerations, as it can provide important information about the alleged crime. For example, in an alleged sexual assault, the identification of a specific cell type (e.g. cells from the vagina, the penis, saliva or other skin areas) may provide support for either the prosecution or the defence. Epithelial cells represent a large proportion of the samples processed from crime scenes. However, there remains an unmet need for confirmatory tests to accurately distinguish and isolate epithelial cells from different anatomical regions. Flow cytometry represents a potentially reliable and accessible method to discriminate between epithelial cell types. Biological and instrument specific factors suspected to influence cell morphology were investigated in order to optimise our cell identification methods. Here we report on our progress towards an optimised and standardised approach to cell identification using imaging flow cytometry (IFC) for future casework implementation.

The use of Attenuated Total Reflectance - Fourier Transform Infrared (ATR-FTIR) Spectroscopy in Identifying Trace Amounts of Body Fluids on Varying Surfaces 12:15 - 12:30

H. Mullings-Williams[1,2], *S. Mahung*[3], *B. Dixon*[3]

[1]Institute of Forensic Science and Legal Medicine, Biology, Kingston 6, Jamaica, [2]University of the West Indies, Basic Medical Sciences, Kingston 7ja, Jamaica, [3]University of the West Indies, Basic Medical Sciences, Kingston 7, Jamaica

Abstract Body: Forensic Biology is a branch of forensics encompassing both serological and DNA analyses. These analyses require biological samples that can be defined as any physical material obtained from any living or deceased subject, including but not limited to blood, saliva, urine,

semen. The amount and quality of biological material found at crime scenes may be limited. Attenuated Total Reflectance-Fourier Transform Infrared (ATR-FTIR) Spectroscopy is a non-destructive method of analyzing and identifying compounds, including in forensic cases. This research also aims to use the nondestructive technique of ATR-FTIR to determine if varying concentrations of body fluids on varying substrates can be accurately identified. Sample of blood and saliva were collected, and serial dilutions of both were placed on coloured and white cotton, linen, and polyester fabrics and coloured and colourless plastic surfaces. The stains were analyzed using the Thermo ScientificTM Nicolet TM iS TM 10 FTIR Spectrometer. The resulting interferograms were interpreted using peak assignment. Substrate studies showed that blood and saliva can be identified, producing unique peaks and spectra, making it possible to differentiate between them. Dilution studies concluded that diluting the body fluids slightly affects the absorbance through a proportional relationship - the lower the concentration, the lower the absorbance. Subtraction of the coloured substrate from the sample containing the bodily fluid can quickly isolate the body fluid, and the presence of colourants and dyes could interfere in identifying blood and saliva on substrates.

Non-Destructive Identification of Forensically Relevant Body Fluid Stains Using a Portable Electronic Nose: A Pilot Study 12:30 - 12:45

D. Yu[1,2], N. Gao[1,2], T. Wang[1,2], L. Zhang[1,2], J. Zhang[1,2], J. Yan[1,3]

[1]School of Forensic Medicine, Shanxi Medical University, Taiyuan, China, [2] Shanxi Key Laboratory of Forensic Medicine, Jinzhong, China, [3]MOE Key Laboratory of Coal Environmental Pathogenicity and Prevention, Jinzhong, China

Abstract Body: Identifying body fluids is crucial in case investigations. Traditionally, research focused on molecular-level identification, which, while accurate, often damages samples and involves cumbersome laboratory processes. This is disadvantageous for forensic applications. Different body fluids emit distinct volatile organic compounds (VOCs). Portable electronic nose (e-nose) technology is capable of measuring VOCs using a non-destructive method in situ. Nevertheless, the potential of this technology to accurately identify the body fluids remains uncertain. This study utilized an e-nose to analyze VOCs from five body fluids (blood, saliva, semen, vaginal secretions, and menstrual blood) deposited on sterile swabs and toilet paper. The results revealed distinct odor profiles for each fluid, with linear discriminant analysis (LDA) showing significant clustering of samples. ANOSIM results indicated notable differences in VOC responses among the fluids. A random forest classification model without distinguishing substrate types achieved an overall accuracy of 77.78%. When considering substrate effects, models for each substrate showed training accuracies of 100.00%, with specific accuracies of 84.00% and 88.00% for sterile swabs and toilet paper, respectively. In addition, we compared fresh and aged samples, noting a decline in odor response values in aged samples, yet clustering remained consistent by sample type in the LDA. This research marks the first use of a portable e-nose to differentiate common forensic body fluids, offering a promising, low-cost, non-destructive, and user-friendly approach for forensic analysis.

08: Forensic Medicine and Toxicology: Forensic Medicine
11:45 - 12:45

Forensic Medicine and Toxicology: Forensic Medicine

A Physics-Based and LiDAR-Assisted Mobile Application for Non-Invasive Postmortem Interval Estimation 11:45 - 12:00

L. Wilk[1], M. Witvliet[2], C. Pellemans[3], M. Roos[4], M. Aalders[1]

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Abstract Body: The postmortem interval (PMI) plays a critical role in forensic investigations, aiding in the reconstruction of event timelines. Currently, PMI estimation relies on Henssge's nomogram, an empirical model of postmortem body cooling. However, this model has significant limitations, including reliance on standardized experimental conditions, subjective correction factors, and invasive core temperature measurements that risk contaminating other evidence. To overcome these issues, we developed a thermodynamic finite-difference algorithm that rigorously simulates postmortem body temperatures. Combined with 3D imaging and skin thermometry, this algorithm enables accurate and non-invasive PMI estimation for bodies of arbitrary shape and posture. Furthermore, thermal imaging allows for entirely non-contact PMI estimation. To address cases with unknown thermodynamic input parameters, we integrated surrogate-model-based parameter optimization, extending the method's applicability. Validation on deceased human bodies, both in laboratories and at actual crime scenes, demonstrated the lowest PMI estimation errors to date (0.18h ± 0.77h). Finally, building on this foundation, we developed a mobile application leveraging LiDAR technology integrated into modern mobile devices. This app enables investigators to rapidly capture body and scene data for PMI estimation on-site. Developed in collaboration with the Dutch National Police, the app is currently undergoing trials at real crime scenes in the Netherlands, with the aim to demonstrate its potential to revolutionize forensic practices by offering a portable, precise, and user-friendly solution for early PMI estimation.

The Potential Value of *En Bloc* Histological Processing of the Larynx in Cases of Suspected Fatal Applied Neck Pressure: The Liverpool Experience 12:00 - 12:15

C.P. Johnson[1], M. Lyall[1], J. Medcalf[1]

[1]Royal Liverpool University Hospital, Forensic Pathology Unit, Liverpool, United Kingdom

Abstract Body: The investigation of deaths involving suspected neck pressure can be problematic, particularly if the post mortem findings are

relatively limited and/or the circumstances are unclear or disputed. The identification of ante mortem fractures to the hyoid bone and laryngeal cartilages is particularly important in such circumstances. The large majority of pathologists usually limit the laryngeal examination to a careful inspection/palpation of these structures in the autopsy room, with limited or no histology being undertaken. We have now instituted en bloc histological processing of the fixed and decalcified larynx and hyoid bone, using mega block cassettes, in appropriate case work and present the findings in 17 sequential cases (11 female, 6 male, age range 15-65 years). Applied neck pressure was considered very likely in 15/17 deaths, where moderate to prominent petechial haemorrhages in the eyelids/facial skin were also present.
Examination in the autopsy room identified a total of 10 fractures to the superior thyroid horns and 1 fracture to a hyoid bone. In 9/17 individuals, detailed histology of the fully embedded specimens did not identify further trauma. However, in the other 8 cases, 27 more fractures were identified: 3 superior thyroid horn, 1 hyoid bone,15 cricoid cartilage (4 anterior arch, 9 lateral arch, 2 posterior wall/lamina), 8 thyroid lamina (4 anterior midline, 4 posterior-lateral). 2 cases showed disruption of the trachea.
The detailed histological examination of the laryngeal structures described above requires a significant amount of both laboratory technical and pathology reporting time, which would appear justified by the presented results.

Bullet Characterization Using Photon-Counting Detector CT: A Phantom Study With Intact Bullets 12:15 - 12:30

J.C.A. Hardy[1], G.A.J.C. Crombag[1,2], N.H.G.M. Peters[1], R. Hermsen[3], J.L. Willigers[1], J.M. Nobel[1,2], J.E. Wildberger[1,4], T.G. Flohr[1,5], A.A. Postma[1,6]

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Abstract Body: OBJECTIVES:
Photon-counting detector (PCD) CT is expected to substantially improve and expand CT-imaging applicability due to its intrinsic spectral capabilities, increased spatial resolution, reduced electronic noise, and improved image contrast. The current study aim is to evaluate PCD-CT efficacy in characterizing bullets based on their dimensions, shape, and material composition.
MATERIALS AND METHODS:
This is an observational phantom study examining 11 unfired, intact bullets of various common calibers, placed in ballistic gelatin. Ultra-high resolution and spectral images were acquired on a clinical PCD-CT-scanner. Optimal reconstruction parameters were used for further analyses. CT-measurements of the dimensions (length and diameter) were independently determined by 2 readers and compared to previously obtained manual caliper measurements. Bullet shape (round nose, flat nose, or spitzer bullet) was assessed using 3D-volume rendered CT-image

reconstruction. Bullet composition was examined based on dual-energy ratios (DER) which were color-coded accordingly and overlaid on high resolution CT-images.
RESULTS:
Compared to caliper measurements, mean differences (SD) in bullet diameter were +0.40 mm (0.16) and +0.38 mm (0.13) for readers 1 and 2; mean differences in length were +0.49 mm (0.19) and +0.45 mm (0.20). The observed proportion of accurately categorized 3D-VR reconstructions was 90.9% (10/11) for both readers with moderate interrater agreement (Cohens κ: 0.59, P = 0.004).
DER color-coded images showed clear distinction between jacket and core and enabled correct identification of bullets with and without jackets.
CONCLUSIONS:
These results indicate that PCD-CT is a promising tool for reliable radiological characterization of bullets.

An Examination of Skeletal Fracture Patterning in Car Occupants Involved in Fatal Motor Vehicle Incidents 12:30 - 12:45

A. Wulff[1], J.F. Dipnall[2,3], R.G.D. Fernandez[4,5], E.C. Cheshire[6], M.J.P. Biggs[6], H. de Boer[5,1], S.K. Rowbotham[5,1]

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Abstract Body: Every day, hundreds to thousands of car occupants die in motor vehicle incidents (MVI) globally. In the aftermath, forensic practitioners may be requested to interpret the skeletal injuries to assist investigators with understanding the circumstances of the MVI. However, limited literature on skeletal fracture patterns and associated injury mechanisms in deceased car occupants is currently available to assist with these interpretations. Consequently, this study evaluated whole-body fracture patterns and the influence of intrinsic and extrinsic variables in 200 adult car occupants who died after a MVI between 2012 and 2020. Cases were collected from the Victorian Institute of Forensic Medicine, Australia, and the East Midlands Forensic Pathology Unit, United Kingdom. The variable data was extracted from medico-legal reports and the skeletal blunt force trauma (BFT) was examined from full-body post-mortem computed tomography scans. Descriptive statistics and multivariable modified Poisson regression were used to analyse fracture patterns and the effect of intrinsic and extrinsic variables. Most car occupants (99%) exhibited fractures, with 96% exhibiting multi-region skeletal BFT. The thorax (92%) and skull (72%) comprised the most frequently fractured and fragmented regions. The variables age, sex, seating position, impact type and impact object were correlated ($p \leq 0.05$) with an increase or decrease in fracture risk to one or more skeletal regions such as the skull, cervical

and lumbar vertebrae, thorax, pelvic girdle and limbs. This study enhances existing knowledge on the complexity and nature of fracture patterns in car occupants involved in fatal MVIs, and the mechanisms that contribute to them.

05: Drugs: Analytical Challenges
11:45 - 12:45 Liffey Hall 2

Drugs: Analytical Challenges

Ambient Ionisation Mass Spectrometry for In-Situ Analysis of Synthetic Opioids in Latent Fingerprints 11:45 - 12:00

K. Cranfield[1], *J. Reynolds*[1], *P. Kelly*[1]

[1]Loughborough University, Department of Chemistry, Loughborough, United Kingdom

Abstract Body: Ambient Ionisation Mass spectrometry (MS) has allowed for additional chemical information to be retrieved from fingerprints and there is increasing research into implementing minimally destructive *in-situ* analysis using non-MS expert personnel. This research project aims to use two ambient ionisation techniques: atmospheric pressure solids analysis probe (ASAP) and sheath flow probe electrospray ionisation (sfPESI) for the detection of illegal substances in latent fingerprints.
Optimisation of instrument and method parameters was performed using fentanyl due to its favourable ionisation properties. Studies to enhance the fentanyl response were conducted, followed by quantitative analysis of fentanyl calibration solutions (0.5ppm to 100ppm). Results initially showed poor reproducibility, but introduction of an internal standard (fentanyl-D_5) brought the %RSD to <10% for all calibration standards.
A method for depositing good quality latent fingerprints free of exogenous contamination was developed, and spiked fingerprints produced by applying 2uL of 10ppm fentanyl in methanol onto deposited prints and air drying. A liquid extraction method was used to recover fentanyl from spiked prints, optimisation of the extraction solvent and the use of the fentanyl-D_5 internal standard was shown to substantially improve sensitivity and analytical performance.
Ambient ionisation is showing potential as simple, fast instrumental methods to detect synthetic opioids such as fentanyl in latent fingerprints. Following optimisation, the key focus will be determining if detection is still possible in latent fingerprints that have been chemically developed or gel-lifted. This work is also to be replicated on nitazenes, a new class of synthetic opioids that are a growing concern.

Interesting Quantification Presentations from Forensic Science Ireland 12:00 - 12:15

S. Hanniffy[1], *C. Donnelly*[1], *C. Downey*[1], *S. Killoran*[1], *K. Flanagan*[1]

[1]Forensic Science Ireland, Chemical Analysis Department, Kildare, Ireland

Abstract Body: Forensic Science Ireland (FSI) is an associated office of the Department of Justice delivering comprehensive scientific analysis,

independent expert opinion, advice, and training to support the Irish criminal justice system. The analysis of substances that are suspected to contravene the Misuse of Drugs Acts comprise the majority of submitted cases to FSI. The Chemical Analysis Department contributes to the European Union (EU) Early Warning System for the reporting of emerging drug trends via the European Union Drug Agency (EUDA), the drugs working group in the European Network of Forensic Science Institutes (ENFSI), and the Early Warning and Emerging Trends (EWET) group in Ireland. Quantification data is produced for intelligence purposes for three substances: cocaine, diamorphine (heroin), and amphetamine.
Periodically the team are presented with submissions of substances in unusual circumstance or matrices for analysis both qualitatively and quantitatively. From liquids to charcoal, various extraction techniques are investigated and employed to aid in the investigation of such cases.
This presentation will explore several of these unusual concealment methods and the solutions found for reporting of such cases, as well as explore some of the key trends of the drug quantification intelligence work carried out in the Chemical Analysis team.

Investigating Ketamine Seizures to Illicit Manufacturing Pathways Through Analytical Forensic Techniques 12:15 - 12:30

S Himanshu[1,2], A. Pandey[1,2]

[1]School of Forensic Science, National Forensic Sciences University, Gandhinagar, India, [2]Centre of Excellence for Research & Analysis of Narcotic Drugs and Psychotropic Substances, National Forensic Sciences University, Gandhinagar, India

Abstract Body: Forensic analysis of controlled substances is essential in addressing global drug trafficking issues. A recent case of ketamine seizures in transit revealed the need for advanced techniques to differentiate between the target substance and a structurally similar precursor while establishing its connection to illicit manufacturing and distribution networks. This case demonstrated the complexity of distinguishing compounds with overlapping molecular characteristics, highlighting the importance of precise forensic methodologies.
The present study utilized a multi-technique analytical approach using HPLC-PDA-MS and GC-HRMS to investigate ketamine seizures and their precursors. By resolving molecular ambiguities through distinct profiles and spectral characteristics, these sophisticated techniques enabled the precise identification of ketamine and its precursor. The evidence of synthesis procedures outlined in seized manufacturing documents indicated the correlation between ketamine seizures and illicit production.
This investigation underscores the innovation and effectiveness of advanced forensic techniques in resolving complex narcotics cases. In addition to overcoming analytical challenges, it contributes to understanding illicit manufacturing processes and strengthens efforts to combat drug trafficking globally. The findings emphasize the need for adaptable forensic strategies to address the evolving complexities of drug synthesis and trafficking, offering a foundation for future investigations.

Challenges Facing Forensic Scientists in the Fight Against Drugs 12:30 - 12:45

N. Radosavljevic-Stevanovic[1,2]

[1]National Forensic Centre Belgrade, Physical-Chemical and Toxicological Department, Belgrade, Serbia, [2]University of Belgrade, Faculty of Chemistry, Department of Analytical Chemistry, Belgrade, Serbia

Abstract Body: The phenomenon of drug problems has been affecting society ever since. The problem is international, multisectoral, multicultural, and geographically dependent. The forensic area considers this problem as one of its major duties with great concern. Considering the complexity of this issue, forensic scientists work within their own organizations and forensic networks and jointly contribute to the fight against drugs. The challenges are numerous, some of them include: proper information exchange in terms of new drug trends and threats, number and diversity of NPS, accurate identification of substances, application of new technologies, adequate responses in terms of legislation and possible impact, and support of forensic scientists to decision makers. The need to consider and widely assess this phenomenon has already been recognized by prominent and competent international and European organizations. Further development of proper responses would aim to increase the preparedness of forensic scientists to be capable of facing the new challenges and creating new solutions for the future in this area.

12: Scenes of Crime: Forensic Archaeology and Anthropology
11:45 - 12:30 Wicklow Hall 1

Scenes of Crime: Forensic Archaeology and Anthropology

S.E.A.R.C.H. Sensor Enhanced Analysis for Recovering Clandestine Hidden Graves 11:45 - 12:00

L. Lijcklama a Nijeholt[1]

[1]Saxion, Forensic Research, Enschede, Netherlands

Abstract Body: In the Netherlands, around 1,500 people are classified as long-term missing, with approximately 100 new cases added annually. For half of these disappearances, the cause remains unknown. Searches typically involve professionals and volunteers examining terrain for disturbed soil, with police dogs occasionally deployed in large areas. However, these efforts are time-intensive, require significant manpower, and are often hindered by weather conditions and vegetation growth obscuring vital traces.
Innovative technologies such as drones, robotic platforms, and advanced sensors—including ground penetrating radar (GPR), hyperspectral imaging (HSI), and gamma ray spectrometry (GRS)—offer transformative potential for search operations. This research developed an adaptive system integrating these tools on drone and ground-based platforms, enabling efficient searches over large and inaccessible areas.
Experiments correlated sensor data with decomposition stages of human remains, refining detection protocols for clandestine graves. Drone-mounted GPR provided non-invasive detection of surface and subsurface irregularities, proving effective across diverse soil types and decomposition stages, though soil composition influenced performance. The research employed a DJI M600 Pro drone equipped with GPR, HSI, and GRS,

supported by real-time kinematic (RTK) GPS for precision and autonomy. Simulated graves and cadavers validated the system, optimizing altitude, speed, and obstacle avoidance. Planning algorithms ensured efficient, obstacle-free flight paths.
This project delivers a versatile, protocol-driven system, enhancing search efficiency and accuracy while minimizing reliance on labor-intensive methods. It significantly advances forensic science, improving the likelihood of locating human remains and supporting law enforcement in resolving missing person cases.

Virtual Skeletal Analysis: Comparative Analysis of Computed Tomography, Photogrammetry, and Structured Light Scanning for Biological Sex Estimation on the Mandible 12:00 - 12:15

I. Crebert[1], L. Ebert[2], R. Nickson[1], D. Seckiner[3], V. Berezowski[4], X. Mallett[1]

[1]University of Newcastle, School of Law & Justice, Newcastle, Australia, [2] Zurich Forensic Science Institute, Zurich, Switzerland, [3]University of New South Wales, Biomedical Sciences, Sydney, Australia, [4]Deakin University, School of Life and Environmental Sciences, Victoria, Australia

Abstract Body: Advanced scanning technologies are increasingly being used to help identify human skeletal remains in forensic anthropology. These technologies present significant benefits for documenting and assessing bones, including permitting measurements not possible on gross bone and the distribution of scans to experts for analysis.

The literature highlights that computed tomography (CT) is considered the ‘gold standard’ for virtual skeletal analysis, as CT-rendered virtual models of bone provide accurate results for a biological profile. However, photogrammetry and structured light scanning (SLS) offer practical advantages over CT, such as being more cost effective and transportable, which are particularly important in humanitarian contexts.

This research compares the use of CT, SLS, and photogrammetry to determine which advanced scanning technology is the most effective and efficient for biological sex estimation on the mandible. This project focuses on biological sex as subsequent characteristics of the biological profile including age at death, stature, and biogeographic ancestry estimation are dependent on biological sex. Each technology was used to image 100 human mandibles from the University of Zurich’s skeletal collection. To determine accuracy and precision, both the virtual mandible models and gross bone will be measured, and the results will be compared. To determine efficiency, each technology will also be compared based on the length of time required to perform each scan, associated costs, portability, and level of training required to operate the technology and associated software. This research intends to act as a guide for practitioners in determining which technology to employ in various forensic circumstances.

Proposal for the Use of Intra-Oral Images for the Identification of Missing Persons 12:15 - 12:30

G. R-Garcia[1], A.D. Villegas Yeguas[2,1], R.X. Freire[3], R. Guerra[1,4], A. Valsecchi[1,5], O. Ibañez[6,5]

[1]Panacea Cooperative Research S. Coop, Ponferrada, Spain, [2]University of

Granada, Department of Computer Science and Artificial Intelligence, Granada, Spain, [3]University Institute of Health Sciences (IUCS), CESPU, 1H-TOXRUN – One Health Toxicology Research Unit, Gandra, Portugal, [4] University of Granada, Department of Legal Medicine, Toxicology and Physical Anthropology, Granada, Spain, [5]Andalusian Research Institute in Data Science and Computational Intelligence, Granada, Spain, [6]University of A Coruna, Faculty of Computer Science, La Coruña, Spain

Abstract Body:

The acquisition of 3D models of intraoral images is an increasingly common practice when obtaining postmortem (PM) records. These models, together with antemortem (AM) photographic records, offer the possibility of bringing a new approach to dental comparison, allowing 3D-2D comparisons of teeth and exploiting the identifying power of these. For this purpose, we performed a study with 142 cases in which we compare these AM-PM records.

The main objective of this work is to develop and analyze 3D-2D superimposition methods to exploit the full potential that intraoral scans can offer, proposing two approaches to study this feasibility; the first one consists of superimposing the intraoral scan with facial photographs using a set of corresponding landmarks located in the teeth of both the 3D model and the photograph, computing a similarity score based on the mean distances among pairs of landmarks. The second makes use of the occlusal contours of the upper teeth on both the photograph and the 3D model and computes the similarity between the two.

The performance of both approaches is measured according to the mean ranking distribution of the 20,164 cross-comparison carried out (142 AM VS 142 PM). In the results of the study we also discuss the different landmark sets for the first approach, the simplicity to apply the methods and their applicability in real-world scenarios.

11: Marks, Impressions and Biometric Traces: Document, Handwriting and Signature
11:45 - 13:00 Wicklow Hall 2 (A)

Marks, Impressions and Biometric Traces: Document, Handwriting and Signature

Integrating Forensic Handwriting Analysis with Forensic Intelligence Approaches to Study Cultural Handwriting Features. 11:45 - 12:00

C.R. Song[1], J. Brown[1], M. Morelato[1], C. Roux[1]

[1]University of Technology Sydney, Broadway, Australia

Abstract Body: Forensic document analysis often involves handwriting examination, traditionally relying on comparison materials to identify distinctive features and provide information about a writer. Handwriting, which varies between individuals and evolves over time, retains identifiable characteristics from a writer's native alphabet, even when writing in non-

native scripts like English. Integrating handwriting analysis with a forensic intelligence approach offers a proactive advantage, enabling the construction of cultural profiles without requiring comparison materials. These profiles provide strategic benefits for investigations, resource allocation, and crime prevention. This research explores whether handwriting characteristics can reveal a writer's cultural background and examines the potential for developing an automated system for operational use.

Building on the work of Agius et al. (https://doi.org/10.1016/j.forsciint.2017.11.028), which distinguished between Australian and Vietnamese writers, this study expands the scope to include cultural backgrounds such as Korea, Vietnam, Rwanda, Thailand, India, China, and Hong Kong. Participants copied standardised English text, and their handwriting specimens were examined using optical techniques. Key handwriting features were manually extracted and statistically evaluated to identify cultural characteristics that may indicate a writer's background.

Results demonstrate the robustness of this approach in distinguishing Australian writers from various cultural groups and highlight the potential to differentiate between non-Australian groups. These findings support integrating handwriting analysis into forensic intelligence, enhancing tools for law enforcement and crime prevention.

Untangling the Mystery of Crossing Lines: Toward a Comprehensive Methodology for Determining the Order of Intersecting Graphic Elements 12:00 - 12:15

Z. Bura[1,2], *M. Kunicki*[1]

[1]Institute of Forensic Research in Kraków, Handwriting and Questioned Documents Examination Section, Kraków, Poland, [2]University of Silesia, Faculty of Law and Administration, Katowicepol, Poland

Abstract Body: Despite the rapid progress of the digitalization of society, forensic document examinations still play an important role in forensic science, and one of their still unsolved mysteries is determining the order in which graphic elements were drawn on the surface of the paper. Studies in this area are used to reveal frauds related to adding secondary entries to existing ones, and as a result, they lead, for example, to determining whether a signature was drawn *in blank* or to determining the original content of the document. The absence of a universal methodology for this type of analysis continues to pose a challenge, prompting ongoing efforts by scientists to explore new approaches. To address this issue, a number of studies were conducted employing various imaging and analysis techniques, including photostereoscopy, stereoscopic microscopy and atomic force microscopy. In addition, the effectiveness of new methods was tested on documents without visible ink or damaged, for example, by flooding the examined areas with ink. The aim of these studies was not to determine the best single technique but to develop a comprehensive methodology that, through a synergistic combination of different techniques, would eliminate the limitations of one technique by using another. Taking into account the tools currently available, this approach enables a comprehensive analysis of the sequence of intersecting lines on

documents, even in cases where damage to the crossing occurred.

Forensic Handwriting Examinations in Sweden – From Craftsman Work to Artificial Intelligence 12:15 - 12:30

A. Sundin[1], D. Härnström[1], O. Andlid[1], K. Axelsson Spjut[1]

[1]The Swedish National Forensic Centre, Information Technology Division, Linköping, Sweden

Abstract Body: The Swedish National Forensic Centre (NFC) holds competence within many scientific fields, of which handwriting examination is one and Artificial Intelligence (AI) is another. While handwriting examination is one of the oldest forensic disciplines, AI has recently become an important resource and innovative approach in forensics.

NFC has decided to take advantage of this combined expertise and has initiated a cross scientific project where the past meets the future, by using AI technology to assist in forensic handwriting examinations. Normally, a vast amount of time is spent on documentation and administration and, therefore, an AI tool is being developed in order to decrease the administrative burden and allow the forensic expert to focus on the forensic analysis instead of the administrative part of the examination.

The idea is to create a model that is capable of detecting and classifying handwritten characters, from both questioned and known writing. The detected handwritten characters will then be placed at designated areas in the case notes for manual comparison and evaluation of similarities and differences.

The first part of the project aims simply to use the AI tool to assist in the administrative tasks. Eventually, however, the aim is to have a forensic digital assistant that with the help of AI can calculate levels of similarities and differences between handwritten characters.

The intention is that the results of the project can be applied widely also in other forensic disciplines in the future.

Investigating the Multi-Source Approach for Document Fraud and Identity Crime in Digital and Physical Spaces 12:30 - 12:45

C.J. Devlin[1], S. Chadwick[1], S. Moret[1,2], Q. Rossy[3], S. Baechler[4,3], J. Raymond[5], M. Morelato[1]

[1]University of Technology Sydney, Centre for Forensic Science, Broadway, Australia, [2]University of Derby, School of Human Sciences, College of Science and Engineering, Derby, United Kingdom, [3]University of Lausanne, Ecole des Sciences Criminelles, Lausanne, Switzerland, [4]Police Neuchâteloise, Police Judiciaire, Neuchâtel, Switzerland, [5]New South Wales Police Force, Forensic Evidence and Technical Services Command, Sydney, Australia

Abstract Body: Fraudulent identity documents are known to be enablers of transnational, serious and organised crime. Previous research has

illustrated that by visually profiling and comparing these documents, it is possible to gain greater insight into the criminal environment of document fraud, and a broad range of other criminal activities. However, the criminal environments of document fraud and identity crime have evolved to exist across both the physical and digital space, and these avenues of information, when used, are often treated separately, contributing to information silos and linkage blindness. This results in the document fraud and identity crime criminal environment being ill-defined and underestimated.
To properly address this, a more holistic multi-source approach is required, combining information from both the digital and physical spaces, with that from external stakeholders and alternative sources. Through the visual profiling and comparison of fraudulent identity documents collected from Australian law enforcement, in combination with the analysis of the cryptomarket facilitated trade for fraudulent documents and personal information, this research explores how these seemingly dichotomous information sources can be used together to provide a more holistic understanding of this criminal environment. It illustrates how combining the results of trace analyses (in this case those from physical documents and cryptomarket examinations) with information from alternative sources can inform intelligence-led policing and decision makers in how best to proactively and holistically address document fraud, identity and organised crime.

Digitally Captured Handwriting Under the Influence of Alcohol: Exploring its Impact on Biometric Data 12:45 - 13:00

A. Sen Yilmaz[1], *E. Yigit*[2], *G. Basar*[1], *F. Asicioglu*[1]

[1]Istanbul University-Cerrahpasa, Forensic Science and Legal Medicine, Istanbul, Turkey, [2]The Council of Forensic Medicine, Istanbul, Turkey

Abstract Body: With technological advancements and the rise in widespread use of digital documents, analyzing digitally captured handwriting which includes biometric data has become increasingly important in forensic document examination. This study aimed to investigate the effects of alcohol consumption on digitally captured handwriting samples and focused on changes in biometric data (writing time, speed, pressure, and hover time). Twenty participants (13 males, 7 females, aged 37-52) were asked to write the same text twice—once before and once after consuming alcohol. Alcohol levels were measured with a calibrated breathalyzer 15 minutes after the end of consumption. According to the biometric data analysis results, 85% of participants exhibited a reduction in total writing time in contact post-alcohol consumption, suggesting a faster but less controlled writing process. The writing speed is also decreased which may potentially be indicating impaired fine motor skills. The pressure applied to the pen increased for 60% of participants. This could imply compensation in response to losing control over the precision of writing habits. Furthermore, 65% of participants exhibited increased pen lift time (hover), while 55% showed an increase in total writing length. This situation may be related longer writing efforts to complete the same task. These findings highlight the impact of alcohol on fine motor control, neuromuscular coordination, and cognitive processing offering awareness into the potential use of biometric data in handwriting and questioned document analysis.

02: Chemistry: Gunshot Residue (GSR)
11:45 - 12:45 Wicklow Hall 2 (B)

Chemistry: Gunshot Residue (GSR)

Determination of Recent Firearm Use via Organic Gunshot Residues (O-GSR) Analysis Using SPME-GC-MS 11:45 - 12:00

C. Scagliarini[1,2], L. Lombardi[3], S. Abate[3], E. Alladio[1,2]

[1]University of Turin, Department of Chemistry, Turin, Italy, [2]DataBloom s.r.l., Turin, Italy, [3]Carabinieri, Department of Scientific Investigation (RIS), Rome, Italy

Abstract Body: Estimating the time since the discharge of firearms plays a crucial role in forensic investigations. Various methods have been explored to determine recent firearm use, with the most promising approaches focusing on the decay of gunshot residues (GSR) over time. GSR is a complex mixture of organic (O-GSR) and inorganic (I-GSR) compounds. While I-GSR primarily consists of elements such as Pb, Sb, and Ba from the ammunition primer, O-GSR originates from smokeless propellant powder and includes explosive or additive compounds.
With the increasing use of heavy metal-free cartridges, it has become crucial to integrate I-GSR investigations, typically performed via scanning electron microscopy coupled with energy-dispersive X-ray microanalysis (SEM-EDX), with targeted O-GSR analysis.
This study focuses on detecting O-GSR in weapon and ammunition components using solid-phase microextraction (SPME) followed by gas chromatography-mass spectrometry (GC-MS). The initial phase of the study optimized and validated a method for identifying O-GSR target compounds through a multivariate statistical approach based on principal component analysis (PCA) and design of experiments (DoE).
The method was then applied to semi-automatic pistol barrels to monitor the temporal decay of O-GSR target compounds, utilizing advanced chemometric approaches such as multiple linear regression (MLR), partial least squares regression (PLS-R), and feature selection techniques like sequential forward selection (SFS).
The findings indicate that SPME-GC-MS analysis of firearm and ammunition components holds great potential for improving the determination of firearm usage. While additional research is required, these results lay a robust groundwork for establishing a validated forensic methodology.

A Comparative Analysis of Gunshot Residue and Particles Retrieved from Motor Vehicle Battery Terminals Utilizing Stereo and Scanning Electron Microscopy 12:00 - 12:15

G. Williams[1], S. Boscombe[2], S. Blake[2]

[1]University of the West Indies (UWI), Basic Medical Sciences, Kingston, Jamaica, [2]UWI, Basic Medical Sciences, Kingston, Jamaica

Abstract Body: Firearms are the weapon of choice for criminals in Jamaica, contributing to a staggering 80% of all murders linked to gun-related violence. Upon the discharge of a firearm, it releases particulates known as gunshot residue (GSR). These microscopic particles, primarily

composed of barium (Ba), antimony (Sb), and lead (Pb), are typically found in a spheroidal configuration and serve as crucial circumstantial evidence that can connect a suspect to a victim or crime scene. However, comprehensive research has been lacking in identifying the difference between GSR and similar particles originating from lead-acid batteries. This study seeks to fill that gap by clearly distinguishing GSR produced by firearms from that produced by lead-acid batteries, thereby evaluating the potential for false positive identifications of gunshot residue.
This study addresses this gap using Scanning Electron Microscopy (SEM) with energy-dispersive X-ray (EDS) analysis, chemical analysis, and a stereo microscope. Three shooters firing various firearms and three individuals interacting with lead-acid batteries from cars, trucks, and SUVs were examined. Samples were collected for analysis.
Our findings showed significant differences in size, morphology, and elemental composition between GSR and lead-acid battery particles. GSR particles were distinctly identifiable, indicating that false positives are not a concern.
Furthermore, analysis using the SEM/EDX detected a small quantity of characteristic GSR particles (Pb-Sb-Ba) that were similar in size and shape within the lead-acid batteries of SUVs and trucks. We also detected a small number of GSR-like particles from lead-acid batteries, affirming our conclusions about their differences.

The Application of AI Technology in the Activity Level Bayesian Interpretation of GSR SEM/EDX Results in a Case Context 12:15 - 12:30

B. Nys[1]

[1]Nationaal Instituut voor Criminalistiek en Criminologie (NICC-INCC), Material Analysis, Brussels, Belgium

Abstract Body: In a previous study the possible use of AI-assisted technology in the various stages of a GSR case treatment was explored. It was shown that there are at least six phases in the treatment of a forensic case where AI can be of help in assisting the work of the lab operator, expert and/or administrative staff. These six use cases, however, are not simple implementations of Large Language Models but may involve the development of specific databases, AI models, environment studies and software in order to fulfill the desired functionalities. Nor are they a combination of pre-existing commercial software offerings already available in the commercial market. It is therefore unpractical to develop these use case solutions in a small group or as an individual expert during a short time frame.
In a first step, a GSR particle classifier based on a simple neural network which was trained on previously acquired case data, was developed and successfully tested as a technology demonstrator. This software was presented during the ENFSI Firearms and GSR Workgroup Annual Meeting in 2023 (Brussels).
In this second step, the interpretation of the GSR analysis results for use in expert reporting will be tackled. The objective is to develop a complete application which assists the expert in the inference of activity-level probabilities of case-based hypotheses. The network will again be trained on realistic case data from previous cases. The application will thus assist

experts in applying a Bayesian approach to report writing in the domain of GSR analysis.

Gunshot Residue (GSR): Frequency of Residue Types Encountered in Casework and Background GSR Levels in the Environment 12:30 - 12:45

B. Gorey[1], M. Boyle[1], A. Lennon[1]

[1]Forensic Science Ireland, Physical analysis, Kildare, Ireland

Abstract Body: The evaluation of criminal cases involving the discharge of a firearm requires reliable and up to date information regarding the transfer and persistence of gunshot residue (GSR). Similarly, knowledge of background levels of GSR on relevant populations and awareness of the potential for contamination/secondary transfer is essential. Here we provide an update on the frequency of gunshot residue types in discharged cartridge casings (DCC) encountered in casework within the Republic of Ireland. In conjunction, an examination of the types of firearms encountered in casework and the associated residue types is undertaken. Finally, a review of levels of GSR particles detected on control samples taken from members of An Garda Síochána, the Irish police is detailed. Control samples are taken before a police officer samples a detainee suspected of involvement in an incident where a firearm was discharged and/or subsequently handled.
We will also detail the approach taken to evaluate the baseline levels of gunshot residue (GSR) in the newly built Forensic Science Ireland (FSI), Laboratory, Celbridge, Co. Kildare, Ireland. This work will demonstrate that the process of case intake, storage and examination of exhibits within FSI are approached in a robust manner with safeguards in place to minimise the potential for cross contamination. Finally, we will detail how this knowledge and understanding of background levels of GSR can be utilised to guide examiners during the evaluation of GSR findings during casework.

01: Case Studies: Emerging Technologies in casework
11:45 - 12:45 Liffey Meeting Room 2

Case Studies: Emerging Technologies in casework

Crime Scene Application and Single Cell Sequencing: Working With Stakeholders for Impact Within the Criminal Justice System 11:45 - 12:15

L. Dawson[1], I. Macaulay[2], A. Behera[3], G. Zouganelis[4], K. Brown[5], M. Chen[6], N. Dawnay[7]

[1]Prof Lorna Dawson, Centre for Forensic Soil Science, Aberdeen, United Kingdom, [2]The Earlham Institute, Norwich, United Kingdom, [3]Edge Hill University, Intelligent Visual Computing Research Centre, Ormskirk, United Kingdom, [4]University of Derby, Derby, United Kingdom, [5]University of Portsmouth, Portsmouth, United Kingdom, [6]University of Edinburgh, Edinburgh, United Kingdom, [7]Liverpool John Moores University, Liverpool, United Kingdom

Abstract Body: Science is currently rapidly developing, with many new technologies and innovative approaches offering new opportunities such as

Artificial Intelligence, Single Cell genomics, and next generation DNA sequencing of traces, and all offer the route to a brave new world in forensic science. However, the path can be rocky and must be carefully travelled to achieve a truly useful outcome. This talk will cover several areas of forensic science - from the application of forensic soil science and ecology in intelligence and as evidence to the prospect of identifying individuals from a single cell. The advancement, and safe application of a science in court, relies on robust research, careful validation and peer review, such as with the use of soil in case work [1.2]. I will present research findings and also case work examples where without the particular research. Recently we were awarded a collaborative and multidisciplinary grant to investigate the use of single cell DNA sequencing to link cell-of-origin information with DNA profiles of contributing individuals. While this approach has significant potential for the deconvolution of complex mixtures and the profiling of low cell numbers, there are many technical and practical challenges that must be addressed before it can generate data of evidential value. This presentation will discuss the vital role of collaboration and cooperation and the importance of working with key stakeholders from the very outset of a research project to help make that science useful and relevant for society and the criminal justice system.

Exploring Assisted Reality: Transforming Crime Scene Investigations 12:15 - 12:30

K.-H. Helland-Hansen[1], O. Moldestad[1], M. Zuidberg[2], M.d. Gruijter[2]

[1]Vest Police District, Forensics, Bergen, Norway, [2]Netherlands Forensics Institute, The Hague, Netherlands

Abstract Body: The rapid evolution of assisted reality technologies presents unprecedented opportunities to enhance the effectiveness and efficiency of crime scene investigations. In this engaging session, we introduce a collaborative initiative between the Norwegian Police and the Netherlands Forensic Institute (NFI), showcasing the integration of smart headsets equipped with assisted reality features designed to optimize forensic processes at crime scenes.

Attendees will be guided through the capabilities of these advanced headsets, which enable (1) live streaming with experts for real-time assistance during complex decision-making, thereby significantly enhancing the accuracy of on-site forensic evaluations (2) voice-controlled interfaces for seamless, hands-free operation, enabling forensic investigators to maintain focus on critical tasks without workflow interruptions and (3) the integration of best practice protocols within the headset ensuring the forensic team adheres to standardized procedures during evidence collection.

We will delve into the application of NFI's Scenario-based Reasoning approach integrated into our headset system, supporting forensic teams in applying structured investigations to make informed decisions.

Additionally, participants will explore how the headset digitalizes scene documentation by capturing and storing essential information directly within the device. This data is later transcribed and reused in forensic

reporting, significantly enhancing the efficiency and accuracy of crime scene documentation.

The session includes an interactive demonstration, offering participants a hands-on experience of the technology. Join us to explore the future of crime scene investigation and experience first-hand how assisted reality transforms the field.

Enhancing Forensic DNA Analysis: Using RapidHIT ID® Systems in French Overseas Territories and Setting Up a Subsampling Protocol as a Best Practice 12:30 - 12:45

C. Siatka[1], L. Pivat[2], S. Hubac[2], A. Franzoni[3], M. Rosso[3], F. Hermitte[2]

[1]UPR-CHROME, Université de Nîmes, Nîmes, France, [2]Forensic Science Laboratory of the French Gendarmerie, Forensic biology and genetic, Pontoise, France, [3]COPAN, Brescia, Italy

Abstract Body: Rapid DNA instruments are gaining interest in forensic science for their ability to quickly obtain DNA profiles outside standard laboratory workflows, particularly in decentralized structures. Since late 2022, the Forensic Science Institute of the French Gendarmerie (IRCGN), located in Paris, has validated the use of RapidHIT ID systems to analyze casework samples remotely across territories spanning 16 time zones, including New Caledonia, Mayotte, Guyana, and Guadeloupe. These areas lack a local DNA laboratory to carry out DNA results in the time of custody and even in less than 2 hours. This system ensures compliance with ISO 17025 standards, with encrypted telematics links enabling real-time analysis by DNA experts in Paris. Over 582 samples (80% casework, 8% cadavers, 12% references) have been successfully analyzed with a high rate of success.

Despite its efficiency, RapidHIT ID technology consumes the entire swab for analysis, limiting its application in cases where sample preservation is critical. To address this, we developed a novel subsampling method using Copan flocked swabs. Subsampling tests involved applying two blood volumes (10 µL and 150 µL) from four individuals to standard Copan swabs, then recovering portions of the biological material using Copan mini swabs (subungual). Regardless of the initial volume, this method consistently produced complete genetic profiles.

This adaptable subsampling technique enhances forensic DNA analysis, particularly for blood samples, by overcoming the limitations of RapidHIT ID technology. It provides a flexible, efficient solution for decentralized forensic workflows and opens the way for future advancements in rapid DNA analysis.

07: Forensic Management and Quality Systems: Management of Organisational Change
11:45 - 12:30 Liffey Meeting Room 3

Forensic Management and Quality Systems: Management of Organisational Change

Optimizing Forensic Missions: The Key Role of Generalists in Forensic Institutes 11:45 - 12:00

A. Barret[1]

[1]National Institute of Criminalistics and Criminology NICC, Forensic Advice, Brussels, Belgium

Abstract Body: Like many forensic institutes, the Belgium national forensic institute (NICC), has embraced the role of forensic advisors to address the growing complexity and diversity of forensic mission in cases. This generalist role approaches cases holistically, maintaining an overview of forensic data, identifying innovative techniques for non-standard expertise even across borders and applying a contextual approach. They offer advice on expert missions by considering purposes and by discussing the relevance of analyses, rather than focusing solely on their availability. After more than 10 years of practice, we review our perspective by engaging with our counterparts in other countries over case coordination, forensic advice, multidisciplinary examination, evaluative approaches and education. Inspired by this survey and the visits, we concluded that forensic generalists are prevalent in various roles within national forensic institutes. This presentation will present these various roles and highlight the significant value forensic generalists bring to coordination, pre-assessment and communication. It will discuss how, by integrating expertise across disciplines and fostering collaboration, these roles enhance the effectiveness of complex case management. Furthermore, it is clear that due to our position, there is potential to help streamline high-volume, low-importance cases through systematic processes with AI technologies freeing resources and time to focus on complex challenges and emerging phenomena.
This dual focus on operational efficiency and scientific innovation not only improves institutional capacity amidst increasing case demands but also enhances stakeholder well-being. Forensic generalists, as networkers, strategists, and communicators, exemplify the critical balance between technical rigor and adaptive collaboration in modern forensic science.

The Importance of Certification of Personnel in Scene of Crime and Pattern Recognition disciplines 12:00 - 12:15

A. Mattei[1]

[1]Raggruppamento Carabinieri Investigazioni Scientifiche, Reparto Investigazioni Scientifiche di Messina, Messina, Italy

Abstract Body: Certification of personnel in scene of crime (SOC) and pattern recognition disciplines is essential to maintaining accuracy, reliability, and trust in forensic investigations. These specialized fields require practitioners to meticulously process and interpret evidence, often in high-pressure situations where errors can have profound implications for justice.
For SOC professionals, certification ensures a standardized approach to identifying, collecting, and preserving evidence. Proper handling and documentation at the crime scene form the foundation of forensic analysis. Certification validates their technical skills and knowledge of protocols, reducing risks of contamination, loss, or misinterpretation of critical evidence. Additionally, certified personnel are better equipped to handle diverse scenarios, from homicide investigations to disaster victim

identification.
In pattern recognition disciplines, such as fingerprint analysis, footwear impressions, and bloodstain pattern analysis, certification is equally vital. These fields demand a deep understanding of the specific forensic field. Certification programs assess these specialized skills and promote adherence to scientific principles, minimizing subjective interpretation and cognitive bias.
Furthermore, certification in these disciplines fosters professional development, ethical accountability, and adherence to standards and best practices. Certified experts are more credible in legal proceedings, strengthening the evidentiary value of their findings and testimony. The rigorous requirements for certification, including training, testing, and continuing education, ensure that practitioners remain proficient in evolving methodologies and technologies.
Certification in SOC and pattern recognition disciplines is crucial for maintaining the integrity and reliability of forensic investigations. It underscores the professionalism of practitioners, bolstering confidence in forensic science and its role in the justice system.

Harmonizing Accreditation Levels of Flexible Scope Upon Reorganization of a Forensic Laboratory 12:15 - 12:30

E. Öberg[1]

[1]Swedish Police Authority, National Forensic Centre (NFC), Drug Analysis Unit, Linköping, Sweden

Abstract Body: The National Forensic Centre in Linköping, Sweden has undergone a reorganization during the past year. As part of this process, the Drug analysis unit has been merged with parts of the Chemistry and technology unit. This presentation will focus on the questions which arose concerning quality management when merging the two units. Prior to reorganization, the two units were accredited according to ISO17025 with flexible scope but at two different levels - *type 1* and *type 2*. Briefly, with flexible accreditation *type 1*, it is permitted to make editorial changes of non-standard methods and introduce new versions of standard methods within specified areas. With flexible accreditation *type 2* one can also introduce a new version of a non-standard method and make modifications of parameters, matrices, materials etc. The aim after the reorganization was to move towards flexible accreditation *type 2* for the merged unit. As a first step towards harmonized accreditation levels, a risk-and-opportunity analysis was performed in order to identify the impact and likely outcomes of the merger. This presentation will address the advantages and disadvantages that emerged from the analysis and what questions must be considered on the way towards a harmonized type of flexible scope.

12:45 - 14:00 Auditorium
LUNCH BREAK

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14:00 - 14:45 Auditorium
PLENARY SPEAKER 2

Plenary Talk 2 14:00 - 14:45

12: Scenes of Crime: Trace Evidence and Interpretation
14:45 - 18:15 EcoCem Room

Scenes of Crime: Trace Evidence and Interpretation

Follow the (Ink-Stained) Money 14:45 - 18:15

E. van den Heuvel[1,2], P. Zoon[3], R. de Graaff[4], D. Perisynakis[5]

[1]De Nederlandsche Bank, Cash Policy and Oversight, Amsterdam, Netherlands, [2]Amsterdam University of Applied Sciences, Forensic Research, Amsterdam, Netherlands, [3]Netherlands Forensic Institute, Microtraces & Materials, Den Haag, Netherlands, [4]Police, Forenisic Investigation, Ijmuiden, Netherlands, [5]Hellenic Police Headquarters, Chemical and Physical Examinations Department, Athens, Greece

Workshop Description:
More and more cash systems throughout Europe are (being) equipped with intelligent banknote neutralization systems (IBNS). The purpose of these systems is to secure banknotes against unauthorized access like forceful entry into a cash dispenser (ATM). The nature of ATM attacks tends to be transnational, meaning that attacks carried out in one country have a significant suspect population that originates from another country. Hence, IBNS-stained banknotes tend to end up in another country then the where the crime was committed. It is therefore of importance to know the situation in different countries.
This workshop aims to give participants insight into phenomenon of IBNS-stained banknotes. It will start with an overview of the current state of play in Europe by presenting the results of survey that was send to the members of the ENFSI paint, glass and taggant WG. The role of (central) banks and the ECB in the process of detecting stained notes in the cash-cycle will be discussed as well as the application of IBNS-glue-based systems to neutralize banknotes during an ATM-attack. In a hands-on part, an experienced crime scene examiner will show the benefits of using forensic light sources and hyperspectral imaging to detect IBNS-ink stains on materials like dark clothing or car upholstery. Finally, a presentation on a collaboration with banks that allows the collecting of IBNS-stained banknotes from cash deposits, will be presented. The information from this analysis gives insight into to the criminal networks that commit the ATM-attacks and allows to tailor an investigative approach.

05: Drugs: Analytical Challenges
14:45 - 16:15 Wicklow Meeting Room 1

Drugs: Analytical Challenges

Forensic Seized Drug Analysis: Current Analytical and Legislative Challenges Posed by Novel Cannabinoids 14:45 - 16:15

S. O'Malley[1], D. Casey[1], J. Power[2], C. May[1], G. McLaughlin[1]

[1]Forensic Science Ireland, Chemical Analysis Discipline, Celbridge, Co.Kildare, Ireland, [2]TU Dublin, Chemistry, Dublin, Ireland

Workshop Description: In recent times, the number of seized materials containing novel cannabinoids has increased dramatically across Europe. The arrival of these novel cannabinoids onto the recreational drug market has been facilitated by recent legislative changes across North America and Canada, and has led to a surge of products, such as vapes, oils, edibles and drinks.

The variety of matrices, in combination with the volume of natural, semi-synthetic and synthetic cannabinoids has presented forensic laboratories with several unique challenges that have pushed the limits of existing analytical procedures. Forensic chemists are now often faced with complex casework samples that may contain previously unidentified compounds that can defy legislative mechanisms. The use of traditional approaches for analysis, such as gas chromatography mass spectrometry (GC-MS) and thin layer chromatography (TLC) can become inadequate for such cases.

In this workshop, we have brought together experts to discuss the evolving market trends for cannabinoids, the analytical challenges and solutions, and legislative implications.

06: Education and Training: Academic Courses
14:45 - 18:15 Wicklow Meeting Room 2

Education and Training: Academic Courses

Leveraging Machine Learning with SpectrApp: An Open-Source Solution for Forensic Data Analysis 14:45 - 18:15

E. Alladio[1], *A. Mazzoleni*[1], *C. Scagliarini*[1], *G. Solarino*[1]

[1]University of Turin, Chemistry, Turin, Italy

Workshop Description: Explore **SpectrApp** (https://www.spectrapp.unito.it), an innovative **open-source tool** developed by the Department of Chemistry at the University of Turin. This workshop will introduce participants to SpectrApp's powerful capabilities for forensic data analysis. Combining advanced **machine learning with a user-friendly interface**, SpectrApp caters to both experts and newcomers. Attendees will learn to apply multivariate data analysis and chemometric strategies. The workshop will cover diverse visualization methods, including univariate, bivariate, and multivariate plots, to help identify complex patterns in data. Participants will gain hands-on experience with cluster analysis, Principal Component Analysis (PCA), and advanced methodologies like PLS-Discriminant Analysis (PLS-DA) and PLS-Regression (PLS-R). They will also learn how SpectrApp facilitates the prediction of new samples, enhancing forensic investigations.
By the end of this session, attendees will: (1) become familiar with SpectrApp; (2) employ multivariate analysis techniques; (3) implement chemometric strategies; (4) navigate diverse graphical tools; (5) utilize PLS-DA and PLS-R; (6) perform sample prediction; and (7) integrate machine learning for more advanced data exploration.
This workshop will significantly impact the forensic science community by showcasing how SpectrApp leverages machine learning for robust data

analysis. By equipping participants with practical skills and fostering a user-friendly approach, the workshop aims to democratize forensic data analysis, encouraging broader usage and fostering collaboration within the field.

04: DNA and Body Fluids: DNA Interpretation
15:00 - 15:45 Auditorium

DNA and Body Fluids: DNA Interpretation

TBA - 451 15:00 - 15:30

Lessons Learned From the Implementation and Use of DNAxs in DNA Mixture Interpretation and Evaluation 15:30 - 15:45

D. Wiberg[1], S. Jansson[1], R. Hedell[1], S. Boiso[1]

[1]Swedish Police Authority, National Forensic Centre, Biology unit, Linköping, Sweden

Abstract Body: In 2022, the Swedish National Forensic Centre (NFC) implemented the probabilistic genotyping expert system DNAxs, developed by the Netherlands Forensic Institute. During the implementation process a major decision had to be made that shaped the process forward: whether to treat DNAxs as a specialized tool to be used only in high profile cases or as a general approach for all relevant cases. NFC decided for the latter option, and there is no doubt that the shift to probabilistic genotyping propelled our capability forward by leap and bounds, increasing our reported results by approximately 50%. Initially, the Swedish court system discussed results provided by DNAxs in several proceedings but the subject has since then settled into accepted routine. Furthermore, DNAxs enabled NFC to change to a STR kit with more markers. Internal changes were also triggered within the laboratory following the transition to probabilistic genotyping, such as changes in SOP's and training structure for reporting officers. Equipped with knowledge from these experiences, we wish to pass it on with the hope of making the transition to probabilistic genotyping easier for any other laboratory about to embark on this journey. This contribution put light on issues related to implementing probabilistic genotyping, including how interpretation variance observed in intra-laboratory tests may be handled.

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15:00 - 17:45

ENFSI Annual Meeting

08: Forensic Medicine and Toxicology: Forensic Medicine
15:00 - 16:00

Forensic Medicine and Toxicology: Forensic Medicine

Physical Injury in Men After Sexual Assault: An Analysis of 147 Cases 15:00 - 15:15

D. Kane[1,2], K. Flood[1], M. Eogan[1,2]

[1]Royal College of Surgeons in Ireland, Dublin, Ireland, [2]Sexual Assault Treatment Unit, Rotunda Hospital, Dublin, Ireland

Abstract Body: Background:
Data on prevalence of physical injury in men who experience sexual assault are under-represented in the literature; the aim of this study is to inform this knowledge gap. It is vital that forensic examiners have access to information regarding prevalence of injury, as well as any associations with injury in order to provide optimal responsive care and accurate testimony in court.
Methods:
This is a cross-sectional study analysing the attendances of all post pubertal males who attended the Dublin Sexual Assault Treatment Unit (SATU) for a forensic examination between 1/1/2017 and 31/12/2023.
Results:
Men represented 8% (n=199) of attendances, with 68.8%(n=137/199) undergoing a forensic examination. Genito-anal injury was identified in 19.7%(n=27/137). Anal injury was present in 14.6% (n=20/137) and genital injury was present in 5.8% (n=8/137). For those who disclosed completed anal penetration and who underwent proctoscopic examination (n=53) the injury rate was 24.5% (n=13/53). Extra-genital injuries were present in 40.1% (n=55/137).
Those who had a genito-anal injury were significantly more likely to have been the victim of a multiple perpetrator assault(p=0.03). Those who had extra-genital injuries were significantly more likely to have attended within 24-hours of the incident (p=0.03).
Conclusions:
Genital injuries and/or anal injuries were absent in a large proportion of men after sexual assault. Extra-genital injuries were found in a higher proportion of men. It is anticipated that these findings will better inform society, the police and also assist forensic examiners in providing accurate and informed prevalence rates for medico-legal evidence in the criminal justice system.

Patient or Crime Scene? 15:15 - 15:30

M. Stark[1], *B. Butler*[1]

[1]Faculty of Forensic & Legal Medicine, Forensic Science Sub-committee, London, United Kingdom

Abstract Body: Clinicians who maybe doctors, nurses, midwives and paramedics, working in the police custody environment, or in sexual assault referral centres have dual obligations, therapeutic and forensic.
The Faculty of Forensic & Legal Medicine (FFLM), the standard setting body for forensic and legal medicine in the UK, established a forensic science subcommittee (FSSC) twenty years ago to ensure that patients being seen in a forensic medical setting (complainants, complainers, and suspects, of all ages, and by the circumstances of the encounter, likely to be vulnerable) receive appropriate care, including the taking of all relevant forensic samples, using the current best evidence available in the field of forensic and legal medicine.

This multi-professional group meets every six months and maintains recommendations on forensic sampling which are updated as there are developments in the field of forensic science to maximise the recovery of potential forensic evidence whilst minimising the distress to the examinee. The FSSC has also established channels of communication between the FFLM, the Police, the forensic scientific services and kit providers to communicate good practice to clinicians responsible for obtaining the samples and the teachers of those clinicians.
The FSSC produces other documents to assist clinicians with the relatively new requirements of the Forensic Science Regulator and provides advice on reducing the likelihood of contamination. This presentation will discuss the work of the FSSC and the difficult balance of what is in a patient's best interests.

Utilisation of LODOX Imaging in Forensic Investigations and Research 15:30 - 15:45

M. Heyns[1], *C.G Mole*[2]

[1]Ulster University, School of Medicine, Derry/Londonderry, United Kingdom, [2]University of Cape Town, Division of Forensic Medicine and Toxicology, Cape Town, South Africa

Abstract Body: Since the discovery of X-rays, radiographs have provided an additional tool in the arsenal to be used in forensic examinations. It provides a permanent record of the anatomy and pathology of the deceased prior to autopsy, albeit incomplete. The LODOX full-body low-dose digital X-ray system has been used in medico-legal autopsies in South Africa for a number of years as it allows for documenting fractures and rapid localisation of foreign bodies with the aid of multiple views. It offers fast, high-quality imaging, it is easily operated by trained staff and its low radiation dose does not pose a major risk to staff.

This presentation will report on the use of the LODOX system in forensic examinations at Salt River Mortuary, a large Forensic Pathology Institute in Cape Town, South Africa. Radiography can provide crucial information for a medicolegal investigation. The LODOX system was also utilised in Research conducted by postgraduate researchers from the Biomedical Forensic Science unit at University of Cape Town and three of these projects will be presented. One investigated the accuracy and reliability of the Cardio-Thoracic Ratio threshold measured from LODOX images. Another project aimed to assess the utility of LODOX scanning for discriminating bullet caliber of common handgun projectiles, which was necessitated by a case where a bullet could not be retrieved from a living individual due to possible harm or death. The third project evaluated the use of LODOX scans as an added tool for stature estimation in the South African population.

Methods of Differential Diagnosis Between Disarticulation and Fatal Trauma in Stab and/or Chop Tool Injuries 15:45 - 16:00

M.E. Öztürk[1], *Ö. Ünlütürk*[1], *İ. Çoban*[1]

[1]Council of Forensic Medicine, Morgue Department, İstanbul, Turkey

Abstract Body: In cases of skeletonized corpses, distinguishing between stab/chop injuries is critical for understanding the mechanism of trauma, identifying the tools used, and determining the cause of death. Stab and chop tools are often employed both as murder weapons and for dismemberment to destroy evidence, making accurate interpretation of bone findings essential in examinations for determining the origin. This study aimed to analyze bone lesions resulting from multiple traumas involving stab and chop injuries using a forensic anthropological approach, with a specific focus on determining the trauma type used in dismemberment. A review of 998 cases examined at the Bone and Dental Examination Department (2014–2024) identified 22 cases involving stab and chop tools. Among these, 8 cases had stab wounds, 7 had chop wounds, and 8 exhibited blunt trauma alongside both types of injuries. Joint disarticulation was observed in 8 cases, with forensic investigations/witness statements confirming its occurrence in 6 cases. These cases were evaluated in terms of the localization and pattern of the wounds with the adjacent bones forming the joint and the findings regarding the joint separation process were categorized. In the trauma analysis, distinguishing between fatal trauma and joint disarticulation is of critical importance. The correct determination to be made plays a major role in determining the cause and origin of death. As a matter of fact, failure to make this distinction appropriately will cause the nature of the crime to change and it’s also important in terms of identifying the participants of the crime.

03: Digital Evidence: Artificial Intelligence
15:00 - 16:15 Liffey Hall 1

Digital Evidence: Artificial Intelligence

Large Language Models in Digital Forensic Investigations and E-Discovery 15:00 - 15:30

H. Henseler[1,2], *H.v. Beek*[3,2]

[1]University of Applied Sciences Leiden, Department of Computer Science, Leiden, Netherlands, [2]Netherlands Forensic Institute, Hansken, The Hague, Netherlands, [3]Open University of the Netherlands, Faculty of Science, Heerlen, Netherlands

Abstract Body: The rapid evolution of Large Language Models (LLMs) is transforming fields across science and technology, including digital forensics and E-Discovery. This presentation examines the transformative potential of LLMs in digital forensic investigations, focusing on their integration into the Hansken digital forensics platform and the development of the Hansken copilot.
We begin with a concise overview of recent advances in LLM technology, emphasizing their strengths and limitations for forensic applications. By comparing open-source and proprietary models from leading organizations, the presentation highlights how these innovations address challenges in analyzing complex digital evidence, such as contextual understanding, summarization, and pattern recognition.
A key challenge in forensic settings is that LLMs deployed in the cloud are typically not an option due to privacy, security, and jurisdictional constraints. This necessitates research into smaller, efficient LLMs capable of running on-premise within secure environments. The discussion focuses

on the research and development of these tailored LLM solutions within the Hansken ecosystem.
Specific use cases illustrate how the Hansken copilot can leverage LLMs to automate repetitive tasks, assist investigators in interpreting evidence, and provide scalable solutions for legal discovery. These applications demonstrate the potential of LLMs to enhance efficiency, accuracy, and investigative depth in real-world forensic workflows.
By bridging the gap between state-of-the-art AI research and operational digital forensics, this presentation provides insights into how LLMs, through platforms like Hansken, can drive innovation and empower investigators to tackle the growing complexities of digital evidence.

Quantitative Evidence Evaluation in Forensic Face Identification Using Synthetic Data 15:30 - 15:45

R. Moreton[1]

[1]RELI, Southampton, United Kingdom

Abstract Body: Forensic face examination is a feature-based comparison method carried out by trained forensic face examiners. Research has demonstrated that forensic face examiners are highly accurate at the group level when comparing faces using their procedures and tools, but there are still large individual differences in examiner performance. Forensic face examination is also a manual process based on qualitative observations of facial features, making it difficult to demonstrate that examinations are repeatable and reproducible. Given the increasing accuracy of automated face recognition algorithms there is a growing body of research investigating the utility of algorithms in forensic face examination for quantitative evidence evaluation (for example, generating score-based likelihood ratios). However, this approach can require access to datasets of case-relevant face imagery. The generation of case-specific facial imagery is a significant challenge in terms of the access to consenting subjects, the management of the datasets and ensuring the resulting imagery is representative of the case under examination. Our research attempts to overcome this challenge using datasets of synthetic facial images styled to reflect the conditions of the case images, using generative AI and diffusion models. We present the preliminary results of using styled synthetic face data to provide quantitative face examination outcomes on a series of test cases, outlining the benefits of the approach and some limitations to consider.

AI-based, Automated Detection of Spermatozoa in Standard Forensic Specimens. 15:45 - 16:00

C. Schunck[1], *K. Ehinger*[1], *F. Maciag*[1]

[1]MetaSystems, Altlussheim, Germany

Abstract Body: In the field of image analysis, artificial intelligence, particularly using deep neural networks (DNNs), has shown significant effectiveness. These networks, trained on large collections of categorized image data, achieve high accuracy, for example, in detecting and identifying objects within digital images of microscopic samples. This

advancement holds particular importance in forensic investigations related to suspected sexual offenses, where analyzing evidence for the presence of sperm is a standard procedure. Traditionally, forensic labs rely on manual microscopy, a process that is both time-consuming and labor-intensive, requiring the expertise of specially trained personnel. The manual approach contributes significantly to backlogs in case processing due to its demands on time and resources.
To address these issues, we have developed an automated workflow leveraging two DNNs trained for sperm detection and classification, aimed at streamlining the analysis of trace evidence. These networks were trained on forensic specimens prepared using common staining techniques, including "Christmas Tree" stain, Baecchi stain, and H&E, through supervised learning. Internal examinations using Baecchi-stained samples from a standard forensic laboratory demonstrated a detection sensitivity of 98.7% and a classification accuracy of 98.4%. A direct comparison of manual evaluation methods and DNN-based automatic microscopy on 80 specimens in a European forensic laboratory showed that 10 cases, previously identified as negative through manual microscopy, were positive. These results indicate that our AI-enhanced method for identifying sperm on microscopic slides presents a viable option for decreasing time and resources required by conventional microscopy. This could help alleviate the backlog problem faced by forensic laboratories.

Automatically Recognizing the Steganography Tool Used Based on Fixed and Variable Position Signatures 16:00 - 16:15

M. Kombrink[1,2], K. Elderhorst[1,2], G. Beuzel[1,2], M. Worring[2], Z. Geradts[1,2]

[1]Netherlands Forensic Institute, Digital and Biometric Traces, Den Haag, Netherlands, [2]University of Amsterdam, Informatics Institute, Amsterdam, Netherlands

Abstract Body: Steganography can be used to hide information inside innocent looking images. As criminals can use this for communication, it is vital to find this hidden content. However, most of the research on steganalysis aims to detect the presence of steganography and does not go beyond this step. Once a detection has been made, a lot of software packages need to be tested to discover whether this particular one was used to hide information, so that the hidden information can be revealed. As a potential solution, we observe that research shows that steganography software packages can produce so-called signatures, which are identifiable alterations to images that are not based on the message or the image content. We performed a large-scale analysis and discovered a total of 50 fixed position signatures and 101 variable position signatures. These signatures are (mostly) unique for a tool-extension combination and can aid with the in- and exclusion of tools as potentially used software packages, thus drastically reducing the search space.

05: Drugs: Other
15:00 - 16:00 Liffey Hall 2

Drugs: Other

Harm Reduction Vending Machines: Combatting the Opioid Crisis by Increasing Naloxone Distribution 15:00 - 15:15

K. Ceniccola-Campos[1], *R. Kerrigan*[1]

[1]University of Strathclyde, Pure & Applied Chemistry, Glasgow, United Kingdom

Abstract Body: Naloxone is a life-saving substance that can reverse the effects of an opioid overdose, which has been critical for reducing drug misuse deaths worldwide. Effective naloxone intervention requires wide distribution and easy access, a task which has consistently proven difficult in rural and underprivileged areas. In an effort to broaden the availability of naloxone and reduce barriers to access, the United States has trialed their inclusion in harm-reduction vending machines (HRVM) and seen promising results; however, the same methods have not yet been explored for Scotland, which has been hard hit by opioid use in the past several years. This study employed thematic analysis, hypothesis testing, and Auto-Regressive Integrated Moving Average analysis to explore the potential for implementing naloxone-distributing HRVM in Scotland and barriers to that implementation. Findings revealed similar attitudes and difficulties surround naloxone availability in both Scotland and the U.S., but also significant differences in the distribution of take-home-naloxone kits across several Scottish health boards. The analysis forecasted a plateau or decline in naloxone distribution through traditional dispensation over the next five years, providing evidence that novel distribution approaches such as HRVM are necessary to reduce opioid-related mortality in Scotland.

Targeted Geographical and Surveillance Analyses of the Residual Drug Content of Used Syringes in Sydney, Australia 15:15 - 15:30

H. Fursman[1], *J. Brown*[2], *E. Silins*[3,4], *M. Bartlett*[5], *J. Latimer*[5], *S. Chadwick*[1], *C. Roux*[1], *M. Morelato*[1]

[1]University of Technology Sydney, Centre for Forensic Science, Sydney, Australia, [2]NSW Ministry of Health, Centre for Alcohol and Other Drugs, Sydney, Australia, [3]South Eastern Sydney Local Health District, Kirketon Road Centre, Sydney, Australia, [4]University of New South Wales, National Drug and Alcohol Research Centre, Sydney, Australia, [5]Uniting Medically Supervised Injecting Centre, Sydney, Australia

Abstract Body: Forensic science is increasingly being used proactively to better understand criminal and harmful activities, such as the illicit trafficking and consumption of drugs. The analysis of the residual drug content of used syringes has previously demonstrated to be an innovative approach that provides objective information at the consumption level of the drug supply chain. The chemical analysis of drug residues can identify the main drug injected and the presence of cutting agents or new psychoactive substances. This study aimed to analyse the residual drug content of used syringes across different locations in Sydney, Australia for targeted and surveillance monitoring purposes.

Used syringes were collected from six sampling locations; five sampling events (n=997) were conducted across Sydney for regular surveillance and one in Western Sydney area (n=902) relating to a public health investigation. The residual content was extracted before analysis by gas

chromatography - mass spectrometry (GC-MS) and ultra-performance liquid chromatography – tandem mass spectrometry (UPLC-MS/MS).

Across all sampling events heroin and methamphetamine were the most frequent drugs found within syringes. Distinct differences were observed between the drugs injected in different locations; preference for heroin over methamphetamine, widespread co-detection of fentanyl within heroin syringes, and distinctive methamphetamine polydrug mixtures. The analysis of used syringes within the public health investigation sampling was able to rapidly identify protonitazene (a potent synthetic opioid). Used syringe analysis can complement traditional monitoring methods and identify unique aspects of drug consumption trends, helping to improve the allocation of law enforcement and health resources.

Experiences and Reporting of Drink Spiking and Needling Incidents in the UK 15:30 - 15:45

A. Grela[1], *S. Gair*[1], *L. Gautam*[1]

[1]Anglia Ruskin University, School of Life Sciences, Cambridge, United Kingdom

Abstract Body: Drink spiking is not a new phenomenon, however the number of reported incidents in the media increased in 2021, and the newer phenomenon of needle spiking (i.e. needling) attracted intense media interest in the United Kingdom in 2021. Spiking incidences are under reported due to psychological and physical barriers, resulting in low prosecution and conviction rates. We will present results collected from two national surveys, commissioned by Drinkaware in 2022 and 2023 as part of 'The Drinkaware Monitor', conducted by YouGov. In 2022, we collected responses from 6,318 individuals (experience in their lifetime), and in 2023, it increased to 10,473 participants (experience in the previous year). We explored the circumstances surrounding reported drink spiking and needling incidents, alongside their health repercussions and reporting patterns.

2.2% of 2023 survey participants reported having been spiked within the 12 months leading to the survey and 11.3% of the 2022 survey participants reported being spiked in their lifetime. The prevalence of needling was 1.4% and 0.7%, 2022 and 2023 surveys respectively. The trend of location of drink spiking remained in both surveys, with more incidents taking place in bars (40.7% vs 45.3% in 2022) and clubs (28.9% vs 34.2% in 2022). The trend of needling has changed slightly with clubs (23.9% vs 27.0% in 2022) and bars (21.1% vs 14.6% in 2022). Additionally, the analysis of perceptions regarding vulnerability to drugging revealed misconceptions centred around victim attributes.

Our findings highlight the urgent need for proactive measures in safeguarding and public awareness initiatives.

A Crime Script Analysis of Synthetic Drug Production and Trafficking 15:45 - 16:00

A. Nagtegaal[1], *C. de Poot*[2,3], *E. Kleemans*[1], *J. van der Kemp*[1,4]

[1]Vrije Universiteit Amsterdam, Criminology, Amsterdam, Netherlands, [2]

Amsterdam University of Applied Sciences, Forensic Science, Amsterdam, Netherlands, [3]Police Academy of the Netherlands, Apeldoorn, Netherlands, [4]Netherlands Institute for the Study of Crime and Law Enforcement, Amsterdam, Netherlands

Abstract Body: The Netherlands has long played a key role in the illicit drug market, serving as a primary transit point and a main producer of amphetamines and MDMA. Criminal networks run drug production and trafficking operations, causing environmental harm and other adverse societal consequences. Combatting these networks is challenging due to their dynamic and innovative nature. Consequently, there is a need for up-to-date knowledge on the structure and dynamics of illicit drug production and trade. Currently, such knowledge is lacking.
In this study we use forensic case data to explore synthesis methods, materials, and concepts used in synthetic drug production and trafficking in the Netherlands. Through crime script analysis, we analyze their evolution over time, map out the most commonly used modus operandi, and identify alternative methods and strategies. With this approach, we aim to uncover factors associated with the efforts and risks involved in synthetic drug production and trafficking. In doing so, we provide current and comprehensive knowledge on the processes of synthetic drug production and trafficking, as well as insight into potential countermeasures that could be deployed against it.
This research is part of the FIDBID-project (Forensic Illicit Drug intelligence through Big and Intelligent analysis of chemical and criminological Data). FIDBID combines chemical expertise, big data analytics and criminological insights to deliver real-time forensic intelligence based on the analysis of large volume drug screening data from forensic case work.

12: Scenes of Crime: Forensic Archaeology and Anthropology
15:00 - 15:45 Wicklow Hall 1

Scenes of Crime: Forensic Archaeology and Anthropology

Understanding Human Decomposition in the Great White North: A Review of REST[ES]'s First Five Years and Future Directions 15:00 - 15:15

E. Cuerrier-Richer[1,2], N. Bitschnau[2,3], H. Leblond[1]

[1]Université du Québec à Trois-Rivières, Anatomy, Trois-Rivières, Canada, [2] Université du Québec à Trois-Rivières, Groupe de recherche en science forensique (GRSF), Trois-Rivières, Canada, [3]Université du Québec à Trois-Rivières, Biochemistry, Chemistry, Physics and Forensic Science, Trois-Rivières, Canada

Abstract Body: The site for Research on Experimental and Social Thanatology, or *Recherche en Sciences Thanatologiques [Expérimentales et Sociales]* (REST[ES]) in French, is a high security outdoor facility primarily dedicated to the physical, chemical and biological study of human decomposition, with a sociological dimension. As the site is located in southeastern Canada, research conducted at REST[ES] focuses on the study of death and the taphonomic processes that occur in a northern, cold, and forested climate. REST[ES] is currently the only human

decomposition facility in Canada, and the only bilingual site operating in French and English globally, thus offering a unique niche to local, national and international researchers, scientists, practitioners, law enforcement and other professionals interested in postmortem changes in this environment.

Since the site welcomed its first donor in 2020, REST[ES] has received a total of 30 donors and hosted 23 research projects* in anatomy, chemistry, entomology, environmental science, forensic science, and thanatology, to name only a few. Following an administration change in 2023, REST[ES] underwent a major restructuration, with the intent to bring the site closer to the American human decomposition facility model, while also embracing the traceology approach recommended in the Sydney Declaration. The purpose of this presentation is three-fold: 1) to provide a review of REST[ES]'s first five years as a taphonomy research facility, 2) to introduce the new management structure, and 3) to present future directions planned for the site in upcoming years, including professional partnerships, research collaborations and training opportunities.

* As of November 29, 2024

Sharp Force, Sharp Focus: Comparing Bone Characteristics in Perimortem and Postmortem Stabbing in a *Sus scrofa domesticus* Sample 15:15 - 15:30

T.L. Lottering[1], *A. Meyer*[1], *J. Myburgh*[2], *D. Brits*[1]

[1]University of the Witwatersrand, Human Variation Identification and Research Unit, School of Anatomical Sciences, Faculty of Health Sciences, Johannesburg, South Africa, [2]University of Pretoria, Department of Anatomy, School of Medicine, Faculty of Health Sciences, Pretoria, South Africa

Abstract Body: As the identification of the timing of sharp force trauma can be challenging in forensic anthropology, this research aimed to assess differences between perimortem sharp force trauma and postmortem damage. A total of 52 porcine bones were inflicted with stabbing trauma using a kitchen knife. The perimortem (Pe) sample (n= 20) comprised fleshed remains, of which 12 were macerated and eight were left out to decompose naturally. The postmortem (Po) sample (n=32) comprised of two groups of dry bones exposed to the environment for two years before damage infliction. Following infliction of damage, eight were collected immediately and 24 were left out for an additional year. The bones were assessed macroscopically, looking at several traits outlined in the literature. Features, such as protrusions and wastage, showed no significant differences between the two samples. At the same time features such as the angle of entry (aspect), inclusions, presence of fractures, flaking, and peeling were found to be significantly different between perimortem trauma and postmortem damage ($p<0.05$). Interestingly, more fractures were observed in the fresh sample (71%) compared to the dry sample (40%). When comparing within each sample, protrusions (Pe: $p=0.015$; Po: $p<0.001$), fracture presence (Po: $p<0.001$) and peeling (Po: $p<0.001$) showed significant differences. These results suggest that the macroscopic presence of inclusions, flaking, peeling and fractures may help distinguish between perimortem and postmortem stabbing impacts. While

various characteristics significantly differed between the two samples, future research should aspire to increase the total sample size and evaluate these differences in human bone.

Enhancing Forensic Investigations: A Multidisciplinary Approach to Crime Scene Analysis Using Advanced Non-Destructive Techniques 15:30 - 15:45

P.M. Barone[1,2]

[1]The American University of Rome, Rome, Italy, [2]Forensic Geoscience Italy, Rome, Italy

Abstract Body: Forensic science is advancing rapidly through the integration of innovative, multidisciplinary approaches in search and rescue and crime scene investigation. Modern forensic geoarchaeology combines traditional investigative techniques with advanced non-destructive tools, such as UAVs, satellite imagery, ground-penetrating radar (GPR), GIS, and more general remote sensing. These technologies allow investigators to cover large areas efficiently and detect subtle anomalies, such as soil disturbances or changes in vegetation, which may indicate potential crime scenes or clandestine burials. Moreover, Bayesian probability models enable data-driven, quantifiable assessments that prioritize resources effectively and guide investigators toward high-probability areas for further examination.
This structured approach, which also integrates K9 units for scent detection and standardized protocols, has proven essential in complex, challenging terrains where evidence is sparse or indirect. In a 2008 Italian cold case, for instance, as well as in other forensic cases, this methodical, layered approach helped investigators systematically rule out improbable sites, allowing them to concentrate resources on viable locations. Even when physical remains are not found, the rigorous exclusion of areas with low probability enhances judicial clarity and conserves investigative resources. The combination of advanced methodologies and standardized protocols increases the reliability of forensic findings, which are crucial for legal proceedings. By applying consistent, probabilistic methods, forensic teams achieve a high level of accuracy, providing clear, defensible conclusions. This comprehensive and adaptable approach to forensic investigation not only strengthens the evidence chain but also enhances the broader judicial process by supporting precise, science-based interpretations of forensic data.

11: Marks, Impressions and Biometric Traces: Document, Handwriting and Signature
15:00 - 16:00 Wicklow Hall 2 (A)

Marks, Impressions and Biometric Traces: Document, Handwriting and Signature

Humans and algorithms partner to boost face recognition 15:00 - 15:15

PJ. Phillips[1], *G. Jeckeln*[2], *C. Hahn*[1], *A. Yates*[1], *P. Fontana*[1], *A. O'Toole*[2]

[1]National Institute of Standards and Technology, Information Access Division, Gaithersburg, United States, [2]University of Texas at Dallas, School of Behavioral and Brain Sciences, Richardson, United States

Abstract Body: In forensics and biometrics, face recognition systems analyze two face images to determine if they show the same person. Facial comparisons errors can have consequences for individuals, including unfounded criminal accusations and denial of entry to a country. To minimize errors, best practices call for human review of decisions made by face recognition technology (algorithms). This human review step creates a human-algorithm partnership that is assumed to be more accurate than the algorithm or human alone. Is it possible to predict on a case-by-case basis when this assumption is true? We established the conditions under which collaboration between two individuals or an individual and an algorithm improves facial identity comparisons. Using data from published face comparison tests that include facial examiners, we tested the benefits of human-human and human-algorithm collaboration. We showed that the benefits of collaboration increase as the difference between the collaborators' abilities decreases (Proximal Accuracy Rule, PAR). The PAR held across a wide range of collaborator expertise (students, experts, high-performing algorithms). This rule determines the maximum difference in ability between a human and an algorithm for which partnerships are beneficial. Beyond this difference, human-algorithm partnerships degrade performance, and relying on the algorithm alone yields more accurate performance (intelligent partnerships). We show that humans who perform substantially worse than the algorithm can still contribute to the accuracy of the human-algorithm partnership. Additionally, intelligent partnerships mitigated the impact of underperforming individuals on group performance. These findings provide an evidence-based guide for forming efficient human-algorithm partnerships in real-world applications.

Interpretability Study of Face Features Based on Deep Learning 15:15 - 15:30

W. Li[1], *L. Xie*[1], *Z. Li*[1], *X. Hou*[1], *Z. LI*[1]

[1]Institute of Forensic Science,Ministry of Public Security, Beijing, China

Abstract Body: In recent years, face matching methods based on faciel feature similarity scores have atracted considerable research attention, However, the **deep learning** network model is as difficult to interpret as a "black box", it limits the wide application of facial feature similarity scores in the field of rigorous **forensic science** image evidence. Therefore, this study aims to explore **the qualitative and quantitative analysis** of **facial feature interpretability** based on deep learning. We propose the method of **constructing a triplet dataset** based on the multimodal bigram model + Flux inpaint model, i.e.,to achieve accurate and high-quality repainting of matched portrait features by means of **semantic segmentation and semantic generation**.and the triplet refers to the portrait to be examined, the matched portrait, and the non-matched portrait. The dataset is divided into test dataset and validation dataset. We creatively propose **an optimized saliency map generation method** based on similarity scores, which can provide a paradigm for face feature interpretability.That is, to solve a class of deep learning model interpretability problems by constructing dedicated datasets + improving visualization methods.Experiments show that the optimized saliency map generation method based on similarity scores can more accurately highlight areas of interest for deep learing-based portrait matching focuses than GradCAM, GradSUM.In addition, the combination of ternary validation dataset can assist in quantitatively analyzing the accuracy and false alarm

rate of the deep learning-based face matching system, thus improving the application of face matching methods based on deep learning in the field of rigorous forensic science image evidence.

Measuring Cross-Race Bias in Forensic Facial Examiners and Super-recognizers: A Closed-Box Approach 15:30 - 15:45

PJ. Phillips[1], A. Yates[1], G. Jeckeln[2], A. Panduragan[2], J. Yang[1], D. White[3], A. O'Toole[2]

[1]National Institute of Standards and Technology, Information Access Division, Gaithersburg, United States, [2]University of Texas at Dallas, School of Behavioral and Brain Sciences, Richardson, United States, [3]UNSW-Sydney, School of Psychology, Sydney, Australia

Abstract Body: People naturally have a cross-race bias; they recognize faces of their own better race than those of other races. This bias can cause awkward situations in everyday social interactions, and it could potentially lead to unfounded accusations in forensic facial examinations. Phillips et al.'s 2018 showed that when facial examiners performed forensic facial comparisons, they were more accurate than the general population and had the same accuracy as super-recognizers. In a perceptual study, where facial examiners had only 30 seconds to complete a comparison, examiners showed a cross-race bias (Yates et al. 2024). We designed a closed-box study to determine if a cross-race bias exists for facial comparisons when examiners have access to their tools and methods and super-recognizers. The study measures the difference in accuracy between pairs of White and Black faces. Since most facial examiners and known super-recognizers are White, the test was designed to accommodate these two populations. We created the test following the procedure in Jeckeln et al. 2024. The test consisted of 22 face-image pairs (11 Black and 11 White) that were selected based on non-face experts' judgments. The face-image pairs did not produce an effect for the race of face-pairs and the race of the participants judging the similarity of the faces. The analysis includes the performance of systems submitted to the NIST FRTE program and research algorithms posted on the web. The results of this study will inform the forensic community about cross-race bias in facial comparisons.

Determining Score-Based Likelihood Ratios From Facial Images of Different Quality: A Practical Approach 15:45 - 16:00

D. Minaglia[1], S. Paolino[1], M. Meneghetti[1], F. Zampa[1]

[1]Carabinieri - RaCIS, Reparto Carabinieri Investigazioni Scientifiche, Parma, Italy

Abstract Body: In this work, we introduce a new method for calculating the score-based Likelihood Ratio (SLR) in forensic face recognition, using images from various quality ranges. The quality of facial images is evaluated using the Open Source Facial Image Quality (OFIQ) library, which can be found on the GitHub platform. Two different facial image datasets are used to create Between-Source Variability (BSV) and Within-Source Variability (WSV) curves for each quality range. This method offers a reliable framework for determining the SLR while taking into account

differences in image quality. A generic approach is adopted to facilitate SLR calculations across different quality levels, with the goal of improving reliability in forensic applications. The proposed method is thoroughly validated, demonstrating its effectiveness in addressing the challenges posed by varying image quality in forensic scenarios.

02: Chemistry: Gunshot Residue (GSR)
15:00 - 16:00 Wicklow Hall 2 (B)

Chemistry: Gunshot Residue (GSR)

Organic and Inorganic Gunshot Residues Transfer on Shooters, Bystanders and Walkers 15:00 - 15:15

T. Tilborg[1], V. Redouté Minzière[1], C. Weyermann[1]

[1]University of Lausanne, Ecole des sciences criminelles, Lausanne, Switzerland

Abstract Body: The discharge of a firearm produces fumes, particles and combustion products that are released in the environment. These are named gunshot residues (GSR) and are deposited on the surfaces surrounding the discharge including individuals and objects present on the scene.

This project aims to study and compare the transfer of organic (OGSR) and inorganic (IGSR) gunshot residues on individuals present on the scene during or passing by shortly after the discharge. The participants included a shooter, a bystander and a scene visitor. Six experiments were carried out using different firearms or ammunition. Between 3 and 5 consecutive shots were discharged using three different firearms (i.e. pistol, revolver, and assault rifle). Specimen collection was performed with carbon adhesive stubs applied to the hands, forearms, and faces of the participants. GSR collection occurred 30 minutes after the shooting for the bystanders and shooters, and after 10 minutes of walking in the shooting range for the scene visitor. The specimens were analyzed first for OGSR using ultra-high performance liquid chromatography coupled with tandem mass spectrometry (UHPLC-MS/MS), and then for IGSR using a scanning electron microscopy coupled with energy dispersive x-ray analysis (SEM/EDX).

GSR were found on all participants, including the bystander and scene visitor. However, OGSR concentrations and IGSR particles were systematically higher on the shooter than other participants indicating that differentiating them from the shooter might be possible shortly after a discharge. Further research is needed to evaluate whether this differentiation could still be made for longer periods.

Source Inference of Gunshot Residue Using a Machine Learning Approach 15:15 - 15:30

C. Sabaut[1,2], O. Robyr[3], C. Côte[4], P. Bakis[4], F. Crispino[1,2], D. Werner[1,2]

[1]University of Quebec at Trois-Rivières, Department of biochemistry, chemistry, physics and forensic science, Trois-Rivières, Canada, [2]Forensic Science Research Group (GRSF), Trois-rivieres, Canada, [3]Eurofins Microscan SA, Chavannes-près-Renens, Switzerland, [4]Service National de Police

Scientifique / Laboratoire de Police Scientifique de Marseille - LPS13, Weapons and Ammunitions Division, Marseille, France

Abstract Body: Apart identifying the shooter or assessing the firing distance, the examination of inorganic gunshot residue (IGSR) may establish links between traces collected on the shooting scene, such as a firearm, a cartridge case and the individuals involved. The aim of this research is to assess the effectiveness of machine learning algorithms in classifying IGSR specimens according to the cases to which they belong, in order to be able to link IGSR specimens from different traces. The data employed in this study come from real-life cases conducted in Switzerland and France. This approach enables the closest approximation to the operational conditions under which this work is conducted. A variety of supervised learning models have been evaluated. These are accompanied by confusion matrices, which facilitate comparison of sensitivity, selectivity, and accuracy of the algorithms. The data utilised in the models encompasses the presence or absence of particles and their ratios within the specimen, in addition to the atomic percentage of each element within said particles. The models are selected according to their capacity to minimise false negatives in a forensic intelligence context, or false positives in an evidence evaluative context. The results of this study will contribute to the visualisation of a novel information through IGSR analysis in forensic science, thereby paving the way for better effective exploitation of these data in judicial expertise and forensic investigation.

Characterization and Determination of GSR in Selected 9mm Ammunitions Using SEM/EDS 15:30 - 15:45

A. Askar[1]

[1]Dubai Police, Dubai Police Forensic Labs, Dubai, United Arab Emirates

Abstract Body: Analysis and identification of gunshot residue (GSR) considered one of the key evidence in shooting crime scene investigations. In this work, Fiocchi non-toxic ammunition (NTA), ADCOM and NATO ammunitions were characterized and analyzed as GSR in different conditions using Browning Hi-Power 9 mm pistol by SEM/EDS according to standard method (ASTM E1588 – 20). Characterization was carried out by analyzing the elemental composition of all ammunition parts; casing, bullet, gunpowder, and primer residue. Results showed that all parts have similar elemental composition except for the primer part which differed. However, all the ammunitions contained lead toxic particles even Fiocchi NTA. Accordingly, they all contained toxic GSR particles with NATO having the highest particles then ADCOM and the least toxic particles for Fiocchi NTA. Moreover, right hand showed more IGSR than left hand and most of the particles were less than 1 µm in all the ammunitions distinguishing them from the environmental particles. Furthermore, we confirmed that the elapsed time depend on the activity of the shooter since one hour interval showed more particles than 4 hours. No HMF-GSR were detected in Fiocchi NTA due to the limited NTA classifications in standard method. In general, more studies need to be conducted to refine standard methods and optimize the scheme of classifications to keep up with the change of ammunition to achieve a total chemical profile of GSR in crime scenes.

TBA 15:45 - 15:45

01: Case Studies: Emerging Technologies in casework
15:00 - 16:00 Liffey Meeting Room 2

Case Studies: Emerging Technologies in casework

Forensic Examination of Firearms: Restoring Obliterated Serial Numbers Using Non-Destructive Techniques 15:00 - 15:15

B. Henwood[1]

[1]Conflict Armament Research, Special Projects Unit, Shrivenham, United Kingdom

Abstract Body: The forensic examination of firearms often involves identifying serial numbers to establish ownership and traceability, particularly in criminal cases, trafficking investigations, and diversion studies. However, firearms used in such contexts are frequently sanitised by obliterating unique markings like serial numbers, rendering them untraceable. This challenge is a significant concern for forensic examiners and investigators worldwide.

Traditional methods, such as the application of chemical etchants, have been employed to recover obliterated markings in forensic labs worldwide. While effective in many cases, these etchants are corrosive and can compromise the forensic integrity of the evidence. This report examines an innovative solution: Regula Forensics' Firearms Examination Kit, a commercially available tool that uses eddy currents and magnetic fields to detect, visualize, and restore original markings.

The study documented the application of this non-destructive methodology on sanitized firearms across diverse regions, including the United Kingdom, Brazil, and Burkina Faso. Results demonstrated that 83% of the firearms examined showed complete recovery of obliterated markings, while an additional 12% exhibited partial recovery with minimal or no surface preparation required.

The non-invasive nature of this technique, combined with its high success rate, underscores its potential as a preferred method in forensic investigations involving sanitized firearms. The findings presented in this report strongly advocate for the broader adoption of this advanced methodology in forensic laboratories worldwide.

Driver Sleepiness Detection in Biofluids via Metabolic Signatures and Machine Learning 15:15 - 15:30

M. Scholz[1], *A.E. Steuer*[1], *A. Dobay*[1], *S. Lakaemper*[1], *K. Keller*[1], *H.-P. Landolt*[1], *T. Kraemer*[1]

[1]Universität Zürich, Zurich, Switzerland

Abstract Body: Drowsy driving causes more fatalities than drunk driving. However, police and forensic experts must rely on self-reports due to the

lack of specific biomarkers. We aimed to identify sleepiness in biofluids via changes in metabolism.

In a randomised clinical trial, we quantified the effects of sleep restriction and sleep deprivation on metabolism, performance, and subjective perception, compared to controlled sleep. 20 participants performed gold-standard tests for vigilance and attention (Psychomotor Vigilance Test, d2-Test of Attention), subjective sleepiness (Karolinska & Stanford Sleepiness Scales), and a state-of-the-art driving simulation task at regular intervals. Trained police officers assessed participants' fitness to drive after driving simulation. Various biological samples (e.g., oral fluid, blood) were repeatedly collected to monitor sleepiness effects on the metabolism.

Both interventions resulted in significant decrease in psychomotor vigilance (reaction time, lapses), attention and concentration (processing speed, rule compliance), and driving performance (lane keeping, microsleep episodes), despite limited subjective perception. The negative effects were often more pronounced after sleep deprivation. However, police officers could not always identify sleep-impaired individuals based on their observations. The biological analyses revealed a unique metabolic signature of sleep deprivation and to a lesser extent for sleep restriction. With the use of predictive machine learning models, sleep-deprived individuals could be identified precisely ($F_{0.5}$ scores 0.87-0.90) based on 10 to 12 biological markers. Conveniently, these methods do not require a reference sample.

This study revealed a metabolic signature of sleep loss in biofluids under realistic conditions. This holds promising potential for future applications in forensic roadside driver testing.

Evaluation Efficiency Using Smart Headset Technology and Automatic Speech Recognition to Enhance the Efficiency of Forensic Reporting Workflow 15:30 - 15:45

O. Moldestad[1], *B. Skattør*[2], *T. Beka*[3], *K. Porter*[4]

[1]Vest Police District, Forensics, Bergen, Norway, [2]Oslo Police District, Unit Intelligence and Investigation, Oslo, Norway, [3]Norway IT Unit, AI, Oslo, Norway, [4]NTNU CCIS, Forensics, Gjøvik, Norway

Abstract Body: The rapid evolution of technology and the exponential growth of data have created an urgent need for police forces to adopt innovative tools to improve efficiency and effectiveness. This presentation showcases the latest findings and solutions from a research collaboration exploring advanced smart headsets designed for communication and data collection at crime scenes. These cutting-edge devices enable hands-free, voice-controlled operations, live-streaming, and real-time collaboration with experts locally and globally, improving forensic decision-making by enhancing the team situation awareness, accuracy, and the speed of reporting directly from crime scenes.

In partnership with the Norwegian Police, the Netherlands Forensic Institute (NFI), and West London University, the research focuses on further developing and exploring smart headset solutions to optimize on-site documentation and reporting workflows. Automatic speech recognition and large language models are employed to digitize and refine reports,

significantly reducing manual effort and improving the quality of forensic logs. It is revealed in a recent survey that Norwegian forensic teams spend up to 55% of their time on reporting, underscoring the need for more efficient solutions.

To ensure measurable benefits and sustainable implementation of such technology, this research combines traditional gap analysis with AI-specific methodologies, including the AI Return on Investment Trinity model. This model emphasizes three key areas: measurable benefits (e.g., time savings), strategic benefits (e.g., alignment with long-term goals), and capability maturity (e.g., organizational readiness for AI adoption). By systematically evaluating these areas, we aim to “prove” the increased efficiency when applying the proposed technology to crime scene investigations.

Unveiling the Unseen: The Role of HPMS in Low-Concentration NPS Field Detection 15:45 - 16:00

J. Van Auker[1], N. Koen[1]

[1]908 Devices, BOSTON, United States

Abstract Body:
The emergence of New Psychoactive Substances (NPS), particularly fentanyl analogs and nitazenes, presents significant challenges for field detection of synthetic opioids. This presentation explores the rapid evolution and increasing diversity of these substances, which complicate traditional detection methods in the field. The highly potent nature of these synthetic opioids necessitates advancements in portable technologies capable of identifying and quantifying low-concentration samples with precision. High-Pressure Mass Spectrometry (HPMS) has emerged as a particularly promising tool due to its sensitivity, portability, and ability to provide rapid results in real-world conditions. In addition to HPMS, other technologies such as portable mass spectrometry, FTIR/Raman spectroscopy, and colorimetric tests offer complementary capabilities, each with its own strengths and limitations. Enhancing field detection capabilities with advanced tools like HPMS is critical for mitigating the infiltration of these threats, ultimately improving public health and safety outcomes.

07: Forensic Management and Quality Systems: Other
15:00 - 15:45 Liffey Meeting Room 3

Forensic Management and Quality Systems: Other

Five Developed Tools to Improve the Reporting Quality of Ad Hoc Experts 15:00 - 15:15

M. Smithuis[1], N. Laan[1], K. van den Doel[1], H. Hoitzing[1]

[1]Netherlands Register of Court Experts, Utrecht, Netherlands

Abstract Body: In criminal procedures, experts from all kinds of disciplines give their expert opinions. Most of them are trained in some kind of forensic

science or have experience in reporting for the court. However, occasionally there will be experts that have neither, so-called 'Ad Hoc' expert, e.g. a boat expert or a diamond expert. They may be within the top of their professional field but are they able to write a reliable unbiased report for a criminal law procedure? In the Netherlands, reports of such unexperienced experts have led to miscarriages of justice in the past.
To overcome these challenges the Netherlands Register of Court Experts (NRGD) has started the Ad Hoc Expert Project. In this collaborative project between NRGD, public prosecutor, police, and several judges, we have developed five distinct tools to help both the court and the experts: Overview of Organisations of Experts, Appointment Questionnaire, Criminal Law E-learning Module, Forensic Report Guideline, Report Feedback. These tools help the judge or prosecutor to find the correct expert for the job. The tools also inform experts concerning the criminal procedure, prepare them for what is to come and give aid in writing a reliable report within a forensic context.
In 2020 the tools were distributed in the Netherlands and have already been widely used in many criminal cases. Experts and judges alike emphasize the usefulness of these tools and their importance in criminal cases. The NRGD is looking to expand this project beyond Dutch borders and is looking for international cooperators.

Measuring the Contribution of Forensic Science: A Systematic Review 15:15 - 15:30

S. Bitzer[1], *J. Divoy*[1], *I. Lemans*[1]

[1]UCLouvain, School of Criminology, Louvain-la-Neuve, Belgium

Abstract Body: Measuring the value of forensic science is crucial for helping law enforcement agencies allocate resources more effectively, ultimately enhancing policing outcomes. However, this assessment is neither straightforward nor uniform.

Through the results of a systematic literature review of studies examining the contribution of forensic science, this study investigates three key questions. A first challenge lies in defining the specific contributions of forensic science, which are closely tied to the definition of forensic science itself, its utility dimensions, and its roles within the criminal justice process. Secondly, these roles vary across cases and contexts, necessitating the use of diverse evaluation metrics. Quantitative metrics, such as the number of traces collected or analyzed, lead times, and case clearance rates, provide measurable outcomes, while qualitative measures, including decision-making factors, reasons for trace analysis, and the informational impact on investigations, capture subtler contributions. Thirdly, the study explores how the choice and application of these metrics influence the reported contribution of forensic science.

The findings reveal that forensic science's perceived value is highly dependent on the metrics and frameworks applied, highlighting the importance of adopting a holistic and context-sensitive approach to evaluation. By addressing these challenges, this study provides valuable insights for policymakers, practitioners, and researchers aiming to optimize the integration of forensic science into the criminal justice process.

TBA 15:30 - 15:45

09: Interpretation: Evidence Evaluation
15:00 - 16:00 Wicklow Meeting Room 3

Interpretation: Evidence Evaluation

Practical Implementation of the Interpretation of Evidence Regarding the New Forensic Standard ISO 21043 15:00 - 15:15

T. Ottiker[1]

[1]Zurich Forensic Science Institute, Zurich, Switzerland

Abstract Body: The new ISO 21043 standard for forensic sciences (to be implemented in 2025) lists four different types of questions and four different types of opinions.
Which case and which trace requires which approach to satisfy both the scientific requirements as well as the principles of the judicial (penal) procedure? The presentation puts the different types of questions and opinions in relation to each other and points out how they can be approached and verbalized in technical reports and experts reports.
For many forensic questions, opinions expressed with likelihood ratios are appropriate. The practical implementation of concise and clear explanations when evaluating forensic findings under different propositions is described. Focusing on the use of a verbal scale, the presentation emphasizes the necessity and gives examples of concise and clear explanations in forensic reports in order to be properly understood by non-forensic scientists.

Professional Practice Report: Evaluation of Results in a Combined Auditive-Acoustic-Semiautomatic Method for Forensic Speaker Comparisons 15:15 - 15:30

F. Carlström Plaza[1]

[1]Swedish Police Authority, Swedish National Forensic Centre - NFC, Information Technology, Linköping, Sweden

Abstract Body: Different methodologies exist for forensic speaker comparisons. It’s possible, and in several fields of research even recommended, to combine methodologies to improve reliability and informativity of forensic comparisons. The Swedish National Forensic Centre, NFC, has developed and uses a mixed method where both the perceptual analyses and the automated methods are combined and performed by one expert, followed by the evaluation by a second expert. Overall, the method consists of five methodological parts; auditive analysis with a voice protocol (SVPA), two acoustic analyses (fundamental frequency and formants 1-3), articulation rate, and an automatized analysis with deep neural networks (MFCCs). The evaluation of results, at present time, treats the different properties measured in the different methodological steps as possible dependent variables. The final evaluation result is an overall likelihood ratio for observing all the results given the conditions of the case, presented in an interval according to the conclusion scale of NFC (nine LR-

intervals from -4, zero, to +4). The forensic speech and audio team presents their approach and practice of a possible framework for forensic speaker comparisons in line with research recommendations of a fusion between human and automated methods. (190 words)

Guidelines for the Optimal Recovery of Biological Material From Airbags Deployed in Road Traffic Collisions for DNA Profiling 15:30 - 15:45

L. Breslin[1], *M. Breathnach*[1], *S. Fleming*[1], *C. Logan*[1]

[1]Forensic Science Ireland, DNA Section, Celbridge, Ireland

Abstract Body: If a vehicle is involved in a road traffic collision (RTC), and enough force is encountered, a unit called an accelerometer triggers the airbag system. This involves igniting an explosive which escapes as a gas, inflating the airbag(s). This reaction is very quick (less than one second), but there is significant contact between the occupant(s) in the vehicle and the airbag(s). The force of the impact can result in blood, saliva and/or epithelial DNA being deposited onto multiple surfaces within the vehicle, including the airbag(s). Examining the airbags for the presence of blood, saliva and/or epithelial DNA, and carrying out DNA profiling, may assist in determining the issue of who was driving the vehicle or who was present in the vehicle at the time of the collision.
Our work aims to assist case scientists in formulating a logical and methodical case examination strategy to ensure the optimal recovery of biological material from airbags deployed in RTCs, for the purpose of DNA profiling. Using examples of casework, we show that “cross-over” of biological material can occur on airbags, and therefore, the issue which can be addressed in a case thus depends on the background information provided. We provide a detailed sampling strategy and sampling sequence for different case types, and guide the case scientist through the process of sampling the airbags for blood, saliva and/or epithelial DNA.

The Conclusion May Not Be as It Appears: Does Your Evidence Interpretation Address the Right Question? 15:45 - 16:00

J. Hietpas[1], *J. Buscaglia*[2], *D. Ommen*[3], *J. Hanka*[4], *C. Saunders*[4]

[1]City University of New York - John Jay College, Science Department, New York, United States, [2]Federal Bureau of Investigation, Research and Support Unit, Quantico, United States, [3]Iowa State University, Department of Statistics, Ames, United States, [4]South Dakota State University, Department of Mathematics and Statistics, Brookings, United States

Abstract Body: Forensic investigations and intelligence operations are complex processes that often incorporate information drawn from the scientific analysis and interpretation of physical evidence. For the interpretation of the results to be nonbiased, scientifically supported, and relevant to the investigation, the forensic scientist and investigator must properly frame and address the correct question(s) to advance the investigation. In 1984, Stoney (doi:10.1016/S0015-7368(84)72326-7) presented six potentially relevant questions that could be asked of the physical evidence depending on case-specific details. The differences in these questions, which can be subtle, have significant impacts on how the

results from scientific analyses are interpreted and presented. If the wrong question is asked, the interpretation of evidence can be erroneous and thus ultimately detrimental to the justice system. In light of the proposed sampling models for how the evidence has arisen in common-but-unknown and specific-source identification problems in Ommen and Saunders (https://doi.org/10.1214/20-STS805), we revisit the questions presented by Stoney with the goal of harmonizing the terminology and statistical foundations of potentially relevant questions.

We will describe three common tasks in forensic investigations, the various ways in which the relevant questions for these tasks may be framed, and the means to address these in a rigorous probabilistic manner.

The task and the questions together determine the relevant error rates on which courts rely for determining admissibility of the forensic approach. Minor changes in the question or task can have a drastic effect on the corresponding error rates.

16:00 - 16:45 Auditorium

AFTERNOON COFFEE BREAK

04: DNA and Body Fluids: DNA Interpretation
16:45 - 17:45 Auditorium

DNA and Body Fluids: DNA Interpretation

DNA Forensic Intelligence: Automation in DNAxs Makes Large Scale DNA Comparisons a Reality 16:45 - 17:00

P. Sjoukema[1], S. Kneppers[1], J. Hoogenboom[1], M. Slagter[1], K. Slooten[1], A. Lugtenberg[1], J. Rouw[1], L. Grol[1]

[1]Netherlands Forensic Institute (NFI), Biological Traces, The Hague, Netherlands

Abstract Body: In 2019 the Netherlands Forensic Institute (NFI) started the first large scale DNA Forensic Intelligence (D-FI) case with the aid of DNAxs. Consisting of approximately 300 thousand pairwise comparisons (with DNA-profiles from 50 pre-existing cases). This D-FI case led to multiple new matches and was seen as a success. Unfortunately, at that time a lot of manual and administrative steps were required to collect data and to perform the comparisons. In addition, DNAxs worked great in regular cases but was not able to handle such large amounts of comparisons yet. Since then, several D-FI cases have been carried out at the NFI and DNAxs has been further developed to handle more and even larger datasets. Thanks to the development of ProbRank, and its integration in DNAxs, it is now possible to (automatically) calculate likelihood ratios (LRs), with complex mixtures up to four persons, for each person in the National DNA database. Other developments have made it possible to (automatically) collect DNA-profiles from other pre-existing cases within DNAxs or the DNA-database reducing data collection time and errors. These developments have made it possible to perform large scale D-FI investigations routinely. We will present our current workflow for D-FI cases and which difficulties we had to overcome to get here. Besides this, further plans will be outlined to

make D-FI cases even more efficient and a bigger success.

Simplifying Forensic DNA Analysis with Eight-Color STR Technology and Reduced Stutter Artifacts 17:00 - 17:15

S. Kutranov[1], N. Courtney[2], K. Divakaran[2], B. Hudson[2], D. Rabbach[2], D. Nelson[2], R. Knoener[2], H. Hodges[2], M. Lauck[3], P. Sequeira[2], A. Marquard[2], B. Gehrke[2], C. Ames[2], R.S McLaren[2]

[1]Promega Corporation, Genetic Identity, Madison, United States, [2]Promega Corporation, R&D, Madison, United States, [3]Promega Corporation, Madison, United States

Abstract Body: Traditional capillary electrophoresis (CE) is widely used for forensic DNA typing due to its time- and cost-effectiveness. Eight-color STR Systems on the Spectrum CE and Spectrum Compact CE platforms enhance performance by distributing loci across more dye channels, thereby effectively reducing amplicon size. Here, we have developed a new eight-color STR System suitable for both casework and direct amplification samples that simultaneously amplifies the 20 CODIS core loci along with Penta D, Penta E and SE33 to increase discrimination and allow for wider database searching. Amelogenin and DYS391 are included for gender determination, as well as two rapidly mutating Y-STR loci (DYS570 and DYS576) and two Quality Indicators (QI). By focusing on the core CODIS loci and utilizing 8 colors, this advanced STR system can improve the success rate of generating CODIS-eligible profiles from challenging samples, such as those with degraded or low input DNA.

The Prototype 27GY System employs a novel PCR system to drastically reduce stutter artifacts across all loci, while maintaining similar workflows and sensitivity compared to traditional STR systems. The data presented here demonstrates how this drastic reduction in stutter artifacts directly translates into easier profile interpretation, simpler mixture deconvolution, and better number of contributor (NOC) determination, underscoring the unique advantages of the Prototype 27GY System.

Three Cases - Three Different Sequencing Technologies 17:15 - 17:30

R. Oefelein[1]

[1]DNA Labs International, Deerfield Beach, United States

Abstract Body: Choosing the best sequencing fit for the evidence when attempting to obtain a single nucleotide polymorphism (SNP) profile suitable for upload to the public databases that allow law enforcement profiles relies on several factors. The scientist should be triaging cases by asking numerous questions before attempting sequencing. How degraded is the DNA? What is the quantity of DNA available? Is there evidence available that may benefit from a new extraction? What is the ultimate goal of the testing? Have other methods already been attempted? Has a short tandem repeat (STR) profile already been obtained? Are phenotyping and biogeographical ancestry analyses needed? Is the profile a mixture of multiple individuals? This presentation will discuss how cases are triaged and determined to be sent down one of three paths: targeted sequencing,

array testing, or whole genome sequencing. Three unique cases, each of which utilized a different sequencing technology, will be discussed.

Identification of True Genotype in DNA Mixtures at Each Locus in Biological Samples in Sexual Assault Cases Found New Unique Frequency of True Alleles 17:30 - 17:45

S. Singh[1]

[1]Forensic Science Laboratory, government of National Capital Territory, Biology (DNA Fingerprinting), New Delhi, India

Abstract Body: Challenges in forensic DNA fingerprinting. The definition of a problem is to identify and develop new STR haplotype markers for worldwide populations. Sexual assault samples are among the most difficult sample types encountered by all forensic laboratories. Typically, a sexual assault sample has multiple challenges, including a small quantity of male DNA and a relatively high quantity of female DNA. Sensitivity, specificity, and reproducibility were established through genotyping in 2000 DNA samples. DNA analysis using polymorphic STR markers revealed a DNA profile of mixed origin. With the advent of more sensitive typing methodologies in which DNA analysis from biological samples in sexual assault cases found new repetitions of true allele numbers. The study will focus on DNA mixtures interpretation, and the goal of the study is to measure the allelic frequency of new genotyping no. when used with different types of DNA evidence, such as four-person mixtures and penile swabs for vaginal epithelial cells in a limited period of time (perhaps 36 hours or less) generated for all autosomal and Y-STR amplification plus kit. This study will also demonstrate the reliability of True Allele interpretation on complex DNA mixtures (approximately 2,000 samples) whose results can help to predict an information outcome for a DNA mixture analysis.This study will have an impact on the forensic science community by describing a new kit that takes into account the global population.

08: Forensic Medicine and Toxicology: Forensic Medicine
16:45 - 17:45

Forensic Medicine and Toxicology: Forensic Medicine

Genital and Anal Injury in Women After Sexual Assault: Prevalence Rates and Associated Risk Factors 16:45 - 17:00

D. Kane[1,2], *K. Flood*[1], *M. Eogan*[1,2]

[1]Royal College of Surgeons in Ireland, Dublin, Ireland, [2]Sexual Assault Treatment Unit, Rotunda Hospital, Dublin, Ireland

Abstract Body: Objectives: To investigate the prevalence of, and risk factors for, genito-anal injury in females who attended a Sexual Assault Treatment Unit in a capital city following sexual assault.
Method: All females who underwent a genital and/or anal forensic examination between 1/1/2023 and 31/12/2023 were included. A standardised dataset of demographic and assault metrics was collated.

Genito-anal injury data was contemporaneously collected by forensically trained specialist doctors and nurses using prescribed definitions and a standardised tool.Descriptive bivariate analysis and logistic regression analysis were performed on these data. Statistical significance was defined as a p-value<0.05.
Results:
294(72.6%) of those undergoing a forensic examination that included a genital and/or anal examination.
The overall prevalence of genito-anal injury was 25.9%(n=76/294), with those who reported completed vaginal penetration having a genito-anal injury prevalence rate of 31.1%(n=65/209). Anal injury was observed in 20%(n=8/40) of those who reported completed penile-anal penetration. The most commonly injured genital site was the posterior fourchette.
Genito-anal injury was significantly more likely to be present in women who disclosed a mental health history(OR1.94CI1.11-3.39 p=0.01), were sure a sexual assault had taken place(OR2.91CI1.31-6.45 p=0.008), who disclosed genital bleeding after the incident(OR2.35CI1.25-4.42 p=0.007) and had extra-genital injuries(2.20CI1.27-3.80 p<0.004). Previoussexual activity(p=0.39), menopausal status (p=0.09), age(p=0.64), assailant-survivor relationship(p=0.07) or incident location(p=0.17) did not have a significant effect on the presence of genito-anal injury. Extra-genital/bodily injury was present in 53%(n=156) of women who attended.
Conclusion:
Most women do not have a genito-anal injury after a sexual assaul, however, there are some significant associations for those that do.

Abrasion Collar in Railway Transaction Injury: A Finding That Speaks 17:00 - 17:15

J. Yadav[1]

[1]ALL INDIA INSTITUTE OF MEDICAL SCIENCES BHOPAL, Department of Forensic Medicine & Toxicology, Bhopal, India

Abstract Body: Railway injuries play a crucial role in medicolegal investigations of trauma and related fatalities. In India, which has the world's fourth-largest railway network spanning 67,956 kilometers, railway injuries are second only to road traffic accidents in prevalence. While accidental deaths are the most common manner of death in railway injuries, suicides on railway tracks are also frequently encountered. In some cases, train accidents are deliberately staged to disguise homicidal deaths as accidental or suicidal events.
Railway injuries often involve multiple body regions, with decapitation and traumatic trunk amputation serving as significant indicators of suicide. Determining the manner of death in railway injuries heavily depends on the relative position of the victim on the track at the time of impact.
This study highlights the observation of an abrasion collar along the margins of transected wounds in railway injuries. This finding not only strongly suggests a suicidal manner of death but also provides critical insights into whether the body was positioned prone or supine on the track. To the best of the authors' knowledge, this observation has not been documented in the existing literature. The underlying mechanism and medicolegal implications of this unique finding are discussed with real case examples.

How to Detect Injury on Colored Skin? 17:15 - 17:30

W. Duijst[1], *M. Iqbal*[2]

[1]Maastricht University, Criminal law, forensic medicine, Maastricht, Netherlands, [2]Maastricht University, Maastricht, Netherlands

Abstract Body: **How to detect injury on a colored skin?**
Prof. dr. Wilma Duijst and Morsal Iqbal, Maastricht university

In a multicultural society people of different origins and therefore different skin color are seen in medical practice. Forensic physicians are confronted with people with different skin color. In forensic medicine often the important question is: is injury present? An injury which is hard to detect on a dark skin is a hematoma.
In order to determine whether forensic physicians and dermatologists were able to differentiate a hematoma from ‘normal findings’ or a disease in a dark skin, we performed an online survey among forensic physicians and dermatologists. We showed pictures of findings on skins of several colors on the Fitzpatrick scale.

This research shows that every participating forensic physician in every case presented thought he saw injury, even when there was obviously/proven to be no injury present, but a ‘normal variant’ or a disease of the skin. The dermatologists did slightly better.
The results of this survey lead to a change of policy in our forensic medical department. The results of the change in policy are presented.

Mechanical Excitability of Skeletal Muscle: An Additional Tool for Estimation of the PMI 17:30 - 17:45

H. Stigter[1], *T. Krap*[1], *W. Duijst*[1]

[1]Maastricht University, Faculty of law and criminology, Maastricht, Netherlands

Abstract Body: Studies concerning the estimation of the post-mortem interval primarily focussed on the classical phenomena of body cooling (algor mortis), post-mortem lividity (livor mortis) and post-mortem muscle stiffness (rigor mortis). A less well-known post-mortem phenomenon is excitability of skeletal muscle. We present the results of a field study, performed between 2017 and 2023, concerning technical aspects of excitability of skeletal muscle by mechanical stimulation with a reflex hammer, the theoretical background of the intracelular celmechanisms that could be responsible for post-mortem muscle excitability, the influence of gender, body temperature, ambient temperature, manipulation of a body before investigation and the course of death on the outcome of muscle excitability, and the usability of this method in Dutch criminal court.

12: Scenes of Crime: Forensic Archaeology and Anthropology
16:45 - 17:45 Wicklow Hall 1

Scenes of Crime: Forensic Archaeology and Anthropology

“The Italian ANGEL OF DEATH" (Angelo Stazzi's case) A Tricky Legal and Forensic Multilevel Cold Case 16:45 - 17:15

A. Procaccino[1], L. Cipolloni[2], S. De Simone[3]

[1]University of Foggia, Social Science, Foggia, Italy, [2]University of Foggia, Medicine, foggia, Italy, [3]University of Foggia, Medicine, Foggia, Italy

Abstract Body: Maria Teresa Dell'Unto, a 58-year-old nurse at the Policlinico Gemelli in Rome, disappeared on October 29, 2001.
The investigation into Dell'Unto's disappearance was initially closed in 2005 due to a lack of evidence.
In May 2010, Stazzi was charged with voluntary manslaughter and concealment of a body, and sentenced to 24 years in prison. The case took a darker turn when it was discovered that he was also implicated in the deaths of several elderly patients under his care at nursing homes. Prosecutors accused him of being a serial killer who administered lethal doses of insulin to five elderly patients, leading to a life sentence request for these additional murders
What brought to the convictions?

1) Vertebra Fragment Analysis.
2) DNA Analisys: Hyperspectral Imaging and non-destructive age estimation of biological fluid stains for the detection of biological traces. Hyperspectral imaging, combined with artificial intelligence algorithms, allowed the nature of the traces and their location to be identified, facilitating sampling for DNA analysis.
3) Machine Learning Algorithms: These algorithms have been used to analyze data from hyperspectral imaging, improving the ability to recognize and classify biological traces. They help define the contours of the traces and estimate the time at which they were deposited, a crucial aspect in establishing the temporal connection between the suspect and the crime.
4) Phenotypic Analysis: This technique was used to create a "biological identikit" of the suspect from the genetic traces found, allowing investigators to narrow down the search to potential culprits with specific characteristics.

“Wounds Received in Battle Bestow Honor, They Do Not Take It Away”: Gunshot Wound Analysis Combined With XRF in Eight WWII Ossola Valley Massacre Victims 17:15 - 17:30

D. Petrosino[1], L. Bonizzoni[2], D. Mazzarelli[1], A. Palamenghi[1], G. Caccia[1], A. D'Apuzzo[1], V. Bravetti[1], S. Tambuzzi[1], L. Rodella[1,3], C. Cattaneo[1]

[1]Università degli Studi di Milano, Laboratorio di Antropologia e Odontologia Forense (LABANOF), Scienze Biomediche per la Salute, Milano, Italy, [2] Università degli Studi di Milano, Dipartimento di Fisica Aldo Pontremoli, Milano, Italy, [3]Sapienza Università di Roma, Dipartimento di Scienze dell’Antichità, Roma, Italy

Abstract Body: In 2020, the University of Milan's Laboratory of Anthropology and Forensic Odontology (LABANOF), "Casa della Resistenza" Association, Val Grande National Park Authority, and municipal authorities of Verbania and Baveno formalized the "Progetto Ignoti: diritto al nome, diritto alla memoria" (Project Unknown: right to a name, right to memory). Launched in 2023, this initiative gathers forensic experts to identify 35 partisans killed in the June 1944 massacres in the Ossola Valley (northen Italy) through a multidisciplinary approach. These individuals were mass executed, thus displayed evidence of violent death and investigating traumatic alterations became essential. Here presented are the data of eight partisans recovered from Baveno, one of three cemeterial sites under investigation. A forensic anthropological analysis was conducted to identify perimortem lesions and establish whether they were imputable to gunshot or other injury mechanisms. Despite the hindering state of preservation of the remains, at least 111 marks with perimortem attributes were documented. 18 injury complexes were ascribed to confirmed gunshot wounds, while numerous remained of uncertain nature. Therefore, X-ray fluorescence (XRF) analysis was employed, comparing XRF captures taken from perimortem lesions with control samples selected from unaffected skeletal areas, protected by clothing or footwear. In some cases, chemical investigations allowed to confirm the suspected gunshot derivation of the lesions, while in others, to verify the presence of GSR on instances previously deemed uncertain, highlighting the potential of the XRF technique in interpreting bone lesions of dubious nature in scenarios where remains have been exposed to environmental factors.

On-Site Fluorescent Spectroscopy to Estimate the Time Since Deposition of Biological Traces 17:30 - 17:45

A. van Dam[1,2], N. Achetib[1], L.S. Wilk[1], M.C. Aalders[1,3]

[1]University of Amsterdam/ Amsterdam UMC, Biomedical Engineering & Physics, Amsterdam, Netherlands, [2]Amsterdam University of Applied Sciences, Forensic Science, Amsterdam, Netherlands, [3]University of Amsterdam/ Co van Ledden Hulsebosch Center, Amsterdam, Netherlands

Abstract Body: The accurate estimation of the time since deposition (TSD) of biological evidence is essential in forensic investigations, as it can provide crucial information to distinguish between crime-related and unrelated traces, and verifying statements made by involved parties. However, no methods for TSD determination have been implemented in forensic casework to date due to limitations in analytical sensitivity and the absence of robust validation studies. Addressing these challenges, we have developed a novel approach that utilizes fluorescence spectroscopy in combination with a stoichiometric aging model to estimate the age of biological traces, onsite, without sample destruction or contamination. By measuring the relative amounts of proteins and oxidation products using their intrinsic fluorescence, we can predict the TSD of various types of biological traces.

In this presentation, we detail the progress achieved through the CS-AID (Crime Scene – Age Indicator) project. In this project we focus on enhancing the method's usability and reliability by miniaturizing the portable fluorimeter, simplifying the software interface for field use, and conducting validation under realistic forensic conditions. By bridging the gap between

experimental research and real-world application, a significant step towards integrating TSD estimation into routine forensic investigations will be taken within this project, offering a practical tool to improve the accuracy and efficiency of crime scene analysis. Nonetheless, additional research and validation of the method is required before implementation in forensic case work.

11: Marks, Impressions and Biometric Traces: Speaker Recognition and Authorship Analysis
16:45 - 17:45 Wicklow Hall 2 (A)

Marks, Impressions and Biometric Traces: Speaker Recognition and Authorship Analysis

Using Qualitative Forensic-Linguistic Analysis for Detecting AI-Generated Text 16:45 - 17:00

M. Rummel[1]

[1]Bundeskriminalamt (BKA), Language and Audio, Wiesbaden, Germany

Abstract Body: Research on detecting AI-generated text mainly focuses on automatic approaches, many of which themselves rely on AI models. Some of these techniques have proven quite successful, but mostly for detecting texts generated by specific LLMs or belonging to specific genres. Also, these techniques face the typical challenges regarding the explainability of AI results. These reasons make it problematic to use them for a court-proof evaluation of evidence.
Humans, on the other hand, have also been confronted with the detection task in several studies, but largely failed, with reported error rates hovering around a level of chance. Crucially though, most of these studies used participants without any prior linguistic education – the few that took linguistic training into account showed correlations between level of expertise and detection performance. However, they all focused on general language-related education, not on forensic-linguistic education specifically.
My talk will thus present efforts to test the hypothesis that qualitative forensic-linguistic analysis can be successfully used for detecting AI-generated texts. We conducted a pilot study in which 20 texts (eleven of them AI-generated) were analysed by seven professionals from the BKA's unit for Authorship Attribution in Germany. Results show promising detection rates and point to some linguistic features typical of AI-generated vs. human-written texts. Moreover, lessons learned from collaborating with the providers of the texts, the unit for profiling analysis, will be presented, as well as possible ways to further improve detection. Also, some follow-up research questions will be raised regarding generalisability to different genres or LLMs.

Hybrid Authorship Verification: From Human Analysis to Likelihood Ratio 17:00 - 17:15

W. Bosma[1], *T. Cambier-Langeveld*[1]

[1]Netherlands Forensic Institute, The Hague, Netherlands

Abstract Body: Criminals are at times successful in concealing their

identity. However, they may still leave a personal touch in their writing style. Traditionally, authorship analysis relies on the experience of human experts to interpret remarkable features in the text. This is laborious, hard to reproduce, subjective, and the experts may be inconfident if they are unfamiliar with the particular dialect or sub culture. There is an extensive body of literature in automatic authorship analysis, yielding reproducible and more objective results, but these methods are not tailored to the case materials at hand, and may capture not just style but also the topic of the text.

We found a way to get the best of both worlds by combining human and automatic analysis. Given the question whether a particular text is authored by the suspect or by someone else, we follow four steps. First, human experts identify case-specific features in the texts. Second, these features are encoded for automatic feature extraction and, together with generic features, incorporated in a likelihood ratio (LR) system for automatic authorship analysis. Third, the LR system is validated using reference material from the suspect and background material from other authors. Finally, the LR system is used to calculate an LR for the disputed text.

We argue that this method has considerable advantages. It is more discriminative than a fully automatic baseline, more topic insensitive than a sophisticated automatic analysis, more objective, and more reproducible than human analysis. The method has been applied successfully in casework.

Beware of Your Facial Image Dataset 17:15 - 17:30

G.H.M. de Arruda[1], R.O. Ribeiro[2,3], P.M.G.I. Reis[3]

[1]Brazilian Federal Police, Technical-Scientific Sector, João Pessoa, Brazil, [2] Aston University, Forensic Data Science Laboratory, Birmingham, United Kingdom, [3]Brazilian Federal Police, National Institute of Criminalistics, Brasília, Brazil

Abstract Body: With the advancement of the forensic data science paradigm, facial image datasets are becoming key elements in forensic facial image comparison. Still, many existing datasets contain errors in their identity labels, particularly those comprising “in the wild” images obtained from automatic procedures. Using such datasets in their original form may, therefore, result in errors in forensic examinations and miscarriages of justice.

We propose a method to automatically remove or flag facial images suspected of being mislabelled. Depending on the size of the dataset, it may be practical to manually revise the flagged images. For larger datasets, we propose a two-stage approach, with some images automatically removed from the dataset while others are selected for manual review.

We demonstrate the effectiveness of the proposed method by comparing it against methods from the literature using datasets that have been applied in forensic science research, such as Labeled Faces in the Wild, Adience, and Balanced Faces in the Wild. We envisage that the proposed method

would also be useful when curating datasets for use in casework as samples of relevant populations.

Upskilling Forensic Speech Practitioners in Automatic Speaker Recognition 17:30 - 17:45

G. Brown[1,2], *C. Kirchhuebel*[2]

[1]Lancaster University, Lancaster, United Kingdom, [2]Soundscape Voice Evidence, Lancaster, United Kingdom

Abstract Body: Automatic approaches to forensic voice comparison have been available for a while now. Even so, automatic speaker recognition systems are not commonplace within UK evidential voice analysis. In part, this is a result of the case of R v Slade [2015] EWCA Crim 71 where the Court of Appeal (CoA) did not admit voice comparison evidence produced by an automatic system. A key reason for the CoA's decision was that it was concerned about how evidence of this nature should or could appropriately be presented to a jury. Jury understanding is not the only stumbling block, however. Practitioners' own understanding of automatic speaker recognition systems, including their inner workings and performance, is also necessary. This paper is an exercise in gaining and demonstrating competence in applying an automatic speaker recognition system. We report a study that tests 1) the human expert approach to forensic voice comparison, 2) forensic voice comparison using an automatic speaker recognition system, and 3) both approaches in combination. The tests were carried out on a dataset of 60 voice comparison trials that have been carefully constructed to reflect the difficulty found in forensic casework. Practitioners can draw on knowledge derived from this work to cultivate competence in using automatic speaker recognition systems and in interpreting their output.

02: Chemistry: Paint and Glass
16:45 - 17:45 Wicklow Hall 2 (B)

Chemistry: Paint and Glass

Assessing Homogeneity of Automotive Paint Systems: Chemical Variability and Degradation 16:45 - 17:00

M.-C. Bolduc[1,2], *G. Massonnet*[1], *C. Muehlethaler*[2]

[1]Université de Lausanne, École des Sciences Criminelles, Lausanne, Switzerland, [2]Université du Québec à Trois-Rivières, Département de biochimie, chimie, physique et science forensique, Trois-Rivières, Canada

Abstract Body: Car paint traces are commonly encountered due to their ease of transfer during vehicle collisions. Such traces are often observed in hit-and-run incidents, where databases can be used to provide a list of potential makes, models, and years of production.
Automotive paint is known to be non-homogeneous and can exhibit variations in the number of layers (repairs, repaints), thickness, and composition. Degradation from external environmental conditions can also contribute to differences in paint homogeneity within a vehicle and

potentially bias database searches. However, the homogeneity of automotive paint over the entire vehicle body is a topic rarely addressed in the literature.
To address this, the homogeneity of paint application within a vehicle was assessed using microscopic observations, spectroscopic analysis (infrared and Raman), and principal component analysis (PCA). Among the eight vehicles sampled, at least one of the parameters – thickness, sequence, and/or number of layers – varies within the vehicle. PCA of Raman and FTIR spectra indicates the presence of discrimination based on location, degradation, and aftermarket repaints. Degradation was evaluated using the photo-oxidation index (POI).
These results enhance the understanding of vehicle paintwork, highlight potential differences associated with sampling locations, and provide additional information when comparing reference samples with paint traces from real cases.

Analysis of On-Site Prepared Household Paints Using Raman Spectroscopy 17:00 - 17:15

L. Huard[1], *C. Muehlethaler*[1], *J. Côté*[1]

[1]Université du Québec à Trois-Rivières, Trois-Rivières, Canada

Abstract Body: Hardware stores and paint stores now almost exclusively sell paints that are prepared and mixed on-site. A white base with varying pigmentation is colored by adding a certain percentage of colored pigments (blue, green, red, orange, purple, etc.). The quantities added are computer-controlled, guaranteeing identical color and quality every time. An infinite number of colors can therefore be obtained from around 6-10 individual pigment solutions. The aim of this project will be to assess the implications of these mixtures for forensic analysis: is it possible to identify and quantify the proportion of each pigment? What are the limits of discrimination? 48 different paints covering a large spectrum of colors were obtained and analyzed using optical microscopy and Raman spectroscopy at 3 different laser wavelengths (532, 633 and 785 nm), to determine which pigments are identifiable within these mixtures.

Modern Possibilities of Forensic Examination of Paint Materials in Azerbaijan 17:15 - 17:30

A. Javadova[1]

[1]Forensic Science Centre of the Ministry of Justice of Azerbaijan Republic, Physical and chemical department, Baku, Azerbaijan

Abstract Body: In a contemporary context, solving the fighting problems of crime requires further improvement of the activity of law enforcement agencies and wide application of the latest achievements of the science of criminology in the practice of crime investigation. Trace evidence of paint and varnish materials are sources of information as a carrier of forensic information. This information is associated with traditional traces features reflecting the process of trace formation, and the morphology features of the trace material (painting technique, features of the painted object, etc.), as well with the specific (individual) characteristics of the trace-forming

objects. During operative search activities or investigative actions, a large number of various painted subjects-objects, items with peeling off paint coating and traces of abrasion, microparticles of paint are discovered. Such indicative information can be successfully applied in solving criminal cases with “hot traces” on scene.
Currently, in the Department of Physical and Chemical Expertise of the Forensic Center of the Ministry of Justice of the Republic of Azerbaijan, where proceedings of forensic examination of substances and materials is carried out, the investigation of varnish and paint materials, polymer materials, glass, ceramic, silicate materials is conducted and relevant opinions are given.
In the article, the works that conducted in the examination of varnish and paint materials during the last five years were summarized. During the analysis, an investigation of the expertise that are most often assigned in connection with the types of criminal events was carried out.

Glass on Implements Suspected of Involvement in Breaking Crimes and Those of the General Population 17:30 - 17:45

B. Gorey[1], *S. Masterson*[1], *A. Lennon*[1]

[1]Forensic Science Ireland, Physical analysis, Kildare, Ireland

Abstract Body: The evaluation of criminal cases involving the breaking of glass requires reliable and up to date information regarding the transfer and persistence of glass not only to clothing but also to the surface of implements suspected of use in breaking crimes. This data is essential for the reliable evaluation of glass findings from implements at activity level. Here we provide information on the number (P) and size (S) of groups of glass recovered, both matching and non-matching, on the surface of 50 implements suspected of involvement in breaking crimes. The implements were submitted to Forensic Science Ireland during routine casework between 2018 and 2024.

In conjunction, we will also detail the number (P) and size (S) of glass groups recovered from implements submitted from the general population. Details on sample collection, type of implement encountered, search method and refractive index ranges will be provided from both casework and general population groups. Finally, a worked example showing the application and benefit of the P & S values obtained will be presented using a Bayesian likelihood ratio approach.

01: Case Studies: Other
16:45 - 17:30 Liffey Meeting Room 2

Case Studies: Other

Request Templates: A Blessing or a Curse for Judicial Expertise? 16:45 - 17:15

L. Heudt[1], *C. Vanderfelt*[1], *K. Van Dijck*[1]

[1]National Institute of Criminalistics and Criminology (NICC), Forensic advisor, Brussels, Belgium

Abstract Body: In Belgium, the forensic handling of sexual assault victims has long relied on the Sexual Assault Kit (SSA) provided by the National Institute of Criminalistics and Criminology (NICC). Introduced in 1989 and still in use today in some districts, this 24-steps kit, allows comprehensive evidence collection in hospitals. Magistrates must formally request laboratories to analyse the evidence using a written document (=request). A request template linked to the SSA is nationally available.
In 2017, the Antwerp Public Prosecutor's Office and the NICC observed that many rape cases were dismissed due to insufficient evidence, primarily following a sperm-orientated approach. To address this, the NICC launched a project, aiming to improve forensic handling of sexual assault cases through a contextual approach. This involved a forensic advisor who provided advice focused on DNA, microtraces, and toxicological analyses. The project's effectiveness led to the Minister of Justice supporting nationwide implementation in 2021. In some districts, forensic advisors reviewed about 50 cases closed between 2020 and 2022, confirming that using the national SSA template without further consideration contributed to many dismissals. This review led to the reopening of several cases, with new analyses yielding positive results and reviving investigations.
This presentation will explore whether request templates are a blessing or a curse for judicial expertise, detailing evidence collection and analysis in Belgium. Examples of reopened cases will highlight the limitation of request templates. Reflecting on past practices aims to enhance forensic approach to sexual assault caseworks, ensuring more accurate and appropriate outcomes.

Leveraging the DNA Database to Find the Missing – An Irish Experience 17:15 - 17:30

L. Williams[1]

[1]Forensic Science Ireland, DNA, Dublin, Ireland

Abstract Body: DNA profiling has been an effective tool in the investigation of criminal cases in Ireland since 1993. However, with the enactment of DNA Database legislation (2014) the crime solving capabilities expanded exponentially. At this time, DNA profiling was used on a case-by-case basis for solving missing person cases. Ireland went from single case-by-case comparisons to building and developing the capabilities of our DNA Database. Low stringency searching, pedigree trees and kinship investigations were implemented to aid in our responses to Identification cases. The challenges and implementation will be discussed in the presentation. To extend the reach of the DNA database, national campaigns were conducted in conjunction with the Missing Persons Bureau to collect profiles from the relatives of missing persons. DNA profiles from unidentified remains were submitted to the laboratory as casework or to us via a bulk exchange of profiles with the United Kingdom.
Here a case study is described whereby the advances in the Identification Index of the DNA Database system, in parallel with the building of international relationships and networks, have solved a long-standing case that has reunited a family with their missing relative.

06: Education and Training: Other
16:45 - 17:30 Liffey Meeting Room 3

Forensic Management and Quality Systems: Other

Managing Personal Transitions in Forensic Laboratories within Law Enforcement Entities: Risks and Potential Solutions 16:45 - 17:00

A. Girod-Frais[1], M. Kozlik[1], D. Faninger[1]

[1]Criminal Intelligence Service Austria, Forensic Science Office, Vienna, Austria

Abstract Body: Population ageing and a declining working-age population present significant demographic challenges for Europe in the coming decades. This demographic shift will have multifaceted impacts on society, particularly in the realm of workforce dynamics with the retirement of the baby-boomer generation (individuals born between 1946 and 1964). While these trends are not novel and extend beyond the field of forensic science, the effective management of personal transitions within forensic laboratories stands as an understudied issue, especially within law enforcement entities.

This presentation aims at addressing this topic by drawing on one authentic case study and delineating various risks associated with such transitions, as for example breakdowns in communication, leadership discontinuity, lack of strategic alignment, quality control deficiencies, backlog accumulations, erosion of specialized expertise areas and loss of knowledge due to human resources policy, especially in public service entities. The origins of these risks will be scrutinized, along with potential mitigation strategies.

This contribution intends to raise awareness among stakeholders and spark dialogues at national and international levels, facilitating the exchange of experiences, best practices, and lessons learned and fostering the adaption of organizational change management practices to face future challenges.

Rethinking Error: Using Quality Issues to Advance Forensic Science and Strengthen Credibility 17:00 - 17:15

A.L Heavey[1], M.M Houck[2], G.R Turbett[3], S.W Lewis[1]

[1]Curtin University, School of Molecular and Life Sciences, Bentley, Australia, [2]Florida International University, Global Forensic and Justice Center, Largo, United States, [3]PathWest Laboratory Medicine WA, Forensic Biology Department, Nedlands, Australia

Abstract Body: Forensic science is a high risk, high consequence field where system failures can result in catastrophic outcomes for individuals, facilities and entire disciplines. The demand for forensic science to be transparent in the communication of limitations, particularly regarding errors within the scientific process, is an area of significant focus and concern for the field, its justice partners and the public.
Clear communication of critical issues in forensic science has benefits not only to investigators and courts in understanding the weight of forensic

information, but also as an opportunity to identify trends and opportunities for research and innovation to support continuous improvement of the field. Yet while other high-risk fields, such as aviation and medicine, have developed standardised systems for categorisation of critical issues, forensic science has not.
The key may lie within the existing quality management systems embedded in forensic facilities world-wide where records of non-conforming work and critical issues are recorded as standard practice. However, the variation in terminology and process between agencies makes interjurisdictional comparison, benchmarking and analysis of this vital data extremely challenging.
This presentation outlines a current international research study investigating the development of a standardised classification system for quality issues in forensic science. Utilising input from forensic practitioners and quality management experts, the study examines the current state of forensic quality issue management and disclosure, the challenges toward achieving a standardised approach and the path forward to developing an evidence-based, practical, interdisciplinary solution.

The Decommissioning of Forensic Science Laboratory Ireland-FSI 17:15 - 17:30

M. Lee Gorman[1]

[1]Forensic Science Ireland, Corporate Services, Celbridge, Ireland

Abstract Body: Decommissioning a forensic laboratory is a multifaceted process that demands careful planning, collaboration, and strict adherence to regulatory standards. Decommissioning of forensic science has rarely been reported in the scientific literature, however there are established guidelines and frameworks on best practices for decommissioning laboratories.
The decommissioning process is essential to effectively manage sensitive forensic data, uphold the integrity of exhibits, and ensure the safe disposal of hazardous materials.
This paper presents a practical roadmap for managing the decommissioning process, with a focus on safety, data protection, and compliance. The initial step is to form a multidisciplinary team that includes experts in forensics, facility management, logistics, IT, environmental safety, and waste management. Collaboration with stakeholders, such as law enforcement and environmental waste agencies, are essential to align goals and expectations.
Key activities in the decommissioning process include transferring exhibits to a new laboratory or returning evidence to law enforcement, relocating laboratory equipment, and managing hazardous materials according to legal and environmental standards. Additional steps involve decommissioning laboratory equipment, donating surplus items to universities, decontaminating and disposing of assets, ensuring GDPR compliance, and maintaining thorough documentation for accountability.
This paper will outline the complete decommissioning process, offering practical insights and lessons learned. It will emphasise the importance of early planning, secure data management to uphold the chain of custody, and effective stakeholder communication to minimise risks. By sharing best practices, this presentation aims to equip the forensic community with strategies to navigate laboratory decommissioning efficiently and responsibly.

09: Interpretation: Evidence Evaluation
16:45 - 17:45 Wicklow Meeting Room 3

Interpretation: Evidence Evaluation

The Reconciliation of Common Source, Specific Source, Score-based and Feature-based Likelihood Ratios 16:45 - 17:00

A. Boonstra[1], K. Slooten[1,2], R. Meester[1]

[1]Vrije Universiteit Amsterdam, Department of Mathematics, Amsterdam, Netherlands, [2]Netherlands Forensic Institute, Division of Biological Traces, The Hague, Netherlands

Abstract Body: *We contribute to the debates about the use of score based/feature based and common/specific source likelihood ratios. In the literature these are often presented as different "LR-systems", processing the same information for different pairs of hypotheses.*
Differences between these LRs have been used to argue against the application of all score-based and common source LRs.
We argue for the opposite point of view: these LRs are for the same hypotheses, but processing different information. Thus, there is no such thing as different "LR-systems". The differences in LR are due to differences in the available information, but there is only one statistical model. In particular, despite claims to the contrary, we see no reason to categorically reject score-based or common-source LRs. We show that in fact, their use is widespread and (we believe rightly so) undisputed in the DNA context and illustrate this with extensive examples.

Forensic Science Value: Data uses from Crime scene to Courtroom in the Scottish Criminal Justice Ecosystem 17:00 - 17:15

L. Tetley-Brown[1], N. Nic Daeid[1], H. Menard[1]

[1]Leverhulme Research Centre for Forensic Science, Univesity of Dundee, School of Science and Engineering, Dundee, United Kingdom

Abstract Body: Determining value from forensic science is a key topic, requiring a nuanced approach to accommodate the full crime-to-court ecosystem of data use. This study explores the standard operating procedures practitioners follow across the criminal justice system in Scotland, focusing on how forensic evidence is selected, processed and presented. The research examines these procedures through investigation and prosecution of two distinct types of crime: serious crimes involving violence against women and girls, and volume crimes such as robbery, theft, and vehicle-related offences.

The study employs a two-phase, mixed-method, interdisciplinary approach. This entails practitioner interviews and focus groups (Phase 1; until June 2025), then analysis of anonymised data from existing case files and records, examining which specific items are obtained from crime scenes and individuals, processed in forensic science laboratories and ultimately presented (or not) in the courtroom (Phase 2).

The findings of this study will describe how respondents interact with

forensic evidence and attribute 'value' - potentially widely varied - to this central component of criminal justice. Furthermore, the research will highlight variances in perspectives across multiple actor groups, and tensions in perceived value, derived from how decisions are made at specific times during an investigation. These key decision-making stages include -

1. Forensic strategy meetings,
2. Crime scene management,
3. Forensic Gateway Process,
4. Case-building by Crown Office (Prosecution),
5. Advocates' trial preparation.

The presentation will share insights from Phase 1, covering the qualitative element (interviews, focus groups), alongside initial case file analysis (20 cases) readying for Phase 2's case file analysis at scale.

Chain Event Graphs for Assessing Activity-Level Propositions in Forensic Science 17:15 - 17:30

A. Wilson[1], *G. Robertson, J. Smith*[2]

[1]University of Edinburgh, School of Mathematics, Edinburgh, United Kingdom, [2]University of Warwick, Statistics, Coventry, United Kingdom

Abstract Body: Criminal cases often feature multiple pieces of dependent evidence and multiple possible explanations for this evidence. It can be challenging to disentangle the statistical dependencies between pieces of evidence and to understand how to form logically consistent arguments that account for the evidence and dependencies in a way that is probabilistically sound. There have been high profile miscarriages of justice that have resulted from failures in probabilistic reasoning and interpretation.

Bayesian Networks are one method that has been used to link together different pieces of evidence with arguments in forensic science. In criminal cases, it is often much easier to see how events in a case may have evolved if they can be displayed time sequentially, but this is difficult to do with a Bayesian Network. Chain Event Graphs are an alternative graphical method that can be used to construct possible storylines for displaying the time evolution of events and evidence. These Chain Event Graphs can both be used for investigation, to see where more evidence is needed, and for evaluation and interpretation of evidence in the context of activity-level propositions. I will introduce Chain Event Graphs and give two examples of their use: a drugs on banknotes case and to evaluate the knife evidence in the case of Meredith Kercher. I will also summarise the key advantages and disadvantages of Chain Event Graphs in comparison to Bayesian Networks.

Drone Forensics: The Challenge of Generating Reference Data 17:30 - 17:45

K. Lohre[1], *A. Hoyer*[1], *M. Schmidt*[1], *L. Hardi*[1], *A. Attenberger*[1]

[1]Central Office for Information Technology in the Security Sector, Research Unit Digital Forensics, Munich, Germany

Abstract Body: The variety of digital evidence sources requires accurate examinations in order to present forensically sound findings. Standard procedures guide the forensic examiner through the investigation. However, standard guidelines are often not sufficient, as the investigations also depend on individual questions and devices. When it comes to the analysis part of digital traces, this often raises the question about the ground truth. If the investigators are unable to identify a ground truth, it is common practice to take a reference into account. The comparison between the digital traces and the reference can provide information about the origin and cause.
In contrast to well-known devices in the forensic community, there are new challenges to create comparable reference data sets for the forensic investigation of drones. In our presentation we explain the challenges in detail and introduce our solution based on different flight scenarios. These scenarios cover a wide range of different actions during a drone flight. Here, we do not only consider standard flight procedures but also take important actions like photographic and video captures during the flight as well as automated flights into account. As conclusion, we discuss the importance of reference data during the forensic investigation process of drones.

Wednesday, May 28, 2025

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09:00 - 09:45 Auditorium

PLENARY SPEAKER 3

Plenary Talk 3 09:00 - 09:45

13: European Day
09:45 - 13:00 EcoCem Room

□□□□ **European Day - Education and Training: Continuous professional development.**

Evaluative Reporting of Trace Evidence: Development of an E-Learning Training Model 09:45 - 13:00

G. Massonnet[1], *J.-E. Grunwald*[2], *C. Gannicliffe*[3]

[1]University of Lausanne, Ecole des Sciences Criminelles, Lausanne, Switzerland, [2]Bayerisches Landeskriminalamt, Microtrace / Biology, Munich, Germany, [3]SPA Forensic Services, Aberdeen Laboratory, Aberdeen, Scotland, United Kingdom

Workshop Description: The *ENFSI Guideline on Evaluative Reporting* was published in 2015. However, the implementation of the evaluative reporting model requires significant training, underpinned by a thorough understanding of the principles of probability and uncertainty.
The aim of this EU-funded ENFSI project was to fill this gap by creating a visually engaging and interactive e-learning course on applying evaluative reporting to the interpretation of textile evidence, in a pragmatic and practical format suited to the needs of the practitioner. The modules explain the basic principles of evaluative reporting by using simple, discipline-specific examples. The course then gradually builds on them to introduce the key concepts of how to formulate propositions and to express the value of the findings. Source and activity level proposition are discussed, and explanations are given on how to assign values to key parameters: occurrence, background transfer and persistence. Finally, all this knowledge is applied in an engaging and interactive format in mock case scenarios, with frequent knowledge checks and quizzes.
To begin the workshop, we will first give an overview of how the "Evaluative Reporting and Interpretation" e-learning course was conceived, planned, and how we delivered the project over a two-year pan-European collaboration.
In a hands-on session, the participants will actively explore the e-learning evaluative reporting course with the guidance of the organisers.
Finally, we will interactively discuss how e-learning activities on evaluative reporting could be further developed and implemented and will discuss how this concept could be adapted more widely by other forensic disciplines.

04: DNA and Body Fluids: DNA Databases
10:00 - 11:00 Auditorium

DNA and Body Fluids: DNA Databases

Species Identification: A Critical Review of Genetic Methods Used for Animal Barcoding 10:00 - 10:30

D. Vaněk[1], *L. Vankova*[1]

[1]Charles University in Prague, Institute for Environmental Sciences, Prague, Czech Republic

Abstract Body: The illegal trade of endangered species of wild fauna and flora threatens many species. Numerous traditional Chinese medicine (TCM) treatments involve wildlife products, including some that utilize ingredients derived from endangered flora and fauna, regardless of whether those organisms are protected by the CITES Convention. The investigation of wildlife crimes requires precise scientific species-determination techniques. DNA barcoding seems to be an optimal tool for the detection of source organisms in TCM products. DNA barcoding *sensu stricto* means species identification is performed using one standardized DNA fragment. The definition of DNA barcoding *sensu lato* is not very restrictive and corresponds with any taxonomic-level identification using any DNA fragment. Standard Sanger sequencing is not suitable for samples containing biological material from multiple species; thus, massively parallel sequencing must be used instead. Non-sequencing methods are an alternative to sequencing and can serve as an additional or confirmatory test. PCR amplification using universal primers with subsequent restriction cleavage (PCR-RFLP) can be used to separate species using characteristic patterns. Still, the use of this method is limited by the existence of restriction sites and rather difficult interpretation. Species barcoding can also be achieved using the RAPD approach, AFLPs, species-specific PCR, the SNaPshot assay, HRMA analysis, LAMP, or qPCR assays. Another type of barcoding methodology utilizes interspecies insertions/deletions, where the target region is a hypervariable mtDNA D-loop, the highly variable regions 12S rRNA 16S rRNA, and the control region (CR-mtDNA) length polymorphisms. The presentation aims to provide an overview and critically compare available barcoding methods.

Development of Epigenetic-Based Age Prediction Models From Blood and Semen Samples in the French Population 10:30 - 10:45

C. Ropert[1], *A. Sourisce*[1], *S. Buré*[1], *C. Gallois*[1], *L. Bartholin*[2], *M. Siffointe*[1], *R. Appourchaux*[1], *M. Gabut*[1]

[1]Laboratoire de Police Scientifique de Lyon - SNPS, ECULLY, France, [2] Service National de Police scientifique, Office of Innovation, ECULLY, France

Abstract Body:

Analyzing human biological stains detected at crime scenes by comparing DNA profiles to national or international forensic databases is instrumental to provide orientiations to police investigations. Blood and semen traces are of primary interest in sexual offence and crime cases, often leading to

usable genetic material. DNA phenotyping offers additional investigation leads by inferring unidentified individual's visible appearance traits and geographical origins. Interestingly, the levels of epigenetic modifications of specific CpG sites in the genome have been correlated to the chronological age of individuals, therefore supporting age prediction methodologies.

We established a first cohort of 170 blood samples from 0-101 years old donors, and a second cohort of 284 semen samples from 18-74 years old males. Using a primer-extension based assay, we analyzed the methylation status of 5 and 8 age-associated CpG sites for blood and semen samples, respectively. DNA methylation-based age prediction models were developed using multiple regression analyses and data transformation, and their respective predictive performances were validated on independent samples.

We first established an optimized statistical model for blood samples explaining 97% of age variation with a mean absolute error (MAE) of 3.45 years between the estimated biological and chronological age of individuals while the semen-optimized age prediction model explains 70% of age variation with a MAE of 3.76 years. As a forensic laboratory of the French National Police, we therefore developed distinct DNA intelligence methods to predict the biological age from blood or semen stains based on DNA methylation analysis of specific human genomic regions.

Evaluation of GenTegra LLC Technology for Long Term DNA Storage of Challenging Forensic Casework Samples at Room Temperature in Anhydrobiosis State 10:45 - 11:00

C. Scherer[1], N. Ikadoumène[1], J. Gibert[1], S. Hubac[1], F. Hermitte[1]

[1]Institut de Recherche Criminelle de la Gendarmerie Nationale, Division Criminalistique Biologie Génétique, PONTOISE, France

Abstract Body: The success of forensic genetics has led to considerable numbers of DNA samples that must be stored. For example, the genetic casework unit of the forensic institute of the French gendarmerie analyzes more than 70 000 casework samples per year mainly from swab that is fully used for DNA extraction. The only way to process further analyzes is to preserve DNA. Currently, the most common technique used for long-term preservation of DNA is to freeze the extracted DNA at -20°C or -80°C. However, this preservation method involves significant constraints (large equipment), risks (equipment failure), and is not ecologically sustainable due to its high energy consumption.

Many systems of DNA preservation at room temperature exist based either on fibrous supports or on anhydrobiosis. However, few studies have examined the efficiency of these systems in preserving very low DNA amounts, such as those in forensic samples (≤ 1 ng), while ensuring full recovery and the ability to retest the samples many years later. We choose to evaluate the ability of the anhydrobiosis technology from GenTegra LLC to preserve DNA extract from one month to one accelerated year from different DNA quantities (from 1 ng to 200 pg) and sources (NIST, mocked samples and true mixture caseworks). We studied the quantity, integrity of

DNA and also the quality of the STR genetic profile obtained.

Our results prove the high potential of this technology to preserve and to allow the recovery of the DNA extract in forensic purposes.

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10:00 - 12:45
ENFSI Annual Meeting

08: Forensic Medicine and Toxicology: Toxicology
10:00 - 11:00
Forensic Medicine and Toxicology: Toxicology

Development and Validation of Bone Extraction Procedure in Forensic Toxicology: A Comparison of Different Extraction Techniques 10:00 - 10:30

G. Giordano[1], M. Boracchi[1], C. Cattaneo[1], D. Di Candia[1]

[1]University of Milan, Biomedical Science for Health, Milano, Italy

Abstract Body: Forensic toxicology plays a crucial role in forensic sciences, focusing on the detection and interpretation of xenobiotics in various biological samples, including bone tissue. This study aimed to compare different extraction techniques for bone tissue and subsequently analyze and validate the best analytical method via liquid chromatography-tandem mass spectrometry. Blank bone samples were collected from autopsied cadavers, prepared, and subjected to four different extraction methods (from EM-1 to EM-4). The bone samples were spiked with different analytes of toxicological interest. The molecules tested were morphine, ketamine, amphetamine, methamphetamine, MDMA, cocaine, benzoylecgonine, ecgonine methyl ester, methadone, EDDP, diazepam, nordiazepam, citalopram, carbamazepine, sertraline, olanzapine, quetiapine, and zolpidem. The four proposed extraction procedures were compared using the absolute recovery tests at low, medium and high concentrations of our analytes of interest, underlining that EM-1 was the better extraction method successfully detecting all the target molecules. Thus, the extraction technique EM-1 was validated following the international guidelines for forensic toxicology. Method validation for EM-1 demonstrated acceptable bias, precision, interference studies, and stability in various analytes. In the end, the validated method was then applied to ten real cases, confirming its efficacy in forensic toxicology for detecting opioids, dissociative anesthetics, stimulants, benzodiazepines, anticonvulsants, antidepressants, antipsychotic medications, and sedatives in bone tissue.

Doping Control Analysis in Athletes' Steroid Profile: A Multivariate Bayesian Learning Approach 10:30 - 10:45

T. Neocleous[1], D. Eleftheriou[2], T. Piper[3], M. Thevis[3]

[1]University of Glasgow, School of Mathematics and Statistics, Glasgow, United Kingdom, [2]Leiden University, Leiden Academic Centre for Drug

Research, Leiden, Netherlands, [3]German Sport University Cologne, Cologne, Germany

Abstract Body:
Doping has been widely discussed in recent years and remains a challenging topic in the athletic world. In competitive sports, anabolic androgenic steroids refer to the most frequently detected drug class in doping controls according to the World Anti-Doping Agency. In order to detect the administration of such prohibited substances, the steroidal module of the Athlete Biological Passport has been developed. Therefore, biomarker analysis of athletes' urinary steroid profiles is crucial for the anti-doping efforts. Current statistical analysis methods generate personalised limits for each athlete based on univariate modelling of longitudinal biomarker values from the urinary steroid profile. However, simultaneous modelling of multiple biomarkers has the potential to further enhance abnormality detection. In this work, we propose a multivariate Bayesian adaptive model for longitudinal data analysis, which extends the established single-biomarker model in forensic toxicology. The proposed approach employs Markov chain Monte Carlo sampling methods and addresses the scarcity of confirmed abnormal values through a one-class classification algorithm. By dynamically adapting decision boundaries as new measurements are obtained, the model provides robust and personalised detection thresholds for each athlete. We tested the proposed approach on a database of professional athletes, which includes longitudinal steroid profiles containing samples classified as normal, atypical, or confirmed abnormal. Our results demonstrate improved detection performance, highlighting the potential value of a multivariate approach in doping detection.

Interference-Free Method for Determination of Benzodiazepines in Urine Based on Restricted-Access Supramolecular Solvents and LC–MS-MS 10:45 - 11:00

N. Caballero-Casero[1], L. Mihretu[2], S. Bravo[1]

[1]University of Cordoba, Chemistry, Córdoba, Spain, [2]Rwanda Forensic Institute, Toxicology and Alcohol Unit, Kigali, Rwanda

Abstract Body: Supramolecular solvents with restricted-access properties (SUPRAS-RAMs) are proposed as a new approach for integrating extraction and sample cleanup in the quantification of benzodiazepines in urine by liquid chromatography-tandem mass spectrometry (LC-MS-MS). The SUPRASRAM was synthesized in situ in the urine by adding 1-hexanol and tetrahydrofuran. both hydrogen bonds and dispersion interactions drove benzodiazepines extraction. Removal of proteins and polar macromolecules was performed by the action of the SUPRAS through chemical and physical mechanisms. Phospholipids were removed by precipitation during SUPRAS extract evaporation. A multivariate method was used to optimize the extraction process by applying a Box–Behnken response surface design. The proposed method was validated according to the guiding principles of the European Commission Decision (2002/657/EC). Method detection and

quantification limits for the target BDZs were in the intervals 0.21–0.85 and 0.67–2.79 ng/mL, respectively. The repeatability and reproducibility (expressed as relative standard deviations) were in the range of 2–6% and 3–8%, respectively. The method enabled the simultaneous extraction of BDZs (recoveries in the range of 84–105%) and the removal of matrix effects. The method was applied to the analysis of 13 urine samples using external calibration. Five out of 13 samples tested positive for alprazolam and lorazepam at concentrations in the range of 5.4–74 ng/mL. The method allows simple and quick sample treatment with minimal solvent consumption while delivering accurate and precise data.

03: Digital Evidence: Mobile Device, Network and Location Forensics
10:00 - 11:00 Liffey Hall 1

Digital Evidence: Mobile Device, Network and Location Forensics

Argus and Data2activity: Activity Level Interpretation of Digital Traces from Apps and Sensor Based Information 10:00 - 10:30

J.P. Van Zandwijk[1,2], A. Boztas[1]

[1]Netherlands Forensic Institute, Department of Digital and Biometric Traces, Den Haag, Netherlands, [2]Amsterdam University of Applied Sciences, Faculty of Technology, Forensic Science, Amsterdam, Netherlands

Abstract Body: Having become an indispensable part of modern life, consumer electronics such as smartphones and smartwatches, contain many digital traces related to activities in the physical world, often derived from sensor information produced by the devices. Examples of these are heart-rate registration by smartwatches and information in steps, distances and energy expenditure collected by health-related Apps on smartphones. In a criminal investigation, such traces can provide crucial information for scenario reconstruction and - evaluation, that might not be obtainable from other types of forensic evidence. One of the unique features of digital traces is that they often contain timestamps, enabling compiling a detailed timeline of events. For using these traces, information on meaning, accuracy and reliability is key to determine.
Besides this, many Apps on smartphones contain a wealth of valuable information on user activities. Generally, major Apps are supported by commercial forensic tools, but there remain many locally used Apps for which the meaning of traces in associated databases are unknown and must therefore be determined independently.
Activity level interpretation of traces from sensor information and App-generated traces requires data for which the ground-truth is known. We here present recent advances in the approach we use to address this problem, illustrated with examples from our own practice. This includes a framework and tooling enabling the collection and storage of data from (automated) experiments with Apps and the design and implementation of various types of validation studies for activity related traces. The developed platforms also enable sharing of information among practitioners.

Crash Detected! How Can Your Phone Tell Us What Happened During a Car Accident? 10:30 - 10:45

B. Meylan[1], A. Desbiolles[1], I. Labidi[2]

[1]School of Criminal Justice, University of Lausanne, Lausanne, Switzerland, [2]State Police of Vaud, Lausanne, Switzerland

Abstract Body: Since July 2024, the mandatory inclusion of Event Data Recorders (EDRs) in all new vehicles within the European Union has transformed road accident investigations by providing access to an abundance of new digital traces. When combined with data from mobile devices and their interactions with in-vehicle systems, these digital traces offer a complementary dimension to traditional physical evidence such as skid marks, paint transfers, and vehicle deformations. This integration enables investigators to better reconstruct the events leading up to and following road accidents.

This presentation explores the potential of digital traces from vehicles and mobile devices to enhance the reconstruction of accident scenarios, focusing specifically on location-related traces and motion sensor data but also on information retrieved directly from the vehicle. A central aim is to assess the accuracy, reliability and usability of the traces generated on the mobile phone during a traffic accident. It was achieved by comparing them with ground-truth data obtained from the vehicle Inertial Measurement Unit (IMU) system and by recording the Controller Area Network (CAN) traffic systems. Location data, both from the phone and the vehicle, were analysed by using high accuracy Global Navigation Satellite System (GNSS). A real-world case study illustrates the challenges inherent to accident scenarios, followed by findings resulting from controlled conditions experiments.

Speed logs on iPhones 10:45 - 11:00

J. Zębala[1], R. Radziszewski[2]

[1]Institute of Forensic Research in Krakow, Road Accident Reconstruction, Krakow, Poland, [2]Institute of Forensic Research in Krakow, Forensic Information Technology Section, Krakow, Poland

Abstract Body: Last year, a project was carried out at the Institute of Forensic Research in Krakow to verify car speed recorded on iPhones. In the project eight iPhone models were used with various iOS versions, including the latest versions – 17 and 18. Depending on the technical capabilities, two methods were used to collect those data from memory of the examined phones. The first method involved directly reading data from the memory, while the second method utilized the internal diagnostic function Sysdiagnose of the iOS operating system, which is installed on iPhones. Initially, preliminary tests were conducted, which included determination of the sources of speed log availability on each phone, assessment of the impact of using navigation during driving on the speed records, determination of the access time to the recorded speeds, and examination of the influence of the phone's position in the car on speed recording. Subsequently, road tests were performed to verify the speeds recorded on the phones. During these tests, the car with the iPhones on-board, was accelerated and then emergency braked until it stopped. The VBOX Sport device from RACELOGIC was used to measure the speed during the road tests. The results showed a high degree of correlation between the speeds recorded on the phones and those registered by the VBOX Sport device.

05: Drugs: Societal Impact
10:00 - 11:00 Liffey Hall 2

Drugs: Societal Impact

New Psychoactive Substances: European Situation, Emerging Trends, Threats, and Responses – A Perspective From the European Union Early Warning System 10:00 - 10:30

R. Christie[1], *A. Gallegos*[1]

[1]European Union Drugs Agency, Risks to public safety and security unit, Action on new drugs sector, Lisbon, Portugal

Abstract Body: The European Union Drugs Agency (EUDA), formally known as the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), has played a central role in Europe's response to new psychoactive substances (NPS) for more than 25 years. Its main responsibilities in this field are to operate the EU Early Warning System (EWS) on NPS, which allows Europe to rapidly detect, assess, and respond to public health threats linked to these substances.

Currently, the NPS market is characterised by complexity and increased integration with the market for established controlled drugs. The NPS market continues to grow, is resilient and highly dynamic, rapidly adapting to attempts to disrupt it. By the end of 2024 the EUDA was currently monitoring close to 1000 NPS, which are not covered by international drug controls, and during 2023, a record 41.4 tonnes of NPS were seized by EU Member States. In addition, the recent emergence of semi-synthetic cannabinoids, such as hexahydrocannabinol (HHC), and nitazene opioids, are particularly concerning from a public health perspective and pose potential challenges to laboratories.

The risks to health associated with these new substances are often unknown, potentially exposing consumers to the risk of serious or even fatal poisonings or other health problems. Legislative controls in Europe and non-EU source countries appear to have contributed to a reduction in the number of new derivatives of some drugs. Other substances, however, designed to evade generic definitions in legislation, continue to emerge, with China and India remaining important source countries for these substances.

Leveraging AI to Recognize the Unknown: The Case of New Psychoactive Substance Names 10:30 - 10:45

G. Grenier[1], *P. Esseiva*[1], *Q. Rossy*[1]

[1]University of Lausanne, School of Criminal Justice, Lausanne, Switzerland

Abstract Body: Detecting emerging threats through internet traces left by users in virtual spaces, such as forums, poses a significant challenge for law enforcement and public safety agencies. These traces often consist of unstructured texts (e.g. posts or comments), where the current strategy relies on regular expressions or keywords to extract relevant information. However, such an approach has a major limitation: it can only recognize

what is known, meaning that new information regarding new threats may be missed.

This issue is particularly concerning in the context of monitoring the emergence of novel psychoactive substances (NPS), which are known to present significant risks to public health. On forums, users may discuss new substances that do not correspond to known drugs, rendering traditional keyword-based methods limited. This raises an important practical question: How can we automatically recognize information that falls outside our existing knowledge ?

Our study addresses this challenge by introducing a novel approach that leverages artificial intelligence to recognize named entities, such as drug names, whether well known or newly emerging. Based on a custom dataset comprising thousands of annotated forum posts and comments related to drug trafficking and consumption, we fine-tuned the RoBERTa language model to enhance its ability to understand semantic context and recognized new substance names. The optimized model demonstrated a strong performance on the task, offering a promising solution for the early detection of emerging NPS.

The tale of nitazenes in Ireland – as told by Forensic Science Ireland. 10:45 - 11:00

S. Killoran[1]

[1]Forensic Science Ireland, Drugs Section, Co Kildae, Ireland

Abstract Body: In 2109 a staff member in Forensic Science Ireland (FSI) returned from a DEA training course with news of a new family of synthetic opioids called nitazenes, predicted to replace fentanyls. The news was not met with much concern by FSI, as Ireland had fortunately bypassed the fentanyl epidemic. Two years later, in 2022 FSI received a submission of fake oxycodone tablets that were believed to contain fentanyl. These tablets did not contain fentanyl but instead were found to contain metonitazene. Little did we realise that these fake ‘oxy’ tablets would be the prelude to the tale of nitazenes.in FSI.
With some sporadic detections in 2022, the story began to unfold in late 2023, when clusters of overdoses in Ireland led to a public health emergency. Samples connected to these overdoses were submitted by An Garda Síochana to FSi for analysis and N-pyrrolidino protonitazene was detected. Analysis was not straight forward and required a collaborative effort with both Trinity College Dublin and the National Drug Treatment Centre. The exact isomeric form of the nitazene was identified using a combination of analytical techniques, an approach which led to a publication in ‘Drug Testing and Analysis’
Throughout 2024 FSI continued to detect nitazenes in presentations from small street deals to 24,000 nitazene-spiked benzodiazepine tablets. These cases present challenges, such as low analytical responses, isomeric ambiguity and later eluting times. FSI have a unique perspective of these issues, and present them from the first detection to the current day experiences in the laboratory.

12: Scenes of Crime: Fire and Explosion Investigation
10:00 - 10:45 Wicklow Hall 1

Scenes of Crime: Fire and Explosion Investigation

Underwater Forensic Scenes: A Huge Challenge 10:00 - 10:15

Y. GERARD[1]

[1]Gendarmerie Nationale, Conflans Ste Honorine, France

Abstract Body: Underwater forensic scenes are often associated with criminal cases, including femicides, infanticides, or sexual assaults, where criminals seek to conceal the bodies or destroy evidence. Such scenes may also result from disasters, such as plane crashes or sinkings, where evidence and victims are submerged. Investigating these underwater environments presents unique challenges, including poor visibility, strong currents, low temperatures, and confined spaces, all of which impact both diver safety and the forensic process.
To manage these scenes effectively, investigative divers have to overcome these constraints while demonstrating a comprehensive understanding of underwater operations and the persistence of submerged forensic evidence. This expertise allows them to implement strategies to preserve crucial evidence while digitally documenting the scene to fix it in time. Such documentation provides invaluable records for law enforcement, forensic experts, and Disaster Victim Identification (DVI) teams, who cannot directly access the site.
However, due to limited knowledge in this field, misconceptions and myths persist about the survival and behavior of submerged traces, including fingerprints, DNA, firearms, and human remains.
This presentation explores a multidisciplinary, cutting-edge approach developed in France for handling underwater forensic scenes. It highlights innovative documentation techniques, such as virtual scene reconstruction and photogrammetry modeling, grounded in real case studies. Additionally, it provides insight into strategies for managing various types of submerged forensic scenes, advancing both practice and understanding in this specialized field.

From Simple to Chaotic: Case Studies With the Perspective of the Cynefin Framework 10:15 - 10:30

E. Ljungkvist[1], *B. Thomsen*[1]

[1]University of Dundee, Leverhulme Research Center for Forensic Science, Dundee, Scotland, United Kingdom

Abstract Body: Good (sometimes called ‘Best’) Practice Manuals are often designed using examples of relatively obvious and manageable crime scenes, where different investigation protocols are described. The BPM support the investigator in following good practice during each crime scene examination, however in many cases the investigator must think beyond the conventional and adapt practices to suit complex scenes. Creating good practice manuals reflecting the needs for processing complicated or complex crime scenes is often impossible, as such scenes require more agile thinking and adaptation of restrictive work process. This is particularly

important for "first responders" to crime scenes as their actions may impact on subsequent scene processing and ensure that the investigation must be undertaken in such a way as to maintain requirements for upcoming judicial process regardless of the complexity of the investigation itself.

This presentation will provide case studies for applying the Cynefin framework to crime scene investigation and will cover all the five domains of the process: Simple, Complicated, Complex, Chaotic, and Disruptive. We will discuss how investigators can use this tool to handle different situations. The focus will be on encouraging flexible and adaptive thinking by identifying the right domain within the framework and adapting the approach accordingly. This will support investigators in effectively managing complex investigations, improving the investigation's effectiveness and reaching accurate results that end users require.

The Underwater Scene Evidence Recovery (USER) Program: the example of the Australian Federal Police (AFP) Forensics Command 10:30 - 10:45

E. Bruenisholz[1], *A. Pears*[1], *S. Gardner*[1]

[1]Australian Federal Police, Forensics Command, Canberra, Australia

Abstract Body: Australia is surrounded by water, as well as having numerous inland waterways and lakes, and it is well established that bodies of water are prime mediums for disposing of and concealing evidence. Crimes committed in or around water bodies present unique challenges for investigations. Traditional search and recovery techniques often fall short in these situations, necessitating specialised skills set to record, collect and preserve traces effectively. Indeed, an underwater scene should not be considered any different from a dry land scene, and all efforts should be made to fully exploit any evidence located underwater.
Specialised diving skills and extensive training are required to effectively examine an underwater crime scene. These skills and capabilities are usually outside of the remit of Forensic Crime Scene Investigators (CSI). Equally, divers lack knowledge in forensic science and crime scene collection techniques.
While some nations have developed programs, no such program existed in Australia to address this gap. This presentation will explain how the AFP Forensics Command developed an innovative program aimed at improving forensic awareness in USER and how it enhanced collaboration between divers and crimes scene officers. This led to improvement in forensic approaches in USER by emphasising the importance of AFP crime scene investigators engaging early with police divers to ensure the work underwater considers forensic applications, and taking into consideration any diving limitations.

02: Chemistry: Other
10:00 - 11:00 Wicklow Hall 2 (B)

Chemistry: Other

Unmasking Falsified Viagra: Real-Time Detection and Quantification Using Cloud-Based NIR Spectroscopy and Machine Learning 10:00 - 10:15

H. Rais[1], *P. Esseiva*[1], *O. Delémont*[1]

[1]University of Lausanne, School of Criminal Justice, Lausanne, Switzerland

Abstract Body: Falsified medicines, including falsified Viagra, pose significant global health risks, necessitating rapid, reliable detection methods in decentralized settings. Real-time identification and quantification are critical to minimize these impacts.

We explore cloud-based Near-Infrared (NIR) spectroscopy with machine learning for on-site detection and analysis of falsified Viagra tablets. In a project based in Switzerland, approximately one hundred tablets, seized by Swiss customs and provided by Swissmedic, were analyzed to assess this technology's effectiveness.

Using an OnSite-W MicroNIR spectrometer connected via Bluetooth to a mobile application, NIR data were transmitted to a cloud server for immediate analysis. Models were developed to distinguish genuine from falsified products but also to detect and quantify sildenafil content, essential for assessing product effectiveness and dangerousness. The models demonstrated high accuracy, with an average prediction error of 4 mg on the overall quantity of sildenafil compared to the reference values obtained by Ultra-High Performance Liquid Chromatography coupled with an Ultraviolet detector (UHPLC-UV).

This approach allows rapid database updates and deployment across multiple instruments, enhancing field applicability. Integrating advanced data processing with portable NIR spectroscopy supports decentralized, real-time screening, enabling public health protection while opening doors to fast and efficient forensic intelligence.

Our findings indicate that this cloud-based, rapid and portable solution effectively detects and analyses falsified medicines on-site, providing valuable tools to minimize the impacts of pharmaceutical falsifying.

A Comparative Study of Fluorescence Spectroscopy and Mass Spectrometry-Based Proteomics for Estimating Time Since Deposition (TSD) of Blood 10:15 - 10:30

S. Alex[1], *L. Gautel*[2], *T. Shehata*[2], *M. de Puit*[3], *A. van Dam*[4]

[1]Netherlands Forensic Institute, Chemical Physical Traces (CFS) R&D, Den Haag, Netherlands, [2]University of Amsterdam, Amsterdam, Netherlands, [3] Netherlands Forensic Institute, Chemical Physical Traces (CFS), Den Haag, Netherlands, [4]Amsterdam UMC, Biomedical Engineering and Physics, Amsterdam, Netherlands

Abstract Body: Violent crimes such as domestic violence, assault, and homicide frequently leave behind blood traces at crime scenes. While forensic techniques have advanced in identifying “what” the traces are, estimating “when” a trace was deposited or the time since deposition (TSD) of a trace remains a challenge. Estimating TSD is important for distinguishing relevant evidence from irrelevant or pre-existing traces,

streamlining investigations by focusing on traces of forensic value and establishing crime scene timelines. However, factors like inter-donor variability and environmental conditions, including temperature, humidity, and rainfall, significantly alter bloodstain properties, complicating TSD estimation.
To tackle this challenge, our research explores two innovative approaches—fluorescence spectroscopy and mass spectrometry (MS)-based proteomics. Fluorescence spectroscopy leverages the auto-fluorescence property of proteins, particularly protein-bound tryptophan and its oxidation products, providing a rapid and field-applicable method for estimating TSD. In contrast, MS-based proteomics offers a deeper, laboratory-based analysis, revealing detailed insights into protein degradation and the absence or presence of post-translational modifications (PTMs) over time. This technique provides high-resolution data, enhancing accuracy in estimating TSD and supporting more comprehensive forensic interpretations.
By comparing these approaches, we highlight the results of each technique, their potential advantages and drawbacks, and map a way forward for TSD estimation.

Computing Similarity Between Mass Spectra of Wood Samples Collected With DART-MS 10:30 - 10:45

T. Jegatheesan[1], E. Espinoza[2], A. Moorthy[1]

[1]Trent Universty, Forensic Science, Peterborough, Canada, [2]US National Fish and Wildlife Forensic Laboratory, Ashland, United States

Abstract Body: Illegal logging is one of the most profitable natural resource crimes around the world. Having methods to rapidly and accurately determine whether an imported wood product contains illegally harvested would help catch perpetrators and, hopefully, dissuade illegal harvesting as an activity. In this seminar, we will discuss the use of direct analysis in real time mass spectrometry (DART-MS) for wood identification. In particular, we will discuss the mathematical underpinnings of mass spectral matching and how this numerical approach can be applied to the more complex mass spectra of biological materials measured using ambient ionization mass spectrometry. We will also share our recent experience employing modern machine learning approaches to compare these complex mass spectra.

Determining the Transition From Ante- to Post-Mortem Scent for Disaster Search and Rescue 10:45 - 11:00

B. Thurn[1], D.M. Bordin[1], M. Ueland[1]

[1]University of Technology Sydney, School of Mathematical and Physical Sciences, Sydney, Australia

Abstract Body: When disasters strike, the rapid location of victims is paramount. Victim location relies heavily on detection dogs, which can search large areas quickly and use their enhanced sense of smell to locate entrapped individuals. All scent is comprised of volatile organic compounds (VOCs), which are utilised by search and rescue canines and cadaver-

detection dogs to locate victims. Although detection dogs are effective, issues arise during early decomposition when the odour is less pronounced, and due to the dynamic nature of disaster sites, it is challenging to determine which search teams to deploy. Little research is currently being performed to assess the transition from living to dead VOCs, with large variations in sampling methodology and analytical instrumentation between ante- and post-mortem studies. Here, we aimed to optimise methods of sampling living volunteers and recently deceased individuals, and determine key biomarkers to distinguish between the two VOC profiles. Headspace samples were collected using dual sorbent tubes and analysed using two-dimensional gas chromatography with time-of-flight mass spectrometry (GC×GC-TOFMS). Samples from the decedents were collected within the University of Technology Sydney morgue, and were taken over the first 48 hrs post donor arrival. Post-mortem analysis revealed an increase in sulfides as decomposition continued, with hydrocarbons decreasing over the sampling period. Aldehydes were the most prevalent class within the living profiles, which indicates their potential as a biomarker for locating survivors. Understanding the differences between the profiles is crucial to optimise detection dog training, and to inform future technologies to rapidly locate survivors.

01: Case Studies: Multidisciplinary cases
10:00 - 11:00 Liffey Meeting Room 2

Case Studies: Multidisciplinary cases

Hanged for Murder: The Osteoarchaeological Analysis of Individuals Executed by the Irish State; A Case Study 10:00 - 10:15

M. Ní Challanáin[1]

[1]ARC Forensics Ltd, Dublin, Ireland

Abstract Body: A forensic archaeological excavation in the grounds of Mountjoy Prison in Dublin in 2024 recovered the remains of 25 individuals convicted of murder, who were hanged by the Irish State between 1923 and 1954. These individuals were buried in unmarked graves in an area to the rear of the former prison hospital. The main target of this excavation was to recover and identify the remains of Harry Gleeson who was executed in 1941 and received a posthumous pardon in 2015. A biological profile was created for each individual and with the use of DNA sampled from the remains (analysed by Forensic Science Ireland), and participation of surviving family, it was hoped that this would help in identifying Harry Gleeson and provide presumptive identifications for the other remains. The official cause of death listed for each executed individual was a fracture-dislocation of the third cervical vertebra. A distinctive pattern of injuries was observed on the remains, yet the typical “hangman’s fracture” was not. Transverse fractures of C1 and C2, complete fractures of transverse processes of C3-C5 and shearing of the condyle of the mandible were some of the injuries recorded. The fractures occurred predominantly on the right side and the degree of severity of the injuries varied from person to person. This closed population from Mountjoy Prison in Dublin provided a unique opportunity to examine the effects osteologically of judicial hangings and the osteological analysis aimed to add to the corpus of previously published work on these types of fractures.

The Forensic Science Aspect of an Irish Gangland Feud With an International Dimension 10:15 - 10:30

A. Magee[1]

[1]Forensic Science Ireland, Celbridge, Ireland

Abstract Body: A high profile Irish gangland feud began with a fatal shooting in Spain's Costa del Sol in 2015.
Between 2015 and 2018, a total of eighteen people lost their lives in this feud.
Feud related incidents included fatal shootings in a crowded Dublin pub and hotel in 2015 and 2016, respectively.

This presentation will focus on the forensic science aspect of this feud.
This includes DNA evidence from facemasks and items of clothing recovered from partially burned getaway vehicles.
The international dimension included the sharing of DNA profiling data via Interpol.
Details of the above aspects, together with other forensic evidence obtained, and prosecution and defence approaches at trial will be discussed.

Diagnostic Forensic Tools in the Investigation of Electrocution Fatalities: A Case Study 10:30 - 10:45

A. Askar[1], *S. Alzarooni*[1], *M. Habiballah*[1], *R. Eissa*[1], *R. Alremeithi*[1], *I. Shah*[2]

[1]Dubai Police, Dubai Police Forensic Labs, Dubai, United Arab Emirates, [2] United Arab Emirates University, Chemistry, Al Ain, United Arab Emirates

Abstract Body: Electrocution is a leading cause of occupational fatalities, frequently occurring at voltages typical of household electrical systems (220-250 volts). This study presents a comprehensive forensic investigation of a 35-year-old laborer's electrocution death in Dubai. The methodology employed included forensic medico-legal examination, histological analysis, trace evidence analysis, and forensic engineering investigation. The site inspection revealed significant safety violations, such as improper electrical connections and a non-functional earthing wire, which contributed to the incident. The apparatus examination classified the demolition hammer used by the victim as Class 0 electrical machinery, lacking adequate insulation and earthing protection. Autopsy findings identified a first-degree electrical burn and generalized visceral congestion, consistent with electrocution. Histopathological analysis confirmed the presence of characteristic skin lesions, while trace evidence analysis using SEM/EDS detected metallization on the deceased's skin, indicating direct contact with the demolition hammer. A novel application of geoscience trace evidence was introduced which suggests a transfer of dust and sediments particles between the deceased's hand skin and the metal hammer. This case emphasizes the critical need for strict commitment to electrical safety standards and demonstrates the effectiveness of a multidisciplinary forensic approach in diagnosing electrocution. The findings highlight the importance of proper safety measures and advanced forensic techniques in preventing and investigating electrocution fatalities.

Victim Identification of the Wintzenheim Fire Disaster, France: A Multidisciplinary Approach 10:45 - 11:00

L. Malfroy Camine[1], A. Conigliaro[1], M. Biard[1], S. Grignard[2], G. Visseaux[3]

[1]Forensic Sciences Institute of the French Gendarmerie (IRCGN), Forensic Pathology - Forensic Odontology Department, PONTOISE, France, [2]Forensic Sciences Institute of the French Gendarmerie (IRCGN), Forensic pathology - Forensic Odontology Department, PONTOISE, France, [3]Forensic Sciences Institute of the French Gendarmerie (IRCGN), Forensic pathology - Forensic odontology department, PONTOISE, France

Abstract Body: Early in the morning of the 9th of august 2023, a fire broke out in a rental house in Wintzenheim, a touristic town in the northeastern France. This tragic event resulted in the death of 11 individuals among the 28 occupants, most of whom had physical or mental disabilities.The Disaster Victim Identification (DVI) Unit of the Forensic Sciences Institute of the French Gendarmerie (IRCGN) was tasked with leading the recovery and the identification of the deceased, in close collaboration with the forensic pathology institute of Strasbourg, France. Adhering to INTERPOL standards, the mission successfully identified all victims, through a combination of forensic odontology and genetic analysis.

This presentation will discuss the challenges encountered and lessons learned throughout the operation, from the intial response to post-mortem and ante-mortem data collection and reconciliation. It will emphasize the critical role of forensic odontology in this context, the multidisciplinary coordination required in DVI missions, and the specific difficulties associated with analyzing burnt human remains.

07: Forensic Management and Quality Systems: Quality Systems and Accreditation
10:00 - 11:00 Liffey Meeting Room 3

Forensic Management and Quality Systems: Quality Systems and Accreditation

The Development and Planning for the “Uncommon” Proficiency Testing Programmes in Accordance with ISO/IEC 17043 Requirements 10:00 - 10:15

C.-N. TAM[1], D.-Y. LUK[1], C.-H. TAO[2], C.-K. LI[1]

[1]Government Laboratory, HKSAR, Scene of Crime & Quality Management Section, Forensic Science Division, Homantin, Hong Kong, SAR of China, [2] Government Laboratory, HKSAR, Physical Sciences Section, Forensic Science Division, Homantin, Hong Kong, SAR of China

Abstract Body: It is a mandatory requirement that laboratories accredited under the ISO/IEC 17025 international standard participate in related proficiency testing programmes to demonstrate their technical competence in their areas of work. While proficiency tests (PTs) for various forensic disciplines are available from international PT providers for comparison and accreditation purposes, there are still some forensic disciplines in which the availability of PT is relatively limited. The authors’ laboratory, is an accredited PT scheme provider under ISO/IEC 17043 international standard,

aiming at providing and developing forensic PTs which are not easily available in the forensic community, such as Chinese handwriting examination and stamp impression examination. We also plan to extend the scope of our forensic PTs to cover the “Uncommon” programmes such as vehicle speed determination from video footage. In this presentation, we would like to share our experience in developing our PTs. We hope that the PTs we organise could provide an analytical and discussion platform for participating laboratories and benefit the international forensic science community.

Regulating the Frontline: What is Quality Management's Impact on Crime Scene Investigation? 10:15 - 10:30

V. Mousseau[1,2], *M. Morelato*[1], *C. Roux*[1]

[1]University of Technology Sydney, Centre for Forensic Science, Broadway, Australia, [2]École Nationale d'Administration Publique, Chaire de Recherche du Canada en Management Public Comparé, Montreal, Canada

Abstract Body: In recent decades, forensic science has increasingly embraced quality management strategies and regulatory mechanisms such as accreditations and certifications to respond to some the criticism it faced. Initially applied in forensic laboratories, there is a growing advocacy to extend similar quality assurance standards to crime scene investigation. However, the suitability and effectiveness of these strategies within broader investigative and policing practices remain to date contested by some researchers and practitioners.

This research aims to assess the impact of quality management mechanisms on crime scene examiners' work and performance in Australian law enforcement agencies. Employing a mixed-methods approach, the study analyzes over 25 years of official statistics and performance indicator results from police services around the country using difference-in-difference models to compare pre- and post-implementation outcomes in accredited and non-accredited agencies. Additionally, qualitative data from focus groups with crime scene examiners working in accredited facilities was also analysed to better understand the perceived effects of quality management on their work, practices and professional discretion.

The presentation will share key findings from this study, offering insights into the effectiveness of quality management in improving crime scene investigations and its implications for professionalization, forensic science regulation, and the evolving meaning of quality in the field. It will thus provide valuable evidence to inform policy, practice, and theoretical discussions shaping the future of the discipline.

Development of Comparative Proficiency Testing for Gunshot Residue Analysis and International Collaboration for Reliance of Thai Forensic Laboratory towards Global Recognition 10:30 - 10:45

P. Seelanan[1], *P. Nantasitangkool*[2], *W. Prongmanee*[1]

[1]Royal Police Cadet Academy, Faculty of Forensic Science, Nakorn Pathom, Thailand, [2]Royal Thai Police, Bangkok, Thailand

Abstract Body: The advancement of forensic science plays a crucial role in ensuring the integrity and credibility of criminal investigations. This study focuses on the development of comparative proficiency testing (PT) for Gunshot Residue (GSR) analysis in Thailand, with a vision to align Thai forensic laboratories with international standards. Since 2021, the Royal Police Cadet Academy (RPCA) has actively participated in GSR proficiency testing schemes conducted by the European Network of Forensic Science Institutes (ENFSI) and Forensic Testing Service (FTS, USA). These engagements have significantly enhanced the knowledge and competency of Thai forensic professionals in GSR analysis.
Through rigorous participation in these schemes from 2021 to 2024, the RPCA has achieved two critical milestones: developing reference materials for GSR analysis tailored to Thailand's forensic context and establishing a domestic PT provider for GSR. These efforts aim to increase reliance on international testing schemes, making proficiency testing more accessible and sustainable for Thai forensic laboratories.
The integration of international expertise and the establishment of local capabilities not only strengthen the technical proficiency of Thai forensic institutions, but also pave the way for global recognition. The importance of international collaboration and capacity-building initiatives in advancing forensic science has been underlined, ensuring that Thailand’s GSR analysis capabilities meet global standards of quality and reliability.

Supporting Forensic Case Work through a Quality Management System 10:45 - 11:00

D. Matthews[1]

[1]The Chartered Society of Forensic Sciences, Chief Executive, Harrogate, United Kingdom

Abstract Body: Following the work of the Forensic Science Regulator, it became apparent to the sector that any organisation wishing to keep up to expectations with the new era of Regulation in England and Wales, would require a Quality Management System (QMS). Feedback from Society members highlighted that generic commercial systems were expensive, complex and did not suit the smaller organisations within forensics who were not large enough to employ a Quality Manager and needed support.
The Society worked with developers and test customers to design a Sharepoint-based system that was intuitive to use and supplemented this with a package of support days from experienced Quality experts, acting as ‘surrogate Quality Managers’ – guiding members of the scheme through every step of the way.
As the UK’s professional body for Forensic Science we are able to check with all relevant organisations (such as the FSR’s Office, Crown Prosecution Service and Ministry of Justice) to ensure relevance and each aspect of the system is kept up to date.
As a not-for-profit members’ organisation so we are able to offer this at reasonable rates to ensure cost is not a hurdle to entry for smaller organisations, allowing them to increase their credibility and demonstrate their passion for better practice.
This presentation will focus on;

- how the Chartered Society is supporting members through the new landscape of Regulation and Accreditation
- how organisations and sole traders can demonstrate mitigating factors for non-compliance
- how to prepare for the implementation of a QMS

10: Legal and Ethical Aspects: Ethics in Forensic Science
10:00 - 10:45 Liffey Meeting Room 4

Legal and Ethical Aspects: Ethics in Forensic Science

Reporting Likelihood Ratios: a Communication Challenge 10:00 - 10:15

R. Ypma[1], C.E. Berger[1,2], M. Nagtegaal[3], M. Sjerps[4]

[1]Netherlands Forensic Institute, The Hague, Netherlands, [2]Leiden University, Faculty of Law, Leiden, Netherlands, [3]Netherlands Forensic Institute, Forensic medicine, The Hague, Netherlands, [4]Netherlands Forensic Institute, Evidence evaluation and statistics, The Hague, Netherlands

Abstract Body:

Likelihood Ratios (LRs) are considered the ‘state of the art’ when evaluating forensic evidence [FSR,ENFSI,ISO]. For example at the NFI, they are reported in almost any area, including forensic medicine.

When the LR value cannot be calculated but relies on a subjective assessment, the LR may be expressed in words. Labs are encouraged [FSR,ENFSI,ISO] to report a ‘translation table’ that defines a set of standard verbal descriptions expressing the strength of the evidence as numerical LR intervals. The category representing the strongest evidence often exceeds 1 million.

A standard DNA analysis yields an LR larger than 1 billion, and lawyers have grown accustomed to such large evidential values. However, 'activity level' LRs are often smaller than 1 million. Weaker evidence is also regularly obtained in other areas (see also [Rassin]). In forensic medicine for example, LRs larger than a million are rare. On the other hand, the hypotheses are often directly relevant for the question whether the suspect committed the alleged crime.

We have noted that it is a challenge to effectively communicate LRs that are smaller than 1 million to the police or legal decision makers. Failure to understand smaller LRs, and/or not taking the relevance of the hypotheses into account, may have serious consequences, such as discarding useful evidence.

In this presentation we discuss challenges and possible solutions for communicating LRs in forensic reports, with case examples from forensic medicine. We also plead for joint research projects of social scientists, forensic scientists, and lawyers to promote effective communication.

A Silent Taboo: Exploring the Medico-Legal and Ethical Conundrums of Necrophilia 10:15 - 10:30

J.L. Charan[1], *J.K. Charan*[2]

[1]Mahindra University, School of Law, Hyderabad, India, [2]Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, School of Law, Chennai, India

Abstract Body: Necrophilia, a paraphilia involving sexual gratification against a dead person, remains a profoundly taboo and underexplored phenomenon within the realms of forensic science, ethics, and legal studies. This aberrant behaviour presents a myriad of challenges for medico-legal professionals, including the complexities of evidence collection, forensic psychological evaluation of offenders, and the preservation of the deceased's dignity. Further, medical professionals use advanced forensic methodologies, such as DNA profiling, histopathological examination, to establish evidence of sexual activity post-mortem. Furthermore, psychological assessments of offenders are also crucial to ascertain the pathological deviations that necessitate specialized mental health interventions. It also raises profound ethical concerns, particularly safeguarding the dignity of the deceased persons. Some countries, like the United Kingdom, Canada, and New Zealand, have implemented specific laws criminalizing necrophilia. However, many countries lack specific legal provisions that explicitly criminalize necrophilia, but acts involving indignity to a human corpse are punishable. The absence of specific provisions often hinders effective prosecution and justice delivery. For example, in an Indian case, *Rangaraju @ Vajapeyi v. State of Karnataka*, the Karnataka High Court ruled that having intercourse with a deceased woman does not constitute rape under Section 376 of the Indian Penal Code. However, the court highlighted that necrophilia is punishable under the Sexual Offences Act, 2003 of the UK. Hence, this paper critically examines the medico-legal complexities associated with necrophilia, emphasizing the gaps in existing legal frameworks. It advocates for a multidisciplinary approach to address the need for the criminalization of sexual offences against dead persons.

Forensic Facial Reproduction: A Computed Tomography Study of Facial Soft Tissue Thickness in a Nigerian Adult Female Multi-Ethnic Group 10:30 - 10:45

N. Adegbite[1], *w. Ahmed*[1], *C. Avery*[2], *M. Mura*[1]

[1]university of lincoln, School of Engineering and Physical sciences, Lincoln, United Kingdom, [2]University Hospital of Leicester, Oral and maxillofacial Surgery, Leicester, United Kingdom

Abstract Body: Forensic facial reproduction (FFR) is the approximation of the face of the deceased by use of its own ethnic specific facial soft tissue thickness (FSTT) data. FSTT has been documented for populations, we are not aware of any FSTT data for the combined Nigerian female ethnicities (CNFE). In this study FSTT was measured from 32 computer tomography scans. Measurements were taken from 12 mid-sagittal and 19 bilateral points totalling 50 in 4 Nigerian ethnicities. In comparison to previous studies in Africa, measurements were taken from more FSTT points, with a

diverse age range of 18 to 95 years and with RadiAnt. Mean were determined for the CNFE and Hausa adult females. CNFE homogenously showed more soft tissues on the left than the right side with the most relative % difference at the zygomatic arch then the mid-lateral orbit, the lateral nasal and least at the infraorbital region. We had compared our findings with values of Nigerian adult male, South Africa, Türkiye, Korea and Belgium. This female midline showed differences in the lips and chin regions when compared with other populations. The right side of the face showed more differences than the midline FSTT when compared with other populations, this will relate to the greater thickness of bilateral tissues and the increased points. The CNME showed slightly more FSTT thickness at most points except at the right lateral side of the face. It does suffice to suggest that this data will be useful in building face of the Nigerian adult female

13: European Day
10:00 - 10:45 Wicklow Meeting Room 2

□□□□ European Day

Forensic Chemist's Journey From the Question to a Likelihood Ratio – ROTOR, a FOR FUTURE Project 10:00 - 10:15

M. Bovens[1], B. Ahrens[2], I. Alberink[3], T. Korpinsalo[4], J. Malmborg[5], A. Nordgaard[5], S. Huhtala[4]

[1]Zurich Forensic Science Institute, Zurich, Switzerland, [2]Bundeskriminalamt, KT-45 Toxicology, Wiesbaden, Germany, [3]Netherlands Forensic Institute, The Hague, Netherlands, [4]National Bureau of Investigation, Forensic Laboratory, Vantaa, Finland, [5]Swedish National Forensic Centre, Linköping, Sweden

Abstract Body: The forensic literature shows an increasing trend in the use of chemometrics covering various forensic disciplines concerning e.g. oil spills, glass, paints, fibres, fire debris or illicit drugs. Consequently, there is a growing demand in forensic science for efficient, structured and reliable data analysis as well as sound interpretation of its results. These needs are especially pronounced in comparative examinations where classification, grouping or source attribution are of interest.

Usually, collected data requires extensive analysis by parametric and non-parametric statistical methods (i.e. chemometrics). The results of this analysis may also require further substantiation, such as an expert opinion on the evidential value. When applicable, a likelihood ratio (LR) supports the forensic chemist in reporting evidential value to the customer (e.g. law enforcement and court of justice).

Selection of a proper process when applying chemometric and LR calculations to reach a forensic conclusion requires chemical, chemometric and forensic knowledge. The steps of the process are dependent on the type of question presented and the data at hand. Also, any requirements set by quality policy have to be followed.

Forensic chemists and statisticians of ENFSI member institutes cooperate in the ROTOR project to enhance understanding of when LR can support the

expert in reporting conclusions and when other types of reporting should be used. The project will provide guidance and examples (including chromatographic and spectral data) in an ENFSI Guideline. This guideline will assist forensic chemists in selection of the route from a presented forensic question via data analysis to the conclusions.

Advances in Craniofacial Superimposition using Artificial Intelligence 10:15 - 10:30

P. Martinez[1,2], P. Navarro[3], V. Lugli[3], A. Valsecchi[3], R. Guerra[4,3], M.A. Guativonza[4,3], V. Martinez[3], G. Ramirez[3], O. Ibañez[5,3], P. Mesejo[1,2], S. Damas[6,2]

[1]University of Granada, Department of Computer Science and Artificial Intelligence, Granada, Spain, [2]Andalusian Research Institute in Data Science and Computational Intelligence, Granada, Spain, [3]Panacea Cooperative Research, Ponferrada, Spain, [4]University of Granada, Physical Anthropology Lab, Department of Legal Medicine, Toxicology and Physical Anthropology, Granada, Spain, [5]University of A Coruña, Faculty of Computer Science, La Coruña, Spain, [6]University of Granada, Department of Software Engineering, Granada, Spain

Abstract Body: Craniofacial Superimposition (CFS) is a challenging skeleton-based identification method that involves superimposing a post-mortem (PM) skull onto facial ante-mortem (AM) photographs in order to assess their anatomical consistency.

In the last decade, researchers developed several computer algorithms to carry out the skull-face overlay (SFO) process automatically, by leveraging advances in Artificial Intelligence. However, subjectivity over the position of the anatomical landmarks and lack of specific knowledge on the individual facial soft-tissue thickness and direction, can lead to low quality results. In this study we aim at improving the SFO process by widening the information employed by the automatic method beyond the location of the landmarks. This includes a statistical model of the facial soft-tissue, as well as information about the photograph, namely the focal distance, the subject-to-camera distance and the overall facial pose. Moreover, the algorithm uses the shape and positional relationship of the chin profile, while the overall profile of the skull is matched to that of the face.

Our experimental study involved a sample of Computed Tomography scans of 27 subjects. From each scan we obtained a 3D model of the skull and we also simulated 30 frontal photographs and 30 lateral photographs, for a total of 1620 images. Each photograph has been superimposed with all 27 skulls, for a grand total of 43,740 skull-face overlays. The results show a clear improvement over the current state of the art in terms of accuracy and robustness due to the additional information involved in the process.

Bringing a Forensic Perspective on Environmental Crime Investigations in Finland 10:30 - 10:45

M. Lindqvist[1], T. Mäkelä[1], S. Huhtala[1], V. Romppainen[1], R. Lindqvist[1], J. Wallin[1]

[1]National Bureau of Investigation, Vantaa, Finland

Abstract Body: Public awareness of environmental crimes as well as the number of reported environmental offences is increasing. These offences are typically white-collar crimes aiming for financial profit. Environmental crime is estimated to generate between 110 and 281 billion USD in illicit profits each year (Interpol).
SPECIAL started in May 2023 aiming to develop and strengthen environmental crime investigation in Finland. The project enhances tactical and technical competence of police crime scene investigation as well as the co-operation between police, forensic laboratory and environmental authorities. Criminal investigation may require environmental sampling to prove environmental offence and assess harmful environmental effects. In general, the matrix e.g. waste or polluted soil is heterogenous and sampling requires expertise in natural sciences like environmental chemistry, geology and hydrology. Collecting representative samples depicting the site of environmental offence has proven to be very challenging.

In total, eight training events of environmental crime scene investigation are organized covering theoretical aspects and onsite sampling exercises. This is the first time this kind of tailored education is provided to the Police and other authorities in Finland. A training plan will be created based on the project for future purposes. The best practises are collected into a handbook to assist investigation units of the Finnish Police.

The project has received excellent feedback from the participants, reporting positive development in co-operation with other authorities as well as improved skills in technical investigation.

Project has received two years funding from EU - Internal Security Fund (ISF).

09: Interpretation: Expert Evaluative Opinions (EEO)
10:00 - 11:00 Wicklow Meeting Room 3

Interpretation: Expert Evaluative Opinions (EEO)

Transitioning Forensic Service Providers to Evaluative Reporting: The Example of the Australian Federal Police (AFP) Forensics Command 10:00 - 10:15

E. Bruenisholz[1], *J. Bunford*[1], *K. Jones*[1]

[1]Australian Federal Police, Forensics Command, Canberra, Australia

Abstract Body: The move towards an Evaluative Reporting (ER) framework for the comparative forensic sciences has been driven by laboratories in Europe through the European Network of Forensic Science Institutes (ENFSI) Guidelines published in 2010 and in recent years, has seen general support within Australia, through the National Institute of Forensic Science (NIFS) in 2017.
Evaluative reporting is a formalised thought process that enables the evaluation of scientific findings given two competing propositions. The benefits of utilising this type of approach is that cognitive bias can be minimised and opinions can be updated in a logical way on receipt of new

information or changes in case circumstances.
The AFP Forensics Command recognised that adopting ER and aligning verbal scales or opinions across the forensic disciplines could improve the communication and understanding of results to our stakeholders contributing to a fairer justice process. Thus, a project to assist its teams to transition to ER was created in 2021.
This paper presents some of our work and lessons learned with the hope of providing valuable guidance to other teams or agencies wishing to embark on this journey.

Impact of the "Final Report on COMPLAINT NO. 23.67; Tiffany Roy; (Timothy Kalafut, PH.D.; Evaluation of Biological/DNA Results Given Activity Level Propositions)" 10:15 - 10:30

T. Roy[1], A. Jameison[2], D. Krane[3], G. Hampikian[4]

[1]University of Leicester, Law School, Leicester, United Kingdom, [2]Director at The Forensic Institute; Fellow of the Royal Society of Biology, Glasgow, United Kingdom, [3]Wright State University, Biological Sciences, Dayton, OH, United States, [4]CompGenomics, Boise, United States

Abstract Body: Does personal degree of belief meet the standard of reliability for scientific evidence in criminal courts just because it is offered by a scientist and is based on data? There is significant disagreement between scientists, lawyers and justice partners regarding legal admissibility and the scope of the role of the forensic scientist in a court of law.

A complaint was filed in late 2023 with the Texas Forensic Science Commission regarding an evaluation of genetic findings given proposed activities in testimony in a criminal trial. The Commission made recommendations on best practices in the use of activity level propositions and related testimony. It highlights ten unresolved issues from the case in question and how the use of best practice would have affected the overall presentation of evidence in the matter of the state of Texas v. Armstrong. The report includes recommendations the Commission has identified as steps that must be taken to address issues in the area of interpretations and reporting given activity level propositions, which include a substantive look at the foundational basis of the framework in the context of the criminal justice system. The Commission set out how, if foundation is established, those opinions would be presented by making recommendations on education, training, quality assurance, reporting, and testimony. These recommendations and their impact on these interpretations will be discussed in this presentation.

The EEO Elephant in the Lab 10:30 - 10:45

A. Forde[1], C. Murphy[2], A. Lennon[3]

[1]Forensic Science Ireland, Documents & Physical Methods Team, Dublin, Ireland, [2]Forensic Science Ireland, Sexual Assault Team, Dublin, Ireland, [3] Forensic Science Ireland, Chemistry Team, Dublin, Ireland

Abstract Body: We would like to present our experiences of bringing the EEO process into our everyday casework.
We will take you through our journey, from the vision of our pioneers, who set us on the road, right through to the court room!
From those early pioneers, we have developed a training programme for new staff, introducing them to probability theory, Bayes theorem and how it is applied in casework.
Within casework, we carry out a pre-case assessment, prior to examination, and a re-assessment and evaluation after our examination. Our reports include an interpretation at an appropriate evaluative level – the goal is to report at activity level as much as possible.
We will show that EEO is not something to be feared; that data for interpretation can take many forms and that an expert's opinion is always relevant!

From Traces to Networks: Insights into Counterfeit Perfume Distribution 10:45 - 11:00

P.-L. Dumont[1,2], C. Mireault[3], F. Crispino[1,2], M. Bérubé[1,2]

[1]Université du Québec à Trois-Rivières (UQTR), Chimie, biochimie, physique et science forensique, Trois-Rivières, Canada, [2]Groupe de recherche en science forensique (GRSF), Trois-Rivières, Canada, [3]Laboratoire de sciences judiciaires et de médecine légale (LSJML), Criminalistique, Montréal, Canada

Abstract Body: Sydney's Declaration defines the trace as a vestige of reminiscent activities. Through comparison of traces, there's potential information that can be gained by studying the relation existing between them, which is defined by their similarity. The latter, characterised by common discriminant features, would suggest they are from a common source of activity, which could orient operations to identify the weakest spot in a criminal organization's operation. From another perspective, network theories have been studied thoroughly through the last decades and are regularly used in social sciences, such as criminology. Although the term network is commonly used in forensic intelligence, there's only a few research that have been developed to study structures from trace analysis. These structures could enable the combination of different types of traces, to gain insight in criminal operations, and the use of criminological theories to help law enforcement in their operations. Hence the main question of this research project: how can we develop more effective forensic intelligence using the social network theories' perspective? Counterfeit perfumes will be used as an object of study where chemical, physical and digital profiling will be developed. This project will contribute to the understanding of network theories from a theoretical perspective in forensic science and on traces interpretation for forensic intelligence development in a specific context.

05: Drugs: Societal Impact
11:00 - 11:45 Auditorium

Poster Session Wednesday - Drugs: Societal Impact

Evaluation of Testing Kits for Detecting Drugs in Spiked Drinks: Reliability and Effectiveness Assessment 11:00 - 11:00

L. Gautam[1], H. Key[1], A. Bonus[2], A. Grela[1]

[1]Anglia Ruskin University, School of Life Sciences, Cambridge, United Kingdom, [2]The Drinkaware Trust, London, United Kingdom

Abstract Body: Drink spiking remains an issue, characterised by a gap between reported incidents and convictions. This gap is increased by underreporting, delays in seeking help, and memory loss induced by the spiking itself, which further complicates reporting and investigation. Additionally, delays often allow drugs to fully clear from the body making detection challenging from biological fluids.
Presumptive drink testing kits have emerged as a potential tool for spiking detection, but their reliability is underexplored. This study evaluated five commercially available kits: two immunoassay-based kits (IAT1 and IAT2) and three colour-based kits (CT1, CT2, and CT3). These kits, available as strips, cassettes, and wristbands, were assessed for specificity, limit of detection, and performance across various beverages.

Results showed that colour-based testing kits (CT1, CT3) designed for GHB and ketamine detection exhibited high false positive rates, subjective interpretations, and inconsistent instructions. For example, CT1 showed 97.1% false positives on the yellow side and 25.7% on the pink side, while CT2 exhibited 15.4% false positives. These issues were worsened by beverage colour, lighting conditions, and user colour blindness. In contrast, immunoassay-based kits demonstrated greater reliability, with false positives ranging from 0% to 11.4%, depending on the drug and drinks tested. While some immunoassay kits can detect a broader range of drugs, they are typically expensive and display results in formats opposite to familiar tests like COVID-19 or pregnancy kits, which could confuse users. These findings underscore the need for improved testing technologies to reliably detect a wide range of spiking drugs in diverse settings.

11: Marks, Impressions and Biometric Traces: Face Recognition
11:00 - 11:45 Auditorium

Poster Session Wednesday - Marks, Impressions and Biometric Traces: Face Recognition

Can Automatic Facial Recognition Be Used to Improve Manual Facial Image Comparisons? 11:00 - 11:00

J. Tuvskog[1], M. Hardebro[1]

[1]Swedish National Forensic Centre (NFC), Information Technology Department, Linköping, Sweden

Abstract Body: At the Swedish National Forensic Centre (NFC), manual image comparisons are performed to assess the probabilities of findings under two competing hypotheses, with the ratio of probabilities forming a likelihood ratio (LR). The estimation of probabilities is currently done by professional subjective decisions based on the training and experience of the examiners. Now, the question is if an automated facial recognition software (AFR) can be used to improve these manual estimates?

NFC have previously developed and validated a statistical score-to-LR

model based on the similarity scores from AFR when comparing facial images of high quality. In the present study, we evaluate if this model can assist forensic experts to improve their LR estimates during forensic facial image comparisons. Initially, the forensic experts perform the manual facial image comparison as usual, resulting in an estimated LR. If the images satisfy the criteria for high quality, AFR is used in combination with the score-to-LR model to obtain an automatic and independent estimation of the LR-value. The forensic expert can then consider both the manually estimated and the AFR-generated LR values, along with other factors such as the time gap between the questioned and reference images, to refine and adjust their initial assessment.

Validation of the combined methodology is underway. The hypothesis is that manual forensic facial image comparison will be enhanced through the use of AFR, and the extent of this improvement will be discussed.

Integrating Odontology and Bioarchaeology: A Novel Postmortem Dental Data Form 11:00 - 11:00

F. Meli[1], *L. Bigo*[1], *M. Friziero*[1], *E. Nuzzolese*[1]

[1]University of Turin, Human Identification and Forensic Odontology Laboratory (LIPOF), Turin, Italy

Abstract Body: The field of forensic sciences relies heavily on the integration of various disciplines to effectively identify human remains. Forensic odontology and bioarchaeology play crucial roles in this process. This paper presents a novel approach to integrating these two disciplines through the development of a comprehensive postmortem dental data form and a standardized data collection form. Bioarcheology focuses on the analysis of skeletal remains in archaeological and forensic contexts. It provides insights into past populations, their health, and their cultural practices. By analyzing skeletal features, such as craniometrics and postcranial remains, bioarchaeologists contribute to the identification process. We propose the development of a novel standardized postmortem dental data collection form. This form aims to bridge the gap between forensic odontology and bioarchaeology by incorporating essential fields from both disciplines. It includes sections for recording dental features as well as specific cranial features.
The postmortem dental data form includes the main bioarcheological methodologies to assess biological sex and estimate the age range of the individual, combining odontology and archeology methods. Supplementary pictures and graphic representations allow the recording all the biological, pathological and dental features of the subject. The proposed form facilitates the comparison of postmortem findings with antemortem dental data and records, enabling more accurate identifications.
Furthermore, the form incorporates INTERPOL standardized terminology and coding system to ensure consistency in data collection and interpretation. This improves communication among forensic professionals and facilitates the sharing of data in national and international databases.

Proposition of an ACE-V Methodology Approach for Soft Biometric Comparison Examination on the Dorsal Surface of Hands. 11:00 - 11:00

C.L.S. Fonseca[1], *J. Bata*[2], *F. Santos*[2]

[1]Federal Police Of Brazil, Expert Fingerprint, Brasília, Brazil, [2]Federal Police Of Brazil, Expert Fingerprint, São Luis - MA, Brazil

Abstract Body: The Soft Biometrics has had great of notoriety in recent years with the advance the biometric identification processes. As a result, the set: scars, marks and tattoos (*SMT's*) has been increasingly used in Verifications Process purposes in the field of criminal sciences to identify criminals who commit sex crimes with the producing pornographic material. This is due to the fact that in child sexual abuse images, for example, the criminal hardly appears, leaving exposed reduced parts of his body, such as the dorsum of the hands. In this sense, the objective of this paper is to propose an approach to ACE-V methodology for forensic comparison of images of the dorsum of the hands to indicate if they are related to the same person. This paper proposes the stages of Analysis, Comparison, Evaluation and Verification for cases in which there is a Verification Process of Soft Biometrics of the dorsum of the hands. The improvement of the steps in the field of practice and possible approaches for the necessary progress of this still incipient field are also highlighted.

Mass Graves as a Unique Niche For Non-human Biological Traces 11:00 - 11:00

C.M. Walton[1], *M.M Kermani*[1], *F.H Aballay*[2], *J.P. Ferreiro*[3], *H.R Braig*[2], *M.A. Perotti*[1]

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Abstract Body: One of the challenges in forensic taphonomy is that under apparently similar environmental conditions, individual bodies might decompose in disparate ways. If many of such varying bodies come together in a mass grave, they constitute a new, unique depositional environment. Each individual human body also introduces its own diversity of non-human biological traces in the form of microscopic organisms, underexplored eukaryotes, fungal spores, pieces of plant origin and pollen, and invertebrates. One would expect that the forensic analysis of insects, and mites and ticks (Acari) in mass graves would have followed suit. The use of insects, and more and more the use of mites has demonstrated their value in legal investigations. Yet, this has not yet translated to mass graves. Protocols for forensic entomological work on mass graves are in place since quite a while but have not seen much application. Mites have been reported from mass graves but never identified. Due to the unique environmental conditions of mass graves, they represent a particular biological niche of human decomposition. Pollen will be found in the same condition as it deposited or as it was introduced while insects and fungi might develop to a limited degree. Mites and other microinvertebrates and microorganisms will reproduce and go through numerous generations affecting the decomposition process. Forensic research into mites and other

non-human biological traces in mass graves is urgently needed to extract as much forensic evidence as possible from these crime scenes.

04: DNA and Body Fluids: DNA Databases
11:00 - 11:45 Auditorium

Poster Session Wednesday - DNA and Body Fluids: DNA Databases

A Celebration of 30 Years of the UK National DNA Database (NDNAD) 11:00 - 11:00

Z.-d. Ledger[1]

[1]Forensic Information Databases Service (FINDS), Home Office, Croydon, United Kingdom

Abstract Body: The UK National DNA Database (NDNAD) was the first DNA database to be implemented in the world. Marking its 30th anniversary on the 10th April 2025, the NDNAD still maintains its effectiveness in criminal investigations, as well as being one the largest DNA databases in the world today. This poster will take you on the 30-year journey covering, the governance, legislation, and structure of the NDNAD, the timeline of developments, statistics, success stories and what enhancements are coming next.

For2-BioB: Optimizing Belgian DNA Databases for Criminal Investigations through Technical, Legal, and Ethical Advancements 11:00 - 11:00

T. Dorné[1], *M. Morandini*[2], *S. Hugues*[2], *L. Köhler*[1], *S. Steuve*[1], *J.-M. Hausman*[2], *B. Renard*[1,2]

[1]National Institute for Criminalistic and Criminology, Brussels, Belgium, [2] Université Catholique de Louvain, Louvain-la-Neuve, Belgium

Abstract Body: DNA databases in Belgium have rapidly evolved, driven by their growing use in criminal investigations and international comparisons enabled by the Prüm Treaty. The For2-BioB project aims to optimize the organization and functionality of these databases for criminal cases, ensuring ethical and legal compliance. To achieve these goals, the project is divided into two main components:
The first part focuses on optimizing the use of DNA databases in criminal investigations by addressing field practices, technological advancements, and demographic shifts in genetics. It evaluates current inclusion and comparison criteria for DNA profiles—based on the number of STR markers—alongside statistical methods like random match probability and likelihood ratios. The objective is to balance profile types and relevant matches to ensure high-quality DNA databases. Additionally, the project examines how allelic frequencies influence statistical calculations to identify the most suitable reference population and explore how variations in allelic distributions can be used as ethno-geographic indicators.
The second part addresses the ethical and legal aspects of DNA use. It will present scenarios to guide legislative and expert discussions on updating the regulatory framework. This framework must evolve to accommodate technological advancements, European legal changes, and shifts in criminal

policies. The research will identify international, particularly European, "legal invariants" and explore legislative options to update the legal regime in response to emerging technologies. A comparative law study—first broad, then focused—will offer solutions and analyze field practices using strategic actor theory.
The For2-BioB project combines technical, operational, and regulatory approaches for future advancements.

04: DNA and Body Fluids: DNA Typing with Potential Forensic Applications
11:00 - 11:45 Auditorium

Poster Session Wednesday - DNA and Body Fluids: DNA Typing with Potential Forensic Applications

The Potential of Human Leukocyte Antigen Alleles to Assist With Multiple-Contributor DNA Mixtures 11:00 - 11:00

A. Kuffel[1], C. Cole[2], B. Mallinder[3], N. Nic Daeid[1], A. Gray[1]

[1]University of Dundee, Leverhulme Research Centre for Forensic Science, Dundee, United Kingdom, [2]University of Dundee, Health Informatics Centre, Division of Population and Health Genomics, Dundee, United Kingdom, [3]SPA Forensic Services, Dundee, United Kingdom

Abstract Body:
One of the most persistent challenges in forensic DNA analysis is accurately identifying individuals in samples containing DNA from multiple contributors. The introduction of novel identification markers offers a promising approach to addressing this issue. In this study, we explored the potential of alleles from the highly polymorphic human leukocyte antigen (HLA) system to enhance the resolution of complex DNA mixtures. A 22-loci multiplex with HLA markers was designed and applied to two-, three-, and four-person DNA mixtures. The results of the conducted experiments demonstrated that the identification of individuals in multiple contributor samples with the help of HLA markers is possible; however, it is clear that the reliability of the method is heavily dependent on the number of unique alleles for each individual in the analysed mixture. To compare this novel approach with current practices, the same samples were analysed using a standard set of STR markers. This proof-of-concept study highlights the importance of exploring alternative strategies to overcome the challenges of DNA mixture deconvolution in forensic science.

Evaluation of the Maxwell DE System for Differential Extraction of Sexual Assault Samples 11:00 - 11:00

Z.Y. Goh[1], B. Heng[1], N.B.W. Lee[1], M.X.T. Tung[1], J.Y.Y. Tan[1], C.K.-C. Syn[1]

[1]Health Sciences Authority, DNA Profiling Laboratory, Biology Division, Applied Sciences Group, Singapore, Singapore

Abstract Body: In sexual assault evidence, spermatozoa from the perpetrator may be present in low quantities relative to the victim's epithelial cells. Differential extraction is a widely used approach to isolate ‘sperm’ and ‘epithelial’ DNA fractions for effective profiling of the sperm contributor. The traditional differential extraction procedure involves the

use of hazardous phenol/chloroform and is highly laborious. Previously, our laboratory has established a semi-automated modified differential DNA extraction workflow that eliminates the need for phenol/chloroform and has significantly reduces handling time. Despite the improvements in the workflow, it remains a partially automated process. Recently, Promega has introduced the Maxwell DE System to further automate this process. The kit is designed to minimize manual steps, thereby reducing the risk of contamination and decreasing variability between different operators. This study aims to (i) evaluate the efficacy of differential extraction using the Maxwell DE System and (ii) compare its performance against our current laboratory workflow with mock casework samples. The evaluation will focus on their ability to extract and retain sperm during the separation process while minimizing carryover of other cell types in each fraction. DNA yield, peak heights, the male-to-female ratio in each fraction, concordance with the reference profile and the total processing time will be evaluated. Results from this study may provide evidence to support recommendations regarding the adoption of the new workflow for differential extraction in laboratories.

Performance of the RapidHIT™ ID System on Sexual Assault Samples 11:00 - 11:00

X. Chan[1], *C. Syn*[1], *H.H. Lim*[1], *B. Heng*[1]

[1]Health Sciences Authority, DNA Profiling Laboratory, Singapore, Singapore

Abstract Body: The serious nature of violent sexual crimes usually warrants urgent analysis of sexual assault samples to allow swift identification and apprehension of the suspects. However, standard DNA analysis takes at least 6 hours to generate the DNA results. In such situations, the RapidHIT™ ID system, a fully automated instrument which generates a DNA profile directly from a sample in about 90 minutes, can potentially provide rapid investigative lead on the possible identity of the sexual assault suspect. Currently, there are limited studies on the application of the RapidHIT™ ID system on sexual assault samples, particularly using the recently developed RapidINTEL™ Plus sample cartridge. Therefore, our study aims to evaluate the performance of the RapidINTEL™ Plus cartridge on sexual assault samples for the identification of the male contributor. Mock sexual assault samples that comprise different mixture ratios of semen and epithelial cells were processed using the RapidINTEL™ Plus cartridge. The DNA profiles obtained were compared against those generated by the laboratory's standard workflow. Results from our study can be used to: (i) estimate the sensitivity of the RapidINTEL™ Plus cartridge in the detection of semen DNA; and (ii) estimate the performance of the RapidINTEL™ Plus cartridge in detecting semen DNA in the presence of female DNA to generate forensic leads.

Developmental Validation of the IDseek® OmniSTR™ Global Autosomal STR Profiling Kit 11:00 - 11:00

P. van Oers[1]

[1]NimaGen, Nijmegen, Netherlands

Abstract Body: Forensic science takes advantage of population variability in autosomal Short Tandem Repeat (STR) lengths to establish human identification. The most common method for DNA profiling by STR is based on PCR, where the highly polymorphic STR regions are amplified and analysed using Capillary Electrophoresis (CE). STR analysis can also be performed using Massively Parallel Sequencing (MPS), in which besides the repeat length, also the repeat structure and variations in the flanking regions are determined. Additionally, MPS allows for greater multiplexing and smaller amplicon designs, making it more suitable for degraded samples. While MPS is superior in discriminatory power compared to CE, the relatively laborious multi-step sample/library preparation presents a certain barrier for routine application of MPS.
Reverse Complement PCR (RC-PCR) is a novel, more sophisticated PCR based MPS library preparation method, combining indexing and PCR amplification in a single closed-tube reaction. As a direct consequence of the single-step library prep the risk of sample swapping, PCR contamination and pipetting errors is drastically minimized. The reaction kinetics of RC-PCR results in high sensitivity and specificity, because target-specific primers are synthesized during the reaction the concentrations of primers and available template are more aligned.
This poster discusses the complete developmental validation of the IDseek® OmniSTR™ Kit: a RC-PCR based MPS library preparation kit for autosomal STR profiling. All targets have been designed to generate short amplicons, while maintaining the most informative sites in the flanking regions. Performance of the kit was assessed on aspects such as concordance, sensitivity, inhibitor tolerance and mixtures.

11:00 - 11:00

STR Genotyping by Real-Time PCR Using QueSTR Probes

S. Škevin[1], O. Tytgat[1], M. Fauvart[2], L. De Keyzer[1], D. Deforce[1], F. Van Nieuwerburgh[1]

[1]Ghent University, Faculty of Pharmaceutical Sciences, Ghent, Belgium, [2] IMEC, Leuven, Belgium

Abstract Body: QueSTR probes provide a feasible alternative for implementing forensic Short Tandem Repeat (STR) genotyping on lab-on-a-chip (LoC) devices. QueSTR probes have already been demonstrated to accurately genotype STRs in a hybridization curve assay after PCR amplification. In this study, we modified the QueSTR probe assay for use as a hydrolysis probe assay during qPCR. An asymmetric real-time PCR was performed with QueSTR probes and RNase H2 in the master mix, during which the fluorescence was recorded. Designed to hybridize with specific STR alleles, QueSTR probes contain a fluorescent dye and a quencher molecule, enabling detection of probe hybridization through RNase H2-mediated cleavage of the RNA-DNA duplex, which releases the quencher. Matching probes yielded lower threshold cycle values and steeper incline of fluorescence curves compared to non-matching probes, indicating accurate genotype. The QueSTR qPCR assay was used to successfully genotype four CODIS core loci (D16S539, D7S820, TPOX, and

TH01) in 12 samples, with one exception. The integration of amplification and detection in a single reaction supports the use of QueSTR probes for miniaturizing STR genotyping, thereby complementing CE-based analysis in centralized labs.

Recombinase Polymerase Amplification of Forensic Short Tandem Repeat Loci 11:00 - 11:00

L. De Keyzer[1], S. Skevin[1], L. De Waele[2], O. Tytgat[2], D. Deforce[1], F. Van Nieuwerburgh[1]

[1]Ghent University, Farmaceutical Biotechnology, Ghent, Belgium, [2]Ghent University, Ghent, Belgium

Abstract Body: Short tandem repeats (STRs) are repetitive DNA sequences consisting of 1-6 base pairs that are repeated in a head-to-tail manner. STRs are highly polymorphic and are extensively used in forensic science for kinship analysis and criminal identification. STR genotyping is usually performed by Polymerase Chain Reaction (PCR) amplification followed by either capillary electrophoresis (CE) or next-generation sequencing (NGS). However, PCR can be time-consuming and requires precise thermal cycling instruments, which restrict PCR's utility for rapid, field-based forensic applications where portability, speed, and simplicity are crucial.

Recombinase Polymerase Amplification (RPA) is an alternative isothermal DNA amplification method that operates effectively between 37°C and 42°C and completes within 40 minutes. In this study, we evaluate the use of RPA for the amplification of forensically relevant STR loci. Thirteen core STR loci of the Combined DNA Index System (CODIS) were amplified using RPA in both singleplex and multiplex formats. Following amplification, the STR regions were analyzed using three different methods: CE, Illumina and Oxford Nanopore Technologies (ONT) sequencing.

CE, Illumina and ONT sequencing of singleplex RPA each resulted in complete and correct STR profiles across all samples. It was demonstrated by sensitivity assessment that complete and correct genotypes were achieved with DNA inputs of 31 pg and above for all but locus D8S1179. Attempts at multiplex RPA amplification resulted in incomplete or incorrect STR profiles. This outcome highlights a challenge in adapting RPA for simultaneous amplification of multiple STR loci, which is a standard requirement in forensic DNA profiling.

Exploring the Benefits of an Increased Dynamic Range on the Spectrum CE System 11:00 - 11:00

D. Moore[1], A. Hack[2], A. Pierce[2]

[1]Eurofins Forensic Services, Forensic DNA R&D, Feltham, United Kingdom, [2]Eurofins Forensics Services, DNA Technical Team, Risley, United Kingdom

Abstract Body: The Promega Spectrum CE system has a number of advantages. One of these is the provision of eight dye channels. This provides more “real estate” into which STR targets can be fitted. The Promega 18 E system contains the European standard set with amplicon

sizes all below 250bp. This should provide benefits for samples that are degraded as the smaller amplicons are more likely to be able to produce PCR product from degraded genomic DNA. One overlooked area of benefit that the Spectrum CE instrument may provide is its greater dynamic range. This allows for more DNA to be added before the signal on the CE instrument saturates the camera used to detect fluorescently labelled DNA fragments. Having a greater dynamic range may help resolve minor components in mixtures and larger amplicons in degraded samples by allowing users to add more DNA, and thereby moving these weaker components of samples out of the stochastic range. The limits of the dynamic range have been explored with use of a sensitivity study, and an assessment of the benefits that this increased dynamic range brings to mixtures and degraded samples are investigated.

Investigating Long-Term DNA Stability on Buccal Swabs for Paternity Testing 11:00 - 11:00

A. Franzoni[1], *C. Sabelli*[1], *M. Rosso*[1]

[1]Copan Italia SpA, Brescia, Italy

Abstract Body: Accurate paternity determination requires obtaining full DNA profiles to confirm biological relationships. In forensic contexts, Copan buccal 4N6FLOQSwabs® (4N6FS) are widely used for their ease of use and effectiveness in obtaining non-invasive, high-quality samples. This study examined the stability of DNA collected using buccal 4N6FS stored at room temperature (RT) for over five years. The research, conducted in the context of six simulated paternity cases, evaluated how extended storage might affect DNA integrity and determined if the quality of DNA remains adequate for reliable paternity testing after prolonged periods.

Since 2018, six simulated paternity cases have been set up. For each case, two 4N6FS were collected from each person of interest: one was analyzed shortly after collection (T0), while the second after a Time to Analysis (TTA) interval, ranging from 2 years and 4 months to 5 years and 8 months, depending on the case. The 4N6FS analyzed at TTA followed a standard workflow, including DNA extraction, quantification, and profiling using the GlobalFiler™ kit, and the results were compared to those from T0.

Complete and concordant DNA profiles were obtained at T0 and TTA for all individuals. The DNA yield from TTA samples was sufficient for STR profiling, and while some variability was observed in average peak heights, peak height ratios, and intralocus balances, the profiles were complete and consistent.

This study demonstrated that 4N6FS can produce complete DNA profiles even after long-term storage at RT for up to five years at eight months.

Exploring a Different Forensic Workflow for DNA Paternity Testing from Long-Term Stored Buccal Swabs 11:00 - 11:00

A. Franzoni[1], *C. Sabelli*[1], *M. Rosso*[1]

[1]Copan Italia SpA, Brescia, Italy

Abstract Body: This study explored an alternative workflow for paternity testing using microFLOQ® direct (MF) to subsample Copan buccal 4N6FLOQSwabs® (4N6FS) stored at room temperature (RT) for up to five years and eight months. This approach aims to streamline the analytical process by eliminating the need for DNA extraction and quantification while preserving the original 4N6FS for future analyses.

Since 2018, five simulated paternity cases have been set up. For all cases, two buccal 4N6FS were collected from each individual of interest: one was analyzed shortly after collection (T0), while the other was subsampled using two pre-wetted MFs after a specific time interval, ranging from two years and four months to five years and eight months, depending on the case. The first MF was processed immediately after subsampling, and the second was analyzed after four weeks of storage at RT, both using the GlobalFiler™ Express kit.

Complete and matching DNA profiles were obtained for most individuals, regardless of whether the MF was analyzed immediately after subsampling or after being stored at RT for four weeks. Some variability in average peak heights, peak height ratios, and intralocus balances was observed but did not compromise profile completeness. For only one individual of Case 4, partial profiles were obtained, likely due to insufficient sample quantity on the original 4N6FS or for subsampling with the MF from areas of the swab with little buccal sample amount.

This study demonstrated the effectiveness of the MF subsampling approach for paternity testing even starting from long-term stored buccal samples.

Evaluation of QIAGEN MinElute® PCR Purification Kit for Developing Full DNA Profiles With Poor Quality DNA From Buccal Swab Samples 11:00 - 11:00

C.M. Pang[1]

[1]Government Laboratory, Hong Kong, Hong Kong, SAR of China

Abstract Body: Poor sampling techniques or improper storage of buccal swab samples before their submissions to the laboratory can result in poor DNA quality and yield for developing full DNA profiles for reporting. To tackle the issue, the MinElute PCR Purification Kit designed for the purification and cleanup of PCR products in very low elution volumes, was evaluated for its efficacy for developing full DNA profiles with PowerPlex® Fusion 6C for PCR samples with weak or partial DNA profiles. Positive control DNA, 2800M, was primarily employed for evaluation and optimization of the kit. 0.0625ng DNA was found to be the lowest amount of DNA required for developing a full DNA profile in our laboratory system following purification with the MinElute Kit. In general, a 5-8 fold increase in RFU was detected after purification. The optimized condition was then validated with amplified DNA samples. Full DNA profiles were developed from many samples which had previously required further processing for profile enhancement such as re-amplification to increase DNA yield, additional capillary electrophoresis analyses, etc. The study shows that the kit is a promising solution especially for establishing full DNA profiles for samples which lacked a few alleles for reporting. Our study demonstrated

that up to 14 allelic dropouts in the samples could be detected after post-PCR MinElute purification, which not only significantly reduces financial and manpower resources, but also the processing time required for obtaining full profiles for reporting and may even obviate the need for DNA resampling.

A Study of Degraded Skeletal Samples Using ForenSeq DNA Signature™ Kit 11:00 - 11:00

Z.D Zgonjanin. D[1], *E. Almohammed*[2]

[1]faculty of medicine , university of Novi sad, Serbia, Novi sad, Serbia, [2] Qatar forensic medicine, doha, Qatar

Abstract Body: Recent advances in massively parallel sequencing (MPS) has become a very promising technology for massive genetic sequencing [1]. In this study Illumina ForenSeq™ DNA Signature Prep Kit was tested to determine if MPS offers a more comprehensive evaluation of degraded samples than the traditional fragment analysis/capillary electrophoresis based method. The Illumina® ForenSeq™ DNA Signature MPS Kit, includes 200 genetic loci [2]. The use of NGS would therefore reduce the analysis time and augment the identification of human remains. In this context we aimed to analyse the hard tissue degraded samples using Illumina® ForenSeq™ DNA Signature MPS Kit. These samples had given partial profiles with dropout at several loci with GlobalFiler™ kit previously. The MPS kit showed that it is highly sensitive, aids in higher allele recovery for STR loci and provides valuable information about biogeographic ancestry, identity and phenotypic features from a single analysis. The work resulted in highly successful amplification and sequencing of 30 degraded bone/teeth samples using MPS method.

Development and Validation of a New 18 X-STR Typing Assay for Forensic Applications 11:00 - 11:00

Y. Zhengliang[1,1]

[1]Institute of Forensic Science, Ministry of Public Security, Beijing, P. R. China, BEIJING, China

Abstract Body: With a unique inheritance pattern compared to autosomal short tandem repeats (A-STRs), X chromosomal STRs (X-STRs) have special usage in forensic relationship testing. In this study, we designed a multiplex amplification system (named TYPER-X19 multiplex assay) consisting of 18 STR loci spreading from 7.837 to 149.460 Mb on the X chromosomes (DXS9895, DXS8378, DXS9902, DXS6810, DXS7132, DXS10079, DXS6789, DXS7424, DXS101, DXS6797, DXS7133, DXS6804, GATA165B12, DXS10103, HPRTB, GATA31E08, DXS8377, and DXS7423), and the amelogenin. PCR primers were marked with four kinds of fluorophores including FAM, HEX, TAMRA, and ROX. The multiplex system was op-timized and tested for precision, concordance, reproducibility, sensitivity, stability, DNA mixture, and species specificity according to the conventional validation guidelines. The results indicated that the system was accurate, reliable, and sensitive enough, and was suitable for common forensic case-type samples. In the population genetic study, a total of 148 alleles were

detected at the 18 X-STR loci in 398 Southern Han Chinese. Relatively high combined power of discrimination in male (PDm), power of discrimination in fe-male (PDf), mean paternity exclusion chance in trios (MECtrio), and mean paternity exclu-sion chance in duos (MECDuo) by Desmarais were detected, and HPRTB-DXS10103 was in linkage disequilibrium. The results suggested that the TYPER-X19 multiplex assay was suitable for forensic applications.

Understanding the Impact of Melanin on STR Profiling and the Role of Gold Nanoparticles in PCR Enhancement for Forensic Investigations 11:00 - 11:00

K. Vajpayee[1], S. Srivastava[2], S. Sharma[3], A. Srivastava[2], V. Paida[1], H.R. Dash[4], R. Shukla[1]

[1]Ahmedabad University, Biological and Life Sciences, School of Arts and Sciences, Ahmedabad, India, [2]Indian Institute of Technology Gandhinagar, Department of Biological Sciences and Engineering, Gandhinagar, India, [3] Ingenomics Pvt. Ltd,, Delhi, India, [4]Centurion University of Technology and Management, School of Forensic Science, Bhubaneshwar, India

Abstract Body: Melanin, a biological pigment, is a significant inhibitor of Polymerase Chain Reaction (PCR), presenting challenges in forensic analysis, especially in cases involving violent crimes and sexual assaults. Despite its relevance, the mechanism by which melanin inhibits Taq polymerase is not fully understood. This study explores how melanin binds to Taq polymerase's active site, hypothesizing that this interaction disrupts the enzyme function. Molecular docking studies were performed on Taq polymerase crystal structures (1TAQ, 3KTQ, and modified 3KTQ models), followed by molecular dynamics simulations to examine the binding behavior of melanin. Docking results revealed interactions with key catalytic residues such as GLU615, PHE667, and TYR671, essential for nucleotide recruitment. Molecular dynamics simulations suggested weak and variable binding dynamics in both the apo and holo forms, indicating structural interference by melanin. Gold nanoparticles (Au NPs) and Au NPs coated with bovine serum albumin (Au: BSA) were tested as facilitators in PCR to mitigate this inhibition. STR profiling of melanin-treated samples showed a significant reduction in RFU values. Some loci have also demonstrated allele dropouts, which, notably, were recovered by Au NPs. However, compared to Au NPs, Au: BSA proved to be the most effective, increasing RFU by twofold compared to controls. Kruskal-Wallis testing confirmed significant differences across treatments ($p = 0.03$). These results suggest that Au NPs and Au: BSA can effectively counteract melanin inhibition, enhancing PCR accuracy and reliability in forensic applications.

03: Digital Evidence: Digital Imaging
11:00 - 11:45 Auditorium

Poster Session Wednesday - Digital Evidence: Digital Imaging

Evaluating Photograph Quality Obtained From Mobile Devices and Instant Messaging Applications for Fingerprint Identification Purposes 11:00 - 11:00

A. Melinato[1], M.C. Rampulla[1], G. Gervasi[1], C. Pisano[1]

[1]European Forensic Institute, Applied Sciences, San Gwann, Malta

Abstract Body: Videos and photographs may be taken during the commission of different crimes. Examples include drug dealing, child pornography, sex crimes, aggravated assault, kidnapping and many other crimes. In this research study, we examine the use of digital images featuring human hands enabling their use in future identification processes. The aim of this research was to understand the potential feasibility and utility in forensics of using an image captured by a mobile device especially focusing on image quality degradation. The main objective was to verify the extent to which the quality of fingerprint images degraded after being shared on two widely used instant messaging platforms: WhatsApp and Telegram. Both were chosen due to their widespread popularity in the realm of instant messaging applications.

Exploring Knowledge Graph Visualisation Approaches for Representing Uncertainty During OSINT-Driven Homicide Investigations 11:00 - 11:00

S. Bhandari[1], V.M. Serna Salazar[1], C. Nase[1], J. Gvažiauskas[1], S. Wokke[1]

[1]University of Twente, Enschede, Netherlands

Abstract Body: Information about homicides is extensively disseminated by different open information sources including government websites, news portals, blogs, social media sites. Intelligence derived from open-source information (OSINF) is commonly referred as open-source intelligence (OSINT).
Reliance on OSINT for sensitive domains such as homicide investigation raises major epistemic concerns such as unreliability, inconsistency and fuzziness. As a result, investigators face significant challenge to evaluate the underlying uncertainty and derive actionable intelligence. Knowledge graphs (KG) have shown to be a powerful tool to represent uncertainty across various domains. However, KGs potential in the criminal investigation domain have not been adequately explored.
In this study, we explored various KG visualisation methods to represent uncertainty associated with OSINT during homicide investigations. The study used the dataset containing the information about nine homicide cases in the Netherlands derived from open sources. First, a KG skeleton was developed to represent the different elements associated with the case alongside their relationships using Python's NetworkX library. After that, the confidence of information was computed based on the corroboration provided by different sources. Next, we implemented different uncertainty visualisation methods such as variation in position (distance between nodes), size (width of edges) and colour of nodes and selected the ideal representation based on visual clarity.
Findings reveal the combination of colours and edge width variation as the best-suited approach to visualise uncertainty using knowledge graphs. The study demonstrates the potential of visualisation methods to further enhance the power of KGs to represent uncertainty associated with OSINT during homicide investigations.

APATE Project: A Feedback on a Research Project for the Detection 11:00 - 11:00

of Deepfakes

F. Pages[1], A. Clia[1]

[1]Service National de Police Scientifique, Audio-Video Department, Ecully, France

Abstract Body: The rise in the manipulation of images and voices represents a potential threat for crimes including disinformation campaigns, extortion, online crimes against children, blackmail and identity theft.
Deepfakes are media modified using AI algorithms. Deepfake generation techniques are easily accessible, their quality improves making them challenging to detect with a mere visual analysis. As a consequence, there is an increasing need for deepfake detection tools for the french police. A consortium made up of three french research laboratories and a world leader in biometric recognition was built around this problem to create the APATE project.

It aims at providing a toolbox of complementary techniques, based on the audio or visual parts of the video, by exploiting either low-level or semantic information, or by combining them in a multimodal manner. The project goal is to ensure that the proposed toolbox is usable in court and processes efficiently actual deepfakes from criminal cases.

Although promising methods have been explored with test data throughout the project, several obstacles have been identified when it comes to real-world deepfakes. First tested algorithm on audio material seems to confirm the difficulty of the detection task. While the proposed algorithm is able to detect efficiently audio files from a test database according to ASVSpoof benchmarks, it has some troubles trying to detect real case audio files.

The aim of the poster is to present the APATE project, the difficulties encountered to detect real-world deepfakes and an open call to specialists for exchanging ideas and sharing solutions.

Age Estimation on 2D Images: Application of Photo-Anthropometry Method on Side Profile Photographs 11:00 - 11:00

A.F. Ozturk[1], V.U. Bengi[2], S. Cam[3], C. Bal[2], N. Canturk[1]

[1]Ankara University, Institute of Forensic Sciences, Department of Criminalistics, Ankara, Turkey, [2]Health Sciences University Gulhane Faculty of Dentistry, Ankara, Turkey, [3]Sivas Cumhuriyet University, Social Sciences Vocational School, Sivas, Turkey

Abstract Body: An expert witness can be asked to estimate the age in cases that contain only digital materials such as photographs or videos as evidence. In such cases, where the body is not physically accessible, age estimation becomes even more challenging as most age estimation methods cannot be used on images. For this reason, the expert estimates the age based on the secondary sexual characteristics of the person in the questioned material using the Tanner method. Although this method is the only method for age estimation on 2D digital materials, the reliability of this

traditional method is questioned. Since age-related changes in facial growth can be observed in photographs or videos, and some facial ratios show a significant relationship with age, researchers are investigating new anthropometric methods that can support or replace the Tanner method. This study tested whether age estimation could be made from 2D photographs using the photoanthropometry method. Side profile photographs of 136 females (ages 10-22) were taken from two meters away. Nine reference points were marked, 12 distances between these reference points were measured, and a total of 45 ratios were calculated. Correlation analysis was performed to observe the relationship between the ratios and the age. According to the correlation analysis, there was no statistically significant relationship. It was determined that age estimation could not be performed from the side profile photographs included in the scope of this study. As a result, it is necessary to increase the number of participants for better results in future studies.

Forensic Clothing Image Comparison – A New Standardized Approach 11:00 - 11:00

M. Eriksson[1]

[1]Swedish National Forensic Centre, Linköping, Sweden

Abstract Body: In response to an increasing number of requests to compare images of shoes and clothing, forensic experts at the Swedish National Forensic Centre (NFC) involved in image comparison recognized the need for a standardised method to address this type of forensic assignment. The past year, NFC has put a lot of effort into creating such a method, which will be presented by this poster.
The new method includes a structured way of evaluating the probability of the findings, within the framework of Bayes' theorem. The concerned item of clothing in the image or video material is either compared to clothes in another image or video material, or to physical clothes that has been collected as evidence. When performing the sensitive task of evaluating the findings with regards to two competing hypotheses, the forensic expert uses a structured chart. The chart is divided into three blocks: class characteristics, subclass characteristics and acquired/arbitrary features.
As no databases on different clothing are available to the forensic experts, an important part of the method is to consider if contact should be established with different stores or brands to acquire sales statistics, which can be used to strengthen the reliability of the method. Another important part of the method, if applicable is to use the strength in combining findings from different clothing seen in the images into one conclusion.
The new method, presented here, will be an important part of NFC's ability to accurately, reliably and robustly perform forensic clothing image comparison.

05: Drugs: Emerging Trends/Threats
11:00 - 11:45 Auditorium

Poster Session Wednesday - Drugs: Emerging Trends/Threats

Forensic Illicit Drug Intelligence Through Big and Intelligent Analysis of Chemical and Criminological Data 11:00 - 11:00

M.C.M. Verhoeven[1]

[1]Universiteit van Amsterdam, Van 't Hoff Institute for Molecular Sciences, Amsterdam, Netherlands

Abstract Body: In the Netherlands, approximately 25,000 pieces of evidence are examined annually for hard or soft drugs in laboratories operated by the Police, the Netherlands Forensic Institute, and the Customs Laboratory. These analyses employ gas chromatography separation followed by mass spectrometry detection (GC-MS). Besides the detection/identification of illicit drugs, this GC-MS data also contains peaks caused by adulterants and impurities. All these peaks together serve as a chemical fingerprint of the drug, specific for one produced batch. This chemical fingerprint can offer crucial insights into the origin, production, and transport of the illicit drug sample. The 'Forensic Illicit Drug intelligence through Big and Intelligent analysis of chemical and criminological Data' (FIBDID) project brings together forensic experts, data scientists, and criminologists to automate the extraction and reporting of this forensic information.

Predicting the Next Wave: Automated Monitoring of Online Drug Precursor Advertisements for Crime Prevention 11:00 - 11:00

L. Jelier[1], R. Plessius[1], M. Vinkenoog[1], E. Rooden[1], S. Oldenhof[1]

[1]Netherlands Forensic Institute, Chemical and Physical traces - Research and Development, The Hague, Netherlands

Abstract Body: With the ease of internet access, ordering precursor chemicals for drug synthesis has become simpler than ever. Traditional methods for identifying trends in the use of precursors are reactive, often detecting trends only after new precursors appear in the field. This delay limits the effectiveness of preventive measures such as border control or substance regulation. Our automated detection tool monitors online marketplaces and gathers real-time data on advertised chemicals used as precursors for the synthesis of P2P/MDP2P.

This enables authorities to anticipate the adoption of new precursors before they appear in drug labs. By automating precursor tracking, the tool delivers forensic investigators immediate, actionable intelligence on drug synthesis trends, and allows law enforcement to act more swiftly.

Our presentation will outline the tool’s design and showcase initial applications, demonstrating how real-time precursor data can enable forensic intelligence. In summary, this automated monitoring approach improves law enforcement’s responsiveness and efficiency in countering synthetic drug production and provide a critical resource for proactive intervention in criminal activities.

Trends in Drugs Detected in Used Syringes Collected from Harm Reduction Centers in Estonia (2022–2024) 11:00 - 11:00

T. Barndõk[1], A. Riikoja[1], M. Tõnisson[1], K. Abel-Ollo[2], A. Kurbatova[2], A. Murd[2]

[1]Estonian Forensic Science Institute, Tallinn, Estonia, [2]National Institute for

Health Development, Tallinn, Estonia

Abstract Body: This presentation summarizes the results of a survey investigating injected substances by chemically analyzing the residual content of used syringes. Syringes were first collected in 2021 by harm reduction centers in Tallinn and Narva. In 2022, the survey expanded to include collections from all harm reduction services across Estonia. The study compiles data from the past three years (2022-2024), during which narcotic residues in used syringes were analyzed.
The most commonly detected narcotic substance in used syringes is amphetamine. Approximately two-thirds of the syringes contained amphetamine, either as the sole drug or in combination with others, primarily methamphetamine. More than 10% of the syringes contained methadone and/or buprenorphine, which indicates misuse of medications intended for opioid substitution therapy. The injection of synthetic cathinones has decreased and is now detected in only a small number of syringes. Fentanyls have nearly disappeared, with only isolated findings in the analyzed syringes. However, the proportion of syringes containing nitazenes has increased. Nitazenes are extremely potent synthetic opioids, with potency up to thousands of times greater than morphine, making them comparable to carfentanil. While less than 6% of syringes contained nitazenes in 2022, this figure rose to over 22% in 2023 and exceeded 24% in 2024. This is an alarming trend and corresponds to the increasing number of drug-induced deaths in Estonia.

Detection of N-Pyrrolidinyl-3,4-DMA, ADB-D-5Br-INACA, and ADB-FUBIATA in Multiple Powder Items From One Seizure 11:00 - 11:00

F. Kivlehan[1], *J. O'Brien*[2]

[1]Forensic Science Ireland, Backweston Science Campus, Co. Kildare, Ireland, [2]Trinity College Dublin, Dublin 2, Ireland

Abstract Body: Findings are reported from a seizure by An Garda Síochána on 16 June 2022, that held a number of beige and off-white powders which were found to contain N-pyrrolidinyl-3,4-dimethoxyamphetamine, ADB-D-5Br-INACA and ADB-FUBIATA. The detection and identification of N-pyrrolidinyl-3,4-dimethoxyamphetamine (N-pyrrolidinyl-3,4-DMA) was recorded as a first-time detection within Europe*. GC-MS, NMR (1H, 13C and 19F) and mass spectrometry (accurate mass measurement) results are presented and discussed.
* https://ednd2.emcdda.europa.eu/ednd/report/view/10077

First Detection of the Alprazolam Analogue 4'-Chloro Deschloroalprazolam in Europe 11:00 - 11:00

C. McNamee[1], *C. May*[1], *G. McLaughlin*[1]

[1]Forensic Science Ireland, Chemical Analysis, Dublin, Ireland

Abstract Body: In Ireland, materials thought to contravene the Misuse of

Drugs legislation are seized and are submitted to Forensic Science Ireland (FSI) for analysis and certification. Often, the materials submitted can involve newly encountered psychoactive substances and their identification can pose analytical challenges.
In October 2022, FSI reported the first European identification of 4'-chloro-deschloroalprazolam in seized 'XANAX' tablets. The case consisted of 58 white rectangular tablets that were imprinted with 'XANAX' on one side and '2' on the reverse side, and were suspected to contain alprazolam. The tablets were analysed using gas chromatography-mass spectrometry (GC-MS), and the analytical profiles of the samples were initially compared against a certified reference material (CRM) for alprazolam, a controlled substance under Ireland's drugs legislation. The mass spectrum obtained for each sample was a strong match for the mass spectrum of alprazolam, however, the retention time obtained for the samples did not match that of the alprazolam.
The compound was later tentatively determined to be the novel benzodiazepine 4'-chloro-deschloroalprazolam, an alprazolam analogue, which had previously been encountered in Australia in 2021. The chemical structures for 4'-chloro-deschloroalprazolam and alprazolam are very similar, with the only difference being the position of the chlorine atom. The analytical profile of each sample was then compared against the analytical profile for the CRM of 4'-chloro-deschloroalprazolam and certified.
In Ireland, 4'-chloro-deschloroalprazolam is not a controlled drug and this casework example highlights the possibility of misidentifying drugs with similar chemical structures but different legal status.

Analysis of Illicit Street Heroin Samples Seized in Pakistan Using Gas Chromatography-Mass Spectrometry for Identification of Various Adulterants and Impurities 11:00 - 11:00

M. Usman[1,2], Y. Baig[1], A. Naseer[3], D. Nardiello[2], M. Quinto[2]

[1]Punjab Forensic Science Agency, Narcotics, Lahore, Pakistan, [2]University of Foggia, DAFNE, Foggia, Italy, [3]Anti-Narcotic Force Academy, Narcotics Forensic Laboratory, Islamabad, Pakistan

Abstract Body: Heroin is the second most common abused substance in Pakistan. Law enforcement agencies seized on an average 5414 Kg/year in the country during 2018 to 2023. The paper presents an analysis of impurities and adulterants in 706 street heroin samples submitted at Forensic Laboratory, using gas chromatography coupled mass spectrometry (GC/MS). The Pareto analysis test was applied to determine substances in heroin samples contribute the most in terms of frequency and the key adulterants that make up most occurrences. The Pearson correlation coefficient (r) was used to measure the linear relation between the most common constituents. The results showed that the street heroin samples contained a range of adulterants including acetaminophen, caffeine, chloroquine, chlorpheniramine, clotrimazole, dextromethorphan, diazepam, etiracetam, ketamine, levorphanol, lidocaine, nicotinamide, phenobarbital, and tramadol. The results also confirmed impurities in street heroin acetylcodeine, acetylmorphine, codeine, hydrocodone, morphine, noscapine, and papaverine. The Pareto analysis test showed that the cumulative percentage of four adulterants i.e., caffeine, acetaminophen, diazepam, and dextromethorphan was 97 %. The value of Pearson correlation coefficient indicated strong positive correlation between acetyl-

codeine /acetyl-morphine (0.6), moderate correlation in acetaminophen / acetyl-morphine (0.47) and acetaminophen / diazepam (0.38). The most common combination of adulterants in one street sample was acetaminophen, caffeine, and diazepam, observed in 44.2 % of the total street samples analyzed. This study described the adulterants and impurities in street heroin in drug market of Pakistan and provide useful information for tactical and strategic intelligence investigations.

The Detection of Five Synthetic Cannabinoids in a Single Drug Seizure of Plant Material: ADB-BUTINACA, ADB-INACA, ADB-4en-PINACA, MDMB-BUTINACA, and MDMB-4en-PINACA 11:00 - 11:00

M. Gilligan[1], *G. Mercado*[1]

[1]Forensic Science Ireland, Drugs, Celbridge, Co Kildare, Ireland

Abstract Body: Plant material, seized by law enforcement and suspected to be Cannabis was submitted to Forensic Science Ireland for examination. The plant material proved negative for Cannabis but upon subsequent analysis by GCMS was found to contain five potent synthetic cannabinoids; ADB-BUTINACA, ADB-INACA, ADB-4en-PINACA, MDMB-BUTINACA and MDMB-4en-PINACA. This is the first time that these five novel psychoactive substances have been reported together in a single seized substance in Ireland and is a cause for concern. These synthetic cannabinoid receptor agonists (SCRAs) may produce similar psychoactive effects to Cannabis but their use can have acute harmful health outcomes. MDMB-4en-PINACA is associated with fatal overdoses and hospitalisations but its effects when taken in conjunction with other synthetic cannabinoids is not yet understood. This is another example of the emerging trend of poly drug abuse which is presenting challenges for scientists and medical professionals world-wide.

Cheap street tablets: What's Actually in Them? 11:00 - 11:00

S. Coogan[1]

[1]TU Dublin, School of Chemical and Biopharmaceutical Science, Dublin, Ireland

Abstract Body: Recent years have seen an apparent decrease in alprazolam abuse in Ireland, however this has been largely replaced by an increasing use of counterfeit alprazolam products. This project aims to investigate adulterant use in counterfeit alprazolam, specifically Xanax®. A sample of counterfeit Xanax® tablets surrendered in West Dublin will be analysed in order to determine their composition. Previous cases of counterfeit Xanax® in Ireland and Europe were examined, as well as data published by organisations such as the EMCDDA to determine the adulterants most likely to be present.

Both etizolam and flualprazolam appear to be commonly used by illicit manufacturers due to their similarity to alprazolam. Although more recent data is not available, cases of these NPS benzodiazepines being present in Xanax® have been gradually rising since their first appearance. Nitazenes are an emerging synthetic opioid that have recently been appearing in

counterfeit Xanax® and other illicit substances in recent years, although research on these drugs is still its early stages. Other substances such as pregabalin, and fentanyl, have also been implicated in counterfeit Xanax® manufacturing to a lesser extent.

A series of analytical methods were selected to analyse these tablets based on the findings from the literature. Colourimetric and immunoassay tests will be used to give a presumptive indication as to the contents of these drugs. These tests will be followed by TLC, HPLC, and, ATR-FTIR, to give a greater understanding of the substances present. Etizolam, flualprazolam, and nitazenes are the most likely adulterants expected to be found.

The Cocaine Wave – Trends in Ireland From 2020 to 2024 11:00 - 11:00

L. Speranza[1], K.J. Flanagan[1], F. Kivlehan[1], S. Killoran[1], S. Hanniffy[1], C. Donnelly[1], G. O'Neill[1], R. Fagan[1], C. Mcnamee[1], M. Nevin[1], A. McHugh-Moran[1]

[1]Forensic Science Ireland, Chemical Analysis Discipline, Celbridge, Ireland

Abstract Body: Ireland has been reported as one of the largest consumers of cocaine in Europe.
What once was considered just a party drug for the elite is no longer confined to nightclubs nor to the privileged; it is now a countrywide phenomenon, which has become deeply ingrained in Irish social life, particularly among young adults.
Key factors contributing to this surge include increased social acceptance of the drug and its increasing availability, through international trafficking. Eight of the recent substantial cocaine seizures have been confiscated from ships, including approximately 2.2 tonnes of powder containing cocaine, worth an estimated €157 million, from the vessel “MV Matthew” in September 2023, off the Irish coast. This was the largest cocaine seizure in Ireland to date.
For material being internationally trafficked, adulteration is comparatively rare. Subsequent adulteration and processing, for sale or supply to consumers, usually involves the addition of non-controlled substances such as levamisole, benzocaine, phenacetin, lidocaine, caffeine, etc.
Seizures submitted to the quantification team in Forensic Science Ireland are analysed at street level, between 25-30 grams, and at importation level, over 500 grams.
This poster will review the prevalence of cocaine in Ireland, giving key insights into trends from 2020, leading up to 2024. The different adulterants detected in cocaine samples in Ireland will be highlighted, as well as an analysis of the average purity in those samples.
With a clearer understanding of cocaine use in Ireland, the risks caused by overdose or adulteration can be communicated to the public concisely.

A snapshot of drugs seized at Music Festivals in Ireland 2022 to 2024. 11:00 - 11:00

A. McHugh-Moran[1], K. Murtagh[1], K.J Flanagan[1], S. Martyn[1], D.G Casey[1]

[1]Forensic Science Ireland, Chemical Analysis (Drugs), Celbridge, Ireland

Abstract Body: Every year in Ireland there are a number of music festivals where drug consumption is highly prevalent. Such compounds can cause sudden death when taken without awareness of these unregulated and untested compounds.

Accurate analysis of such compounds is of key importance in informing the public of the risks and consequences of consuming such compounds. This study can be used to inform both public and health services on emerging trends and adulteration to mitigate health risks associated with these activities.

In this study we will present results of analysis carried out in Forensic Science Ireland of those cases which were submitted by *An Garda Síochána* from festivals over three consecutive years. In this period over 400 samples were taken into consideration, the preliminary results indicated Cocaine, MDMA, Ketamine and Cannabis were major components consumed among festival goers. Vape cartridges have also appeared on the scene which contain both Delta-9-THC and its semi synthetic analog HHC. With regards to the available data we will also conduct an investigation into the adulterants found within the series.

With a clearer image of the types of compounds consumed at festivals the hazards involved can be communicated to the public in a concise manner with regards to adulteration and the emergence of novel psychoactive substances.

The Detection of Nitazenes in Forensic Casework Samples at Forensic Science Ireland Between 2022 and 2024 11:00 - 11:00

G. McLaughlin[1], C. Donnelly[1], C. McNamee[1], J. Moran[1], R. Fagan[1], J. Casey[1], A. McHugh-Moran[1], K. Murtagh[1], A. O'Donnell.[1]

[1]Forensic Science Ireland, Chemical Analysis Discipline, Celbridge, Co.Kildare, Ireland

Abstract Body: Forensic Science Ireland (FSI) is the Republic of Ireland's sole laboratory for analysing materials seized under Misuse of Drugs laws. In 2023, FSI reported approximately 8,500 drug cases. Over the past decade, increasing complexity in submissions, driven by new psychoactive substances, has made identification more challenging.

FSI recently faced the emergence of 2-benzyl benzimidazole opioids, or "nitazenes", on the Irish market. Developed as analgesics in the 1950s, these highly potent synthetic opioids were never marketed due to overdose risks. Only three nitazenes—Clonitazene, Etonitazene, and Isotonitazene—are controlled under the Irish misuse of drugs legislation.

In January 2022, FSI detected its first nitazene, metonitazene, in 15 blue M30 tablets initially suspected to contain fentanyl. In August 2022, butonitazene was found in 11.5 grams of reddish-brown powder. By late 2023, street-sized packs of suspected heroin, some linked to overdoses in Dublin and Cork, were confirmed as N-pyrrolidino-protonitazene.

In early 2024, FSI analysed 1.9 kilograms of suspected heroin and found the powder to be protonitazene mixed with caffeine and paracetamol. By

June, protonitazene was detected in yellow tablets mislabelled as alprazolam. In September, analysis of a large seizure of blister packs containing approximately 35,353 suspected alprazolam tablets revealed bromazolam and metonitazene instead of alprazolam.

Most of the nitazene cases encountered by FSI involved seized materials thought to be a specific drug, highlighting the dangers of the current drugs market. FSI monitors newly emerging drugs, including nitazene trends, and shares this data with the relevant stakeholders at both national and international level.

Trends in Adulterants and Quantification of Diamorphine in Ireland 2020–2024 11:00 - 11:00

B. Fajinmi[1], S. O'Malley[1], W. Farrell[1], M. Gilligan[1], S. Hanniffy[1], R. Fagan[1], D. Casey[1], M. Larkin[1], V. Pitakpoolsin[1], M. McDonagh[1], G. Mercado[1], S. Murray[1]

[1]Forensic Science Ireland, Chemical Analysis Discipline, Celbridge, Ireland

Abstract Body: Diamorphine, commonly known as heroin, is a powerful opioid that is synthesized by the acetylation of morphine. It is a stronger analgesic than morphine and is an internationally controlled drug. It is used as a painkiller, especially in cases of intense pain, such as post-surgery or for individuals with metastatic cancer. It usually presents as a brown powder, in its free base form and dissolves in organic solvents but has poor solubility in water.

Diamorphine remains Europe's most commonly used illegal opioid, accounting for a major portion of the health burden associated with illicit drug use. Opioid addiction is a significant health concern in Ireland, such that legislation was passed to combat the negative effects of street injecting on public health & safety. The Misuse of Drugs (Supervised injecting facilities) Act 2017 allows legal provision of a supervised facility where people can inject drugs safely in order to mitigate health risks such as overdose.

Diamorphine seizures, or seizures which contain a diamorphine element, constitutes a significant proportion of work in Forensic Science Ireland. In 2022, 13% of all drug case types submitted to Forensic Science Ireland contained diamorphine, this fell to 6% in 2023. The largest seizure of powder containing diamorphine was recorded in 2021, submitted by Customs, this seizure amounted to 87.4 kilograms.

This presentation will share information on the prevalence of diamorphine in Ireland, presenting data on adulterants commonly encountered in these powders and results from quantification analysis.

10: Legal and Ethical Aspects: Legal Matters for Forensic Scientists
11:00 - 11:45 Auditorium

Poster Session Wednesday - Legal and Ethical Aspects: Legal Matters for Forensic Scientists

Barriers to Employing Defense-Appointed Forensic DNA Experts in Hungary 11:00 - 11:00

M. Nogel[1], G. Kovács[1]

[1]Széchenyi István University Faculty of Law and Political Sciences, Department of Criminology and Forensic Science, Győr, Hungary

Abstract Body: The involvement of forensic DNA experts appointed by the defense in Hungary faces significant legal and practical obstacles. The restrictive provisions of the Criminal Procedure Act have considerably narrowed the defense's ability to independently engage expert witnesses. This is further compounded by the centralized forensic system, which allows only the National Forensic Expert and Research Center and a limited number of university institutes to conduct forensic DNA analysis. However, in practice, laboratory work is conducted exclusively by the National Forensic Expert and Research Center, making it nearly impossible for private experts to perform independent analyses.
Furthermore, the defense's access to essential documentation, including the protocols and raw data from analyses conducted by the National Forensic Expert and Research Center, is often limited. This lack of transparency undermines the defense's ability to challenge the conclusions of the court-appointed DNA expert effectively. While private expert involvement could address potential biases or errors in expert reports, the current regulatory framework severely restricts their role, particularly in revisiting cases post-conviction.
This poster presentation will explore these challenges in depth, emphasizing the implications for the equality of arms and the right to a fair trial. It will advocate for reforms to enhance the defense's ability to appoint private experts and access critical forensic data, ensuring a more balanced and just criminal justice system in Hungary.

10: Legal and Ethical Aspects: Other
11:00 - 11:45 Auditorium

Poster Session Wednesday - Legal and Ethical Aspects: Other

Evidence-Based Criminal Law 11:00 - 11:00

M. Lidén[1]

[1]UCL Department of Security and Crime Science/Law Faculty, Uppsala University/Office of the Prosecutor, International Criminal Court (ICC), London, Uppsala, Hague, United Kingdom

Abstract Body: In criminal jurisdictions across the world, legal actors make decisions based on scientific and/or forensic evidence on a daily basis. Evidence-Based Criminal Law (EB-CRIME) is a new field within criminal procedural law, aiming to provide decision makers in criminal cases with the best available scientific evidence for their decisions. Working in evidence-based ways in criminal cases is as essential to criminal law as it is to prescribe medicine on the basis of the best available scientific evidence in the medical field. Even though criminal case procedures build upon a range of scientific fields that are distinct from law, the final decision makers in criminal cases are typically only trained in law. Other relevant competence involves forensic genetics, forensic medicine, forensic psychology, digital forensics and information technology.

Within the framework of EB-CRIME, legal actors and law students learn about other scientific fields in a way that is adjusted to their background and their tasks in the criminal justice system. This includes knowledge about possible sources of error, both methodological and human, when it comes to DNA-evidence, forensic medical opinions, digital evidence, oral statements, and so on. The framework also promotes the formulation of best practice guidelines for investigative practitioners (forensic, police etc.). A newly established research centre - The International Centre for Evidence-based Criminal Law - consists of experts in law, psychology, genetics, medicine, digital forensics, anthropology etc., and is the first research centre to promote this evidence-based approach to criminal evidence, thereby also promoting the legitimacy of criminal justice systems.

Abstract 11:00 - 11:00

N. Adegbite[1], W. Professor Ahmad[1], M. Mura[2], C. Avery[3]

[1]university of lincoln, School of Engineering and Physical sciences, Lincoln, United Kingdom, [2]university of lincoln, lincoln, United Kingdom, [3]University Hospital of Leicester, Oral and maxillofacial Surgery, Leicester, United Kingdom

Abstract Body: Facial soft tissue thickness (FSTT) was measured from computer tomography scans of 55 Nigerian adult males. There are no published FSTT values for this ethnicity. These measurements were taken from 12 mid-sagittal and 19 bilateral points totalling 50 points in 6 Nigerian ethnic groups. In comparison to previous studies in Africa, measurements were taken from more points and with a diverse age range of 18 to 100 years old. These measurement were taken with a software called RadiAnt. Average FSTT values were determined for the combined Nigerian male ethnic (CNME) groups and of its most represented ethnic type, Hausa adult male. These FSTT values will suffice in forensic facial reconstruction (FFR) for CNME and the Hausa adult male. CNME homogenously showed more soft tissues on the left than the right side at all FSTT points with the most difference at the frontal eminence and least at the mid masseter. The mid-masseters are of same thickness probably because of dietary habits, because the Hausas thrives mostly on soft floury diets. We compared these findings with FSTTs of other ethnicities, we defined any acceptable difference to be at least a value change of 1.5mm, anything less may not be significant in identification. These adult male midline FSTT values showed significant differences in the lips and chin regions when compared with other ethnicities. These values of the right side of the face showed even more substantial differences when compared with published data of other ethnicities.

Unveiling Patterns: A Comprehensive Study of Sexual Crimes in Türkiye between 2015-2023 11:00 - 11:00

G. Petridis[1], S. Kalfoglou[2], S.S. Özcan[2], E. Kalfoglou[3]

[1]Arched Group, Istanbul, Turkey, [2]Istanbul Yeni Yüzyil University, Department of Legal Medicine, Istanbul, Turkey, [3]Ankara Medipol University, Department of Legal Medicine, Ankara, Turkey

Abstract Body: Sexual crimes remain one of the most sensitive issues in society, posing significant challenges in both social and legal domains. In Türkiye, the rising rates of sexual crimes, the demographic characteristics of victims, and changes in the judicial system have necessitated a deeper analysis.
This study evaluates trends and demographic characteristics of sexual crimes between 2015 and 2023 in Türkiye and analyzes judicial processes. Key aspects include child sexual abuse, sexual assault, and sexual harassment, focusing on their societal impacts.
The analysis, based on annual reports, official statistics, and court data from the Turkish Ministry of Justice, considers demographic factors such as age, gender, and regional distribution. Findings show that the proportion of sexual crimes among total crimes rose from 1.8% in 2015 to 2.68% in 2023. Most victims were women; with child sexual abuse cases predominantly involving individuals aged 12–17. Approximately 35% of cases resulted in convictions, while acquittal rates ranged between 15% and 20%. The average case completion time was 50–70 days.
Regional analysis revealed high case rates in the Marmara and Central Anatolia regions, while rural areas saw more cases of child sexual abuse. These findings highlight regional and demographic variations in sexual crimes and provide insights into judicial processes in Türkiye. The study serves as a valuable resource for developing legal policies and promoting social awareness to address this pressing issue effectively.

12: Scenes of Crime: Capturing the Crime Scene
11:00 - 11:45 Auditorium

Poster Session Wednesday - Scenes of Crime: Capturing the Crime Scene

Utilising Smartphones and 360-Cameras to Construct More Comprehensive 3D Representations of Crime Scenes 11:00 - 11:00

A. Tingvall[1]

[1]Swedish Police Authority, National Forensic Centre, Linköping, Sweden

Abstract Body: Photogrammetry with smartphone and 360-cameras can be used to document spaces and objects that are otherwise inaccessible due to physical or temporal constraints. This work aimed to establish a practical contactless approach for acquisition of data that is difficult to attain with current methodology at the Swedish Police Authority (SPA). With a more complete dataset, the generated 3D models are improved for forensic contexts in terms of quality, reliability and usefulness. Integrating 3D data from Terrestrial Laser Scanners (TLS) creates a more comprehensive 3D model, upon which a greater extent of forensic analysis can be performed.
A 360-camera with a monopod can capture images through limited openings, granting access to photogrammetric 3D data of areas previously unavailable for 3D modelling.
In addition, the ubiquity of smartphone cameras allows for data acquisition of objects or bodies that are likely to be displaced by crime scene first responders before they can be scanned with a TLS. Smartphone photogrammetry is an established technology outside the SPA, but there is a need for standardised instructions which produce data of predictable

qualities, regardless of operator skill.
The initial findings from this work have resulted in strategies that produce 3D models of potentially desired quality.
Monopod-mounted 360-camera data collection and processing methods should factor quality degradation of photos toward the edges of the fisheye lenses.
Instructions for data collection with smartphones should emphasise the importance of swift and abundant data collection rather than an overly strict approach aiming for perfection.

Integrating AI and Hands-Free Technology to Revolutionize Forensic Documentation 11:00 - 11:00

K. Helland-Hansen[1], *O. Moldestad*[1]

[1]West Police District, Crime Scene Investigation Unit, Bergen, Norway

Abstract Body:
Traditional forensic documentation is often time-intensive and error-prone, potentially delaying investigations. This project evaluates integrating AI and hands-free technology to streamline workflows, enhance documentation quality, and ensure secure communication during crime scene investigations.

The pilot phase, conducted in Oslo Police District, tested RealWear Navigator 520 headsets in real-case scenarios. These hands-free devices allow voice-recorded notes, later transcribed into reports, and offer secure video streaming capabilities. This ensures encrypted communication of live visuals with remote experts while adhering to law enforcement protocols.

An AI bot was also developed to analyze crime scene images, generating hypotheses using advanced image recognition algorithms. This guided investigators toward critical evidence discovery, such as identifying signs of forced entry based on AI insights.
Results showed a 30% reduction in documentation time and a 25% decrease in errors, with enhanced decision-making through real-time expert support and AI contributions. Despite initial resistance to technology adoption, comprehensive training sessions addressed staff concerns.
The project underscores the potential of AI and hands-free solutions in revolutionizing forensic workflows, with significant efficiency gains, improved safety, and secure communication. Future plans include expanding implementation to more districts, advancing AI for predictive analysis, and strengthening security protocols to address evolving threats.

This initiative highlights how innovative technology can transform forensic documentation, enabling faster, more accurate investigations while maintaining the highest standards of data protection.

Suspicious Strangulation Death: A case study 11:00 - 11:00

F.A. Virk[1,2]

[1]Punjab Forensic Science Agency, Crime Scene Investigation, Lahore, Pakistan, [2]Minhaj University, Dept of Criminology, Dept of Peace and Counter Terrorism, Lahore, Pakistan

Abstract Body: When visiting a death scene, the crime scene investigator should be careful, as attempts to conceal a homicide as suicide are made by criminals after committing a crime. The case under discussion highlights the contribution of DNA evidence in solving a homicide case concealed as a suicide case by a cunning murderer. Keen observation of all aspects of the evidence is key for a crime scene investigator to uncover the truths. The deceased was a 14 years old madrasa (village school) student and his dead boy was found hanging with his own scarf by with a branch of tree in a mango orchard near his house. On the basis of observations made during crime scene processing (position of hanged body, height of victim and height of the point of hanging from ground, appearance of ligature mark and position of ligature) it was suspected as case of ligature strangulation concealed with hanging strangulation. Which was later proved as homicide on the basis of external DNA recovered from internal side of knot of ligature.

3D Documentation of the Fire Crime Scene 11:00 - 11:00

R. Hrcka[1]

[1]Institute of Forensic Science, Chemistry and toxicology department, Bratislava, Slovakia

Abstract Body: Post-fire 3D crime scene documentation represents an innovative approach in the field of criminalistics and forensic science that is fundamentally changing the way evidence is collected, analyzed, and preserved. The approach uses advanced technologies such as laser scanning and photogrammetry to create an accurate three-dimensional model of the crime scene. The 3D documentation allows for a detailed analysis of the fire-damaged area from different angles, giving investigators a comprehensive view of the extent and dynamics of the fire, as well as identifying possible sources and causes of the fire. This technology also facilitates subsequent reconstruction of events and can be used in court as evidence. The poster focuses on the benefits of 3D documentation, including increased accuracy and objectivity in the investigation process. Its practical application is illustrated through a number of real-life cases in which various crime scene documentation techniques have been used.

Past Blast Crime Scene Reconstruction: A Case Study 11:00 - 11:00

E. Seyhan[1]

[1]HASAN KALYONCU UNIVERSITY, ENGINEERING FACULTY, GAZIANTEP, Turkey

Abstract Body: The case relates to a bookstore owner claiming that two DM-41 hand grenades exploded. There were three males at the store when the explosion occurred. One claimed that he escaped after the explosion without any harm; the other one survived with very minor.
The hospital report stated "cuts on the right femur with sizes of 0.5x2 and 0.5x1 cm and one cut of 0.5x2,0 cm on the left food which are curable with simple medical intervention; generalized skin erosions on the body with the

sizes between 0,5 to 1,0 cm"; the third male was standing and killed. The autopsy report stated deceased was killed due to the shrapnel/fragmentation effect, breaks on the humerus, radius, femur, and cranium, and cerebral and internal hemorrhage. The males witnessed at the court that they had survived with no vital damage on their bodies. It was the court's wonder if the survived men could have no or very minor nonfatal fragmentation effect on their bodies even being in the same room with the deceased.
It was mainly aimed to test the fragmentation effect of 2 DM-41 defense hand grenades when detonated in a closed environment. The test room was empty with no secondary fragmentation sources. 3 male mannequins were used as test materials. The post-blast reconstruction of the crime scene was aimed at determining if the test results and the autopsy report were very coherent and if the persons having the direct blast effect would be expected to have maximum exposure to the fragmentation.

The Categorisation of Sudden Deaths: An Exploration of CSI and Police Officer Interaction 11:00 - 11:00

S. Evans[1], *H. Earwaker*[1], *R. Milne*[1]

[1]University of Portsmouth, School of Criminology and Criminal Justice, Portsmouth, United Kingdom

Abstract Body:

Dealing with the death of a person is a significant aspect of policing but there has been significant criticism of processes associated with declaring the death as suspicious or non suspicious. There are many possible causes of an unexpected death, categorised in one of four ways; expected death, unexpected death which is under investigation, unexpected death that has no suspicious circumstances and homicide. This categorisation determines the next steps in the process, including the type of autopsy requested by the coroner. If the initial scene is categorised incorrectly as non-suspicious, then crucial evidence and opportunities to obtain evidence can be lost.

The present study explores the decision mechanisms of uniformed officers and CSI's who are first attenders at a the scene of a sudden death through analysis of body worn video footage. The interaction between the CSI and the police officer was reviewed and analysed using a bespoke coding system in order to determine the mechanism of decision making and knowledge transfer and establish scope to improve the accuracy of these decisions. The data obtained informed interviews conducted with police and CSI stakeholders to further investigate not only the decision making process but also relevant training received.

The findings of the study are presented and discussed in terms of decision making and knowledge transfer, and recommendations are made for improvements to practice to enhance the reliability of the categorisation of sudden deaths by first responders.

01: Case Studies: Multidisciplinary cases
11:00 - 11:45 Auditorium

Poster Session Wednesday - Case Studies: Multidisciplinary cases

One Murder Case: Advantages of a Holistic Approach in Forensic Science 11:00 - 11:00

J. De Sousa[1], *A.P. De Sousa*[1]

[1]Eppur si - Forensic Consulting, Bucelas, Portugal

Abstract Body: This case highlights the importance of a holistic approach to forensic sciences, demonstrating how integrating diverse disciplines contributes to excellence in criminal investigations. While traditional areas like Thanatology, Biology, and Dactyloscopy often play key roles in murder cases, this investigation illustrates that other specialized fields can be equally crucial.
On July 10, 2005, in Setúbal district, Portugal, a burned male corpse was found in a remote dumping ground after a fire. The victim was gagged, hands tied, and showed evidence of beating. Without tattoos or identifiable objects, and lacking immediate leads, forensic sciences became essential for progress. Thanatology, Forensic Anthropology, Lofoscopy, and Chemistry were employed, yet after two months, the victim remained unidentified.
The breakthrough came when a bloodstained vehicle was presented to the Judicial Police. DNA analysis at the Department of Forensic Biology matched the blood to the victim, identified as Mr. X, a 71-year-old male. Investigation into the vehicle's ownership revealed a forged sale contract, analyzed by handwriting experts. Subsequent collaboration with crime scene specialists uncovered critical evidence at the suspect’s residence, identifying the murder site, torture locations, and the means of corpse disposal.
This case emphasizes how forensic sciences work like pieces of a jigsaw puzzle—each discipline contributes a fragment of the picture. By piecing them together, investigators identified the perpetrators, leading to convictions of 18 and 25 years. This underscores the necessity of a multidisciplinary forensic approach to achieve justice.

Cracking the Case: Interdisciplinary Approach of Examining a Skull Bone after Blunt Force with a Dumbbell 11:00 - 11:00

M. Weber[1], *S. Siegel*[2], *P. Rosendahl*[1]

[1]Landeskriminalamt Nordrhein-Westfalen (LKA NRW) - Institute of Forensic Science, Marks, Düsseldorf, Germany, [2]Universitätsklinikum Düsseldorf, Institute of Forensic Medicine, Düsseldorf, Germany

Abstract Body: This case report details a homicide in which the victim sustained fatal blunt force trauma to the head. In addition to soft tissue injuries, the victim also suffered a single depressed fracture on the central calvaria.
In the forensic medical examination, the cause of death was determined to be a combination of exsanguination and craniocerebral trauma. Histological analysis revealed foreign material containing iron within the wounds. In the

Marks examination, the cracks in the fracture of the external plate of the calvaria were compared with the potential tools of the crime. Striking similarities were identified with regard to the shape and size of the cracks in the bone and scratch marks in the paint coating of a weight plate of a dumbbell that was recovered at the crime scene. Further material analysis confirmed the presence of black, polyester-based paint within the bone fractures, chemically identical to the paint coating of the suspected weight plate. These findings led to the identification of the weight plate as the instrument of injury, a conclusion upheld by the court.
This case underscores the critical importance of interdisciplinary collaboration within forensic science. By integrating forensic medical and histological examination, material trace analysis, and comparative marks examination, the weight plate could successfully be identified as object used for blunt force, highlighting the value of a multifaceted approach in cases of blunt force trauma.

Characteristics of Vertebroplasties and Kyphoplasties in Dry Human Skeletal Remains 11:00 - 11:00

N. Passalacqua[1], E. Taylor[2], A. Konda[3], N. Perera[4], R. George[2], E. Chapman[5], D. Rowcroft[6]

[1]The Ohio State University, Anthropology, Columbus, United States, [2] Western Carolina University, Anthropology and Sociology, Cullowhee, United States, [3]Michigan State University, Anthropology, Lansing, United States, [4]Western Carolina University, Chemistry and Physics, Cullowhee, United States, [5]University of Buffalo, Anthropology, Buffalo, United States, [6]UMass Chan Medical School, Department of Radiology, Worcester, United States

Abstract Body: Vertebral body compression fractures are extremely common in adults, particularly postmenopausal women. They are associated with increased mortality and morbidity and often require medical intervention. The diagnosis of a vertebral body compression fracture is based on the observation of at least a 20% loss of vertebral body height in the anterior, middle, or posterior craniocaudal dimensions. Vertebral body compression fractures may result in chronic pain, immobilization, kyphosis, pulmonary deterioration due to pain and kyphotic deformity, and subsequently, depression. Clinically, vertebral body compression fractures are often treated with analgesics, bed rest, and external bracing, however approximately one third of patients require additional treatment with a percutaneous vertebroplasty or kyphoplasty to relieve pain and improve mobility.
Here we present two unrelated case studies of willed-body donors exhibiting gross dry bone vertebral augmentations consistent with percutaneous vertebroplasty and kyphoplasty. Vertebrae on both donors exhibit characteristics associated with vertebral body compression fractures such as decreased vertebral height, as well as protruding areas of a hard, off-white colored substance, which was determined to be bone cement. Additionally, radiographic imaging of the affected vertebrae of both donors exhibits the internal presence of bone cement throughout much of the vertebral bodies. Understanding this medical procedure as well as its characteristics in dry bone permits forensic anthropologists to correctly identify these vertebral abnormalities. Additionally, knowledge of these procedures could potentially assist in the identification process of

unknown individuals expressing these characteristics.

How a Combination of Forensic Techniques Helped Secure a Conviction at the Ashling Murphy Murder Trial in November 2023 11:00 - 11:00

K. Connick[1], L. Flanagan[1], J. Hoade[1], D. Carroll[1], A. Slevin[1]

[1]Forensic Science Ireland, Fingerprints, Dublin, Ireland

Abstract Body: Ashling Murphy, a 23 year old teacher, was fatally stabbed on the banks of the Grand Canal in Tullamore, County Offaly on the 12th of January 2022. This quickly became the most widely covered case by Irish media that year and a man hunt ensued for the killer. A large number of Forensic Science Ireland (FSI) staff, across multiple disciplines, contributed to assist this murder investigation. Their contribution included urgent and out of hours work to perform forensic, Fingerprint and DNA analyses.
As part of this work, DNA analysis and fingermark visualisation techniques were carried out within FSI's laboratories on several exhibits including a large men's mountain bicycle, sunglasses and a rain coat. The two sections collaborated heavily as part of the analysis, including DNA swabbing superglue fumed ridge detail which was deemed unidentifiable by fingerprint scientists.
The joint effort resulted in, identifying the suspect by both DNA and Fingerprints to place him at the scene, and in contact with the deceased, which ultimately helped lead to his conviction in October 2023.
In this presentation we will discuss the techniques used to help secure this conviction, including the collaborative nature of the work.

How Pediatric Abuse Can Translate Into Self Harm – A Forensic Perspective 11:00 - 11:00

M. Soares[1], I. Abundância[1], I. Dias[1], P. Marcelino[1], M. Cura[1], V. Rodrigues[1], S. Andrade[1], J. Neto[1], M. Heitor[1], J. Albuquerque[1]

[1]Instituto Nacional de Medicina Legal, Forensic Clinic and Pathology, Lisboa, Portugal

Abstract Body: In recent years, self-inflicted injuries in pediatric patients, particularly adolescents, have risen, often linked to strained parental relationships. This phenomenon highlights the potential causal link between psychological harm from verbal and psychological aggression and self-inflicted injuries, frequently observed in forensic clinics.
This work explores the management of such cases within emergency services, pediatric outpatient settings, and the referral process for medico-legal evaluations. The primary goal of forensic examinations in Criminal Law is to document physical and psychological injuries and establish a causal link to reported events, especially in domestic violence contexts that endanger youth.
Assessing cases where verbal and physical violence coincide with self-injury episodes is complex, particularly when determining the patient's risk. Self-inflicted injuries can be distinguished from third-party-inflicted ones during physical examinations in forensic settings. These injuries are often attributed to psychological harm inflicted by an external aggressor, such as a parent, and may or may not coincide with a psychiatric diagnosis.

This work highlights two case studies of adolescent examinees, where parents were repeatedly identified as aggressors, with reports of recurrent physical and psychological abuse. Such assessments underscore the importance of distinguishing self-inflicted injuries in pediatric evaluations and ensuring proper referral to forensic services.
By raising awareness about this differentiation, the study aims to enhance the understanding of self-inflicted injuries in the context of psychological aggression and their implications for medico-legal practices.

12: Scenes of Crime: Complex Scenes
11:00 - 11:45 Auditorium

Poster Session Wednesday - Scenes of Crime: Complex Scenes

Suicide Mystery: A Case Study 11:00 - 11:00

F.A. Virk[1,2]

[1]Punjab Forensic Science Agency, Crime Scene Investigation, Lahore, Pakistan, [2]Minhaj University, Dept of Criminology, Dept of Peace and Counter Terrorism, Lahore, Pakistan

Abstract Body: Suicide is one of the leading mental health crises and takes one life every 40 seconds globally. Risk factors associated with suicide include stressful environments, trouble with relationships, internal family and parental problems, financial crises, threats, alcohol, substance abuse, feeling of social isolation and other psychiatric problems i.e. mood disorders, anxiety disorders, sleep problems, loneliness and post-traumatic disorders. In respective case study suicide victim was ha 45 years old female living in her cousin's house for last two to three years. Victim was divorced and suffering from post traumatic disorders, health issues and depression. Victim committed suicide using three kitchen knives in her room. Room was observed locked from inside and there was no other possible entry point to the room. Police officials, in the presence of crime scene investigation team broke door and entered into the room. Suicide by self stabbing turned out to be unusual, particularly in case of female victims. These types of cases are quite challenging for crime scene investigators to unfold mysteries hidden inside the untold stories.

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11:00 - 11:45 Auditorium

MORNING COFFEE BREAK & POSTER SESSION 2

12: Scenes of Crime: Bloodstain Pattern Analysis
11:00 - 11:45 Auditorium

Poster Session Wednesday - Scenes of Crime: Bloodstain Pattern Analysis

The Reliability of Bloodstain Pattern Analysis: A Retrospective Study 11:00 - 11:00

L. Filiatrault[1]

[1]Université du Québec à Trois-Rivières, Département de Biochimie, Chimie,

Physique et Science Forensique, Trois-Rivières, Canada

Abstract Body: The interpretation of bloodstain pattern analysis is a complex task. The NAS report posits that bloodstain pattern analysis exhibits low pattern identification thresholds and a high error rate in its conclusions. In 2021, the study “Accuracy and Reproducibility of Conclusions by Forensic Bloodstain Pattern Analysts” (Hicklin et al., 2021) undertook a black box study with the objective of evaluating the accuracy and reproducibility of expert opinions, specifically on classification of patterns. The accessibility of the experimental data permitted the execution of a complementary analysis, whereby the probative value of the aforementioned analyses was estimated in the form of a likelihood ratio. This poster will present these initial findings. Taking into account the limited experiments in the 2021 study, a Bayesian approach was used to interpret the data, which made it possible to estimate the minimum value of the likelihood ratio for bloodstain patterns involving mechanisms with an apparent specificity.

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Visualization of Latent Bloodstains on Laundered Dark Fabrics Using Bluestar 11:00 - 11:00

C. Rampulla[1], *G. Gervasi*[1], *A. Melinato*[1]

[1]European Forensic Institute, Malta Life Sciences Park, San Gwann, SGN, Malta

Abstract Body: Latent bloodstains are among the most sought-after types of evidence by forensic experts when investigating a crime scene. After a violent event, blood is often the most prominent material that perpetrators attempt to remove, typically using cleaning products or laundering bloodied fabrics in washing machines. In some cases, the item may be discarded or destroyed. However, in other instances, the perpetrator may try to clean the scene thoroughly and leave no visible evidence behind. A particular challenge arises when the fabric is light-colored, as the bloodstain may be difficult to remove completely. One common method used to “remove” blood from fabrics is applying pre-treatment products before washing them. Conversely, when the fabric is dark-colored, the bloodstain may be less visible after laundering. Perpetrators may mistakenly believe that the stain has been entirely removed.
The aim of this project is to investigate whether latent bloodstains can be detected after applying the Bluestar reagent to five different black fabrics that have been laundered at various temperatures, using Dash detergent and stain removers.

12: Scenes of Crime: Fire and Explosion Investigation
11:00 - 11:45 Auditorium

Poster Session Wednesday - Scenes of Crime: Fire and Explosion Investigation

Finding the Ignition Source From Bone: A Forensic Investigation Into the Effects of Intense Heat and Fire on Porcine Bone 11:00 - 11:00

C. Logan[1], *S. McColl*[1]

[1]Liverpool John Moores University, Pharmacy and Biomolecular Sciences, Liverpool, United Kingdom

Abstract Body: The focus of this research is to understand the changes that can occur to the bones though intense heat and fire and to be able to decipher what may have happened at the scene. Samples of porcine long bone, specifically femurs, were burned at a multitude of temperatures ranging from 300 – 900 degrees Celsius. This involved the use of a muffle furnace for the application of intense heats, burning at 300 – 900 degrees Celsius, in increments of 150 degrees, and a realistic fire scenario, burning at ~612 degrees Celsius, in which the samples could encounter open flames. The samples were each analysed using Fourier Transform Infrared (FTIR), and X-Ray Fluorescence (XRF) to collate data such as mineral content, elemental content and changes to the bone's structural integrity. The results found the outputs of burning butane to have been absorbed into the boned that were placed in the open fire, elements that were not present in the control samples or in those burned in the muffle furnace. The elements absorbed included Neodymium and Bromine, both outputs of burning butane, but also Cerium, an output of lighter flints. This coupled with the results of the FTIR, with that of the samples burned in the muffle furnace at 600 degrees Celsius provided a great insight into the changes that can occur to bone depending on temperature, but alight to the ignition source, allowing for the results to potentially be applied to forensic investigations and medicolegal situations.

Digital Forensics as a Complement to Fire Scene Investigations and Reconstructions 11:00 - 11:00

J. Bengtsson[1,2], *F. Jonsson*[1], *O. Delémont*[3], *T. Souvignet*[3]

[1]Swedish Police Authority, Swedish National Forensic Centre (NFC), Linköping, Sweden, [2]Linköping University, Department of Electrical Engineering (ISY), Linköping, Sweden, [3]University of Lausanne, School of Criminal Justice (ESC), Lausanne-Dorigny, Switzerland

Abstract Body: Traditional forensics based on natural science research disciplines have served fire scene investigators well for a determination of where, when, and in what sequential order, a fire started and was spread.

To complete the occasionally unsolved forensic jigsaw puzzle, fire scene investigators can get additional support from a sparsely used resource: digital forensics. We have identified four types of scenarios where digital forensics can contribute to a fire scene investigation, given that hardware was present before or during the fire. Here, we include scenarios where hardware 1) directly or indirectly were the cause of fire, 2) caused the fire

in conjunction with non-electronic components, 3) were present on the targeted fire scene, and 4) were used by nearby witnesses.

Digital forensics is not only useful for the fire scene investigation itself; digital forensic analysis may also reveal circumstances where arson is the very cause for the concealment of underlying criminal activities.

This presentation demonstrates how digital forensic principles are applicable on fire scene investigations and reconstructions. Furthermore, how data from e.g. home and building automation systems, HVAC systems, Internet of Things hardware, network connected devices, and control systems for building entrance, elevators, fire, and lighting, and so forth, can provide timestamped events that concurrently and in parallel occurred with an arson. This is done by real case examples and general digital forensic principles in the context of fire scene investigations and reconstructions.

Investigation and Analysis of Fires: An Interdisciplinary Approach to Prevention and Safety Through Traces 11:00 - 11:00

O. Piat[1], N. Deslauriers-Varin[2,3], F. Crispino[1,4], C. Muehlethaler[1,4]

[1]Université du Québec à Trois-Rivières, Department of Biochemistry, chemistry, physics and forensic science, Trois-Rivières, Canada, [2]Université Laval, University School of Social Work and Criminology, Quebec City, Canada, [3]International Centre for Comparative Criminology, Quebec City, Canada, [4]Groupe de Recherche en Science Forensique, Trois-Rivières, Canada

Abstract Body: Fire investigations have a significantly low-resolution rate compared to other crimes and offenses. Investigators face numerous challenges, including the destruction of evidence by fire and the fragmentation of information across different services (e.g., fire protection services, police services, insurance companies). These limitations prevent both the resolution of individual cases and the detection of broader patterns, such as serial cases.

This project aims to improve the resolution rate of fire cases and reduce their occurrence by fostering a proactive approach to investigations. It focuses on enhancing collaboration among key stakeholders, centralizing data, and integrating forensic intelligence into investigative practices to identify patterns early and prevent further incidents. By combining prevention and improved detection, this initiative seeks to better understand, resolve, and prevent serial fire cases and thereby strengthening public safety.

Preliminary findings indicate that the number of cases shared between services is low, despite the need for systematic data sharing. Furthermore, the contribution of physical traces is often undervalued, leading to a limited ability to leverage their added value across all three levels of intelligence: tactical, operational, and strategic.

Future directions of the research include detecting new links and further exploring already known connections. Moreover, the implementation of technological tools to quickly link cases with clear similarities is planned for the near future. This project ultimately aims to issue a detailed report

describing lessons learned from this research and proposing optimized investigative procedures intended to service managers, practitioners, and municipal policymakers.

Examination of Electrical Fan Heaters Within Fire Scenes 11:00 - 11:00

G. Strong[1], K. Robertson[2], E. Ljungkvist[3]

[1]SPA Forensic Services, Forensic Operations, Gartcosh, United Kingdom, [2] SPA Forensic Services, RDI, Gartcosh, United Kingdom, [3]Dundee University, LRCFS, Dundee, United Kingdom

Abstract Body: Within a mocked-up scene, a fire was set with known ground truths relating to point of origin, source of ignition and fire development. This scene was then used to assess the competencies of the Scottish Fire Investigation cadre from SPA Forensic Services and Scottish Fire and Rescue Service (SFRS). During this process, FI's were asked to consider a damaged electrical heater within the fire scene.
A gap in confidence, knowledge and understanding was observed across the range of FI's involved with the majority of FI's involved opting to carry out minimum of examination without prompting. The hypothesis was that a process could be created to address gaps in knowledge and confidence in the SPA FI cadre. It was predicted that this may lead to:
•Greater knowledge and understanding within the Fire Investigation cadre
•Less reliance on external Subject Matter Experts (Electrical Engineers) sourced by the UK National Crime Agency
•Better results in terms of time taken, expense and Satisfaction on the part of Police Scotland and / or Crown Office and Prosecution Service

03: Digital Evidence: Mobile Device, Network and Location Forensics
11:00 - 11:45 Auditorium

Poster Session Wednesday - Digital Evidence: Mobile Device, Network and Location Forensics

AI-Powered Identity Fraud Detection: A Collaborative Innovation 11:00 - 11:00

S. Sebti[1], S. Rezig[1], P. Davadie[2]

[1]ShareId, Paris, France, [2]Inedix, Paris, France

Abstract Body: In partnership with the French Gendarmerie Nationale, we developed a cutting-edge technology leveraging artificial intelligence to combat identity document fraud. This innovative solution employs machine learning to analyze text, images, and embedded security features, significantly enhancing the accuracy and reliability of identity verification processes.
Central to the system is the integration of advanced algorithms into mobile applications, combined with chip-reading technology. This fusion enables the creation of an offline fraud detection tool, offering seamless operation without the need for constant internet connectivity.
This application played a pivotal role during the Olympic Games, where it was deployed to streamline identity verification for over 12 million visitors. By providing swift, secure, and reliable identity checks, the system ensured both efficiency and security in managing large-scale public events.

ShareID's AI-powered solution demonstrates the potential of technology to address real-world challenges, reinforcing trust and reliability in identity verification systems while supporting large-scale operations with unparalleled precision.

Investigation of Cloud Storage Services on Mobile Devices Through Online Data Acquisition Method 11:00 - 11:00

M. Güngör[1]

[1]Türkiye Gendarmerie Forensic Department, Data and Hardware Examination Unit, Ankara, Turkey

Abstract Body: Mobile devices have become an indispensable part of daily life and have begun to work in an integrated manner with cloud-based storage services. Popular cloud platforms such as Google Drive, OneDrive, Dropbox and iCloud offer users large storage areas and flexible data sharing opportunities. However, these conveniences have also created opportunities for cybercriminals. Cybercriminals use cloud environments both to hide their illegal activities and to remotely delete evidence. Cloud-based systems cause the traces to become more complicated in various crimes from child abuse to financial fraud. This situation requires forensic experts to examine cloud environments, not just the data on the device. In this context, the aim of the research is to review the effectiveness of new methods and tools used in the cloud and to determine to what extent the data in the cloud can be accessed by using forensic tools. In the experimental part of the research, images of mobile phones with iOS and Android operating systems were acquired by using different methods. Multiple assessments were carried out on cloud storage services like Google Drive, OneDrive, Dropbox, and iCloud. Oxygen Forensic® Detective software was used to evaluate the feasibility of accessing user credentials and cloud-stored data, as well as to determine whether the extracted information meets forensic standards. The conclusion was that utilizing both offline and online data acquisition tools together is crucial for obtaining the best outcomes, allowing access to more tangible digital evidence in cloud-based mobile investigations.

Experimental Analysis of Data Acquisition Techniques in IOT Forensics 11:00 - 11:00

Z. Özkara[1], *Y. Ar*[2]

[1]Gendarmerie Forensic Department, Ankara, Turkey, [2]Ankara University, Computer Engineering, Ankara, Turkey

Abstract Body: As technology progresses, one of the most commonly discussed topic is undoubtedly the Internet of Things (IoT).Our surroundings are increasingly filled with IoT devices, making our lives more digital every day. While these devices offer convenience and efficiency, they also present both advantages and challenges in forensic investigations. Many IoT-enabled devices store valuable information that can be crucial for solving crimes. For example, data such as a person's location and movement patterns, vehicle sensor data like door open/close times, the number of passengers detected by weight sensors, or whether seat belts

are fastened, can all provide key insights. Similarly, sensors within buildings or homes can reveal if an unauthorized person enters, detect fires, and track the time and origin of such events.
However, despite the benefits IoT devices offer, they also introduce several difficulties for forensic investigations. These challenges include the constant emergence of new devices and technologies, the difficulty of accessing data using traditional forensic methods, a lack of expertise among forensic professionals in handling such devices, and the inability of current forensic tools to fully address the complexities of IoT technology. Within the scope of this research, four different frequently used IOT devices (smart band, smart watch, smart scale and baby camera) were examined. It was aimed to access the records created as a result of user behaviors performed with the devices.

Automating Mobile Forensics with Puma: A Tool for Generating Realistic Test Data 11:00 - 11:00

H. Henseler[1,2], B. Timbermont[2], A. Claij[2]

[1]University of Applied Sciences Leiden, Department of Computer Science, Leiden, Netherlands, [2]Netherlands Forensic Institute, Hansken, The Hague, Netherlands

Abstract Body: Generating realistic test data is a crucial step in mobile forensic research and development, but it is time-consuming and error-prone. To address this need, the Puma library was developed by the Netherlands Forensic Institute (NFI). Puma is a versatile tool that automates interactions with mobile devices, enabling users to simulate actions such as sending messages, making calls, and spoofing GPS locations. By simplifying these processes, Puma allows forensic professionals to create complex scenarios with minimal coding effort.

With a single line of code, Puma can automate tasks such as opening WhatsApp, starting a chat, sending messages, or simulating video calls. This functionality is particularly valuable for generating test data at scale, facilitating the development and validation of forensic tools. Additionally, Puma supports advanced features like GPS location spoofing, which enables testing navigation scenarios in applications such as Google Maps.

This poster showcases the capabilities of Puma, highlighting its applications in automating mobile interactions and generating synthetic datasets for forensic analysis. Real-world use cases are presented, demonstrating how Puma streamlines workflows, reduces manual effort, and increases the reliability of testing processes. Puma is open source (https://github.com/NetherlandsForensicInstitute/puma) and is an initiative from the Hansken Community (https://hansken.org).

During presentation of the poster we will discuss Puma's technical structure and potential applications in forensic casework and research. By leveraging tools like Puma, forensic teams can enhance their efficiency, improve testing accuracy, and focus on addressing emerging challenges in mobile forensics.

Thousand Percent Faster 11:00 - 11:00

J. Freiberger Fernandes[1], D. Oliveira Balen[1]

[1]Policia Científica de Santa Catarina, General Office, Florianópolis, Brazil

Abstract Body: The project was implemented in a State Scientific Police in Brazil with the aim of increasing productivity and facing crime.
The scientific police are responsible for analyzing traces of crimes in Brazil, whether physical, chemical or biological. Based on this work, expert reports are made in the various areas of forensic science.
In 2019, the annual dispatch of expert reports in the area of forensics computer was approximately 4500 across the state.
In the same period, the pent-up demand was approximately 4000 reports, meaning it would not be resolved in less than a year. Faced with this problem, it was determined to implement a new methodology for preparing expert reports in the police.
The first step consisted of standardizing all forensic units with the same forensic tools. To this end, the Cellebrite Physical Analyzer technological solution was adopted with Premium access in regions where cell phones and equipment seized for the investigation were serviced.
The experts' technical knowledge was then leveled and trained to act in a similar way to a production line.
There was some resistance at the beginning of the process, however, in a short time the efficiency showed that we were on the right path.
At the end of this cycle, production increased to more than 11,000 reports in 2023, with a tendency to exceed 14,000 reports in 2024, a 300 percent gain.
Pent-up demand fell to less than 2000 cases, however, the average response time for a report rose to 30 days, a 1000 percent gain.

Poster Session 2 (Multiple Topics): All except 6 and 7
11:00 - 11:45 Auditorium

Poster Session Wednesday

01: Case Studies: Other
11:00 - 11:45 Auditorium

Poster Session Wednesday - Case Studies: Historical/Cold cases

Warming up Cold Cases: Evaluating the Efficiency and Effectiveness of Forensic Techniques in Investigations of Unidentified Victims. 11:00 - 11:00

P.P. Raja[1]

[1]University of Huddersfield, Centre of Archaeology, Huddersfield, United Kingdom

Abstract Body: This poster will present the scope and findings of a doctoral project focused on reviewing the use of forensic techniques in cold cases involving unidentified victims. The project was created through participation in the International Cold Case Analysis Project (ICCAP) run by Amber Alert Europe (AAEU). The overall objectives of this project are to examine the nature and prevalence of forensic techniques and their

effectiveness in cold case investigations, to determine whether modern or older techniques are being used, and to investigate further whether external expertise is being utilised in investigations. Building on literature highlighting the shortcomings of not adequately deploying forensic techniques, this poster will present a preliminary analysis of approximately 48 unidentified victim cases in Ireland, approximately 1016 in the United Kingdom, and 46 female cases in Interpol appeals from six European countries. As in the wider doctoral project, the poster will present the results of quantitative and qualitative analysis to demonstrate initial trends. Further, a model that would allow for more effective investigations of unidentified victims will be proposed. The poster will argue that integrating standardised methodologies during investigations and a centralised reference database would help investigators choose forensic techniques more effectively during investigations.

The Importance of the Forensic Medical Expert in the Judicial System: A Practical Analysis 11:00 - 11:00

J. De Sousa[1], *A.P. De Sousa*[1], *A. Pinto*[2]

[1]Eppur si - Forensic Consulting, Bucelas, Portugal, [2]Aníbal Pinto & Associates, Law Firm SP RL, Porto, Portugal

Abstract Body: This publication explores the critical role of forensic medical experts in court, focusing on the impact of their testimony and the importance of video evidence in homicide cases. Based on national and international practices, this analysis highlights the expert's contributions to justice in three real cases from Portugal.
The study emphasizes how forensic experts contextualize injuries using assault videos, validate hypotheses regarding the origin of injuries, and produce more accurate autopsy reports. Their testimony clarifies technical terms, reinforces the credibility of conclusions, and allows lawyers and judges to address questions directly with the expert.
In case **293/20.7 GCSTB**, the court permitted the forensic expert's testimony, leading to a well-founded decision and definitive case closure. In contrast, case **266/22.5 SGLSB** excluded the expert's testimony and video evidence analysis, resulting in unanswered questions and doubts regarding the conviction.
The third case, **6270/22.6 T9LSB**, involving a defendant originally part of case **266/22.5 SGLSB**, demonstrated the transformative impact of the expert's presence. Their testimony clarified facts across both trials, establishing the cause of death and assigning responsibilities, ultimately enabling a just outcome.
These cases illustrate the essential role of forensic experts in bridging gaps between complex medical findings and legal processes. International guidelines from the WHO and IALM emphasize integrating all available evidence for precise analysis. This summary underscores the critical intersection between forensic medicine and the judicial system, advocating for active expert involvement at all procedural stages to ensure fair and robust justice.

Disclosing and Strengthening Forensic Science in Portugal:A Homicide Case 11:00 - 11:00

J. De Sousa[1], *A.P. De Sousa*[1]

[1]Eppur si - Forensic Consulting, Bucelas, Portugal

Abstract Body: In July 2018, a 51-year-old triathlete disappeared near Lisbon after his daily cycle training. His skeletonized body was found over a month later, 91 miles away, with signs of firearm injuries. The subsequent investigation uncovered a firearm in the house of the triathlete's wife's lover, leading to their preemptive arrest. Despite autopsy findings and forensic evidence, the people's jury initially acquitted the lover while sentencing the wife to 25 years in prison. A higher court later overturned the acquittal, sentencing both to maximum penalties for co-authorship of the murder. The case sparked national debate about the integrity of Portugal's justice system.
Flaws in the criminal investigation and judicial proceedings were highlighted, including mishandling of crime scene evidence, misinterpretation of forensic findings, inadequate court testimony by forensic practitioners, and insufficient knowledge of forensic science among judges and lawyers. For example, the autopsy did not follow recommended protocols, failing to perform radiological imaging (Virtopsy) for firearm cases. A hyoid bone fracture, potentially critical evidence, was dismissed without determining its timing relative to death. Moreover, the forensic firearm analysis was inconclusive, yet the court ruled on its involvement. These issues were compounded by police failure to follow protocols and the discovery of additional ballistic evidence mid-trial. This case underscores the urgent need for enhanced forensic science training and adherence to scientific standards in criminal investigations and judicial processes. Without these improvements, errors in evidence handling and interpretation will continue to compromise justice and lead to wrongful verdicts.

Diatoms Offer a Useful Line of Forensic Enquiry 25 Years After a Homicide: A Cold Case Report 11:00 - 11:00

K. Scott[1,2]

[1]Liverpool John Moores University, School of Biological & Environmental Sciences, Liverpool, United Kingdom, [2]Liverpool John Moores University, Forensic Research Institute, Liverpool, United Kingdom

Abstract Body: Diatoms are an abundant and species-rich group of microscopic algae, prevalent within most water bodies. Diatoms have predominantly been used to support forensic pathology investigations where drowning is suspected, however, they also yield an important trace evidence technique to reconstruct contact between suspects and scenes of crime involving water. Whilst most casework applications of diatom analysis involve contemporary investigations, the robustness of diatoms via their resistant silica cell wall, means they can potentially offer useful insights within historic forensic investigations.

This presentation will discuss the contribution of diatom trace evidence analysis during a cold case murder investigation in the UK. The body of a young girl was found partially submerged in a river in Scotland in 1996; there was insufficient evidence to charge several suspects at the time.

Forensic testing in 2021 incorporated diatom analysis of suspect, victim, and secondary scene exhibits. Diatoms were recovered from several samples, providing circumstantial information on the type and extent of environmental exposure. The long-term preservation, and subsequent recovery, of diatoms from evidential exhibits stored for over twenty years is unprecedented. These novel findings highlight the potential of diatom trace evidence analysis to provide valuable intelligence in historic unsolved cases, particularly those involving aquatic crime scenes, where forensic investigations are being revisited.

02: Chemistry: Other
11:00 - 11:45 Auditorium

Poster Session Wednesday - Chemistry: Other

Introducing Isotope Ratio NMR to the Forensic Field: Development and Implementation for Source Level Profiling 11:00 - 11:00

L. Jelier[1]

[1]Netherlands Forensic Institute, Chemical and Physical traces - Research and Development, The Hague, Netherlands

Abstract Body: By applying isotope ratio nuclear magnetic resonance (IR-NMR) in the forensic field a significant advancement in chemical source comparison of e.g. drugs, explosives and other organic molecules can be achieved. Traditionally, isotope ratio mass spectrometry (IR-MS) has been the technique used for source comparison. However, IR-NMR offers many advantages over traditional isotopic analysis. Unlike IR-MS, the use of IR-NMR is non-destructive, allows for direct analysis without extensive sample preparation and has been shown to have a higher discriminatory value than IR-MS due to the atomic level of isotope analysis rather than only providing the average bulk isotopic ratio.

By presenting the advancements and results made in the field we want to show the possibilities for forensic investigators. Furthermore, we will present proof-of-concept results of this technique and further achieved results with an outline of possible case applications to link evidence to specific sources, and help (criminal) investigations by providing forensic intelligence.

Ultimately, with this poster we want to highlight and inform the forensic field of current advancements and developments of isotopic NMR analysis as a source comparison method.

Forensic Analysis of Contact Lenses Using ATR-FTIR Spectroscopy: Identifying It's Chemical Fingerprints and Time-Dependent Changes at Crime Scenes 11:00 - 11:00

Ü. Ateş[1], *A. Kocabaş*[1], *T. Ünsal Sapan*[1], *H.H.S. Atasoy*[1]

[1]Üsküdar University, Instution of Addiction and Forensic Sciences, Istanbul, Turkey

Abstract Body: Contact lenses, commonly used for both health and aesthetic purposes, are increasingly found at crime scenes and can serve as valuable evidence. These lenses, produced by various companies with unique chemical compositions tailored to individual needs, may belong to the victim or perpetrator. Analyzing the chemical content of these lenses can provide crucial information for solving forensic cases.
One effective method for analyzing contact lenses is FTIR (Fourier Transform Infrared) spectroscopy. This technique allows rapid, non-destructive analysis of crime scene samples, identifying their chemical composition without altering or reducing the sample. FTIR spectroscopy has gained popularity in forensic science, with growing databases of spectra from potential evidence.
In this study, 32 different types of contact lenses were analyzed using ATR-FTIR spectroscopy, and their unique chemical fingerprints were recorded in a database. The lenses were then stored for 1 and 30 days to simulate crime scene conditions, and their IR spectra were re-examined. Changes in the spectra over time were observed, helping to determine the duration since the lens was deposited at the scene.
This study concluded that a contact lens found at a crime scene can be analyzed to determine its type, estimate the duration it has been at the scene, and provide insights into the approximate time of the crime. Moreover, such an analysis can potentially reveal identifying features of the victim or suspect.

Large-Scale Intelligence-Led Monitoring of Hydrophobic Micropollutants in the Lake Geneva Basin 11:00 - 11:00

I. Tascon[1], *F. Pfeiffer*[1], *C. Weyermann*[1], *N. Estoppey*[2]

[1]University of Lausanne, School of Criminal Justice, Lausanne, Switzerland,
[2]Norwegian Geotechnical Institute, Oslo, Norway

Abstract Body: Water pollution is one of the principal threats to water security. In response, several legislations and conventions have been developed over the past few decades to ensure a good water quality. Persistent organic pollutants (POPs), such as polychlorinated biphenyls (PCBs), are particularly concerning due to their high toxicity and persistence, even at low concentrations. Monitoring these compounds in surface waters is therefore crucial for maintaining water quality and detecting pollution problems.
The aim of this study is to establish a large-scale monitoring of hydrophobic micropollutants in the Lake Geneva basin, with a five-year retrospective analysis. In 2018, 2019, and 2023, three monitoring campaigns were conducted to measure hydrophobic pollutants, including PCBs, polybrominated diphenyl ethers (PBDEs), and polycyclic aromatic hydrocarbons (PAHs) in several rivers within the Lake Geneva basin. Passive samplers were used to measure contaminant concentrations, as they offer a relatively simple and effective deployment system with a low sensitivity.
The produced intelligence from each monitoring campaign was useful to highlight pollution problems by targeting contaminated rivers, detecting patterns and helping decision-makers to define and apply adapted measures to reduce these pollutions. Recommendations were also addressed (e.g., sampling sites, target contaminants, passive sampler extraction efficiency) and applied in subsequent campaigns. This five-year retrospective monitoring allowed to assess the evolution of pollutants

concentrations in the basin in relation to the measures implemented since 2018. Additionally, it provided a deeper understanding of micropollutant pollution, highlighting temporal and seasonal trends.

Development of a Method for Comparing Soil Traces Using an Isotopic Approach 11:00 - 11:00

A. Devresse[1], *M. Ousmane*[1]

[1]IRCGN (Institut de Recherche Criminelle de la Gendarmerie Nationale), Microanalysis, Cergy-Pontoise, France

Abstract Body: A new experimental method to analyze soil traces using isotope ratio mass spectrometry (EA-IRMS) has been developed at the Criminal Research Institute of the National Gendarmerie (IRCGN). This technique is based on the study of stable isotopes such as carbon, nitrogen, oxygen, hydrogen, and sulfur, which are naturally present in various environments. Analyzing their isotopic composition allows for the characterization and differentiation of soil samples, paving the way for the creation of isoscapes.

Implementing this method involves several essential preparatory steps, including precise drying, rigorous sieving, and controlled weighing of samples. Appropriate isotopic standards have been selected to ensure measurement accuracy, and analytical parameters such as dilution have been optimized.

The isotopic ratios of certain elements, such as carbon, nitrogen, and oxygen, provide crucial environmental information, particularly regarding plant types. Similarly, oxygen and carbon isotopes in plants provied data on distance from the sea, influenced by precipitation and freshwater sources.

This isotopic approach, combined with traditional physicochemical analysis, allows for more robust conclusions in criminal investigations. It enhances the ability to locate and identify the origin of soil samples at a reduced cost and within reasonable timeframes, thereby strengthening the evidential value of soil traces.

Towards a Predictive Approach to Soil Traces in Forensics 11:00 - 11:00

A. Devresse[1]

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Abstract Body: Soil traces represent valuable evidence at crime scenes, particularly for establishing links between an individual and a location. Their analysis can help identify the movement of vehicles or people, as well as clarify situations involving theft, assaults, or the bodys discovery. The National Gendarmerie’s Criminal Research Institute (IRCGN) currently relies on comparing soil samples taken from objects (shoes, clothing, etc.) with reference samples from specific locations. It is comparison is based on physico-chemical analyses of the clay, sand, and macro-remains fractions, using techniques such as X-ray diffraction or microscopy coupled with

spectrometry. However, there is currently no method in France for geographically locating a soil sample, despite the clear interest this would hold for complex investigations or cold cases.

An method called Predictive Soil Provenancing (PSP) was developed in Australia. By coupling soil data available through Geographic Information System with geostatistical techniques, this approach has significantly reduced search areas. This study aims at evaluating the feasibility of applying this methodology in France. It is also necessary to prioritize the discriminating variables (elemental contents, pH, isotopes) and explore geological databases, particularly those from the GIS-SOL program.

This research is structured around key areas: first, the exploration and validation of French databases for their potential in predictive soil analysis; second, comparing this with other approaches, notably soil classification models based on Principal Component Analysis (PCA) and the K-Nearest Neighbors (KNN) method; and lastly, a Bayesian method developed by the Geosciences Center in Fontainebleau to refine the geographical localization of soil samples.

A Problem-Oriented Forensic Approach to Address Technical Safety Risks: A Case Study on Brake Fluid Contamination 11:00 - 11:00

A.-F. Prior[1], *L. Besson*[1], *F. Coppey*[1], *O. Delémont*[1], *P. Esseiva*[1]

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Abstract Body: Forensic science serves as a cornerstone not only for resolving criminal justice cases but also for providing scientific insights that inform security-related decision-making. This poster presents a practical example of how a forensic approach was developed and applied to assess and mitigate a specific safety risk, showcasing its value in supporting targeted interventions to reduce negative outcomes.
The case involves the accidental contamination of a drum of brake fluid at a major car dealership, which went undetected until brake system malfunctions occurred. A risk assessment estimated that approximately 1,000 vehicles could be affected, posing a significant risk of brake failure and accidents.
A tailored analytical strategy was designed to address this issue effectively, integrating two complementary techniques : Near-Infrared spectroscopy (NIR), a rapid screening method, and Gas Chromatography-Mass Spectrometry (GC-MS), a more resource-intensive but more comprehensive technique. The strategy unfolded in four phases:

1. Characterizing the nature of contamination, and deciphering the associated safety risks.
2. Developing an instrumental protocol to enable a rapid but above all reliable screening of brake fluid samples from a broad vehicle pool.
3. Implementing this protocol operationally, analyzing approximately 1,000 samples within a practical timeframe.
4. Delivering actionable indicators derived from the analysis results, supporting decisions on vehicle recalls and brake system replacements.

This example underscores the value of a forensic science approach grounded in a thorough understanding of the issue at hand, to reach relevant solutions to complex technical safety issues.

Multi-technique Spectroscopic Analysis of Lipstick Stains on Laundered Clothing 11:00 - 11:00

F. Carlysle-Davies[1], *P. Maraj*[1]

[1]University of Strathclyde, Centre for Forensic Science, Glasgow, United Kingdom

Abstract Body: The pervasive nature of cosmetics in today's society exemplifies the adage "every contact leaves a trace", and lipstick traces in particular are often encountered on bedding, clothing, glassware, and tissues. Such traces can be used to link a suspect to a victim or crime scene, but in the case of fabric substrates, are limited by the persistence of the stain after laundering. Identification of lipstick stains is therefore restricted by visual discrimination, the analytical method employed, and the minimal amount of sample available for analysis. This study utilized a combination of three spectroscopic techniques – near-infrared (NIR), attenuated total reflectance Fourier-transform infrared (ATR-FTIR), and Raman spectroscopy – coupled with chemometric data analysis for discrimination of lipstick samples deposited on fabric. After laundering under various conditions, lipstick traces could still be detected, and principal component analysis (PCA) and hierarchical cluster analysis (HCA) of the FTIR spectra demonstrated that the lipsticks could still be classified by formulation. NIR and Raman spectra were found to be limited in their practicality by substrate interference and fluorescence respectively. These findings indicate that lipstick stains can be detected and distinguished after laundering of the fabric substrate, via application of non-destructive spectroscopic methods and pattern recognition techniques, and expands the existing knowledge on cosmetic trace persistence and identification.

Linking 3D-Printed Firearms Material and Used Printer 11:00 - 11:00

A. Korpi[1], *M. Söderström*[1], *J. Ollikka*[1], *O. Laine*[1]

[1]National Bureau of Investigation, Vantaa, Finland

Abstract Body: 3D printing has become more accessible to consumers and it is used also for illegal activities, notably illegal firearms. Printed weapons are of varying quality, but many have been found lethal and capable of being fired multiple times. Policework has revealed "workshops" equipped with multiple 3D printers programmed to produce parts for firearms, supposedly aiming to produce weapons to be sold illegally.
We conducted an investigation of chemical analysis methods that may be used to aid the police in linking together printed firearms and the used printer or print workshop by analysing the plastic used for printing. Six different black polylactic acid (PLA) printing filaments were compared using FTIR and Raman spectroscopy as well as pyrolysis-GC-MS. Both unused filaments and printed objects were included in the study.
It was found that printing does not chemically alter the filament, so a printed object can be compared to a filament used in a 3D printer. FTIR and

Raman spectroscopy were found effective for screening of the type of plastic but insufficient for comparing two filaments with only slightly different chemical composition. Pyrolysis-GC-MS method was found more effective in differentiating between these kinds of samples and individual filaments could be identified in most comparisons and the results were found to be repeatable. The comparison is based on pyrolysis products of the polymer and the plastic additives.
The results are promising but more work is required, including a study of differences in chemical composition of different batches of printer filaments from the same producer.

Heat Deflection of Resins Present in Food at Various Oven Temperatures 11:00 - 11:00

J. Jung[1], *S. Jeon*[1], *G. Nam*[1], *B. Gong*[2]

[1]Gwangju Institute, National Forensic Service, Forensic Toxicology and Chemistry, Jeollanam-do, Korea, Republic of, [2]Seoul Institute, National Forensic Service, Chemistry, Seoul, Korea, Republic of

Abstract Body: The issue of foreign substances in food has garnered significant societal attention, with recent cases of plastic and sponges found in items like hamburgers, salads, and fried foods on the rise. Determining how these foreign substances became incorporated into food—whether during the cooking process or through deliberate tampering—is crucial for resolving incidents. These foreign substances can take various forms, including packaging materials, sponges, and plastics, necessitating not only forensic analysis but also witness testimonies and CCTV reviews.
During the heating process of food, there is a possibility that foreign substances may undergo physical changes.While studies on the thermal deformation of resins have been conducted, the inherent characteristics of these materials may change when mixed with actual food due to effects like shielding.
Therefore, this study aimed to simulate the presence of resins (plastics) in food and observe their thermal deformation characteristics in an oven at various temperatures. To replicate the scenario of baking bread, various types of resins (e.g., epoxy) were embedded in glutinous rice dough, formed into spheres of different sizes (0.5, 1, and 1.5 cm). The results indicated that the presence of food creates a shielding effect that alters the thermal deformation characteristics of the resin. Notably, the larger the size of the dough, the more pronounced the shielding effect, and as the temperature increased, differences in the morphological characteristics of the resin and dough mixtures were observed. These findings may serve as foundational data for verifying the incorporation of foreign substances in food.

Forensic Applications of FTIR Spectroscopy for Hazardous Chemical Detection and Disaster Management 11:00 - 11:00

W. Oh[1], *S. An*[1], *K. Lee*[1]

[1]National Disaster Management Research Institute, Disaster Scientific Investigation Division, Ulsan, Korea, Republic of

Abstract Body: This study presents the application of Fourier-Transform Infrared (FTIR) spectroscopy for detecting hazardous chemical substances and conducting forensic analyses during chemical disaster incidents. Chemical accidents, such as fires, leaks, and explosions, require rapid and precise on-site analysis, particularly when hazardous materials are involved, to determine causes and minimize damage. This research conducted long-range detection experiments with an FTIR spectrometer at national industrial parks, identifying hazardous substances such as methane, ammonia, and ethylene. FTIR-based analysis enables non-contact, real-time detection of hazardous substances, providing critical data for forensic evidence collection and disaster response simulations. The findings suggest that systematic and efficient early investigations and analyses can effectively support legal accountability and disaster recovery processes. This study highlights the forensic applicability of FTIR technology and proposes directions for advancing chemical disaster investigation systems.

Biophotonic Emission From Living Systems: A New Forensic Perspective 11:00 - 11:00

A. Barbaro[1,2], A. Rubio[3,2], G. Montalvo[3,4], F.E. Ortega-Ojeda[5,4], C. García-Ruiz[3,2]

[1]SIMEF, Reggio Calabria, Italy, [2]Universidad de Alcalá, Instituto Universitario de Investigación en Ciencias Policiales, Alcalá de Henares (Madrid), Spain, [3]Universidad de Alcalá, Departamento de Química Analítica, Química Física e Ingeniería Química, Alcalá de Henares (Madrid), Spain, [4]Universidad de Alcalá, Instituto Universitario de Investigación en Ciencias Policiales, Alcalá de Henares Ss, Spain, [5]Universidad de Alcalá, Departamento de Ciencias de la Computación, Alcalá de Henares (Madrid), Spain

Abstract Body: Biophoton emission, or ultra-weak photon emission (UPE), is a spontaneous, low-intensity emission present in all living systems, generated by metabolic reactions such as oxidative metabolism or cell division. This emission can be induced by various external factors, such as light exposure. Thus, this research aimed to analyse the light emission ofdifferent samples after exposure to various light sources to observe UPE from different levels of biological complexity and propose this technique as a novel analytical tool in forensic sciences.
For these UPE measurements, an *ad hoc* system was developed using an almost zero dark-noise,high-sensitivityastronomicalcharge-coupled device camera, with peak quantum efficiency in the 400–800 nm range.Additionally, acustomised algorithm was designed to convert qualitative data (images) into quantitative data (UPE intensity in numerical form),allowing for objective comparison across all obtained datasets.
This study examined four biological systems. In plants, UPE was analysed to understand light or darkness adaptability, especially relevant for assessing growth conditions of drug-producing plants. In humans, UPE was assessed for potential cosmetic applications, revealing that hyaluronic acid and naturally grey hair produced higher emission intensities. Fruits,serving as an intermediate between living systems and simpler biological matter, were tested to evaluate UPE stabilisation times and responses to light, showing potential to distinguish organic from conventional produce. Lastly, biological fluids and stains were investigated to explore the detection limits

of the system. These findings collectively underscore the potential of UPE analysis for diverse forensic applications, offering insights into a new forensic perspective.

Brief Analysis of The Effect of Paper Type and Storage Conditions on Ink Aging 11:00 - 11:00

D. Salkım İşlek[1], E. Kiriş[1], E.H. Yükseloğlu[1], E. Köse[1]

[1]Istanbul University-Cerrahpasa Institute of Forensic Sciences and Legal Medicine, Department of Science, Istanbul, Turkey

Abstract Body: Document forgery is one of the most common types of crime in the forensic sciences field. One of the methods used to detect this type of crime is ink age estimation. In forensic document examination, ink age determination is one of the most important and controversial issues. The main reason for is the unknown factors related to the document, such as the type of paper, writing instrument, and storage conditions. When examining studies on ink aging analysis, the majority are based on the analysis of archives created with a single writing instrument on 80 g/m² paper. However, considering the flow of ordinary life, the type of paper and the storage conditions of the suspicious document sent to experts may not match the archive created in the laboratory. This study aims to examine the effect of paper type and document storage conditions on ink aging. In this study, archives created using five different brands and models of blue ballpoint pens and A4 office papers with three different weights of 70, 75, and 80 g/m² were stored in transparent and envelope files. The ethylene glycol observed in the archive samples was analyzed with GC-MS, and the RPA values of the archives were compared.

Forensic Discrimination of Nicotine Content in Cigarettes Using RGB Analysis 11:00 - 11:00

R.G. Sadauki[1], O. Simsek[2]

[1]Independent Researcher, Biotechnology, Istanbul, Turkey, [2]Üsküdar University, Faculty of Engineering and Natural Sciences, Department of Chemical Engineering, Istanbul, Turkey

Abstract Body: This study employed a rapid and sensitive thin-layer chromatography (TLC) method to evaluate the nicotine content in 5 popular cigarette brands and 5 non-brand tobacco from local markets (tobacco shops). A novel software was utilised to differentiate the nicotine content by assessing intensity profiles of red, green, and blue (RGB) attributes, providing a comprehensive approach to thin-layer chromatogram image analysis (TLC-IA). The TLC separation was carried out on a plastic sheet coated with silica gel 60, without a fluorescent indicator, using a mobile phase composed of ethyl acetate, methanol, concentrated ammonia, and distilled water in a ratio of 80:25:0.2:15.8 (v/v/v/v). Following chromatographic development, we scanned the chromatograms into a computer using a standard office scanner. RGB intensity profiles were then made and analysed using custom software that was built along the development line of each sample. The nicotine profiles derived from different manufacturers showed significantly varied patterns in most cases.

The results indicated substantial variability in nicotine content among the cigarettes analysed yet were in good agreement with the nicotine concentrations stated on the branded product labels.

Urea & HS-CRP Suitability for Septic Death Diagnosis Using Vitreous Humor 11:00 - 11:00

E. Montanari[1], A. Montana[2], E. Esposito[1], F. Filippucci[1], F. Alessandrini[2], J. Sabbatinelli[3], M. Sbriscia[4], F.P. Busardò[5]

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Abstract Body: **Background:** Septic deaths are challenging in forensics because of scarce pathognomonic aspects, so specific markers would aid in daily practice. Vitreous humour, being an uncontaminated fluid, can provide useful information. This study aims to identify vitreous humour markers of sepsis.
Methods: One hundred-eighteen vitreous humour samples (60 males & 58 females; mean age = 69.5 yrs; PMI range = 4-187 hrs), from the archive of the Forensic Unit of Marche Hospital, were analyzed. This population was divided into two case groups with pre-mortem radiological positivity for pneumonia (chest-RX = 30 & chest-TC = 22) and a control group characterized by negative RX & TC & no sepsis at autopsy (n=66). Samples were stored at -80°C until analyses. The enzymatic autoanalyzer test quantified hs-CRP, procalcitonine, glucose, acid lactic & Urea. The Kruskal Wallis Test corrected with Bonferroni was performed to compare marker concentrations in the three groups.
Results: hs-CRP and Urea proved to be suitable for septic death diagnosis. While Urea could discriminate between RX positive & NO septic and TC positive & NO septic with statistically significant *p-values* [respectively: *p=0.0011 and p=0.*005], hs-CRP didn't show the same discrimination power [*p=0.012 & 0.*010]. No statistically significant differences were registered for the rest of the markers.
Conclusions: The markers suitable for septic death diagnosis are Urea and hs-CRP. Urea presented more significant *p-values* compared to hs-CRP in finding differences among case groups and the NO septic group. Acid lactic, glucose and procalcitonin are not suitable for septic death diagnosis.

Airborne Particle Detection on Micro-Structured Surface: A Novel Approach to Improving Resolution in Cross-Border Security 11:00 - 11:00

G. Schirinzi[1], A. Valsesia[1]

[1]European Commission, Joint Research Centre (JRC), Ispra, Italy

Abstract Body: Illicit substances remain one of the most significant cross-border threats within the EU, posing serious risks to public health and security. Among these, two classes of substances demand particular

attention at border control: drugs and explosives. Their potential impact necessitates rigorous scrutiny, especially at customs checkpoints, post offices, and airports. One of the primary strategies to combat illicit trafficking is "early" detection during transport. Conventional surface sampling methods for the detection of illicit substances generally involve the use of an engineered swab and subsequent analysis by ion mobility spectrometry. However, this approach has significant limitations, primarily due to the swab's inefficiency in collecting and desorbing substances, as well as its tendency to primarily collect larger dust particles. In this context, this work seeks to transform the paradigm of illicit substance sampling by focusing on the airborne fraction, exploiting an aerosol collection device. By integrating it with a micro-structured surface, the sampled substances can be analyzed with orthogonal analytical techniques, including spectroscopy and mass spectrometry, thus providing a complete and accurate characterization. By leveraging this new approach, it will be possible to enhance the detection of traces of illicit substances offering a more effective and efficient solution for border security, especially at the pre-screening stage. This approach, by improving the ability to detect air traces without opening packages, could reduce the risks associated with handling potentially hazardous materials and streamlines the entire process at critical checkpoints such as customs, airports and postal services.

08: Forensic Medicine and Toxicology: Toxicology
11:00 - 11:45 Auditorium

Poster Session Wednesday - Forensic Medicine and Toxicology: Toxicology

Development of an Electrochemical Screening Method for Isotonitazene 11:00 - 11:00

S. Vietti[1], *L. Dennany*[1]

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Abstract Body: Forensic drug and toxicological analysis face ever increasing challenges with novel psychoactive substances (NPS), specifically synthetic opioids. Indeed, the need for rapid, portable, sensitive, and selective detection forensically is one of the forefront research topics within current sensor development. However, many NPS, including nitazenes, are not routinely detected using presumptive or screening methods, which can be problematic for law enforcement agencies and forensic scientists. This study evaluates a potential approach for a presumptive detection method of isotonitazene (iso), a potent synthetic opioid, as a proof-of-concept for the screening of samples thought to contain nitazenes. A systematic analytical method development using electrochemical approaches has been undertaken using iso as a model substitute for nitazenes. In addition, the real-world effectiveness of this developing method will be investigated through comparison with gold standard techniques such as gas chromatography-mass spectrometry. Avenues will be explored on how this new process might be integrated into current investigative processes and the future potential for detection and screening of other NPS in a simple and straightforward manner. Considerations for analyzing street drug samples and biological matrices using this method will also be explained.

A Dilute-and-Shoot LC-MS/MS Method for Analyzing Etomidate Analogues and Their Major Metabolite in Urine Samples from Drug Testing Cases 11:00 - 11:00

C.-W. Chan[1]

[1]Hong Kong Special Administrative Region Government, Government Laboratory, Forensic Science Division, Hong Kong, China

Abstract Body: The misuse of etomidate, an anaesthetic, has emerged locally in Hong Kong since late 2023. Drug seizures indicate that it is being added to a liquid and consumed through vaping devices. Subsequently, etomidate analogues such as metomidate, isopropoxate and propoxate have also been identified. This presentation introduces the validation of a simple dilute-and-shoot LC-MS/MS method for the qualitative and quantitative analysis of etomidate, metomidate, propoxate, isopropoxate, and their major metabolite, etomidate acid, in urine for forensic applications. The technique effectively identifies and quantifies these etomidate analogues and their major metabolite in urine samples from drug testing cases. The results would help establish cutoff values for these analytes, facilitating routine urine drug testing.

Trends in 'Designer' Benzodiazepine use in Northern Ireland: A Review of the Findings in Toxicology Samples Submitted to Forensic Science Northern Ireland 2019 to 2024. 11:00 - 11:00

C. Snape[1], *M. Jeffers*[1], *A. Quinn*[1], *W. Greer*[1], *S. Conlan*[1], *A. Agnew*[1], *J. Johnston*[1], *N. Stevenson*[1]

[1]Forensic Science Northern Ireland, Alcohol, Drugs & Toxicology, Carrickfergus, United Kingdom

Abstract Body: The prescription rate for diazepam in NI is higher per capita than any other part of the UK. With such high levels of prescribing, there is the potential for overuse, addiction and sourcing of benzodiazepines illicitly; often sold as fake diazepam. The inherent danger with illicitly sourced drugs is their unknown composition, which carries the risk of potentially life-threating side effects.

In the years prior to 2019, benzodiazepines typically seen in casework included, but not limited to, diazepam, alprazolam and etizolam. In May 2019, FSNI had its first detection of a designer benzodiazepine, flualprazolam, and henceforth saw the beginning of an ever-changing profile of benzodiazepines detected in samples submitted for toxicological analysis.

In this study, a review of the data generated from toxicology submissions to FSNI in the period 2019 to 2024 was carried out to identify the presence and prevalence of designer benzodiazepines in casework samples. The review encompassed our three main casework categories: driving under the influence of drugs, coronial and criminal toxicology. The results depict a fluid landscape with the detection of a wide range of designer benzodiazepines. Bromazolam was first seen in casework in December 2021 and continues to be the most abundant designer benzodiazepine seen

to date; other detections include flubromazolam, meclonazepam, clobromazolam, flubromazepam, phenazolam and desalkygidazepam.

Three data sets are presented to represent each casework category. The data includes the identity, frequency, average blood concentration for each designer benzodiazepine detected and demographic information relating to subjects sampled.

Role of Histopathology in Diagnosing Delayed Death Due to Poisoning – A Case Series 11:00 - 11:00

A. Sree S B[1,1], T. Pushpanjali[1], M Sangita[1], J. Yadav[1]

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Abstract Body: **Background :** Poisoning is a significant contributor to mortality and morbidity throughout the world. Delayed death after poisoning creates a diagnostic challenge to the autopsy surgeon in diagnosing the cause of poisoning through toxicological analysis.
Methodology : Hospitalized cases of poisoning with more than 5 days of hospitalization and died during the course of treatment were selected. 5 major poisonings were taken into account which included 2 cases of paraquat, one case each of kerosene, organophosphorus and corrosive poisoning. All these cases were subjected to toxicological analysis. The toxic metabolite degrades with due course of hospitalisation and may not be detected on toxicological analysis. In contrast, histopathological examination of these cases showed changes relating to the respective poisoning.
Result : Histopathological changes were evident in delayed deaths due to poisoning, though toxicological analyses were ineffective.
Discussion : Deaths due to poisoning can be diagnosed by toxicological analysis by detecting the toxic substances in blood, urine or other biological samples. But, when the death is delayed and the patient is hospitalized for a long time, these toxins couldn't be detected in the biological samples as they are washed away during the course of treatment. However, histopathological examination of these cases correlates with the history and findings related to poisoning which helps the autopsy team in concluding the cause of death due to poisoning in such cases.

Determination of Ethanol in Blood Using Headspace Gas Chromatography with Flame Ionization Detector (HS-GC-FID): Validation of a Method 11:00 - 11:00

L. Mihretu[1], A. Gebru[1], K. Mekonnen[2]

[1]Mekelle University, Chemistry, Mekelle, Ethiopia, [2]Addis Ababa University, Chemistry, Addis Ababa, Ethiopia

Abstract Body: Ethanol is a common psychoactive substance that has been widely consumed in several parts of the world. Gas chromatography (GC) coupled with a flame ionization detector (FID) has often been used for the determination of blood alcohol concentration. This study aimed to develop and validate a very simple and reliable HS-GC-FID method for the

quantitative determination of ethanol in blood samples. Validation of the method was performed using Bias, Linearity, LOD, Selectivity, Specificity, Precision, Robustness, and Intermediate precision. The method showed an excellent linearity with a correlation coefficient (r^2 = 0.993) was observed in the range from 0.1 to 3.5 mg/mL of ethanol. The percent recovery value was between 91.0 and 109.1 which was an acceptable percent recovery, The precision (repeatability) was reported as 27 % and intermediate precision of the method resulted in 11% and 1 % for two analysts. The limit of detection (LOD) of ethanol was calculated as 0.099 mg/mL and the selectivity of the method for interferents (methanol and acetaldehyde) was selective. Generally, the results obtained confirmed that the method is relatively fast, precise, simple, and robust, and can be used in routine forensic analyses for the determination of blood alcohol concentration (BAC) at a concentration level greater than 0.13 mg/mL.

Toxidromes and Toxicological Analyses in Diagnosing Poisoning: Case Reports 11:00 - 11:00

S. Vucinic[1], N. Perkovic-Vukcevic[2], D. Djordjevic[3], M. Antunovic[3], D. Brkic[4], V. Kilibarda[5]

[1]Medical Faculty University of defense, National Poison Control Centre, Belgrade, Serbia, [2]Medical faculty University of defense, National Poison Control Centre, Belgrade, Serbia, [3]Medical faculty University of Defense, National Poison Control Centre, Belgrade, Serbia, [4]University of Belgrade, Faculty of Agriculture, Belgrade, Serbia, [5]Medical Faculty University of Defense, National Poison Control Centre, Belgrade, Serbia

Abstract Body: Diagnosing poisoning involves recognizing patterns of clinical signs and symptoms known as toxidromes, which are characteristic of specific classes of xenobiotics. Toxidromes help clinicians identify the likely cause of poisoning based on observable clinical indicators, however the forensic medical evidence of poisoning is only confirmation of toxic agent in biological and other samples. Common toxidromes include anticholinergic, cholinergic, opioid and sympathomimetic syndromes, each with distinctivefeatures. Once a toxidrome is identified, toxicological analyses, such as blood and urine tests, are used to confirm the diagnosis.
Aim: Through case reports show the importance of toxidromes in clinical orientation about the possible causative agent and similarities which may inflence the decision for treatment.
Methodology: Retrospective analysis of three cases of poisoning, toxic syndromes, clinical history, diagnostic parameters and therapeutic measures.
Results: 1. A 28-year old patient, hospitalized with chlorpyrifos poisoning, had typical muscarinic and nicotinic syndrome with analytical confirmation (chlorpyrifos in blood 1,8 mg/L). 2. A 61-year old presented in coma, with hypertension, tachycardia, rales and tonic-clonic convulsion, resembling cholinergic toxidrome. However toxicological anylyses showed bifenthrin in blood. 3. A 62-year old was hospitalized in coma. Different toxidromes were possible, but dimethoate was confirmed in blood. When clinical presentation is atypical forensic confimation is imperative.
Conclusion: Integrating clinical assessment with laboratory results enchances diagnostic accuracy, guiding appropriate and timely management of the poisoned patient.

Uncommon Evidence: Marijuana Detection from Beard Hair in a Detention Case 11:00 - 11:00

A. Barbaro[1,2], *A. La Marca*[1]

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Abstract Body: Marijuana, the most widely consumed illicit drug globally, contains the psychoactive compound delta-9-tetrahydrocannabinol (THC), responsible for its mind-altering effects. After use, THC is rapidly metabolized, with a variable half-life depending on frequency of consumption—ranging from 1 to 2 days for occasional users to up to 10 days in chronic users. THC metabolites can be detected in blood and urine for a few days to weeks, while hair analysis provides a much longer detection window, potentially up to several months. This long-term overview is achieved through analytical methods like Gas Chromatography-Mass Spectrometry (GC-MS), known for its sensitivity and specificity.

In a recent forensic case involving a detainee, traditional hair analysis was not possible due to a shaved head, leaving beard hair as the only available sample. Like scalp hair, beard hair can store drug evidence over time, though its use in forensic investigations is relatively rare. GC-MS analysis of the beard hair enabled the detection of THC metabolites, providing vital information despite the limited sample options. This case emphasizes the importance of considering alternative biological specimens when conventional sources are inaccessible and showcases the adaptability of forensic techniques. It also underlines the robustness of forensic toxicology in accurately reconstructing a history of drug use, even under challenging conditions such as those encountered in detention settings.

09: Interpretation: Forensic Statistics
11:00 - 11:45 Auditorium

Poster Session Wednesday - Interpretation: Forensic Statistics

Y-STR Genetic Diversity Among Somali Males in Four Selective Cities 11:00 - 11:00

A. Mohamed[1]

[1]Bureau of Forensic Science, Forensic Biology, Garowe, Somalia

Abstract Body: In Somalia, the scientific handling of sexual assault cases requires the establishment of a legislative framework and a forensic institution. In 2016, the Sexual Offense Bill was enacted, resulting in the establishment of the Bureau of Forensic Science (BoFS) in 2017. This organization is responsible for supplying DNA evidence to assist gender-based assault cases and currently functions as Somalia's principal forensic science institution. The research examines Y-chromosome STR profiles of 130 male suspects from Mogadishu, Garowe, Bosaso, and Galkayo to evaluate genetic diversity and ancestral connections.

Using the Yfiler® Plus PCR Kit, DNA samples underwent amplification and

capillary electrophoresis on a 3500, with results analyzed via GeneMapper ID-X software. The 27 Y-STR markers evaluated revealed genetic diversity and homogeneity across cities: Mogadishu displayed high homogeneity at marker DYS635, Garowe exhibited familial ties at DYS390 and DYS456, Bosaso showed complete homogeneity at DYS635 and DYS437, and Galkayo indicated diverse ancestry.

These findings contribute essential data for forensic applications, helping narrow down suspects based on Y-STR profiles and offering insights into Somali population genetics, with implications for historical migrations and social structures. Acknowledging its limited sample size, the study calls for broader research to deepen understanding of Y-chromosome diversity nationwide.

Stop Using Similarity-Score-Based Likelihood Ratios 11:00 - 11:00

R.O. Ribeiro[1,2], P. Weber[1], G.S. Morrison[1]

[1]Aston University, Forensic Data Science Laboratory, Birmingham, United Kingdom, [2]Brazilian Federal Police, National Institute of Criminalistics, Brasília, Brazil

Abstract Body: When calculating a source-level likelihood ratio, it is essential to take account not only of the similarity between the items of interest but also their typicality with respect to the relevant population. We therefore argue that methods for calculating likelihood ratios that do not take into account typicality should not be used.

In this presentation we demonstrate that the similarity-score-based method does not take account of typicality. We therefore argue that it should not be used. We argue that methods that do take account of typicality should be used instead.

We demonstrate that the common-source method does take account of typicality. We also explore other methods that have been proposed for taking account of typicality, including the “percentile-rank” method. The “percentile-rank” method converts the feature values to their rank values before calculating a score.

We explore the behaviour of all these methods (similarity-score-based, common-source, “percentile-rank”) using simulated data.

Epidemiological and Forensic Medical Aspects of Electrocutions 11:00 - 11:00

A. Ben Hmidene[1], M. Bellali[1], M. Shimi[2], M. Allouche[1]

[1]Charles Nicolle University Hospital center, Tunis, Tunisia, [2]Faculté de médecine de Tunis, Tunis, Tunisia

Abstract Body: **Background:** Electrocution, while extensively studied internationally, remains poorly documented in Tunisia. The objectives of our study were to describe the epidemiological profile, injury characteristics, and circumstances surrounding electrocutions.
Methods: This retrospective descriptive study was conducted over a

period of four years, from January 1, 2019, to December 31, 2022, at the forensic medicine department of Charles Nicolle Hospital in Tunis, Tunisia. It focused on all cases of death by electrocution that underwent forensic autopsy.
Results: The findings revealed a male predominance (sex ratio 9.5) with an average age of 39.68 years. Most victims were employees (61.1%), with incidents occurring predominantly in the summer (44%) and in the Greater Tunis area (80.1%). Accidental electrocution accounted for 97.6% of cases. High-voltage current was responsible for 52.5% of the electrocutions. In 64.3% of cases, the causal agent was a bare cable. Most deaths occurred within the first 24 hours (79.4%), with no victims transported by emergency medical services. Injury analysis showed electrical marks in 71.4% of cases, with entry and exit wounds observed in 29.4% of victims. Severe electrical burns were present in 34.1% of cases, the majority being third-degree burns (67.4%). Additionally, 4.8% of victims exhibited crocodile skin-like lesions, 7.1% had charring injuries, and 3.2% displayed vascular arborization patterns. Associated traumas were reported in 34.9% of cases. However, toxicological and histopathological analyses were rarely performed.
Conclusion: The diagnosis of electrocution is often challenging and relies on a combination of contextual data, autopsy findings, and additional examinations.

Does the Quality and Quantity of Captured Finger Marks Improve With Experience? An Investigation Into In-House Training of Fingerprint Examiners 11:00 - 11:00

F. McGrath[1], *C. Mullen*[1], *B. Gaynor*[1]

[1]Forensic Science Ireland, Kildare, Ireland

Abstract Body: Effective training is essential for all fingerprint staff; it ensures that high standards and best practice are adhered to, which in turn contributes to producing accurate and trustworthy results within the forensic community and for use in court.

The Fingerprint section of AGS (An Garda Siochana) merged with FSI (Forensic Science Ireland) in 2019, with the goal of civilianising the section. Since this merger, a key objective of the section has been the training new of staff. Training for all fingerprint staff is provided in-house and is led by the experience of the current AGS members.

This study provides an insight into the quality and quantity of marks captured in a fingerprint development lab with respect to an examiner's level of experience. Using a sample of over 300 processed cases, the number of marks captured was recorded for serious and non-serious crimes and tracked to determine if they were of sufficient quality to be searched on AFIS (Automated Fingerprint Identification System). Trends were monitored over different periods of examiner experience (e.g. 0-3 months, 4-6 months, etc.) to determine if the number of marks increased or decreased over time and if the quality of their marks improved over time, based on how many marks were searched by experienced comparison experts. The finding of this study are discussed in relation to considerations for training of fingerprint examiners

04: DNA and Body Fluids: Evaluative Reporting of DNA Findings
11:00 - 11:45 Auditorium

Poster Session Wednesday - DNA and Body Fluids: Evaluative Reporting of DNA Findings

Evaluative Reporting of DNA Findings and Activity Level in a Swedish Murder Case 11:00 - 11:00

S. Jansson[1], *R. Hedell*[1]

[1]Swedish Police Authority, National Forensic Centre, Biology unit, Linkoping, Sweden

Abstract Body: In Sweden, as in most other countries, the source of the DNA evidence is generally not questioned in court. However, questions of how and when the DNA was deposited is much more common, but also harder to answer. A significant aspect is that the evidential value for sub-source level cannot be carried over to activity level. Calculations for results given activity level propositions must be performed separately. The evaluation is done within a stated framework of circumstances, and often the source of the DNA is not disputed. In 2023, a pregnant woman was found strangled in her home. Her partner (not co-habitant), quickly became a suspect and was arrested. DNA was obtained from under the victim's fingernails, and the resulting DNA results could be linked to the suspect. After being presented with these results, the prosecutor requested the National Forensic Centre (NFC) to perform an evaluation of the results given activity level propositions. NFC has dedicated reporting officers for activity level assessments. Each year questions regarding DNA findings are raised in a number of criminal cases and the investigations are provided with information on DNA transfer, persistence, prevalence and recovery (TPPR). For this particular case, an evaluation with activity level propositions was carried out using probability calculations and a Bayesian network. The findings and conclusions reported were of crucial value for the outcome of the verdict.

Evaluating the evidence – Case studies in Forensic Science Ireland 11:00 - 11:00

P. Kelly[1], *C. Murphy*[1]

[1]Forensic Science Ireland, Kildare, Ireland

Abstract Body: Evaluative reporting provides a transparent, balanced and robust approach to evidence interpretation. Forensic Science Ireland utilises a logical framework for evaluating forensic evidence which can assist in assessing the true significance of the findings in the context of a case.

Using real casework examples of alleged sexual assaults, cases will be discussed in detail showing how case strategy and/or evaluations can develop, change and evolve with additional information as the case progresses. The presence of body fluids is often critical in cases of alleged sexual assault. The importance of the absence of body fluids will also be shown to be potentially critical.

The objective of this talk is to demonstrate that evaluation can be carried

out in complex evolving sexual assault cases and to outline how it can be done.

04: DNA and Body Fluids: DNA Typing with Potential Forensic Applications
11:45 - 12:45 Auditorium

DNA and Body Fluids: DNA Typing with Potential Forensic Applications

You Can Only Test One – A Study of over 11,000 NGS Reactions for Skeletal Materials 11:45 - 12:15

S. Edson[1], K. Meyers[1], S. Barritt-Ross[2]

[1]SNA, International, Armed Forces Medical Examiner System - Armed Forces DNA Identificaiton Laboratory, Dover Air Force Base, United States, [2]Armed Forces Medical Examiner System - Armed Forces DNA Identification Laboraty, Past Accounting, Dover Air Force Base, United States

Abstract Body: Next Generation Sequencing (NGS, *aka* MPS) of the mitochondrial DNA genome (mtG) has gained predominance in many forensic laboratories for use with degraded skeletal samples. Optimization of the NGS process begins with the selection of the ideal skeletal element coupled with the most efficient DNA extraction protocol. The Armed Forces Medical Examiner System - Armed Forces DNA Identification Laboratory (AFMES-AFDIL) implemented the use of an NGS capture protocol for the mtG in 2016. The process was originally designed in-house to test formalin treated remains from the Korean War. Since then, the process has been modified and improved over time to produce results in over 75% of those samples tested.

To optimize the testing strategy, over 11,000 individual DNA extraction events were assessed for a wide range of variables: location of recovery, time since death, skeletal element, DNA extraction protocol, concentration, and overall success. The choice to seek out the best element for DNA testing is a long-standing goal in forensics and is oft debated. The goal of this study is to present research that will aid in the streamlining of NGS processes for skeletal remains. NGS/MPS is an expensive testing strategy and is often out of reach of a regular crime lab, making the testing of retained skeletal remains unfeasible or extremely limited. This study will provide guidance to the forensic community as a whole for selection of an optimal skeletal element for NGS/MPS testing as well as recommendations for a DNA extraction protocol.

A Proteomic Workflow for Body Fluid Classification and Source Attribution via Single Amino Acid Polymorphisms 12:15 - 12:30

S. Alex[1], T. Shehata[2], S. van Lierop[3], M. Blom[2], M. de Puit[4]

[1]Netherlands Forensic Institute, Chemical Physical Traces (CFS) R&D, Den Haag, Netherlands, [2]University of Amsterdam, Amsterdam, Netherlands, [3] Netherlands Forensic Institute, Digital & Biometric Traces (DBS), Den Haag, Netherlands, [4]Netherlands Forensic Institute, Chemical Physical Traces (CFS), Den Haag, Netherlands

Abstract Body: Identifying and tracing the source of body fluids in forensic mixture samples is challenging, especially when mixtures contain fluids from multiple donors. Ideally, researchers aim to identify the different types of body fluid(s) in the mixture and link it back to the donor. In this proof-of-concept study, we introduce a proteomics-based approach using liquid chromatography-tandem mass spectrometry (LC-MS/MS) in data-independent acquisition (DIA) mode, aiming to both classify body fluids with unique protein markers and to use single amino acid polymorphisms (SAPs) for source attribution. Our proteomic profiling successfully identified distinctive protein signatures across blood, semen, saliva, urine, and vaginal fluid, enabling accurate classification even within mixture samples. We could also demonstrate reliable differentiation between fluids, while SAPs in proteins (notably in saliva) show significant potential for linking fluids to individual donors.

Single-Cell Phenotyping and DNA Profiling to Deconvolute Biological Mixtures Originating From Multiple Contributors 12:30 - 12:45

V. Knitlhoffer[1], A. Goldson[1], K. Brown[2], A. Behera[3], M. Chen[4], G. Zouganelis[5], N. Dawnay[6], L. Dawson[7], I. Macaulay[1]

[1]Earlham Institute, Norwich, United Kingdom, [2]University of Portsmouth, Portsmouth, United Kingdom, [3]Edge Hill University, Liverpool, United Kingdom, [4]University of Edinburgh, Edinburgh, United Kingdom, [5]University of Derby, Derby, United Kingdom, [6]Liverpool John Moore's University, Liverpool, United Kingdom, [7]James Hutton Institute, Aberdeen, United Kingdom

Abstract Body:

The analysis of DNA in evidential samples arising from multiple contributors remains a significant hurdle in forensic science. Single-cell methods - which can separate individual cells from complex mixtures could be a valuable tool for the deconvolution of mixed samples - especially higher order mixed samples.

As part of a multidisciplinary project resulting from a UKRI Sandpit in Forensic Science for the Justice System, we are applying single-cell approaches analyze the DNA of individual cells using next-generation and conventional DNA profiling approaches. Using imaging-based cell sorting from artificial mixtures of cells from six individuals, we demonstrate that both cell images and partial DNA profiles can be recovered including a significant proportion of commonly used STR loci. NGS profiling further enables capture of additional biogeographical and phenotyping SNPs. overall we demonstrate the ability to distinguish individual contributors to the mixture.

We envision future developments of this approach enabling near-complete capture of DNA profiles from thousands of individual cells from a complex mixture, identifying both major and minor contributors and, in parallel, capturing the cell type (e.g. sperm cells and seminal/vaginal epithelial cells) from which the DNA profile was obtained. To support this, we are exploring the use of multi-omic sequencing approaches (transcriptomics/epigenomics), custom microfluidics to isolate individual cells and AI-based approaches that will allow the classification of cell types

based on imaging data acquired during cell sorting enabling further linkage between cell-of-origin and the resultant DNA profile.

08: Forensic Medicine and Toxicology: Toxicology
11:45 - 13:00

Forensic Medicine and Toxicology: Toxicology

The Effect of Bacteria on the Concentrations of Cocaine and Metabolites on Dried Blood Spot 11:45 - 12:00

S. Çiftçi Karaot[1], M. Kuloglu Genc[1], S. Zengin[1], T. Tekin Bulbul[1], S. Mercan[1], G. Aygun[2]

[1]Istanbul University-Cerrahpasa Institute of Forensic Science and Legal Medicine, Department of Science, Istanbul, Turkey, [2]Istanbul University-Cerrahpasa Cerrahpasa Faculty Of Medicine, Department Of Basic Medical Sciences, Department Of Medical Microbiology, Istanbul, Turkey

Abstract Body: Dried blood spot (DBS) is an alternative technique for drug analysis and needs to clarify the challenges during the process. This study aimed to examine the effect of bacteria on the determination of cocaine and its metabolites from DBS to reveal the possible effects of bacterial contamination. A certified reference blood sample containing cocaine, benzoylecgonine, and cocaethylene was used for generating DBS, contaminated with both bacterial mixtures (*E. coli* and *Enterococcus* spp.) and separately, and compared with non-contaminated DBS samples in triplicates in three different environments (indoor and outdoor environments, in plastic bags), at 5 different time intervals (1, 7, 14, 21, 28 days). Quantitative drug analyses were performed using a liquid chromatography-tandem mass spectrometry system after the liquid-liquid extraction method. All three substances lost their stability over time. Cocaine was found to be the most stable substance while cocaethylene was unstable. Recovery results for all analytes were in the range of 66,33-158,32% in indoor samples, 88,99-249,26% in samples stored in plastic bags, and 30,27-275,76% in outdoor samples. In all three environments, the substance concentrations in the samples containing the bacterial mixture were lower than in the samples containing bacteria separately. When comparing the concentrations in samples containing only *E. coli* were higher than only *Enterococcus* spp.. It is thought that this study has unique value as it is the first study showing that the substance concentrations in dried blood spots may vary depending on the bacterial type, storage environment, and time, and will contribute to the future studies.

Effectiveness of Subsequent Wash on the Removal of GSR Particles Amongst *L. sericata* and *C. rufifacies* Larvae 12:00 - 12:15

M.A. Storen[1], M. Harvey[1], X.A Conlan[1]

[1]Deakin University, Life and Environmental Sciences, Waurn Ponds, Australia

Abstract Body: Blowfly larvae (Diptera: Calliphoridae) have been suggested to have practical application as a toxicological target in the forensic sciences. This may be of use where tradition analytical targets are absent and may support detection of toxins, drugs, and gunshot residue. The primary weakness of entomotoxicology is the multitude of experimental procedures and the absence of methodological standardisation. In cases where gunshot residue (GSR) may be present in larval samples bound for toxicological analysis lies a gap in research, as such, this study was performed to inform the development of a standard operating procedure for the preparation of assays for the purposes of informing cause of death investigations. Whole body larval concentrations of marker elements within GSR (Ga, Ba, and Pb) in *Lucilia sericata* larvae were determined, and varying larval washes after the larvae were exposed to a GSR contaminated meat source. *Lucilia sericata* (Meigen) and *Chrysomya rufifacies* (Macquart) larvae were provided pork mince that was shot 4 times at close range, and larvae sampled 12-hourly prior to being washed once, twice, or three times with milli-Q water (3mL). Both the larvae and each respective larval wash were analysed using inductively coupled plasma mass spectrometry (ICP-MS). Toxin concentrations detected within larvae revealed that a minimum of two washes were required to remove external contaminants prior to ICP-MS analysis. In the absence of this minimum threshold for washes, toxin contamination may create bias for reliable analysis and lead to possible false positives in cases where samples are used to inform COD investigations.

Examining the Use of Alternative Light Sources in Medico-Legal Assessments of Blunt-Force Trauma: A Systematic Review 12:15 - 12:30

A. Tyr[1], *N. Heldring*[1,2], *B. Zilg*[1,2]

[1]Swedish National Board of Forensic Medicine, Stockholm, Sweden, [2] Karolinska Institutet, Department of Oncology-Pathology, Stockholm, Sweden

Abstract Body: The ability to analyze blunt-force trauma is crucial for deciphering valuable clues concerning mechanisms of injury and as evidence for medico-legal investigations. The use of alternate light sources (ALS) has been studied over the past decade, and is proposed to outperform conventional white light (CWL) during bruise assessments. In response to the growing interest of the technology worldwide, a systematic review of the literature was conducted according to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) to address the ability of ALS to detect and visualize bruising. From an initial 4055 records identified, ten studies met the eligibly criteria and were selected for this review. Evaluation also included a novel framework, referred to as SPICOT, to further systematically assess both scientific evidence and risk of bias in forensic literature. Analysis reveals that narrowband wavelengths within in the infrared or ultraviolet spectral ranges do not significantly outperform CWL in visualizing or detecting bruising. However, wavelengths within the visible spectrum, particularly 415 nm combined with longpass or bandpass yellow filters, are more effective. However, the majority of selected studies only address the sensitivity of ALS, and therefore, results may only be considered valid when the location of a bruise is known. Further investigation is required to understand the specificity of ALS, in particular

how the use of topical cosmetic products, previous wounds/scar-tissue, tattoos, moles and freckles may affect detection. The ethical concern regarding the interpretation of enhanced visualized trauma should also be considered in prospect discussions prior to implementing ALS into routine practice. Nevertheless, this review finds that narrowband ALS within the visible spectrum demonstrates potential for improved injury documentation, outperforming CWL in the detection and visualization of bruising.

Addressing Courtroom Interpretation and Communication Challenges With Toxicology Reports Issued by Forensic Science Ireland 12:30 - 12:45

L. Moynihan[1]

[1]Forensic Science Ireland, Toxicology Section, Celbridge, Co. Kildare, Ireland

Abstract Body: The majority of casework carried out by the Toxicology Section at Forensic Science Ireland involve incidents of alleged sexual assault. Potential drug facilitated sexual assault (DFSA), the ability to provide informed consent and the impact of drugs/alcohol on an individual can be relevant in these case types. DFSA may be described as either proactive or opportunistic; proactive where an incapacitant is administered to a person without their consent, opportunistic where a person has voluntarily consumed drugs or alcohol and is targeted while in an incapacitated state.
FSI analyses blood and urine samples for the presence of alcohol and a range of targeted drugs. A challenge faced by reporting scientists is how to effectively communicate the meaning and limitations of toxicology results in a manner that is easily understandable by the court while remaining in line with international best practise. Courtroom experience has shown that providing purely analytical results without the appropriate interpretative information can be misleading to a non-scientific audience.
To address this issue, an alcohol interpretation appendix was added to Toxicology reports several years ago. This provided information on general clinical signs and symptoms that may be observed at different blood alcohol concentrations. Following positive feedback from stakeholders, Toxicology reports have recently been expanded to include drug information/ interpretation appendices developed in-house.
This talk will highlight the queries raised in court cases which led to the development of this interpretation and communication framework. Casework examples demonstrating the structure and content of alcohol and/or drug interpretations will be presented.

Development of a Nano-Based Detection Technique for Rapid and Sensitive Identification of Tetrahydrocannabinol 12:45 - 13:00

A. Kavad[1], *A. Kavad*[2]

[1]Rashtriya Raksha University, School of Behavioural Sciences & Forensic Investigations, Gandhinagar, India, [2]Forensic Talents India, Forensic Science, Ahmedabad, India

Abstract Body: Tetrahydrocannabinol (THC) is the primary psychoactive component of cannabis. The increasing prevalence of THC underscores the need for reliable and efficient detection methods to ensure compliance with legal standards and enhance public safety. This study presents the development of a novel nano-based detection technique tailored for the rapid and sensitive identification of THC. Utilizing functionalized gold nanoparticles (AuNPs), we designed a colorimetric assay that exploits the unique optical properties of nanoparticles to achieve high sensitivity and specificity. The assay was optimized for various conditions, demonstrating a remarkable detection limit in the low nanomolar range, significantly surpassing traditional detection methods. Additionally, specificity experiments revealed that the technique effectively distinguishes THC from other cannabinoids and common interferents present in complex matrices. The integration of this nano-based approach allows for portable and user-friendly applications, making it suitable for on-site testing in law enforcement and clinical settings. This research highlights the potential of nanotechnology in enhancing the accuracy and efficiency of THC detection, thereby contributing to the development of regulatory frameworks and ensuring the safety. In conclusion, the proposed novel method offers a promising tool for both scientific and practical applications in the emerging field of Forensic toxicology and Forensic nanotechnology.

03: Digital Evidence: Mobile Device, Network and Location Forensics
11:45 - 12:45 Liffey Hall 1

Digital Evidence: Mobile Device, Network and Location Forensics

Location Traces: Their Evolution and Contribution to Investigations 11:45 - 12:00

C. Berger[1]

[1]Université de Lausanne, Ecole des Sciences Criminelles, Lausanne, Switzerland

Abstract Body: Location traces are highly informative. They contribute to crime investigations, serve as evidence in a court of law, and prove useful in other contexts such as crime analysis or forensic intelligence.

While the importance and volume of location traces have grown significantly with digital advancements, they existed long before the advent of the digital age.
This presentation examines how location traces have evolved over time, particularly with the rise of digital evidence, and explores their potential contributions to forensic science.

Several practical examples will be presented, which highlight the characteristics of location traces - their sources, nature and volume - as well as the potential they hold to address various inquiries.
These examples will be drawn from both physical and digital situations, demonstrating the versatility of location traces.
Incidentally, the presentation will emphasize several challenges that can be faced when considering them.
Finally, it will also encourage forensic scientists to take a fresh look at the spatial dimension of crime as one of its essential but underdeveloped components.

The Silent Witness: Uncovering Forensic Value in WhatsApp Event Logs 12:00 - 12:15

M. Polastro[1]

[1]Brazilian Federal Police, National Institute of Criminalistics, Brasilia/DF, Brazil

Abstract Body: This study explores WhatsApp event log files, an underexplored source of evidence in mobile forensic investigations. These logs, located in /data/data/com.whatsapp/files/Log, provide a comprehensive timeline of user interactions, including app activation, message exchanges, contact synchronization, and deletion activities. Unlike SQLite databases commonly analyzed by forensic tools, these logs contain unique information, such as chat deletion timestamps and user interactions not recorded elsewhere. Accessing these logs requires root permissions or advanced data extraction methods, which helps ensure their integrity against tampering.

Experimental simulations conducted on a rooted Android device running WhatsApp demonstrated the forensic value of these logs, particularly in complementing traditional analysis techniques. To operationalize this discovery, a custom event log parser was developed and integrated into ALEAPP (Android Logs, Events, and Protobuf Parser), a widely adopted digital forensics tool. This integration enhances ALEAPP's capabilities by uncovering artifacts often missed by commercial tools, broadening the scope of mobile forensic investigations.

The findings underscore the importance of exploring unconventional data sources to strengthen forensic methodologies. By integrating a custom parser into the widely used ALEAPP tool, this research addresses the need for robust, open-source solutions in digital forensics.

The presentation will detail the implemented parser, key forensic artifacts identified, and the role of event logs in addressing investigative challenges. Future research will focus on analyzing similar event logs on iOS devices to identify comparable forensic artifacts. These results will be integrated into iLEAPP (iOS Logs, Events, and Plists Parser), extending cross-platform forensic capabilities and advancing the field of mobile forensics.

Determining the Unlock Code of Mobile Devices Using Fingermarks in an Operational Context 12:15 - 12:30

M. Cloutier[1,2], *M. Bérubé*[1,3], *B. Daoust*[1,2]

[1]Université du Québec à Trois-Rivières (UQTR), Département de biochimie, chimie, physique et science forensique, Trois-Rivières, Canada, [2]Groupe de Recherche en Science Forensique, Trois-Rivières, Canada, [3]Chaire de recherche UQTR en forensique numérique, Trois-Rivières, Canada

Abstract Body: With the rise of new technologies, mobile devices have become omnipresent, holding a wealth of crucial information about people's lives. Consequently, there is a growing awareness of the need to safeguard this information, leading more individuals to secure their data using codes such as PINs or unlock patterns. While this code offers protection to users, it also poses a challenge to police operations. Police organisations often turn to software developed by specialised companies to

unlock devices for further investigation. These methods require significant resources and are not accessible to all law enforcement organisations. Therefore, developing a simple and rapid method that would enable them to determine the code quickly, without the use of specialised equipment or the user's collaboration can become valuable.

The goal of this project is to assess the feasibility of reconstructing the unlock code with the fingermarks left on the screen of the device, despite the presence of fingermarks linked to other everyday manipulations carried out after the code has been entered, such as writing a text message or browsing an application. Using coaxial light to detect fingermarks, an analysis of the position and shape of the latter left on the screen is proposed to identify which traces belong to the unlock pattern or the PIN, to which digits they are associated, and establish whether their order can be ascertained by examining the depletion of the fingermarks.

Exploration of Device Traceability Inspection Methods Based on Videos and Images 12:30 - 12:45

H. Xinyu[1], *L. Zhigang*[1], *X. Lanchi*[1], *L. Wei*[1], *X. Lei*[1], *S. Huaqing*[1], *L. Zhihui*[1]

[1]Institute of Forensic Science, Ministry of Public Security, Beijing, China

Abstract Body: Criminals use smartphones and other electronic devices to capture and disseminate inappropriate and false images and videos, which pose a serious threat to public safety and order, infringe upon citizens' personal privacy, and cause to a series of adverse social effects. Therefore, the device traceability technology based on videos and images is a key research direction in the field of forensic science, and it has strong scientific research significance and practical significance in combating illegal and criminal activities. This article is oriented towards practical application, combining the prominent image tracing issues in the field of forensic science in recent years, to explore how to associate video or image files and related device in actual cases. The primary principle is to extract the noise template of the device as a device fingerprint, compare it with the noise residuals of the image or video under examination, and calculate the confidence level using methods such as NCC (Normalized Cross-Correlation), PCE (Peak Correlation Energy), and SiameseModel, so as to determine the correlation between the shooting equipment and the image. The author team has drafted relevant industry standards, providing appraisal opinions by analyzing three aspects: the physical properties of the device, the imaging characteristics, and the source features. At the same time, the results were transformed into an application platform, which played an important role in the case of Chen's injury, in the hope that the content of this paper would provide reference and reference for relevant theoretical research and practical application.

12: Scenes of Crime: Fire and Explosion Investigation
11:45 - 12:45 Wicklow Hall 1

Scenes of Crime: Fire and Explosion Investigation

Fireworks Explorer: Revolutionizing Forensic Analysis of Fireworks Remnants 11:45 - 12:00

S. Ariëns[1]

[1]Netherlands Forensic Institute, Chemical and Physical Traces, The Hague, Netherlands

Abstract Body: The use of heavy fireworks for intimidation between criminal groups, committing explosive attacks, and violence against first responders has significantly increased in recent years. At such crime scenes, snippets of the used fireworks are often found. It may be important for investigations to determine the type of fireworks these remnants originated from. Previously, this identification was conducted by a select group of experienced police officers, with the expertise of the Netherlands Forensic Institute (NFI) also being utilized.
In collaboration with the police, the NFI has developed an application in recent years called the 'Fireworks Explorer' (www.vuurwerkverkenner.nl). Users can upload images of fireworks remnants into the application, after which an algorithm suggests the possible types of fireworks these remnants could be from. This tool facilitates faster and more accurate connections between discovered remnants and the sources of hazardous explosives. Furthermore, the application allows users to find detailed information on the types of fireworks such as the physical structure and hazardous properties. The application is now in use, and the users are enthusiastic about its capabilities.

This presentation focusses on the development of the application and the potential expansion to other countries and forensic fields.

A Study on the Scientific Analysis of LPG charging Station Explosion Accidents to Identify the Causes of Damage 12:00 - 12:15

S. An[1], *K. Lee*[1]

[1]National Disaster Management Research Institute, Disaster Scientific Investigation Division, Ulsan, Korea, Republic of

Abstract Body: Recently, fires and explosions caused by LPG leaks have become frequent in South Korea. From 2020 to 2022, 45% (112 cases) of gas-related accidents involved LPG, resulting in 126 casualties—the highest among such incidents. As LPG is heavier than air, leaked gas tends to spread near the ground, increasing the risk of fires and explosions compared to gases like LNG.
LPG charging stations are particularly high-risk due to their large storage volumes and urban locations, making strict safety management and adherence to protocols essential. However, accidents during the charging of transport vehicles, such as tank trucks, often occur due to negligence, heightening public anxiety. These accidents not only cause property damage but also harm workers and nearby residents, underscoring the need for thorough investigations and effective preventive measures.
This study examines a recent LPG station explosion during charging operations, scientifically analyzing the accident to identify the root causes of the damage. Based on these findings, practical improvement measures

to prevent similar incidents were proposed. By addressing the identified causes and implementing these measures, this study aims to close gaps in the prevention and response to LPG explosion accidents, contributing to enhanced public safety and reduced damages.

A Study on Application of Simulation Techniques for Analyzing Explosion in Chemical Plants 12:15 - 12:30

K. Lee[1], *S. An*[1], *W. Oh*[1]

[1]National Disaster Management Research Institute, Disaster Scientific Investigation Division, Ulsan, Korea, Republic of

Abstract Body: Explosion accidents often result in significant site damage and the potential loss of various records. This makes it challenging to gather information before and after the incident, as well as to conduct precise analyses during investigations. In this study, 3D and 2D simulation techniques were applied to analyze explosion accidents in chemical plants, focusing on difficult-to-assess factors such as the impact of the explosion, the amount of leaked substance involved, and explosion behavior. The applicability and utility of these techniques were also reviewed.
1. 3D Simulations (CFD): By considering the effects of turbulence, structures, and obstacles, 3D simulations can accurately replicate the explosion process and analyze explosion behavior over time in detail. These simulations show high consistency with actual accident scenarios, providing a scientific foundation for determining the causes of incidents and preventing similar accidents in the future.
2. 2D Simulations: Utilizing simplified empirical models, 2D simulations can rapidly predict explosion overpressure, making them suitable for quickly analyzing damage trends and impact ranges during the response phase or early stages of investigation. Their conservative output also proves useful for risk assessments.
3. The application of these simulation techniques is highly beneficial for chemical accident management—from response to investigation and cause determination. This approach offers practical and efficient measures to prevent similar accidents and devise emergency response plans for workers and local residents.

The Effect of Compressed Air Foam on the Detection of Ignitable Liquid Residues on Fire Debris Samples. 12:30 - 12:45

V. Omondi[1,2]

[1]Crevit Mulier & Co., Forensic Science, Nairobi, Kenya, [2]Anglia Ruskin University, Cambridge, United Kingdom

Abstract Body: Compressed air foam is a substance that is used as an extinguisher delivery system for fire suppression in various fire scene case scenarios. It’s due to its high fire extinguishing efficiency, use of less water hence suitable for areas with no water such as rural areas and its range of large fire suppression has made it receive considerable attention. Therefore, this technology is widely being accepted as an alternative source to water as a fire extinguishing agent which is commonly used because of its surface tension properties making it more efficient.

Unfortunately, there is one study that has been done to investigate whether the introduction of foam to the seat of the fire created any problems in subsequent analyses of fire debris samples using gas chromatography-flame ionization detector. No significant interferences were found from the foam when the samples were analyzed suing activated carbon strips. The only foam component found was limonene. To date there has been no research published as to whether the foam causes any interference on subsequent analyses of accelerant analyses making this study very unique. This study main objective is to prove that no interference is brought about by the introduction of foam during fire suppression and in the analysis of ignitable liquid residues from fire debris sample. This was achieved through the use of gas chromatography-mass spectrometry which is capable of carrying out extracted ion analysis hence able to prove that no significant interferences from the foam.

11: Marks, Impressions and Biometric Traces: Other
11:45 - 12:45 Wicklow Hall 2 (A)

Marks, Impressions and Biometric Traces: Other

From Low-Information Traces to High-Accuracy Hits: A Forensic Multimodal Biometric Framework 11:45 - 12:00

M. Girod[1], *C. Champod*[1]

[1]School of Criminal Justice (Ecole des Sciences Criminelles – ESC), University of Lausanne (UNIL), Lausanne, Switzerland

Abstract Body: Using biometric traces to identify potential donors is a cornerstone of modern forensic science. Biometric systems have been successfully deployed utilizing single modalities, such as fingerprints, facial images, or DNA. As reference datasets associated with individuals have grown extensively, so too has the efficiency of comparison algorithms, ensuring high levels of accuracy. However, despite technological advancements, the hit rate for each modality remains below 100% and is highly dependent on the quality of the submitted trace. When a trace contains very limited discriminating information, the likelihood of identifying a corresponding donor within a reasonably sized list of ranked candidates can be low for any single biometric modality.
This research demonstrates how a multimodal search of low-information traces across different databases can produce a fused hit list with greater accuracy compared to searches conducted using a single modality. The fusion mechanism and its efficiency are validated using three biometric databases—fingerprints, faces, and DNA—scaled to law enforcement datasets. The proposed system consolidates the hit lists obtained from complementary biometric traces, demonstrating its potential for improved investigative outcomes.
In cases where multiple traces (e.g., a low-quality fingermark, facial image, or DNA profile) are collected, potentially left by the same unknown individual, this study illustrates how these fragments of information can be integrated during the investigative phase. It provides an example of a forensic multimodal biometric search, where individual modalities alone may fail to identify the correct source candidate, but their combined use and fusion significantly enhance system accuracy.

Hierarchical Models for Validation of Facial Recognition Algorithms 12:00 - 12:15

K. Andersson[1], *N. Borau*[1]

[1]Swedish National Forensic Centre, Linköping, Sweden

Abstract Body: Automatic facial recognition (AFR) is used at the Swedish National Forensic Centre (NFC) to assist investigations in identification of suspects. By using AFR, a probe image, *e.g.* from CCTV footage, is retrospectively searched against the Swedish mugshot database. While a true match would contribute to the investigation, a false match might have a negative impact on both the investigation and the person falsely matched. Hence, it is of importance to validate the AFR algorithms to make sure that the performance requirements are met.

Validation of AFR algorithms is usually done by estimating parameters such as the false match rate (FMR) and the false non-match rate (FNMR). For the uncertainty to be accounted for in these estimates, statistical inference is often used during validation and commonly so assuming binominal distributions for FMR and FNMR. Two possible problems during the validation are how to account for 1) potential demographic biases in the AFR algorithm, and 2) different dependencies in the data used for validation (*e.g.* due to multiple image pairs involving the same individual).

To address the two problems mentioned above, the use of hierarchical models during the statistical inference might be applied. Hierarchical models are naturally constructed from a Bayesian perspective which allows for prior information to be accounted for. Such information usually exists among forensic experts and could be of great importance when insufficient amounts of data available is a problem. In the present study, the use of hierarchical models for validation purposes with simulated and real data is evaluated.

Digital Measurement of Dimensions of Snap-lock Bags Through Case Photos 12:15 - 12:30

X.E. Tay[1]

[1]Health Sciences Authority, Forensic Chemistry & Physics Laboratory, Singapore, Singapore

Abstract Body: In forensic examinations of plastic snap-lock bags, measurements of dimensions (L, L' and W) serve as the basis for which exclusionary differences in dimensions may be concluded. The current practice of physical measurements is time-consuming due to the large quantity of bags often received by the laboratory. Given that in casework, visual comparison of dimensions is performed and photographs of the bags are typically taken, the use of a software to perform measurements on case photos was explored as an alternative mean to obtain measurements of bags. Photos and measurements from past cases were used for this study. Using GIMP, photos of snap-lock bags were corrected for lens and perspective distortion, and the dimensions of bags were digitally measured. The deviation of these measurements from physical measurements was calculated to assess the validity of digital measurements. Due to the

subjectivity in distortion correction and measurement using GIMP, repeatability and reproducibility of this method would also be assessed within each examiner, and across different examiners. This would allow the uncertainty associated with digital measurements to be determined.

Attendance Impersonation in Biometrics – A Growing Concern in India 12:30 - 12:45

S. Barman[1], *K.K. Bairagi*[2]

[1]All India Institute of Medical Sciences (AIIMS) Guwahati, Forensic Medicine and Toxicology, Guwahat, India, [2]All India Institute of Medical Sciences (AIIMS) Guwahati, Forensic Medicine and Toxicology, Guwahati, India

Abstract Body: Attendance impersonation in fingerprint biometrics refers to the act of falsely representing oneself using another person's fingerprint to gain unauthorized access or to record attendance in situations where biometric verification is employed. Of late, this has become a significant concern in India because of rising incidents. With the implementation of Aadhar Enabled Biometric Attendance System (AEBAS) for digital attendance in many institutional settings, impersonators are developing various new techniques to cheat employers. There are reports of cases where scammers create cost-effective artificial fingerprints using materials such as sealant, liquid silicone, photopolymer, or even 3D printing techniques to replicate a person's fingerprint. This type of practice not only incurs financial losses, decreases productivity and poses challenges in managing human resources effectively but also compromises the integrity of biometric systems and enhances security and privacy concerns. This paper highlights a few recent cases of attendance fraud involving fingerprint-based biometrics in various institutional set up including medical colleges in India.

02: Chemistry: Other
11:45 - 12:45 Wicklow Hall 2 (B)

Chemistry: Other

Liquid Chromatography-High Resolution-Electrospray-Tandem Mass Spectrometry (LC-HR-ESI-MS/MS) Spectral Database Development of Poisonous Compounds of Plants Origin for their Rapid and Accurate Identification 11:45 - 12:00

S.G. Musharraf[1]

[1]H.E.J. Research Institute of Chemistry, International Center for Chemical and Biological Sciences, University of Karachi, Karachi-75270, Pakistan., International Center for Chemical and Biological Sciences, Karachi, Pakistan

Abstract Body: In addition to medicinal plants, which are beneficial to a human being, poisonous plants are also distributed across the globe. They contain several secondary metabolites, which may be toxic to humans and animals. Several cases have been reported due to their harmful and deadly consequences. Moreover, some toxic plants may be used as chemical weapons. Unfortunately, there is a limited repository of toxic compounds of

plant origin available for their rapid analysis in botanical or forensic samples.
In continuation of our work on the metabolomics analyses of toxic plants, we have recently developed a high-resolution electrospray tandem mass spectral database of poisonous compounds of plant origin for their identification. Standards (poisonous compounds) were procured from the "Molecular Bank (a unique repository of purified compounds from natural and synthetic origin)" of the ICCBS. Reference standards of the toxic compounds were analyzed in a high-throughput manner using a smart pooling strategy based on the log p-value and isotopic masses using the High Resolution-Electrospray-Tandem Mass Spectrometry (HR-ESI-MS/MS) approach. HPLC system was used using C-18 column for the separation of compounds, while QTOF system was used for high resolution analysis, and MS/MS spectra were recorded at different Collison energies. The generated spectra were in the best agreement in terms of ppm error, MS/MS spectra, and standard retention time. Moreover, extracts of some toxic plants were also analyzed for the validation of developed database. Details will be presented in the lecture.

Isotope Ratio Mass Spectrometry Analysis of Soft Polymer Materials 12:00 - 12:15

J. Meikle[1,2], K. Jones[2], J. Carter[3], C. Matheson[1], S. Cresswell[1]

[1]Griffith University, Nathan, Australia, [2]Australian Federal police, Canberra, Australia, [3]Queensland Public Heath Scientific Services, Brisbane, Australia

Abstract Body: In the forensic chemical comparisons of polymeric materials, two or more items are often sized at different times and/or locations. The physical features and spectroscopic results are commonly used in the comparisons. To increase the discrimination power of the examinations, the Australian Federal Police (AFP) Forensic Laboratory utilises isotope ratio mass spectrometry (IRMS) in addition to these traditional methods. When using stable isotope ratio analysis in casework there are a number of considerations that need to be applied such as:

- What is the variability within individual samples being measured?
- What are the isotopic range and variation of isotopic compositions for the material of interest?
- Has the sample storage or use had an effect on the results?
- Has any other treatment on the polymer had an effect on the results?

Based on casework performed at the AFP, polyethylene materials with a focus on cling films and resealable bags were measured for the carbon ($\delta^{13}C$) and hydrogen ($\delta^{2}H$) isotope ratio values. This presentation will outline the results to answer the considerations above that are then used to assist in forensic casework interpretation.

Analysis of Sodium Azide in Postmortem Samples of Suicidal Case Using IC and IC-MSMS 12:15 - 12:30

B. Gong[1], J. Jung[2], S.Y. Park[3], S.H. Lee[3], K. Kim[3]

[1]National forensic service republic of Korea, Seoul institute, Forensic

chemistry, Seoul, Korea, Republic of, [2]National forensic service republic of Korea, Gwangju institute, Gwangju, Korea, Republic of, [3]National forensic service republic of Korea, Seoul institute, Seoul, Korea, Republic of

Abstract Body: Sodium azide(NaN_3), mainly used as a chemical preservative in aqueous laboratory reagents and biologic fluids and a fuel in automobile airbag gas generants, has caused deaths. Toxicity of sodium azide is known to be rapidly active after ingestion and its major effects occur some hours after oral intake, depending on the amount ingested. To date, only very few cases of azide intoxicants have been reported in the literature. In our case, a 30 years old female corpse who had sent a text message to her father that she was going to die with sodium azide, was discovered on the stairs. She had been treated for depression syndrome for many years. Because of the circumstances of death, a forensic postmortem examination was performed. Surprisingly, sodium azide was not found in blood whereas significant amount of sodium azide concentration were measured in gastric contents. These results showed that only blood sample are insufficient to figure out cause of death especially poisoning case because of the postmortem lability of reagent. The identification of compound by IC(ion chromatography) has been based on the retention time, which is lack of specificity, especially in biological samples. Therefore, we confirmed that sodium azide in postmortem samples was determined successfully using IC-MS/MS(ion chromatography triple quardrupole mass spectrometer) as specific, simple and developed sensitive analysis method.

Discovery of Novel Triphenylamine Luminescent Derivatives for Latent Fingerprint Development and Anti-Counterfeiting Applications 12:30 - 12:45

M. Vasava[1], M. Karsharma[1], A. RB[1], R. Khandelwal[1]

[1]National Forensic Sciences University, School of Pharmacy, Gandhinagar, India

Abstract Body: The present work represents the synthesis and characterization of luminescent triphenylamine derivatives, which are synthesized using various benzo-halo and alkyl-halo compounds via simple alpha-elimination or dehydration reactions. The synthesized derivatives have excellent luminescent properties in an
aqueous environment, making them suitable for multiple applications. These fluorescent [4-(diphenylamine)benzaldehyde] derivatives (3a-3e), are the most optimal material for forensic applications such as fingerprint development, anticounterfeiting activities, and explosive detection by quenching. They offer a cost-effective, recyclable, eco-friendly, and flexible paper substrate alternative for printed technologies that remain colourless in daylight, enabling further security. These derivatives can also be used for various biological treatment applications. These compounds possess all essential features while minimizing
constraints, thereby bolstering forensic investigations on a global scale.

01: Case Studies: Multidisciplinary cases
11:45 - 12:45 Liffey Meeting Room 2

Case Studies: Multidisciplinary cases

Modifications of Industrial Filters for Concealment of Illicit Substances - A Case Study of tampered CAT 1R-1808 Filters 11:45 - 12:00

M. Wimberger[1], G. Herbst[1], G. Ullreich[1], W. Greibl[1], N. Taubner[1], I. Steinberger-Rihl[1], M. Mraz[1], J. Frasl[1], D. Faninger[1]

[1]Criminal Intelligence Service Austria, Forensic Science Service, Wien, Austria

Abstract Body: The present case examines a method employed by unidentified perpetrators to modify industrial oil filters (CAT 1R-1808) in order to use them for concealment and transport of ketamine. The filters were altered by cutting open the top of the original housing and removing the filter pleats from the core. The internal filter structure was replaced with a welded plastic foil lined with bitumen adhesive tape on one side, creating a compartment for the concealed substance. The filters were subsequently resealed using three welding points, before being spackled, sanded, and repainted.

Different optical, physical and chemical methods were used in this case in order to thoroughly describe traces left by the tampering process, e.g. subtle deviation in the surface finish, sanding traces and other toolmarks, as well as fingermarks on packaging and delivery notes.

This presentation aims at describing the chosen methods and obtained results in order to furnish relevant information to the practitioners community and to highlight the importance of combining visual inspection with physical and chemical analyses to detect modifications in industrial components.

The discussed case-study provides valuable insights into drug trafficking methods and contribute to the advancement of multidisciplinary forensic practice.

How we Process a Vehicle at the IRCGN 12:00 - 12:15

J. Sinnaeve[1], M. Lebel-Daste[1], R. Marchand[2]

[1]FORENSIC INSTITUTE OF THE FRENCH GENDARMERIE, PONTOISE, France, [2]Forensic Science Laboratory of the French Gendarmerie, Dehicle department, Pontoise, France

Abstract Body: In a world where TV shows and movies make new technology appear as the solution to solve any issue very fast and easily, it might seem odd that the forensic analysis of a vehicle as a whole takes time and a lot of expertise. As it can be used either as a means of transportation or as a weapon, a vehicle is present in a wide variety of crimes and it has now become necessary to be able to highlight all the evidences it contains. This fictive hit and run casework, based on data obtained from real caseworks, displays what the Vehicle Department of the

Forensic Institute of the French Gendarmerie is able to do : taking into account the Vehicle as a whole from a forensic point of view and having all kind of experts gathered together to analyze the paint, to calculate the accident cinematic, and analyze the references written on plastic parts or even the numerical data.

Multidisciplinary Approach in Complex Criminal Cases Involving Biological Samples 12:15 - 12:30

M. Gamonal Simon[1]

[1]GENERAL HEADQUARTERS FOR FORENSIC POLICE- SPANISH NATIONAL POLICE, DNA LABORATORY, MADRID, Spain

Abstract Body: DNA has turned into one of the most powerful tools for crime investigations and one of the biggest challenges for DNA and crime scene experts is being able to locate critical biological remains and to obtain an informative DNA profile from them, avoiding also the interference with other forensic fields. This issue requires establishing a rational order of action for different experts.

It is also crucial for experts to have the capability to identify with certainty if a fluid is present in that precise sample, but frequently preliminary and/or presumptive tests for biological fluids detection used in crime scenes and in DNA laboratories are different.

The Spanish National Police DNA Laboratory has recently guided two Masters's dissertations in cooperation with the University of Alcalá de Henares regarding these matters. The first one started some studies about the impact of cleaning methods performed by criminals in different surfaces on the results of different presumptive and certainty tests for blood detection and in obtaining a DNA profile. The second one aimed to check if some fingerprint development procedures based on chemical methods were affecting DNA recovery at a later stage and therefore the possibility of obtaining an informative DNA profile.

Our laboratory is also participating in a serial homicide casework in which combining two different forensic areas has been key to associate three cases. This is part of a well-established procedure developed by our institution in which experts from different specialties examine evidence together before sampling to avoid analytical interference.

Searching for Cadavers in the Rivers Using Dogs: Multidisciplinary Agency Working 12:30 - 12:45

M. Davis[1], *R. Morris*[2]

[1]University College Dublin, Radiography and Diagnostic Imaging, school of Medicine, Dublin, Ireland, [2]K9 Detect and Find, Wexford, Ireland

Abstract Body: The presentation will explore factors to consider when working dogs on waterways seeking human remains detection. The focus will be on forensic considerations which need to be taken into account during a search in order to locate a body such as travel, water

charaacteristics, environment and associated factors which all compound a search. The specific role of the dog and handler will be explored together with the value this bring to any river or waterway search. Examples will be used to highlight the above and the importance of interagency working.

07: Forensic Management and Quality Systems: Quality Systems and Accreditation
11:45 - 12:30 Liffey Meeting Room 3

Forensic Management and Quality Systems: Quality Systems and Accreditation

The Past, Present, and Future of the Netherlands Register of Court Experts 11:45 - 12:00

D. Deckers[1], *M. Smithuis*[1]

[1]Netherlands register of Court Experts, Utrecht, Netherlands

Abstract Body: Historically, anyone could declare themselves an expert in criminal law proceedings, with judges responsible for assessing their competency. While common in many countries, this practice has led to miscarriages of justice, including several high-profile cases in the Netherlands. In response, the Netherlands Register of Court Experts (NRGD) was established to reduce the risk of such errors and assure the quality of forensic expertise in legal matters.

The NRGD established objective quality standards for 13 different forensic fields, including DNA analysis, forensic toxicology, forensic pathology, and digital forensics, developed in cooperation with experts. To date, the NRGD has assessed over 2,000 applications for registration, ensuring that its experts are trusted by courts to provide accurate and reliable testimony. Additionally, we aim to continuously improve the quality of forensic science through collaboration and the exchange of technical knowledge. A key component of this is a dynamic system that encourages experts to enhance their skills and thus providing courts with a reliable pool of experts whose qualifications are rigorously verified in an ever-changing forensic world.

The NRGD is the first register of court experts in the world with a legal foundation and an independent position. Now other countries are following suit in establishing their own registers, which we encourage. This presentation will explore the history, current activities, and future of the NRGD, including its role within the broader forensic network, collaborations with stakeholders (e.g. forensic service providers and the judiciary), and the potential for expanding the register to include other legal professionals.

Harmonizing the Legal Regulation and Operational Framework of Forensic DNA Elimination Databases: Legal and Quality Challenges in the EU 12:00 - 12:15

M. Nogel[1]

[1]Széchenyi István University Faculty of Law and Political Sciences, Department of Criminology and Forensic Science, Győr, Hungary

Abstract Body: Forensic DNA elimination databases play a crucial role in

ensuring the accuracy and reliability of DNA evidence by distinguishing trace contributors from law enforcement personnel, laboratory staff, and other individuals involved in the criminal justice process. Despite their importance, the establishment, regulation, and operation of these databases remain inconsistent across the European Union. While some Member States have well-defined legal frameworks and operational systems in place, others lack such databases altogether. Furthermore, existing databases are often governed by divergent rules, posing significant challenges for legal and operational harmonization.
Transparency is another critical issue. In many EU countries, data related to forensic DNA elimination databases is not readily accessible to citizens, researchers, or policymakers, creating barriers to accountability and scientific inquiry. This lack of openness undermines public trust and impedes the development of best practices that could improve database utility and efficiency.
This presentation will explore the diverse legal and operational landscapes of forensic DNA elimination databases in the EU, emphasizing their importance in preventing contamination, ensuring justice, and maintaining the integrity of forensic science. It will address key challenges in harmonizing the legal regulation and operational frameworks of these databases and discuss quality assurance concerns, including the standardization of data collection, storage, and analysis protocols. Finally, the presentation will advocate for a harmonized and transparent approach to managing these databases, highlighting the potential benefits for justice, security, and public trust across the EU.

Determinants of Implementing an Independent and Holistic Model for Advancing Forensic Science in Africa: Rwanda Case Study 12:15 - 12:30

K. Charles[1], *K.K. Uwantege*[2], *I. David*[3]

[1]Rwanda Forensic Institute, Director General, Kigali, Rwanda, [2]Rwanda Forensic Institute, Forensic Biology Division Manager, Kigali, Rwanda, [3] Rwanda Forensic Institute, Forensic Quality Assurance Specialist, Kigali, Rwanda

Abstract Body: Forensic science in Africa is often fragmented, with many countries facing challenges in coordination, independence, and integration across law enforcement, justice, and health sectors. This lack of cohesion impacts justice administration, public trust, safety, and security. Rwanda's post-genocide experience highlighted the urgent need for an independent and holistic forensic science governance model. The establishment of the Rwanda Forensic Institute (RFI) provides a case study in addressing these challenges by integrating forensic multi-disciplines under a single, impartial command structure.
This study identifies and analyzes key factors influencing the successful implementation of the RFI model. It evaluates its impact on justice administration, public trust, and multi-sectoral collaboration while exploring its scalability across Africa. Combining qualitative and quantitative methods, the research incorporates case studies, stakeholder interviews, and comparative analyses with international best practices. Metrics such as operational efficiency, case backlog reduction, and service quality improvement inform the findings.
Preliminary results demonstrate that RFI's integrated model has reduced case backlogs by 40%, enhanced service quality, and fostered

interdisciplinary collaboration. Its independent structure ensures impartiality, bolstering credibility in justice processes. By unifying forensic multi-disciplines, RFI has improved efficiency and advanced justice administration, setting a precedent for African nations.
The RFI model offers a scalable framework for advancing forensic science across Africa. However, adapting it will require addressing resource constraints, infrastructure disparities, political commitment, and legal frameworks. A proactive approach to these challenges is essential for its successful implementation continent-wide.

10: Legal and Ethical Aspects: Legal Matters for Forensic Scientists
11:45 - 12:45 Liffey Meeting Room 4

Legal and Ethical Aspects: Legal Matters for Forensic Scientists

The Good, The Bad, and The Ugly: Choosing the (Correct) Legal Basis for Investigative Genetic Genealogy in Europe 11:45 - 12:00

T. Kuru[1]

[1]Tilburg University, Tilburg Institute for Law, Technology, and Society, Tilburg, Netherlands

Abstract Body: Investigative genetic genealogy has recently emerged as a powerful tool for solving crimes, gaining prominence after the arrest of the Golden State Killer. Since then, it has helped resolve hundreds of cases. Unsurprisingly, law enforcement authorities in the EU have also begun exploring the potential of this novel technique. In 2020, Swedish authorities closed the second-largest criminal investigation in Swedish history thanks to investigative genetic genealogy. Currently, Dutch law enforcement is working on a pilot project, and the government is already signaling its interest in further investments in investigative genetic genealogy soon. Meanwhile, a law was recently passed by the Danish Parliament permitting the use of this technique under certain conditions. While interest in investigative genetic genealogy grows among European law enforcement authorities, there remains uncertainty regarding the appropriate legal basis under the EU data protection framework for accessing personal data stored in genetic genealogy databases. This ambiguity, however, raises questions about the legality and legitimacy of investigative genetic genealogy. In this regard, this presentation will critically examine whether the legal basis of “manifestly made public by the data subject,” enshrined in Article 10(c) of the Law Enforcement Directive and relied upon by Swedish authorities in their pilot case, is suitable for such purposes. Following this assessment, the presentation will offer insights into ensuring the lawfulness and legitimacy of investigative genetic genealogy in Europe by comparing the (regulatory) approaches adopted in Sweden, the Netherlands, and Denmark.

An Overview of Cannabis Decriminalization Worldwide and an Evidence-Based Approach to Determine Threshold Quantities. 12:00 - 12:15

A.F. Belchior de Andrade[1], *E. Barbosa Gomes*[2], *E. Ferrari Junior*[2]

[1]University of Derby, School of Science, Derby, United Kingdom, [2]Policia Civil do Distrito Federal, Instituto de Criminalistica, Brasilia, Brazil

Abstract Body: A humanized approach to the different international drug conventions opened space for a more flexible illicit drug regime, especially for low harm drugs. An incremental shift towards cannabis decriminalization can be observed with cannabis possession for personal use not being charged as a criminal offence in many countries. However, a homogeneous approach on how to differentiate possession for personal use from possession to supply has yet to be established, with different countries adopting disparate approaches. This study aims to explore drug policies around the world to identify the presence of an objective factor to differentiate drug possession for personal use (DPPU) from drug possession to supply (DPS) and verify if such a factor can be supported by scientific-based evidence. While no singular approach was found between different countries, the majority adopt an objective criterion such as threshold quantities (TQ) with the aim to make a speedy decision regarding cannabis offences. Analysing data from cannabis seizures and their classification as DPPU or DPS, it is clear that no single threshold can be used with 100% certainty to avoid misclassification. The suggestion is made for TQ not to be used as the sole factor to determine intended drug use, but in conjunction with factual circumstances which should also be taken into consideration to provide a clear picture of the matter.

DNA Databases for Forensic Purposes: Public Views and Efficiency for Detection of Crime Perpetrators 12:15 - 12:30

D. Wilk[1]

[1]Jagiellonian University, Department of Forensic Science, Faculty of Law and Administration, Kraków, Poland

Abstract Body: DNA databases have been implemented in many countries for almost 30 years. Although searching of DNA profiles in databases allows for detection of perpetrators, including in cold cases, the processing of such data raises doubts about privacy, presumption of innocence, non-self-incrimination and racial discrimination. The research was focused on legal framework for collection and storage of DNA profiles, especially legitimacy for collection and storage DNA profiles from arrestees or convicted persons and retention time, from two perspectives – public views and efficiency, including familial searching and forensic genetic genealogy (FGG) analysis.

Public views about utilization of DNA databases were evaluated through survey of general public (548 persons), prosecutors (293), police officers (138) and arrestees (141) in Poland. Only 26% of all respondents agreed for providing sample for universal DNA database, which means that idea of collecting samples from all citizens for fighting crime has not society approval. Nevertheless, 49% of respondents were favourable for familial searching, although it incriminates a close relatives. About 56% and 44% of respondents agreed for utilizing medical DNA databases and FGG respectively.

The performance of DNA databases should be crucial for making decisions about collection and storage DNA profiles from different type of persons and retention times. The performance, expressed as ratio of number of matches between person-stain and number of profiles of suspected or convicted persons stored in the database in the following years, calculated

for various European countries and US states, suggests that restricted DNA databases seem to be more efficient than larger databases.

Admissibility and Performance of DNA Mass Screenings for Detection of Perpetrators 12:30 - 12:45

D. Wilk[1]

[1]Jagiellonian University, Department of Forensic Science, Faculty of Law and Administration, Kraków, Poland

Abstract Body: DNA mass screenings, that is massive taking of control (comparative) samples from persons whose exhibits similar features as perpetrator, is one of means for detection of perpetrator.

The first part of research was focused on legal bases for DNA mass screenings. Comparative analyses were carried out for European countries as well as for USA, Canada and Australia. Research shows that DNA dragnets in common law countries are not specified in criminal procedures. In some European countries (Germany, Netherlands, Ireland) such procedure is specified and materials can be collected with consent of person. In Switzerland it is allowed to perform DNA mass screening without consent of the person. In many European countries materials can be taken without consent on legal grounds for collection of materials from third parties. Because DNA dragnets are directed against non-offenders and violate privacy, presumption of innocence principle and *nemo se impsum accusare tenetur* rule, such actions should be based on court order and limited only to serious crimes.

Performance of the DNA mass screenings were evaluated within second part of research. Reports from several countries were analysed. Own studies of criminal cases for Poland were performed. Research shows that DNA mass screenings were unsuccessful in 90% of 21 cases in USA from 1991 to 2004. Much better performance was observed in United Kingdom (21% of 292 cases were solved) and Germany (29% of 69 cases). In Poland DNA dragnets allowed for detection of perpetrators in 36% of 25 cases from 2000 to 2024.

13: European Day
11:45 - 12:45 Wicklow Meeting Room 2

□□□□ European Day

Unnacompanied Minors Automatic Forensic Age Estimation (UMAFAE): Using Artificial Intelligence to Estimate Legal Age 11:45 - 12:15

J. Venema[1,2], *S. De Luca*[3], *P. Mesejo*[2,4], *Ó. Ibáñez*[5,1]

[1]Panacea Cooperative Research S.Coop., Ponferrada, Spain, [2]University of Granada, Department of Computer Science and Artificial Intelligence, Granada, Spain, [3]University of Oviedo, Department of Organism and Systems Biology, Oviedo, Spain, [4]Andalusian Research Institute in Data Science and Computational Intelligence (DaSCI), Granada, Spain, [5] University of A Coruña, Faculty of Computer Science, A Coruña, Spain

Abstract Body: The estimation of the legal age and the identification of migrant minors without family references is one of the most urgent social challenges in Europe. In response to it, and within the UMAFAE project (https://panacea-coop.com/projects/unaccompanied-minors-automatic-forensic-ageestimation-umafae/), we developed three methods that use artificial intelligence (AI) to estimate legal age by using a hand X-ray, an orthopantomogram, and a CT of the clavicles, as proposed by the established European protocols. To do this, we employed three datasets of 10,739 orthopantomographs from twelve countries, 2,881 hand X-rays from Egypt, Australia and the USA, and 1,067 full-body CTs (from which the clavicles were extracted) from the USA. The ages of all individuals ranged from 14 to 25.99 years old (most of the individuals were below 19 for the hand X-rays), and the methods obtained a mean absolute error (MAE) of 1.12, 0.67 and 1.53 years for the teeth, hand and clavicles, respectively. Moreover, the age estimation method using the teeth was validated in a simulated forensic scenario, where 24 forensic anthropologists estimated the age of twenty undocumented migrants (whose real age was later known) with and without using the AI. The developed method was not only more precise than the average human expert, with MAEs of 0.99 and 1.20 years, respectively, but also helped reducing inter-expert variance when used as a decision support system. The combination of all three methods is under research, and is based on the observation that each method is more precise than the other two in specific age ranges.

Analytical Challenges in the Identification of Benzodiazepine Prodrugs within the EU Project "NETZWERK ADEBAR" 12:15 - 12:30

S. Hamer[1], *F. Westphal*[1], *M. Pütz*[2]

[1]State Bureau of Criminal Investigation (LKS) Schleswig-Holstein, Toxicology and Narcotics, Kiel, Germany, [2]Federal Bureau of Criminal Investigation (BKA), Toxicology, Wiesbaden, Germany

Abstract Body: The NETZWERK ADEBAR project is a German cooperation project funded by the European Union between the Federal Criminal Police Office (BKA), several state criminal police offices, the German Customs and three universities. The project aims to collect analytical data of recently emerging substances on the drug market and perform strucural eludication of new compounds to supplement national, European, and world-wide databases as well as performing several additional tasks (also explained in detail in the poster presentation).

Several known and recently emerged benzodiazepine prodrugs have been sent in to the project for characerization, e.g. Rilmazafone, Avizafone, Noravizafone, Clonazafone, Diclazafone and Ethizafone. The analysis of these compounds often poses challenges and pitfalls when using GC-based methods as the degredation and formation of artifacts, including the corresponding benzodiazepines themselves. Some degredation processes are dependent on solvents, workup protocols or hardware setups like the injector temperature of the instrument. For example, Rilmazafone can form the active benzodiazepine Rilmazolam as an artifact which is detected while the prodrug itself is not. Noravizafone can coelute completely with the formed benzodiazepine Nordazepam, covering up the identity of the sample. The detection of these artifacts can cause false interpretation of

the data which leads to false conclusions, especially if the target compound is not detected at all.

We want to highlight the special characteristics in the analytics of these benzodiazepine prodrugs and propose appropriate strategies to ensure the valid and feasible identification of these compounds (e.g. neat FTIR spectroscopy and LC-MS) to complement GC-based methods.

Maggots in Germany - How to Turn an Underestimated Evidence Into a Popular Tool 12:30 - 12:45

L. Lutz[1], M. Pütz[2], L. Thümmel[1], J. Amendt[1]

[1]Institute of Legal Medicine, University Hospital, Goethe-University, Forensic Entomology, Frankfurt am Main, Germany, [2]Federal Criminal Police Office (BKA), Forensic Science Institute, Wiesbaden, Germany

Abstract Body: Although insects are a frequent and useful source of evidence in criminal investigations, they are still too rarely recognized, sampled and analyzed, both in Europe and in Germany. A lack of awareness of the potential of entomological evidence and a lack of knowledge of proper preservation methods are reasons why insects are still a vastly underused investigative tool. In order to change this, a consortium of forensic entomologists, criminal investigators and medical examiners have set up an EU-funded project to establish and professionalize forensic entomology as a method in forensic casework throughout Germany. Over a three-year period from December 2023 until December 2026, we firstly recorded the frequency of insect-associated cases and awareness of the importance of forensic entomological methods in criminal investigations as part of a nationwide online survey with 1189 participants. Secondly, we developed a detailed manual for sampling insects on crime scenes and prepared a catalogue of entomological evidence with explanations of the most common insect species, their biology and distribution in Germany. In the last year, a training concept for the preservation of entomological evidence will be developed and tested with participants from the police, forensic medicine and prosecution, with the aim of recognizing, sampling and analyzing insect traces on cadavers in indoor and outdoor scenarios. Overall, the focus is on the strengthening of interdisciplinary co-operation between the different investigation authorities.The presentation will give an overview of the project, the first results and achievements that have been made so far for the forensic entomology in Germany.

09: Interpretation: Forensic Statistics
11:45 - 12:45 Wicklow Meeting Room 3

Interpretation: Forensic Statistics

Missing and Murdered: How We Can Use Data From Past Cases to Inform Future Decision-Making 11:45 - 12:15

N. McCullagh[1,2], C. McGovern[2], L. Mulligan[1]

[1]Office of the State Pathologist Ireland, Department of Justice, Dublin, Ireland, [2]University College Dublin, Forensic and Legal Medicine, Dublin, Ireland

Abstract Body: One in six bodies of homicide victims are disposed of in a clandestine manner in Ireland. This delays the discovery of the body and subsequent investigation.

The utilisation of data in the search for missing persons has long been employed when searching for those who are missing as result of their own actions. Agencies around the world make data informed search decisions in a variety of geographical contexts to inform their search decisions. This evidence based approach is at the core of an ongoing research project looking at the specific category of missing persons who have been the victims of homicide in Ireland.

Previous research in this area has demonstrated statistically significant patterns of landscape utilisation by homicide offenders. This project is examining data from past homicide cases to determine how we can improve on the search planning decisions we make as practitioners. The objective of this research is to supplement the methods already used and build upon the decision making process to enable a more focused set of procedures to be developed for crime investigators. The data is being analysed to test, refine and extend identified commonalities and from this create a more efficient and functioning set of search protocols for homicide investigations.

This collaborative research project is the first of its kind in Ireland, funded by Research Ireland and the Department of Justice through the Office of the State Pathologist and University College Dublin, who have come together to support the development of missing persons research in Ireland.

Implications of Assuming Common Within-Source Distributions and Their Effect on Evidence Interpretation 12:15 - 12:30

J. Hanka[1], J. Buscaglia[2], J. Hietpas[3], D. Ommen[4], C. Saunders[1]

[1]South Dakota State University, Brookings, United States, [2]FBI Laboratory, Quantico, United States, [3]City University of New York, New York City, United States, [4]Iowa State University, Ames, United States

Abstract Body: Within the forensic science community, there is a need for a statistically rigorous determination of whether an exclusionary difference exists; this determination is integral to the Kirkian Two-Stage approach to evidence interpretation (Parker 1966). If the known source is not excluded as the source of the questioned object in the first stage, then the examiner must determine the rate at which competing alternative sources are excluded. Current methods are typically constructed to ensure the same false exclusion rate for each source. For example, in ASTM glass standards E2927-16e1 and E2330-19, an exclusionary difference occurs if any of the standardized differences between the measured trace element concentrations is greater than a fixed threshold of four. However, if the algorithm's score function has a distribution that varies by source, then the corresponding thresholds will need to vary as well.

In this work, we review strategies for identifying when the within-source distribution of scores varies between sources; methods for estimating thresholds; remedial approaches such as pooling subsets of sources

together; and implications of this type of variability among the sources to the Kirkian and likelihood ratio (LR) approaches. We illustrate these methods with example data from traces such as glass and improvised explosive device components.

Although the focus is on the Two-Stage approach, this work is also important for LR-based methods due to the need to estimate a likelihood function from just a few observations from a specified source. The discussed remedial methods also apply to the LR paradigm for evidence interpretation.

Regression Modelling in Traffic Crash Reconstruction 12:30 - 12:45

H.Y. Sit[1], *M.E.G. Wong*[1], *R.L. Lee*[1]

[1]Health Sciences Authority, Forensic Chemistry and Physics Laboratory, Singapore, Singapore

Abstract Body: The ubiquity of dashcams in Singapore has led to video evidence being the main evidence type submitted for traffic crash reconstructions. Together with well-defined road features, dashcam footages allow the distance-time data of vehicles in question to be obtained at a sufficiently high temporal resolution. Inference from the data then leads to answering key questions in crash reconstructions, such as the speed of a vehicle, if a vehicle was accelerating and if so, when it started accelerating, and whether collisions can be avoided. Conventional methods of reconstruction using segment averages over an interval of interest do not exploit the full range and power of the data and at times may be inadequate to answer the above questions. This presentation explores the use of statistical inference in regression models describing vehicles' kinematics based on their distance-time data and how they can aid in answering key questions. Regression models, rooted in physical laws, are interpretable since parameters are physical quantities such as the vehicle speed and acceleration, account for uncertainties in measurement and give interval estimates of quantities of interest at a specified confidence level. They can also reduce the uncertainty of reported physical quantities, which may be crucial for decision making in edge cases. Therefore, regression modelling can be a powerful tool in drawing inferences from data to aid the court in answering key questions in traffic crash reconstructions.

12:45 - 14:00 Auditorium

LUNCH BREAK

13: European Day
14:00 - 14:45 Auditorium

□□□□ **European Day - PLENARY SPEAKER 4**

Plenary Talk 4 14:00 - 14:45

03: Digital Evidence: Mobile Device, Network and Location Forensics
14:45 - 16:15 Liffey Meeting Room 3

Digital Evidence: Mobile Device, Network and Location Forensics

What Does Your iPhone Know About Your (Pattern of) Life? Take a Look at Apple Unified Logs… 14:45 - 16:15

A. Desbiolles[1], *B. Meylan*[1], *J. Polewczyk*[1], *T. Souvignet*[1], *I. Labidi*

[1]School of Criminal Justice, University of Lausanne, Lausanne, Switzerland

Workshop Description: Apple Unified Logs (AUL) were introduced almost a decade ago, and over the years the amount of data available has grown significantly. However, the full potential of this data source remains somewhat untapped. As we approach the tenth anniversary of AUL, we want to bring it back into the spotlight and explore future applications and upcoming challenges in interpreting and visualising the rich data it provides. This workshop will also present practical use cases to underline the investigative possibilities.

The goal of this workshop is to provide attendees with hands-on experience with Apple Unified Logs and highlight their potential for forensic investigations. Attendees will learn how to collect, analyse and categorise logs to uncover the valuable insights they can provide in an investigative context.

Ideally, attendees will bring their own Macbook laptop and iOS device so that they can uncover their own traces and reconstruct their activities.

13: European Day
14:45 - 18:15 EcoCem Room

□□□□ **European Day - Forensic Management and Quality Systems: Other**

European Forensic Science Area 2.0 Workshop 14:45 - 18:15

M. Bueno Fernandez[1], *D. Kerzan*[1], *A. Lukomska*[1]

[1]ENFSI, ENFSI Secretariat, WIESBADEN, Germany

Workshop Description: In times when international crime poses a real threat, where technological advances are constant, it is important to remember the importance of building together a European Forensic Science Area. The Council of the European Union considered it necessary to continue work in the field of Forensic Sciences by adopting a specific action plan with a timeframe of 2030 (EFSA 2.0). This workshop is addressed to Member States, the European Commission, relevant EU agencies (EJTN, CEPOL, EUROPOL, eu-LISA,) within their mandate, and other relevant institutions and organizations (ECTEG, Academia...) to summarize the status quo in implementation of EFSA 2.0, identify the priority areas and take next steps in the development of action plan, in order to meet current and future needs with the view to strengthen the impact and reliability of forensic results across Europe.
Workshop will present the strengths and opportunities that will arise from

EFSA 2.0 project in the near future and present first results and deliverables already achieved by ENFSI.

13: European Day
14:45 - 18:15 Wicklow Meeting Room 1

European Day - Education and Training: Continuous professional development.

Preparation for the Fundamental Forensic Knowledge Examination (WP2-UNLOCK – Certain-FORS) 14:45 - 18:15

D. Meuwly[1], *T. Hicks*[2], *Y. O'Dowd*[3], *C. McKibben*[4], *C. Champod*[2], *C. Berger*[1]

[1]Netherland Forensic Institute, The Hague, Netherlands, [2]University of Lausanne, School of Forensic Science, Dorigny, Switzerland, [3]Forensic Science Ireland, Biology, Dublin, Ireland, [4]Forensic Science Northern Ireland, Drugs, Carrickfergus, United Kingdom

Workshop Description: **Overview:** This workshop, hosted by the WP2-UNLOCK team of the ENFSI Monopoly project “Certain-FORS,” is designed to prepare forensic scientists and practitioners for the 2025 **fUNdamentaL fOrensiC Knowledge (UNLOCK) Examination**.
This online examination aims to develop, assess and demonstrate general forensic science knowledge and support harmonized practices across ENFSI laboratories. The 2025 examination session will be available free of charge and is scheduled for the second semester (July – December) of 2025. This examination offers a unique opportunity for forensic practitioners to showcase their general forensic competence on a European level.
Target Audience: The workshop is intended for forensic scientists and practitioners who plan to take the UNLOCK examination or are interested in enhancing their general forensic science knowledge.

Workshop Objectives:

- **Introduction to the UNLOCK reader and examination:** Explanation of the reader’s structure and exam’s organization.
- **Key Topics Covered:** Overview of the subjects included in the reader and example of a quiz.
- **Guided Preparation:** Description of the essential literature provided in the reader and an interactive Q&A session to address participants' questions

Participant Requirements:

- **Pre-registration:** Early registration is encouraged to allow participants time to review the reader, which will be distributed to ENFSI laboratories via designated contacts provided by the UNLOCK team.
- **Preparation:** Participants should prepare questions in advance, based on their initial review of the material.
- **Post-workshop Access:** Participants will receive access to an online platform to support their continued preparation.

For any inquiries, please contact: **unlock@unil.ch**.

01: Case Studies: Emerging Technologies in casework
14:45 - 16:15 Wicklow Meeting Room 2

Case Studies: Emerging Technologies in casework

Exploring the Transformative Potential of AI in Forensic Science Using an AI Use Case Inventory and NIST Process Maps 14:45 - 16:15

N. Osborne[1], *M. Taylor*[2], *H. Waltke*[3]

[1]National Institute of Standards and Technology (NIST, Contractor), Auckland, New Zealand, [2]National Institute of Standards and Technology (NIST), Gaithersburg, United States, [3]National Institute of Standards and Technology (NIST, Contractor), Abu Dhabi, United Arab Emirates

Workshop Description: Artificial Intelligence (AI) has the potential to revolutionize forensic science by enhancing efficiency, accuracy, and consistency across various disciplines. The National Institute of Standards and Technology (NIST) is leading efforts to understand how forensic science service providers (FSSPs) can safely integrate trustworthy AI into their processes. Part of this effort includes the development of use case cards and an inventory of possible use cases. Each use case card presents a specific scenario or example that describes how AI technology can be applied to address a challenge or transform a process within forensic science.

Participants will learn how the NIST AI Use Case Inventory serves as a comprehensive resource for identifying where AI can be applied to transform forensic processes. The workshop will also showcase how NIST's forensic science process maps—which outline key decision points in forensic examinations—can be used to recognize and evaluate potential AI use case opportunities.

Key topics include:

- **The Transformative Potential of AI in Forensic Science:** Understanding how AI technologies can revolutionize forensic methodologies and outcomes.
- **Introduction to the NIST AI Use Case Inventory:** Exploring a curated list of AI applications in forensic contexts, providing a roadmap for adoption.
- **Understanding and Applying NIST's Process Maps to Identify AI Opportunities:** Practical guidance for FSSPs on leveraging process maps to uncover and assess AI use cases.

By the end of the workshop, attendees will be equipped with the knowledge and tools to consider and implement AI solutions, driving innovation and improvement in their forensic practices.

04: DNA and Body Fluids: DNA Typing with Potential Forensic Applications
15:00 - 16:00 Auditorium

DNA and Body Fluids: DNA Typing with Potential Forensic Applications

Towards the Assembly of a Population-Relevant Forensic Workflow for Proteomic Genotyping Human Hair Evidence 15:00 - 15:15

R. Tidy[1,2], R. Keane[1,2], M. Rye[3], H. Abbiss[2], G. Parker[4], J. Gummer[1,2]

[1]ChemCentre, Forensic Science Laboratory, Bentley, Australia, [2]Edith Cowan University, School of Science, Joondalup, Australia, [3]PathWest Laboratory Medicine, Forensic Biology Laboratory, Nedlands, Australia, [4] University of California Davis, Davis, United States

Abstract Body: In the absence of DNA, proteomic genotyping has been proposed as a means of associating biological forensic evidence, such as hair, with an individual. This approach has garnered interest as a complementary technique to traditional DNA-based methods, with potential to assist in situations where DNA is poorly or insufficiently recovered. Although any biological evidentiary protein source can hold as a candidate for proteomic genotyping, hair is of particular interest due to being chemically stable and abundantly shed in the environment. Genetically variant peptides (GVPs) within the human hair shaft can be used to infer corresponding SNP genotypes. We present our approach to a population study of recruited participants, from within the Australian community, a group not yet adequately captured in existing GVP studies, with the aim of discovering unique population-relevant SNPs for development of a forensic GVP panel. Participants provided a hair sample, buccal swab, and completed a questionnaire. Hairs were prepared via optimised preparative and LC-MS methodologies to identify previously characterised and novel GVPs for each participant; whole exome sequencing of the DNA from the swab allowed direct validation against inferred SNPs from the proteomic data. This research provides a broader understanding of GVP types in the population, novel GVP identification, and GVP detection accuracy. GVPs correlating with population metrics such as age, hair colour, and ethnic background were also investigated via the questionnaires. The results of this study allow our methodology to progress towards a final enhanced workflow for proteomic genotyping applicable to hair evidence in forensic casework.

STR Genotyping by Real-Time PCR Using QueSTR Probes 15:15 - 15:30

S. Škevin[1], O. Tytgat[1], M. Fauvart[2], L. De Keyzer[1], D. Deforce[1], F. Van Nieuwerburgh[1]

[1]Ghent University, Faculty of Pharmaceutical Sciences, Ghent, Belgium, [2] IMEC, Leuven, Belgium

Abstract Body: QueSTR probes provide a feasible alternative for implementing forensic Short Tandem Repeat (STR) genotyping on lab-on-a-chip (LoC) devices. QueSTR probes have already been demonstrated to accurately genotype STRs in a hybridization curve assay after PCR amplification. In this study, we modified the QueSTR probe assay for use as a hydrolysis probe assay during qPCR. An asymmetric real-time PCR was

performed with QueSTR probes and RNase H2 in the master mix, during which the fluorescence was recorded. Designed to hybridize with specific STR alleles, QueSTR probes contain a fluorescent dye and a quencher molecule, enabling detection of probe hybridization through RNase H2-mediated cleavage of the RNA-DNA duplex, which releases the quencher. Matching probes yielded lower threshold cycle values and steeper incline of fluorescence curves compared to non-matching probes, indicating accurate genotype. The QueSTR qPCR assay was used to successfully genotype four CODIS core loci (D16S539, D7S820, TPOX, and TH01) in 12 samples, with one exception. The integration of amplification and detection in a single reaction supports the use of QueSTR probes for miniaturizing STR genotyping, thereby complementing CE-based analysis in centralized labs.

Identifying Male and Female DNA at the Crime Scene 15:30 - 15:45

L. Rijnders[1], B.B. Bruijns[2,3], H. Gardeniers[4], M. Bennink[2], L.I. Segerink[1]

[1]University of Twente, BIOS lab-on-a-chip group, MESA+ Institute of Nanotechnology, Enschede, Netherlands, [2]Saxion University of Applied Sciences, Enschede, Netherlands, [3]Police Academy, Apeldoorn, Netherlands, [4]University of Twente, Mesoscale Chemical Systems, MESA+ Institute for Nanotechnology, Enschede, Netherlands

Abstract Body: Samples collected from the crime scene and analysed in the forensics laboratory might prove inconclusive, for instance, if no DNA is detected or if the sample only contains the victim's DNA. Pre-selecting at the crime scene could assist in retrieving conclusive evidence. Differentiating between male and female can already add meaningful insights, for example in sexual assault cases were in a high percentage of cases the perpetuator is male and the victim female. Therefore we aim to design a presumptive test in a point-of-interest setting to distinguish male versus female samples. The bioassay used for the identification is based on the detection of Amelogenin (AMEL) X and Y using an isothermal amplification technique: recombinant polymerase amplification (RPA). With RPA, DNA is amplified through a recombinase, single-stranded DNA binding protein and a strand displacing polymerase. The amplification runs for 20 minutes at 37 – 41 °C and can amplify low DNA concentrations. Primers for RPA were designed *in-silico* targeting unique sequences in the AMEL X and Y allele and the primer-pairs are experimentally tested for their performance. With the addition of SYBR green the presence of AMEL X and Y will be detected using real-time fluorescence measurements. By including the AluYa5-element as internal control, human specificity will be confirmed. To achieve the point-of-interest test, the assay will be incorporated onto a multiplexed microfluidic device that is handheld, can perform heating for amplification and can read-out fluorescence for detection. Further validation of the assay is planned with blood samples from donors.

Supporting Criminal Investigations through Y-Chromosome DNA Profiling 15:45 - 16:00

D. Sharp[1]

[1]NPCC Forensic Capability Network, Dorset Police, Dorset, United Kingdom

Abstract Body: Y-STR DNA profiling is a powerful forensic technique used in specific circumstances as an alternative to routine DNA17 analysis. Whilst application of Y-STR profiling by police forces in the UK is on the rise, particularly for rape and serious sexual offences, the value of Y-STR profiling to investigations is severely restricted, from both an evidential and an intelligence perspective. The NPCC's Forensic Capability Network (FCN) is collaborating with the Home Office Forensic Information Databases Service (FINDS) on the 'Swab Out Crime' Project, supported by STAR (Science, Technology, Analysis & Research) funding from the Police Chief Scientific Advisor.

The project aims to create an anonymous UK-wide reference collection of 10,000 Y-chromosome profiles reflecting the unique and diverse ancestry of the UK population. Upon completion, this collection shall be held securely within FINDS as a UK-specific Y-haplotype frequency database to assist forensic scientists in the interpretation of DNA evidence. Following this, statistical performance modelling will be undertaken on the reference collection, to determine a statistical model for the evaluation of Y-STR DNA evidence. This will allow investigators, prosecutors, those working for the defence and members of the jury to understand the evidential significance of a Y-STR profile match, and will under-pin the development of statistical software for routine use by forensic practitioners requiring likelihood ratio statistics for investigative and court procedures.

This will help policing and the courts to convict some of the UK's most serious sexual offenders, bring justice to victims and make the UK a safer place.

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15:00 - 17:45
ENFSI Annual Meeting

05: Drugs: Emerging Trends/Threats
15:00 - 16:00 Liffey Hall 2
Drugs: Emerging Trends/Threats

Identifying Psychedelics in Australian *Acacia* Species: Wattle We Do? 15:00 - 15:15

L. O'Grady[1], *X. Conlan*[1], *L. Webb*[1]

[1]Deakin University, Centre for Sustainable Bioproducts, School of Life and Environmental Science, Waurn Ponds, Australia

Abstract Body: Recent amendments to the classification of some psychedelic substances within Australian legislation highlights the challenge of the changing licit use of hallucinogens due to their emerging medical applications, including the treatment of depression, anxiety, addiction, and PTSD. N,N-dimethyltryptamine (DMT) is a psychedelic compound, similar in function to ketamine or LSD, that is forensically relevant due to its increasing illicit use and clandestine manufacture. In some Australian jurisdictions, policing agencies have reported an increase

in DMT seizures and the detection of DMT producing labs. The psychedelic, its precursors, and similar compounds are naturally produced within a wide variety of plant species, including Australian native *Acacia* species. This research focuses on the development of a robust analytical protocol for the characterisation, and quantitation of DMT within forensically relevant plant material, utilising a rapid liquid chromatographic separation and mass spectral detection.

The research includes investigations into DMT-containing *Acacia* species, utilising both crude and targeted plant extraction methods for whole plant analysis, genetic analysis, a temporal investigation of DMT variation, and metabolomic pathway analyses. These findings provide a novel, robust method for DMT identification, and an understanding of the factors contributing to variation of production within species, practical for use by forensic organisations in potential seizure samples.

Wastewater-Based Epidemiology Dedicated to Intelligence-Led Policing: Proof of Concept by the French Gendarmerie 15:15 - 15:30

L. Fabien[1], *D. Devault*[2], *E. Gaudry*[1]

[1]National Criminal Intelligence Service of the French Gendarmerie, Intelligence Department, Pontoise, France, [2]University of Mayotte, Dembeni, France

Abstract Body: Wastewater based epidemiology is a robust, fast, flexible, anonymous and non invasive indicator of the drug market. Despite these advantages, law enforcement agencies (LEA) and public health services have difficulty mastering this technique and finding operational applications.
Since 2023, the National Criminal Intelligence Service of the French Gendarmerie (SCRCGN) launched a monitoring (sampling, analyses, interpretation) campaign (i) to assess the feasibility of this method at a national level (France and overseas territory) (ii) to meet its specific needs and fill the intelligence gap.

This proof of concept that provides timely and reliable information on drug consumption in a territory (state of art) can be very useful for decision makers.

Combined with other market indicators (e.g. census, drug seizure, hospital admissions, drug checking, OSINT), wastewater based epidemiology offers the possibility of monitoring consumption habits (i.e. between cities or countries and over the time), of creating an alert system, of measuring the effectiveness LEA and public health services.
The use of wastewater based epidemiology by law enforcement agencies remains complex due to the lack of data exchange, the numerous factors impacting consumption habits (e.g. nightlife, proximity to a border or a distribution route, living standards in the cities, etc.) and the heterogeneity of police actions. Despite these challenges, this technique contributes to intelligence-led-policing. This recent policing model based on assessment of risk in a proactive way is now the gold standard for law enforcement agencies.

Geographically Sourcing and Chemically Profiling Cocaine Seizures 15:30 - 15:45

in France, A Collaborative Exercise Between the United States and France

L. Jones[1], D. Morello[1], S. Kerr[1], A. Berthelot[2]

[1]Drug Enforcement Administration, Dulles, United States, [2]Institut de Recherche Criminelle de la Gendarmerie Nationale, Cergy, France

Abstract Body:

Forty-nine cocaine hydrochloride (HCl) samples were analyzed by the United States Drug Enforcement Administration (DEA) Cocaine Signature Program and the French Gendarmerie (FG) in a collaborative exercise to geographically source and chemically profile cocaine samples obtained by French authorities.

The purpose of the collaborative exercise was to share analytical methodology to enhance the capability of the FG by establishing a Cocaine Signature Program, similar to DEA's, to determine cocaine trafficking trends in France. Their current capability is limited to inter-sample matching methods.

The samples analyzed for geographic sourcing originated from three different seizures found during 2023 on beaches in Normandy, France and from a separate operation focused on the collection of waste from airplanes at Paris Orly Airport in 2021. Each cocaine sample was sourced to a region of origin by comparing alkaloid and isotope results from the French seizures to DEA's geographically authenticated dataset. Cocaine chemical pro files between the seizures were evaluated by comparing cocaine purities, cutting agents, trace alkaloids, stable isotopes, and occluded solvents. While this study was limited in scope, differences were observed in the two datasets (maritime vs air). Cocaine samples obtained from the maritime seizures were predominantly sourced to Peru and Bolivia and samples obtained from the airport were sourced to Colombia and Peru. The average cocaine HCl purity was also higher in the maritime seizures compared to the airport collection.

The Evolution of Designer Benzodiazepines and Related Novel Psychoactive Substances (NPS) in Seized Tablets in Ireland 2019-2024 15:45 - 16:00

C. May[1], J. Carroll[1], D. Fox[1], J. Roche[1], M. Nevin[1], C. Downey[1], J. Casey[1], R. Kennedy[1], L. McMenemy[1], K. Stepniak[1], J. Roche[1], R. Lakes[1]

[1]Forensic Science Ireland, Chemical Analysis Discipline, Celbridge, Ireland

Abstract Body: Benzodiazepines are a widely prescribed medication used to treat anxiety, panic disorders, insomnia and seizures. The misuse of this class of drugs in Ireland has increased over the last eight years with a 70% increase in persons participating in drug treatment programmes being treated for benzodiazepines as the main problem. A recent publication from the Health Research Board (HRB) indicated that benzodiazepines and

related NPS were implicated in more than 50% of drug poisoning deaths in Ireland in 2021. Figures were also reported that indicated that this was an upward trend, increasing by 45% overall in the period 2012-2021.

Forensic Science Ireland (FSI) reported in its Annual Report 2023 that 12% of case submissions were tablets seizures or included a tablet element as part of the submission. Analysis of these tablets can be challenging and does not always yield results that are in contravention to the Misuse of Drugs Act in Ireland. Legitimate pharmaceutical presentations are submitted for analysis as well as falsified (fake) pharmaceutical presentations that may contain no drug, intermediates involved in the synthesis of drugs as well as designer benzodiazepines or related NPS that are designed to evade the control of the Misuse of Drugs Act.

In this presentation, we discuss the different tablet types that were submitted to FSI and the results of their analysis in the period 2019-2024. Timelines are presented of different designer benzodiazepines that appeared on the market to evade legislative controls and disappeared soon after controls were in place.

12: Scenes of Crime: Complex Scenes
15:00 - 16:00 Wicklow Hall 1

Scenes of Crime: Complex Scenes

Visualisation of Data From 3D Laser Scanned Crime Scenes 15:00 - 15:15

S. Alenius[1]

[1]Swedish Police Authority, Malmö, Sweden

Abstract Body: The National Forensic Center (NFC) within the Swedish Police Authority has a standardised method for 3D documentation of crime scenes using terrestrial laser scanning. For several years, the sensor technology group at NFC has explored the potential of high resolution spatially correct 3D-data in forensic science and applied the results in crime investigations. To ensure consistency and usability, the group has now developed a workflow aiming to standardise the presentation formats and visualisation of 3D data. The workflow was launched by introducing three basic image visualisation formats: overview, cross section and measurable orthographic view.
The next phase includes development of best practice for video presentation, colour adjustment and markers for points of interest, for further enhancement of the visual communication.
The goal is to continuously expand a set of visualisation tools with standardised workflows, to be employed in a dialogue and iterative process with prosecutors or investigators. The modular design supports combining tools to create case-appropriate materials while maintaining consistency. A growing visualisation toolbox also enables increasingly complex visualisations to be created efficiently and in a uniform way.
The presentation will give an account for the current stage of this process and look ahead towards future development, such as visualised results from volume estimation, deviation, speed analysis and sight line studies.

The Future of Crime Scene Investigation in the Age of Digital 15:15 - 15:30

Transformation

C. Schaefers[1]

[1]FARO Technologies, Public Safety & Forensic Solutions, Korntal-Muenchingen, Germany

Abstract Body: In today's rapidly evolving world, digital transformation is reshaping the field of crime scene investigation, bringing unprecedented accuracy, efficiency, and insights to forensic workflows. This keynote will explore the advancements in how crime scenes are documented, with a focus on FARO's comprehensive solutions that are helping investigators capture detailed, high-resolution 3D models of scenes. Currently, these tools enable law enforcement to recreate and analyze environments with a level of precision that was once unimaginable.

Looking to the future, the talk will delve into emerging technologies that promise to redefine forensic science even further. Through advancements in digital twin technology, investigators will soon be able to create fully immersive, interactive replicas of crime scenes. By integrating AI and machine learning, these digital twins will not only reproduce scenes but also interpret data patterns and provide predictive insights, aiding in crime reconstruction and evidence analysis. Furthermore, virtual reality will allow investigators, analysts, and even juries to experience these recreated environments firsthand, providing deeper understanding and new perspectives in solving cases.

This keynote will present both a snapshot of today's capabilities and a visionary look at what lies ahead, as the integration of AI, VR, and digital twins transforms crime scene investigation into a smarter, faster, and more effective discipline. Join us to uncover the exciting future of forensics and how it is set to revolutionize justice.

Application of 3D Reconstruction Technology in Traffic Accident Scene Investigation 15:30 - 15:45

D. Xiuchao[1], *J. Xuemei*[1], *J. Yifeng*[1]

[1]Institute of Forensic Science of China, Beijing, China

Abstract Body: The high frequency of traffic accidents is an important factor hindering road safety. Quickly and comprehensively recording information at the scene of a traffic accident is an effective means of restoring traffic and reducing adverse effects. In response to the characteristics of diverse marks, complex environment, and variable state of traffic accident scenes, this paper proposes a high-precision RTK fusion algorithm based digital technology for traffic accident scenes. This technology can provide centimeter level or even millimeter level positioning accuracy, providing detailed and accurate on-site information for the analysis of accident. Experiments have shown that this technology can greatly shorten the time of investigation and reduce the difficulty of the investigation. In addition, through high-precision RTK fusion algorithm, we can quickly, accurately, and comprehensively record multi-scale spatial information such as the environment of traffic accident scene, distribution of items, and characteristics of marks, helping technicians analyze and reconstruct the process of the accident.

Ruling the Scene: Contactless Size Referencing in Evidence Photography Using FreeRef 15:45 - 16:00

J.-W.A. Klok[1], K. Hutchinson[1], P. van den Hoven[2], A.J. Loeve[1,3]

[1]Delft University of Technology, BioMechanical Engineering, Delft, Netherlands, [2]Netherlands Forensic Institute, Den Haag, Netherlands, [3]Co van Ledden Hulsebosch - Netherlands Center for Forensic Science and Medicine, Amsterdam, Netherlands

Abstract Body: **Background:** When photographing forensic evidence, physical size references (e.g., rulers/stickers) are often placed next to traces to allow taking measurements from photos. However, this is laborious, often requires a colleague to assist the evidence photographer and introduces contamination risks. We developed the **FreeRef**; a contactless size reference system (**on-camera projector** plus **stand-alone software**) that enables taking forensic photographs with a visual size reference, but without having to approach the evidence. Furthermore, it allows photographing under large angles without losing accuracy, without even having to straighten the photograph. The previously published FreeRef-1 projector, which delivered a convincing proof of concept, was a vulnerable research tool, not suitable for use in the field, and should preferably be more light-weight.

Core of this work: To solve these above-mentioned drawbacks, we designed and improved, robust and simplified FreeRef-3 projector and tested its accuracy and usability.

Methods & Results: The FreeRef system performance was assessed using technical verification tests, inter-observer checks and user tests with forensic professionals. The results show that the measurements taken with photos using the FreeRef system were at least as accurate as those taken using conventional techniques and usually much better. Furthermore, with the FreeRef system, even photographs taken under angles that are normally considered unsuitable for extracting real-world dimensions from photographs provided accurate measurements.

Conclusion: The results suggest that the FreeRef system will facilitate photographing evidence even in hard-to-reach places, such as under tables and on walls and ceilings, while increasing the accuracy and speed and reducing contamination risks.

11: Marks, Impressions and Biometric Traces: Face Recognition
15:00 - 16:00 Wicklow Hall 2 (A)

Marks, Impressions and Biometric Traces: Face Recognition

Witness Artistic Rendition and its Impacts on Visual Memory for Forensic Facial Composite Creation 15:00 - 15:15

C. Davidson[1], T.MR Houlton[1], C.D Frowd[2]

[1]University of Dundee, College of Anatomy and Human Identification, Dundee, United Kingdom, [2]University of Central Lancashire, School of Psychology, Preston, United Kingdom

Abstract Body: This study examines the impact of the novel 'witness artistic rendition' technique, wherein witnesses create their own drawn likeness of a suspect before working with a forensic artist to generate a facial composite. In the absence of photographic evidence, composites provide crucial intelligence in police investigations, though their accuracy depends on the witness's facial memory and recall. In this study, twenty-two participants (11 control, 11 experimental) viewed a facial photograph, followed by a 3-4 hour retention period. Afterward, they participated in a cognitive interview to create a composite face with a forensic artist, the experimental group first producing their own drawings. Witness memory was measured by the number of distinct observations during the free recall phase of the cognitive interview. To evaluate composite recognition, 40 additional participants attempted to identify the composites. Results showed that the experimental witness group provided more detailed observations and yielded higher identification rates. These findings suggest that the witness artistic rendition technique may enhance both the cognitive interview process and the accuracy of forensic facial composites.

Identification Based on Dorsal Hand Images – An Emerging Field? 15:15 - 15:30

I. Siebke[1], *Z. Obertová*[2]

[1]Zurich Forensic Science Institute, Zurich, Switzerland, [2]Centre for Forensic Anthropology, School of Social Sciences, The University of Western Australia, Perth, Australia

Abstract Body: Facial image comparison (FIC) is an established field within the biometric forensic community, using assessments of facial features in images or videos for identification. However, there are cases where a face of a person is not visible, while other body parts are. With increased image quality small scale morphological features, such as finger knuckle creases, have become sufficiently observable for 1:1 image comparisons. While there has been substantial research regarding FIC, research on dorsal hand features and how they could be used in forensic settings is so far limited and no specific guidelines are available for their evaluation.
The presentation will provide an overview of published and ongoing research on dorsal hand image comparison, including information on the first author's longitudinal study about the knuckle crease stability. The overview will serve as a basis to discuss the relevance of the research in terms of practical application and future perspectives for (dorsal) hand comparisons in images.

A Survey of European Facial Examiners Concerning Accreditation-Relevant Topics in Facial Image Comparison 15:30 - 15:45

Z. Obertova[1], *I. Siebke*[2], *G. Schüler*[3]

[1]The University of Western Australia, Centre for Forensic Anthropology, Perth, Australia, [2]Zurich Forensic Science Institute, Zurich, Switzerland, [3] Expert Office for Morphological Anthropology, Berlin, Germany

Abstract Body: Forensic facial image identification (FFII) uses

anthropological knowledge of human variation to compare facial features in images or videos for the purpose of identification. Although the demand for accreditation in forensic disciplines is sharply increasing, the number of accredited units focusing on FFII is small. The aim of this study was to acquire accreditation-relevant information about the working environment in facial image comparison (FIC) units by surveying facial examiners across Europe.
In total, 34 responses from facial examiners from 16 countries were received. All respondents worked for a governmental organization. Nine (26.5%) facial examiners worked in accredited units. All examiners from accredited units reported having standard operating procedures (SOPs), annual proficiency testing, and use of standard methodology compared to 72%, 92%, and 84% from the non-accredited units, respectively. The tasks performed by facial examiners in their routine practice also varied widely. The survey showed that working conditions and routine tasks in FFII vary among European countries. Respondents from accredited facial image comparison (FIC) units differed from those from non-accredited units by seemingly better awareness of SOPs, uptake of intra- and interlaboratory testing, and consistent use of standard methods and regular method validation. Better understanding of best practice recommendations and accreditation requirements would help harmonize practice in facial image comparison.

Enhancing Kinship Recognition in General Face Recognition Models Using Multiple Kinship Portraits: A Probabilistic Approach 15:45 - 16:00

H. Song[1], *B. Lin*[1], *X. Hou*[1], *W. Li*[1]

[1]Institute of forensic science, Ministry of Public Security, Beijing, China

Abstract Body: While practical general-purpose face recognition models have reached maturity, kinship verification models are still limited, especially in terms of their generalization capability in real-world scenarios. we explore the kinship recognition capability of a general-purpose face recognition model. We conducted experiments by leveraging a large dataset consisting of 20,000 positive samples (pairs of images with kinship relations) and 1 million negative samples (pairs without kinship relations). By using the logits output of the model, we analyzed the distribution of scores for both positive and negative samples. Additionally, we proposed a method to improve the kinship recognition performance by increasing the number of kinship-related images (N) involved in the comparison. Through simulations, we observed that as N increased from 1 to 4, the model's ability to distinguish between related and unrelated pairs improved significantly. Key metrics such as the Overlap Coefficient, Hellinger Distance, and Jensen-Shannon Divergence were employed to quantify the separation between the two distributions. Furthermore, the model's accuracy increased from 80.11% to 93.49%, demonstrating that incorporating multiple kinship images can substantially enhance the recognition performance of a general face recognition model.

02: Chemistry: Other
15:00 - 16:00 Wicklow Hall 2 (B)

Chemistry: Other

Unmasking the Driver: Using the Transfer Evidence to Identify the Culprit in Drunk Driving Accident 15:00 - 15:15

A. Michalska[1], *A. Menżyk*[1,2]

[1]Institute of Forensic Research, Krakow, Poland, [2]University of Silesia in Katowice, Katowice, Poland

Abstract Body: In a remote Polish village with no surveillance, a tragic car accident unfolded. Both men inside the vehicle were ejected, leaving one - who had a lifetime driving ban - dead at the scene. The survivor, however, denied being behind the wheel. No evidence of seatbelt use was found on either man's body, and both genetic and fingerprint analyses proved inconclusive. Fortunately, the possibility of solving the case and determining who drove the car during the accident was significantly increased by the microtrace examination.
This case study will focus on the results of the microtrace examination, with particular emphasis on the complex analysis of fiber traces from the clothing of the individuals involved in the incident, embedded in the vehicle's structural elements. Additionally, the individual pieces of clothing were also examined to reveal potential transfer evidence, including those possibly originating from the steering wheel, which could indicate the positions of the men inside the vehicle. During the visual examination stage, these investigations were supported by the use of alternative light sources, specifically a forensic light source equipped with near-infrared, which enabled the detection of traces not visible to the naked eye on black fabrics.
The results of these examinations provided evidence that brought the investigation a step closer to solving the case, shedding light on the truth behind the wheel.

3D-Printed Guns: What to Do if We Want to Link Printed Parts? 15:15 - 15:30

M. Janssen[1], *J. Harting*[1]

[1]Netherlands Forensic Institute, The Hague, Netherlands

Abstract Body: The Liberator challenged the boundaries of creating a home made firearm at its release in 2013. In 2019, the release of the FGC-9 by JStark1802 pushed those boundaries even further. Since then forensic examiners found themselves with challenges on to examine these weapons in preparation of the time when we will regularly see them in case work. In recent times plenty of additional and new designs of 3D printed firearms have been released: the Urutau, the Not-a-Glock and the Decker .380 to name a few. The forensic challenges therefore increase as it will not only be relevant to show a certain person has created a certain home made firearm. It will also be necessary to show whether a person or organization has produced a plentitude of these firearms and perhaps sold them across the country. The current research at the Netherlands Forensic Institute focusses on determining which technique should be used to investigate the PLA that is mostly used for these firearms. Starting with FTIR, several other techniques were used to classify the purchased filament: SEM/EDX, XRF, IPC-MS and DSC. Not all techniques are necessary in every investigation but the research shows different levels of distinguishability between several

brands and within brands.

Assessing protein degradation during a mass disaster 15:30 - 15:45

E.J Sunnucks[1], L. Brockbals[2], D. McNevin[1], M.P Padula[3], M. Ueland[4]

[1]University of Technology Sydney, Centre for Forensic Science, Broadway, Australia, [2]University of Zurich, Institute of Forensic Medicine, Zürich, Switzerland, [3]University of Technology Sydney, School of Life Sciences, Broadway, Australia, [4]University of Technology Sydney, School of Mathematical and Physical Sciences, Broadway, Australia

Abstract Body: The incidence of mass disaster events is increasing and, once remains are recovered, victim identification is paramount. Disaster victim identification (DVI) is challenging but allows for the repatriation of victims and provides closure to their families. However, when remains are fragmented, current victim identification methods are difficult. Current techniques rely on DNA, odontology, fingerprinting, and visual identification, which become increasingly challenging as decomposition progresses.
DNA is the most commonly utilised and standardised practice for victim identification and can be recovered from biological material. However, DNA can degrade quickly and is affected by high temperatures, water submersion, and microbial activity. As an alternative, this project aimed to utilise proteomics on whole and fragmented human cadavers to assess how protein degradation is affected by the extrinsic factors of a mass disaster. Additionally, the proteome was investigated to determine whether muscle tissue provides peptide signatures that could be used to re-associate fragmented remains. Conducted at the Australian Facility for Taphonomic Experimental Research (AFTER), a mass disaster was simulated where eight human cadavers (6 whole and 2 fragmented donors) were placed at the scene of a simulated explosion and allowed to decompose for 2 weeks. Muscle tissue was collected at cadaver placement and recovery, and underwent a bottom-up proteomics workflow, before liquid chromatography-tandem mass spectrometry (LC-MS/MS) analysis.

Trends, Challenges and Strategies for Management of CBRNE Crime Scene 15:45 - 16:00

A. Kavad[1], A. Kavad[2]

[1]Rashtriya Raksha University, School of Behavioural Sciences & Forensic Investigations, Gandhinagar, India, [2]Forensic Talents India, Forensic Science, Ahmedabad, India

Abstract Body: Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) incidents present unique challenges for crime scene management due to the complex nature of the threats and the potential for mass casualty events. Effective CBRNE crime scene management requires a multidisciplinary approach that combines forensic science, emergency management, and public health strategies. This study explores the principles and protocols involved in managing CBRNE crime scenes, emphasizing the importance of rapid risk assessment, the establishment of a controlled perimeter, and the coordination of response efforts among law

enforcement, first responders, and specialized hazardous materials teams. It discusses the critical role of evidence preservation in the investigation of CBRNE-related crimes, highlighting best practices for decontamination and the collection of physical and biological samples. Moreover, the study examines the psychological and operational challenges faced by personnel at CBRNE scenes and the necessity of cross-training responders in both hazardous material handling and investigative procedures. The present study is novel confluence of forensic and behavioural sciences for effective management of CBRNE crime scenes. Ultimately, the findings underscore the vital need for comprehensive planning, training, and inter-agency collaboration to effectively manage the complexities of CBRNE crime scenes, ensuring both public safety and the integrity of criminal investigations.

10: Legal and Ethical Aspects: Other
15:00 - 15:45 Liffey Meeting Room 4

Legal and Ethical Aspects: Other

The Impact of Institutional Authority on Forensic Evidence Evaluation by Criminal Justice Professionals 15:00 - 15:15

R. de Roo[1,2], C. de Poot[1,2], L. Stevens[2,3]

[1]Amsterdam University of Applied Sciences and Police Academy, Amsterdam, Netherlands, [2]VU University, Amsterdam, Netherlands, [3]Dutch Police, Utrecht, Netherlands

Abstract Body: The present study aims to gain insight in the judiciary's capability to assess the accuracy and reliability of expert reports, by first, examine the extent to which criminal justice professionals are able to differentiate between an accurate (or sound) expert report and an incomprehensible (or unsound) expert report. In an online questionnaire 142 professionals assessed a total of 275 sound and unsound forensic reports. The findings show that participants, on average, were unable to distinguish significantly between sound and unsound forensic expert reports. Second, the study explored the influence of institutional authority on the evaluation of forensic reports. Reports that were not recognized as flawed and specifically reports that originated from well-known and reputable institutions were subjected to less critical examination, increasing the risk of errors in evaluation. These results suggest that perceived institutional authority impacts the assessment of forensic evidence. The study highlights the need for tools to support criminal justice professionals in evaluating forensic evidence, particularly when experts are unregistered. Recommendations include using established quality standards, consulting counter-expert evaluations, and enhancing forensic knowledge through training. The results underscore the importance of critical evidence evaluation to reduce the risk of misinterpretation and wrongful convictions in the judicial process.

Forensic Advisers in the Netherlands and Their Role in the Criminal Justice System 15:15 - 15:30

J. Meeuwissen[1], R. de Roo[2], J. Kruithof-van Esch[3], S. van der Heijden[4], M. Claushuis[5], L. van Blijswijk-Kieftenbeld[6], W. Remijn[7]

[1]District Court, Criminal Law, Breda, Netherlands, [2]Court of Appeal, Criminal law, Arnhem, Netherlands, [3]Court of Appeal, Criminal law, 's-Hertogenbosch, Netherlands, [4]District Court, Criminal law, Utrecht, Netherlands, [5]Court of Appeal, Criminal law, Amsterdam, Netherlands, [6] District Court, Criminal law, Amsterdam, Netherlands, [7]District Court, Criminal law, The Hague, Netherlands

Abstract Body: Since late 2020, all district courts and courts of appeal in the Netherlands have internal forensic support in the form of “forensic advisers.” This position was created in 2012 and resulted from the efforts made to expand knowledge of the forensic sciences within the inquisitorial Dutch criminal justice system. Forensic advisers are generalists and support judges in all matters concerning forensic science, for example, ensuring the logically correct interpretation of evidence, assessing the relevant expertise of forensic experts, and helping to avoid statistical fallacies. In this article, we discuss the origins of the position, the activities performed, and both positive and critical remarks about the position in the literature. Extensive attention is paid to the boundaries of the role and of the advice that is offered. We conclude that the forensic adviser has strengthened the forensic science expertise within the Dutch judiciary and we give recommendations for a more robust anchoring of this expertise.

The article was published in 2021 in Dutch in the journal Expertise and Law, and in 2023 in The Journal of Forensic Sciences.

15:30 - 15:45

Trust in Forensic Science Evidence in the Criminal Justice System: The Experience of Marginalised Groups

M. Maclennan[1], E. Johnson[2], V. Kapageorgiadou[3], C. Dempsey[3], E. Nsiah Amoako[4], V. Hughes[5], N. Nic Daéid[6], H. Flowe[7], L. Frumkin[3]

[1]The University of Edinburgh, Edinburgh, United Kingdom, [2]De Montfort University, Leicester, United Kingdom, [3]The Open University, Milton Keynes, United Kingdom, [4]University of the West of England, Bristol, United Kingdom, [5]The University of York, York, United Kingdom, [6]The University of Dundee, Dundee, United Kingdom, [7]The University of Birmingham, Birmingham, United Kingdom

Abstract Body:

Maintaining public trust in forensic science evidence is essential to reinforce confidence in the criminal justice system (CJS). Trust is particularly important for ‘marginalised’ communities who may have less power and choice over their involvement in CJS proceedings, or who face multiple additional barriers in navigating the CJS.

This presentation will discuss emergent findings from a multidisciplinary project, 'Trust in Forensic Science Evidence in the Criminal Justice System: The Experience of Marginalised Groups'. Drawing upon diverse academic

expertise encompassing forensic science, law, psychology, linguistics, and design, the research team are engaging both CJS stakeholders and marginalised communities across the UK as active participants in the research process.

By exploring user perspectives and experiences with DNA and digital evidence, the aim of the project is to identify key touchpoints and influences where (dis)trust in forensic science evidence arises, whilst working closely with service users to co-design outcomes to improve public trust and understanding of forensic science evidence and processes associated with its use.

This presentation will provide an overview of the project's user-centric methodology (encompassing literature review, survey, interviews, focus groups, participatory citizen science, and design prototyping), whilst championing the value of interdisciplinary, participatory, and collaborative approaches in the design of a more inclusive, accessible, and equitable CJS.

Initial findings from the survey (n=300) indicate trust in forensic science evidence among the general public is high. Survey data will be triangulated with data already collected from stakeholder interviews (n=30) and focus groups (n= 60, to date) to inform project outputs.

16:00 - 16:45 Auditorium

AFTERNOON COFFEE BREAK

04: DNA and Body Fluids: Evaluative Reporting of DNA Findings
16:45 - 17:45 Auditorium

DNA and Body Fluids: Evaluative Reporting of DNA Findings

Investigation into the Prevalence of Background DNA on Penises Following Everyday Activities 16:45 - 17:00

C. Woollacott[1], D. Taylor[1,2], R.A. van Oorschot[3,4], M. Goray[1]

[1]Flinders University, College of Science and Engineering, Adelaide SA, Australia, [2]Forensic Science SA, Adelaide SA, Australia, [3]Victoria Police Forensic Sciences Department, Office of Chief Forensic Scientist, Macleod VIC, Australia, [4]La Trobe University, School of Agriculture, Biomedicine and Environment, Bundoora VIC, Australia

Abstract Body: Sexual assault offences are a global issue prominent across various communities, often involving vaginal, oral or anal penetration with a penis. Challenges are often presented to forensic scientist in court, when evaluating evidence associated with investigations of such offences, due to lack of research addressing prevalence and persistence of self and non-self-DNA on a penis following every day, non-intimate contact. This research investigated the prevalence of self- and non-self-DNA on penises following everyday activities. Forty-one adult participants self-collected samples from the head and shaft of their penis,

using wet and dry swabbing. Reference samples from the donors and volunteering co-habitants or partners were collected to establish the source of self- and non-self-DNA detected. The RSID™-Saliva immunological test was used to assess the prevalence of saliva on the shaft samples prior to DNA analysis. Profiles were produced from all samples using standard methodologies. Non-self-DNA was detected in 26.8% of head samples and 56.1% of shaft samples. All mixed profiles revealed two contributors, except one three-person mixture from a shaft sample. The donor was the major contributor in all, but seven samples obtained based on STRmix mixture proportions. Age, the presence of a co-habitant or partner, sample timing, time since sexual activity and the presence of saliva were found to significantly affect the DNA amounts detected. These findings produce valuable data for the evaluation of self- and non-self-DNA amounts detectable on penises following everyday activities opposed to sexual contact involving a penis, relative to sexual assault offence.

Exploring DNA Transfer and Mixture Inversion Frequency 17:00 - 17:15

H. Roebuck[1], L. Zaarour[1], L. Colt[1], D. McNevin[1], B. Szkuta[2], R.A. van Oorschot[3,4], G. Meakin[1]

[1]University of Technology Sydney, Centre for Forensic Science, Sydney, Australia, [2]Deakin University, School of Life and Environmental Sciences, Melbourne, Australia, [3]Victoria Police Forensic Services Department, Office of the Chief Forensic Scientist, Melbourne, Australia, [4]La Trobe University, School of Agriculture, Biomedicine and Environment, Melbourne, Australia

Abstract Body: Research has shown that there are occasions when indirectly transferred DNA can account for the dominant contribution to a mixed DNA profile. Under what circumstances this phenomenon of ‘mixture inversion’ can occur and the likelihood of its occurrence given a specific scenario requires investigation to improve our understanding.

Our research utilises data contained within published studies to elucidate the frequency of mixture inversion and investigates the variables that increase the likelihood of mixture inversion, such as the level of background DNA already present on the item, the type of item and substrate, the duration and nature of handling, and an individual’s shedder status.

This presentation will summarise the work performed to date, identify the volume of data available, and outline the outcomes of the meta-analysis conducted on the extracted data. Shedder status of the participants is discussed as a key variable which influences the rate of mixture inversion.

This study has identified key gaps in scientific knowledge on this topic, which can be used to prioritise future research on DNA transfer. In particular, this study has informed the experimental design of on-going research in our laboratory to breach these gaps. The combined systematic review and laboratory-based research contributes to the body of knowledge and data available for assisting a forensic scientist to provide informed opinion on DNA evidence given different activity level propositions.

DNA Analysis From Phalanx, Femur, and Temporal Petrous Bones: A Comparative Study 17:15 - 17:30

K.M. Elkins[1], *S. Alley*[1], *D.D. Kollmann*[2]

[1]Towson University, Chemistry and Forensic Science, Towson, United States, [2]Towson University, Sociology, Anthropology, and Criminal Justice, Towson, United States

Abstract Body: Adequate DNA recovery is essential for generating complete DNA profiles from bone and teeth of human remains in cold, historic and ancient investigation cases. In this study, the Dabney and EZ1 robotic large volume methods were compared for extracting DNA from human femur and distal phalanx. Five replicates were performed. The extracts were quantitated with the Qiagen Quantiplex Pro RGQ kit. For both phalanx and femur, DNA was recovered with the two methods, however, the yields from the femur were higher than the small phalanx. Full profiles were obtained with the Qiagen 24plex STR kit with the femur but much lower fluorescence and degradation was observed with for the extracts from the EZ1 method. Incomplete profiles were obtained with the phalanx. Higher quantities of DNA were recovered using the Dabney method. Testing with ForenSeq will also be presented including testing with the historic petrous samples.

Male Underwear – The forgotten item in cases of alleged sexual assault? 17:30 - 17:45

L. Flanagan[1], *C. Murphy*[1], *P. Savage*[1], *M. Breathanch*[1], *J. Ryan*[1]

[1]Forensic Science Ireland, DNA Section, Kildare, Ireland

Abstract Body: For the majority of cases of alleged sexual assault the suspected offender is male. Male underwear can therefore be a critical item with high potential evidential value, however it can be overlooked. Body fluids/DNA, which may transfer to the penis during sexual contact, may in turn transfer to the inside front of the underwear, and persist for months or years, provided the underwear are not washed. To highlight the importance of male underwear to the investigation of alleged sexual assaults real-life cases will be presented, in which male underwear were examined for multiple body fluids/DNA, and the findings obtained proved evidentially significant.
These cases demonstrate the versatility of male underwear examination in situations where different body fluids and DNA may transfer based on the specific allegation, and emphasize how targeted sampling can allow the forensic scientist to assess the probability of the findings based on two competing propositions, predicated by particular case circumstances. To maximize the effectiveness of the forensic analysis, and for robust probability assignment in evaluative reporting of scientific findings, it is imperative that the case circumstances drive the sampling strategy.

03: Digital Evidence: Digital Imaging
16:45 - 17:45 Liffey Hall 1

Digital Evidence: Digital Imaging

Emerging Paradigms in Forensic Facial Comparison through 16:45 - 17:00

Artificial Intelligence

E. Bermejo[1,2], M.A. Guativonza Higuera[2], A.D. Villegas[2,1], A. Manzanares[2], P. Navarro[2], V. Lugli[2], O. Ibáñez[3]

[1]University of Granada, Andalusian Research Institute in Data Science and Computational Intelligence (DaSCI), Granada, Spain, [2]Panacea Cooperative Research S. Coop., Granada, Spain, [3]Universidade da Coruña, Faculty of Computer Science, CITIC, A Coruña, Spain

Abstract Body:

Forensic facial comparison (FFC) has become increasingly significant as an identification technique in recent years. However certain forensic methodologies have not fully adapted to these recent technological developments, and the reliability of different approaches within FFC remains a matter of ongoing scrutiny. For instance, international organizations, such as the Facial Identification Scientific Working Group (FISWG), discourage the use of photo-anthropometry or facial superimposition. This recommendation is based on the presence of various factors that restrict their applicability.

In this work, we present advancements that address these limitations through AI-driven methodologies. First, we explore automated techniques for analyzing the quality of evidence used in FFC to minimize biases and subjectivity. Furthermore, we will introduce the application of automated facial superimposition methods using an innovative 3D-2D paradigm, leveraging advancements in 3D scanning technologies to enhance accuracy and reproducibility. Additionally, we present a novel dataset comprising surveillance images and high quality 3D facial scans, capturing a wide range of facial expressions, controlled conditions and in-the-wild scenarios. This dataset considers relevant aspects such as camera parameters, subject-to-camera distance, occluding objects, etc. designed to drive progress in FFC methodology.

Lastly, we present a comprehensive study analyzing the potential of photo-anthropometry through the automatic prediction of 3D Dimensions and proportionality indexes (DPI) from 2D images. This approach can be used to demonstrate how these tools can effectively reduce the number of possible candidates in a long list in forensic investigations, enhancing efficiency and accuracy.

The Impact of the AI Act on Image and Video Forensics 17:00 - 17:15

M. Fontani[1], M. Jerian[1]

[1]Amped Software, Trieste, Italy

Abstract Body:

The European Union's Artificial Intelligence Act (AI Act), effective from August 2024, introduces a comprehensive regulatory framework for AI

technologies. This keynote will **explore the AI Act's implications for image and video forensic analysts**, focusing on compliance requirements and **operational challenges**.

The AI Act categorizes AI systems into prohibited, high-risk, and less sensitive categories. Some forensic applications, particularly those used in law enforcement, fall under the **high-risk category,** necessitating strict adherence to the Act's mandates. Key compliance areas include ensuring transparency, maintaining robust **data governance**, and implementing rigorous risk management protocols.

A critical aspect of the AI Act is its emphasis on transparency and **accountability**. Forensic tools must provide clear documentation of their AI models, including training data and decision-making processes, to facilitate scrutiny and validation. This requirement poses challenges, especially for proprietary systems where **algorithmic transparency** may conflict with intellectual property protections.

Additionally, the Act mandates continuous monitoring and evaluation of AI systems to **mitigate potential biases** and inaccuracies. Forensic analysts must establish procedures to regularly assess and document the performance and reliability of AI-based tools. This ongoing oversight is essential to uphold the integrity of forensic evidence and maintain public trust in judicial outcomes.

The presentation will also highlight that responsibilities don’t belong only to technology providers but are shared with users and other stakeholders, and non-compliance fines and consequences are relevant.

Attendees will gain a comprehensive understanding of the regulatory landscape and practical strategies to navigate the evolving intersection of AI and forensic science.

Unmasking Deepfakes: Using Blood Flow Signals and Neural Networks to Detect Video Manipulations 17:15 - 17:30

Z. Geradts[1], *P. Pronk*[2]

[1]University of Amsterdam / Netherlands Forensic Institute, Multix / Digital and Biometric Traces, Den Haag, Netherlands, [2]NFI / TU Delft, digital and biometric traces, Den Haag, Netherlands

Abstract Body:
With the rapid advancement of deepfake generation technologies, manipulated videos have become increasingly difficult to detect through visual inspection alone. This poses significant challenges, especially in forensic contexts where the authenticity of digital evidence is critical to maintaining the integrity of legal proceedings. This study explored the potential of **remote photoplethysmography (rPPG)** to detect deepfake videos by analyzing subtle color variations in skin pixels that reflect peripheral blood volume pulse (BVP) signals.The study utilized the **pyVHR Python toolbox** to extract BVP signals from videos using rPPG. These signals were then used to train a **Long Short-Term Memory (LSTM)**

neural network to distinguish between real and manipulated (deepfake) videos. Two strategies were tested :

- Different facial patch configurations for BVP extraction.
- Multiple rPPG techniques.

Each approach was systematically evaluated to determine the most effective combination for improving deepfake detection. The optimal configuration involved training the LSTM model on BVP signals extracted from the **green channel's temporal trace**, using **79 facial patches** across the forehead, cheeks, and under-eye regions. This achieved an overall classification accuracy of **93.65%**.
While the study has limitations, such as its applicability to a broader range of deepfake types, it highlights significant opportunities for improvement. Recommendations for future research include:

- Addressing current limitations to enhance generalizability.
- Refining the methodology and model configurations.
- Expanding datasets to include diverse deepfake styles.

As deepfake technologies continue to evolve, ongoing innovation is essential to meet the challenges of this rapidly advancing field, and should be used in combination with other methods.

Artificial Images and Videos Based on Generative AI: New Challenges (and Opportunities) for Forensics and Law Enforcement 17:30 - 17:45

E. Krupicka[1]

[1]Federal Criminal Police Office, KT51 - Image, Audio and Video Forensics, Wiesbaden, Germany

Abstract Body:
Artificial Images based on generative AI software like Midjourney, Leonardo, Dall-E or Stable Diffusion are being produced in massive amounts.
Image forensics is already facing the task to distinguish reliably between real and entirely artificial "photographies" which were generated or maybe just partly modified by means of generative AI. In this presentation we will give a brief description of how easily artificial images can be generated with diffusion models. In addition, we illustrate some case scenarios of relevance for forensics and law enforcement agencies, showing the manifold possibilities how artificial images can be (mis)used by criminals. A special focus is given on the constantly growing phenomenon of AI-CSAM (AI-based Child Sexual Abuse Material) as well as how easily cybergroomers can use generative AI for their grooming activities on social media platforms. We will also briefly explain how current synthetic images can be identified as being artificially generated by various methods. Besides low-level approaches which mostly focus on visible artefacts like shadows, reflections as well as anatomical features, we will also highlight some more advanced methods using "deeper" image forensic methods, which might get even more important, as AI-based generation models further improve in visual quality. A brief overview of the current status of artificial videos

based on generative AI will illustrate the upcoming challenges digital media forensics will face in the (very) near future.

05: Drugs: Emerging Trends/Threats
16:45 - 17:30 Liffey Hall 2

Drugs: Emerging Trends/Threats

Emerging Novel Psychoactive Substances Trends in NSW, Australia, With a Focus on Nitazenes 16:45 - 17:15

A. Connelly[1]

[1]Forensic & Analytical Science Service, NSW Health Pathology, Illicit Drugs Analysis Unit, Lidcombe, Australia

Abstract Body: Connelly, A[1]

[1]Illicit Drugs Analysis Unit, NSW Health Pathology, Forensic & Analytical Science Service, Lidcombe, NSW, Australia

Novel psychoactive substances (NPS) are synthetic compounds which are designed to mimic the effects of commonly misused drugs but can also be designed in an effort to avoid detection by law enforcement agencies or circumvent legislation. NPS pose several challenges for illicit drug analysis laboratories as traditional drug screening techniques, such as gas chromatography-mass spectrometry (GC-MS) can struggle to provide accurate and reliable results due to the novel chemical structures of these substances. NPS detections across the globe seen significant increases between 2010 to 2020, which has since stabilised, however, the detection of nitazenes has increased[2]. Nitazenes are traditionally research only compounds that are posing risks to both inexperienced and experienced users due to unknown long- term effects and increased risk of opioid overdose.

This study explores the trends of NPS detections at the Illicit Drugs Analysis Unit in New South Wales, Australia with a particular focus of the emergence of nitazenes, the challenges they pose in their identification and the methods the IDAU have implemented to ensure that identification of these NPS's can be made to assist in keeping our communities safe.

[2]UNODC Online World Drug Report 2024 – Drug market patterns and trends

Hidden High: Not Your Typical Vape 17:15 - 17:30

S. Zhang[1], *S. Wang*[1], *Y.K. Lee*[1]

[1]Health Sciences Authority, Illicit Drugs Division, Singapore, Singapore

Abstract Body: Electronic cigarettes, commonly known as e-cigarettes or vapes, are battery-powered devices that heat a liquid solution into an inhalable vapour. These devices are often marketed as smoking cessation aids or as less harmful alternatives to traditional cigarettes. Vapes typically come in two forms: disposable units or devices with refillable cartridges

containing e-liquid. Conventionally, e-liquids primarily consist of nicotine, humectants (eg. glycerol and ethylene glycol), and flavouring agents. However, the composition of these e-liquids has undergone significant evolution, becoming increasingly intricate.

Rising emergence of cannabis-based e-liquids containing compounds like tetrahydrocannabinol (THC), cannabinol (CBN), and semi-synthetic cannabinoids (SSCs) are gaining popularity. These may lack humectants and include Vitamin E acetate as an oil-based cutting agent. Additionally, there has been a rise in e-liquids adulterated with New Psychoactive Substances (NPS) and various illicit substances. In 2024, etomidate and its analogues were detected in vape samples analysed by our laboratory. Etomidate is an ultrashort-acting intravenous anesthetic agent used primarily for inducing general anesthesia, facilitating rapid sequence intubation, and other scenarios requiring brief anesthesia.

This presentation will showcase the diverse chemical profiles of various e-liquids analysed by our laboratory with a particular focus on a case study involving e-liquids containing NPS. In this study, gas chromatography-mass spectrometry (GC-MS) analysis revealed an intriguing pair of 'twin' peaks with identical mass spectra. The structural elucidation of these 'twin' peaks will be further investigated using high-resolution mass spectrometry (HRMS), demonstrating the use of advanced analytical techniques required to unravel the complexities of modern e-liquid compositions.

12: Scenes of Crime: Bloodstain Pattern Analysis
16:45 - 17:45 Wicklow Hall 1

Scenes of Crime: Bloodstain Pattern Analysis

Standardizing Bloodstain Pattern Analysis and Assessing Experts 16:45 - 17:15

N. Laan[1], *E. Wijnhorst*[1], *K. van den Doel*[1]

[1]Netherlands Register of Court Experts, Utrecht, Netherlands

Abstract Body: Before 2010, there was no legal Dutch quality system for forensic experts in criminal law. It was up to the judges to determine the capabilities of experts. Opinions of ‘non-experts’ have led to several miscarriages of justice. The Netherlands Register of Court Experts (NRGD) was established to assure the quality of forensic experts and endeavor minimizing miscarriages of justice. To do so, we set standards in conjunction with experts from the field. Then experts are assessed by their peers on their ability to perform a proper forensic investigation and give reliable and accurate statements. The NRGD is the only known organization in the world with a legal basis and an independent position for assessing and registering experts. Currently, the register has developed standards for thirteen fields of expertise, such as DNA-analysis, Forensic Toxicology, and Digital Forensics. The register has over 600 registered experts and is still growing.

In 2023 the NRGD started to standardize Bloodstain Pattern Analysis as a field of expertise. With a committee of international experts, the NRGD has written down the tasks and competencies required for registration. By means of a pilot assessment we were able to determine if assessment can

be done in a uniform manner, if the reports meet the Standards and if the Standards can be used to assess these kinds of reports.
This presentation will cover the current affairs of the NRGD, how the NRGD has standardized BPA and which tasks and competencies are required to become an NRGD registered BPA expert.

Decoding Bloodstain Aging: Effects of Environment, Surface, and Donor on Degradation 17:15 - 17:30

A. Menzyk[1,2], S. Gariglio[3], C. Malegori[3], P. Oliveri[3], M. Vincenti[4], G. Zadora[1,2]

[1]Institute of Forensic Research in Krakow, Krakow, Poland, [2]University of Silesia in Katowice, Institute of Chemistry, Katowice, Poland, [3]University of Genova, Department of Pharmacy, Genova, Italy, [4]Univeristy of Turin, Department of Chemistry, Turin, Italy

Abstract Body: Advancing the understanding of time-dependent information in bloodstains at crime scenes remains a key priority in forensic science. Contrary to common belief, the slow adoption of bloodstain dating methods in practice is not due to a lack of suitable analytical techniques for tracking degradation. Rather, the primary challenge lies in the variability of environmental and situational factors, which significantly influence the kinetics of blood degradation. One potential solution to this issue of unique degradation patterns is the adoption of a completely new dating strategy [1]. In this approach, each dating procedure would be specifically tailored to the individual blood traces under examination, thereby reducing the influence of external factors on the accuracy of age estimations and facilitating practical application at crime scenes.

The present study aims to identify which factors – such as environmental conditions, substrate, and donor – most significantly influence the rate of blood degradation and should therefore be controlled within the proposed approach. To achieve this, the study was structured using the Design of Experiments (DoE) methodology. Blood samples collected from two volunteers and deposited onto four different substrates were monitored using NIR and Raman spectroscopies. The aging process of the bloodstains was tracked over 16 days under conditions simulating four distinct analytical seasons, both indoors and outdoors.

Finally, to identify sources of variation within the data and assess the significance of the experimental factors, the resulting data were analyzed – among others – using ANOVA-Simultaneous Component Analysis (ASCA).

[1] A. Menżyk et al., Forensic Sci. Int., 349, 2023, 111763.

The Perceptions of Uncertainties in Bloodstain Pattern Analysis by the Community 17:30 - 17:45

L. Filiatrault[1]

[1]Université du Québec à Trois-Rivières, Département de Biochimie, Chimie, Physique et Science Forensique, Trois-Rivières, Canada

Abstract Body: Few studies have focused on the effect of quality

assurance processes, particularly in relation to accreditation and certification in the field of bloodstain pattern analysis. This presentation will analyze the results of an exploratory study on the role and perception of practitioners regarding the certification and accreditation process in bloodstain pattern analysis. An online questionnaire was sent to various forensic science associations, laboratories, and groups who then distributed it to the community of bloodstain pattern analysts. The questionnaire was available in both English and French. The survey was made available to respondents on October 11, 2022. Over the course of 5 month, 165 connexions to the survey were recorded, with 24 of them providing responses. Only 17 of the surveys were suitable for qualitative analysis. The analysis of the participants' responses was conducted with a focus on three subjects, with the participants' years of experience and profession serving as factor.

1. Their perception of the usefulness of ten disciplines specified as relevant in the recommendations of the NAS report education criteria, the IAI certification, the SWGSTAIN, and the standard ANSI/ASB 032.
2. Their understanding of the accreditation and certification process.
3. The perceived benefit of accreditation and certification to their expertise, and the justification for their implementation in the workplace.

11: Marks, Impressions and Biometric Traces: Other
16:45 - 17:45 Wicklow Hall 2 (A)

Marks, Impressions and Biometric Traces: Other

The Use of Tattoos as an Investigative Tool at a Crime Scene 16:45 - 17:00

D. Corsetti[1], *M. Miranda*[2]

[1]John Jay College of Criminal Justice, Department of Sciences, New York, United States, [2]Farmingdale State College, The Center for Criminal Justice Studies, Farmingdale, United States

Abstract Body:

Tattoos have not only served as a subject of interest across cultures and disciplines for centuries, but also serve as a critical component of forensic investigations. By examining the location, dimensions, colors and overall imagery of a tattoo, investigators have been able to use tattoos as a method of rapid tentative identification of human remains (1). Tattoos as traces–when properly identified and documented, serve as a valuable tool for investigators when capturing a crime scene. If every tattoo encountered at a scene was treated as its own trace, the chances of bodies becoming and remaining unidentified will be significantly decreased. This presentation will make attendees aware that uniform and detailed reporting of tattoos at the scene can be valuable for providing investigatory leads in cold cases, missing persons cases and unidentified remains cases. Data was collected from redacted records provided by the Camden County

Prosecutor's Office (NJ, USA) along with data collected from public databases such as NamUs and state police agencies across the United States to show how overlooked and underused the tattoo is as an investigative tool. Thus far, there is no mandated method for tattoo documentation for scene investigators or medical professionals, which has caused inconsistencies to arise between both inter- and intra-agency. The goal of this presentation is to raise awareness about the usefulness of tattoos as a trace and to address the need to create a systematic method for tattoo documentation that is consistent across forensic science and the broader criminal justice system.

Identifying the Weapon: Sharp Force Trauma Analysis Before and After Thermal Alterations 17:00 - 17:15

C. Logan[1], *S. McColl*[1]

[1]Liverpool John Moores University, Pharmacy and Biomolecular Sciences, Liverpool, United Kingdom

Abstract Body: This study investigates the identification of weapons responsible for sharp force trauma cut marks, with a focus on the effects of burning on porcine bone. Sharp force trauma, characterized by distinct cut marks, can provide critical insights into the nature of the weapon used, such as the type of knife. However, external factors like burning may obscure and alter these details, complicating forensic analysis. We conducted a series of controlled experiments using three types of knives—serrated, large serrated, and smooth-edged—on different types of porcine bone to create a comprehensive database of cut mark patterns. This study also considers the volume of the cut marks as a potential method for weapon identification. The samples were subsequently subjected to controlled burning scenarios, allowing us to analyse the alterations in the cut marks resulting from thermal exposure.

Non-human Biological Traces in Cases of Infanticides: Forensic Acarology 17:15 - 17:30

C.M. Walton[1], *M. Hani*[1], *M.A. Perotti*[1]

[1]University of Reading, School of Biological Sciences - Ecology and Evolutionary Biology, Reading, United Kingdom

Abstract Body: Infanticide refers to the act of killing a child under the age of one year, and most commonly occurs in the first 24 hours of life. Statistics reveal that children in this age bracket experience the highest homicide victimisation rates, at least double that of any other age group. However, the true prevalence is likely severely underestimated, as bodies are frequently concealed to prevent discovery. Births are rarely reported in these cases, meaning even if the body is discovered, it cannot be corroborated with a missing persons report, complicating identification and reconstruction of events.

To solve these uniquely challenging and distressing cases, forensic

evidence becomes important. Post-mortem interval (PMI) estimations, using insect evidence, are instrumental in event reconstruction, ultimately assisting in solving the crime. However, common concealment methods in infanticide casework, such as wrapping in blankets or sealing in plastic bags, frequently limit or completely block insect access. Non-human biological traces, particularly mites are minute, abundant, and have been reported in multiple infanticide cases. Analysing colonies has successfully enabled PMI estimations, and individuals and colonies have been used to identify location provenance due to their habitat specificity. Despite their potential, there is a lack of research exploring how mite colonies develop in these cases. To address this, experiments are being conducted using neonate porcine carcasses as a proxy for infant human remains, concealed using methods observed in infanticide casework. This presentation will discuss the latest findings from this research, and the implications for forensic acarology.

When All is Tread and Done; Is There Evidential Value? 17:30 - 17:45

M. Needham[1], C. Gwinnett[1], S. Reidy[2], R. Harris[2]

[1]University of Staffordshire, Health, Education, Policing and Sciences, Stoke on Trent, United Kingdom, [2]Yorkshire and the Humber Regional Scientific Support Services, Identification Bureau, Wakefield, United Kingdom

Abstract Body: The analysis of footwear captured in surveillance footage, such as CCTV, body-worn video (BWV), and mobile downloads, represents an underutilized resource in forensic identification. While traditional methods like facial comparisons, height analysis, and gait analysis are widely used, footwear identification offers unique and complementary potential. This gap in published literature highlights a significant opportunity to expand forensic practices.
Footwear evidence often focuses on sole patterns and impressions found at crime scenes, but the examination of shoe uppers visible in video footage is less explored. Yorkshire and the Humber Regional Scientific Support Services have recognized this niche and observed an increase in demand for such analyses, particularly from external agencies like other police forces and the National Crime Agency. This trend underscores the emerging significance of footwear comparisons of uppers as a "growth industry" within forensic science.
Phase 1 of this research established an image capture method for footwear uppers in white and infrared light to replicate CCTV cameras. This project is Phase 2 of the research and successfully investigated the potential evidential value of footwear uppers caught on camera (e.g. CCTV) as a form of identification. It investigated factors that influence the interpretation of class and individual characteristics (e.g. brand and damage, respectively) that could influence the evidential outcome of a comparison. The presentation will summarise key findings. This project was funded by Police STAR fund 24/25.

02: Chemistry: Other
16:45 - 17:45 Wicklow Hall 2 (B)

Chemistry: Other

Light it up! Photoluminescent Lead Detection for Forensic 16:45 - 17:00

Investigations

K. Adelberg[1], A. van der Weijden[1], L. Helmbrecht[2], A. van Asten[3], W. Noorduin[4]

[1]AMOLF, Self-Organizing Matter, Amsterdam, Netherlands, [2]Lumetallix, Amsterdam, Netherlands, [3]University of Amsterdam, 1098 XG, Netherlands, [4]AMOLF, Self-Organizing Matter - Group Leader, Amsterdam, Netherlands

Abstract Body: Gunshot residue (GSR) analysis is essential for the forensic investigation of shooting incidents, but it is oftentimes slow, cumbersome, and limited in spatial resolution. Here, a photoluminescent GSR analysis (PL-Pb) method is introduced for instant, spatially resolved detection of GSR with high resolution. Lead dust in GSR reacts into a lead halide perovskite semiconductor that emits bright green light under ultraviolet irradiation. The sensitivity of PL-Pb enables straightforward detection of trace amounts of GSR from ricochet markings, bullet holes, and combustion plumes. This research demonstrates that GSR is transferable with high spatial resolution and preserves fine details such as the polygonal patterns caused by the rifling of a pistol. PL-Pb detection yields reproducible GSR patterns for shooting distance reconstruction series. The sensitivity and instant results make PL-Pb suitable for rapid presumptive testing of shooting suspects. Surprisingly, even after washing, GSR can still be detected on the hands of shooters, and GSR is easily found on clothes, shoes, and other objects relevant to a shooting incident. Collectively, the instant results and sensitivity of PL-Pb open unprecedented opportunities for on-site forensic investigations and highlight the potential of perovskite-based lead detection methods for lead-containing, crime-related micro-traces. The ease of use makes it an invaluable tool for forensic investigators working at crime scenes with immediate, clear results that can be crucial in time-sensitive situations. The ability to detect GSR even after attempts to wash it off further underscores the robustness, reliability, and nanogram sensitivity of this method, highlighting its potential in shooting incident reconstruction.

Identification of Renewable and Synthetic Fuels 17:00 - 17:15

O. Laine[1], M. Söderström[1], V. Asiala[1]

[1]National Bureau Of Investigation, Vantaa, Finland

Abstract Body: Identification criteria for renewable and synthetic fuels were created for oil spill identification. Renewable and synthetic fuels have been developed to replace especially petroleum-based diesels and light fuel oils. However, a current international standard on oil spill identification does not provide criteria for identification of renewable HVO (hydrotreated vegetable oil) or synthetic GTL (gas-to-liquid) fuels. Identification of renewable and synthetic fuels in this newly created method is based on gas chromatography mass spectrometry-based (GCMS) analysis of oil samples. Ratios of GCMS signal intensities of certain methyl alkanes and n-alkanes in renewable, synthetic, and petroleum-based fuels were used to differentiate fuels with different sources. An influence of weathering on ratios of methyl alkanes and n-alkanes was also studied with a GTL fuel. With this new method also renewable and synthetic fuels may be identified in oil spills.

Establishing the Volatile Profile of Human Remains in a Simulated Disaster Scenario 17:15 - 17:30

B. Thurn[1], *D.M. Bordin*[1], *M. Ueland*[1]

[1]University of Technology Sydney, School of Mathematical and Physical Sciences, Sydney, Australia

Abstract Body: The search for victims in mass disasters is a long-established scientific and operational challenge that is greatly aided by the use of detection dogs. Cadaver-detection dogs use their keen sense of smell to locate deceased victims, and rely on the volatile organic compounds (VOCs) produced through the degradation of human tissue. Despite their successes, these canines are expensive to train and deploy. There is also a lack of knowledge surrounding what these canines are scenting, with little work being done on characterising the VOCs emitted from victims in these disaster events. This research therefore aimed to establish the volatile profile emitted from deceased victims located under rubble.
The research was conducted at the Australian Facility for Taphonomic Experimental Research (AFTER), where a trial was performed to simulate a mass casualty event. The trial took place over two weeks, with six donors placed in a simulated building collapse either alone or commingled with other remains. VOC samples were collected at 100 mL/min for 10 min, and all samples were analysed using comprehensive two-dimensional gas chromatography with time-of-flight mass spectrometry (GC×GC-TOFMS). Over the trial sulfur-containing compounds became more abundant, with nitrogen-containing compounds being in higher concentration from the commingled remains. The abundance of volatiles detected from the remains varied greatly with temperature and wind, with esters increasing in concentration with rain and high humidity. The information gleaned from these trials will aid in the development of future portable technologies, which will ultimately assist in locating deceased disaster victims.

Estimation of Shooting Distance on the Targets Behind a Windscreen 17:30 - 17:45

Ç. Aksoy[1]

[1]Turkish National Police, Forensic Police Laboratories Department, Ankara, Turkey

Abstract Body:

Estimation of shooting distance is an important component in reconstruction of firearm-related cases. A complain, based on the appearance of the bullet entrance hole and the split of the firearm discharge residue (FDR) patterns around the hole, is made using various techniques. In most cases, origin of FDR is primer, propellant, lubricant and metals of the bullet, cartridge case and the gun barrel. But rarely, split of inert particles of materials after a ricochet or passing through various materials may affect FDR content and shooting distance estimation. Ricochet of a bullet is often a mystery issue to understand completely for investigators. At the time of ricochet, speed, direction and physical

appearance of bullet change and generally different results are observed on target. Small differences in shooting conditions may cause big differences on the target.

In this study, shootings into the targets behind a windscreen were performed and interesting results were observed. In most shootings, bullets deformed and their lead inside splitted on to the target surface. Because of the heavy lead contamination by the bullet core, heavy purple color was observed in sodium-rhodizonate test. As a result, it was shown that deformation of bullets significantly effects the shooting distance estimation on the target. Importance of physical examination was implied once again because of the similarity between near distance shooting and behind glass shooting in sodium–rhodizonate test. It was also recommended a griess test to differ near distance shootings' entrances from deformated or ricocheted bullets' on the targets.

01: Case Studies: Other
16:45 - 17:30 Liffey Meeting Room 2

Case Studies: Other

Fighting Against Banknote Counterfeiting and Related Frauds: SICPA's Forensic Division Point of View and Experience 16:45 - 17:00

Ü. Laskay[1], *J.-A. Patteet*[2,3]

[1]SICPA, Forensic competence center, Prilly, Switzerland, [2]University of Lausanne - School of Criminal Justice (ESC), Lausanne, Switzerland, [3]SICPA, Forensic competence center, PrillySwitzerlandsw, Switzerland

Abstract Body: SICPA, a global leader in securing physical and digital documents, including banknotes, is dedicated to safeguarding the integrity of financial systems worldwide. Our forensic team specializes in developing and implementing advanced security solutions that protect against counterfeiting and fraud, which pose significant threats to national economies.
A key focus of our work is material and chemical analysis to trace the origins of counterfeit banknotes and value documents. By identifying the material sources and methods used in counterfeiting, we can develop targeted strategies to combat these threats and safeguard national economies.
In this presentation, we will explore the comprehensive measures necessary to secure the entire cash cycle, from banknote production, through to circulation, and finally destruction. We will highlight the critical importance of protecting physical currency through innovative technologies such as security inks and staining systems, which are essential for ATM protection and cash handling processes.
Our goal is to provide insights into how robust security measures and reverse engineering techniques can enhance the resilience of financial systems and contribute to economic stability. Moreover, we strive to share our competences and knowledge with law enforcement entities and forensic experts, and we aim to contribute to the development of internationally recognized analysis methodology of stained stolen

banknotes and crime related artefacts.
Join us to discover how SICPA's cutting-edge technologies and forensic expertise are making a difference in the fight against counterfeiting and learn about the future of currency protection.

Impact of the African Forensic Sciences Academy (AFSA) 17:00 - 17:15

A. OLCKERS[1], *M. HEYNS*[1], *M. BEN KHELIL*[1], *L.A. MUCHELEG'ANGA*[1], *A.D. ADETIMEHIN*[1]

[1]African Forensic Sciences Academy (AFSA), Kigali, Rwanda

Abstract Body:

The African Forensic Sciences Academy (AFSA.Africa) was founded in December 2022 and launched in March 2023. It is an independent body that represents all forensic science practitioners across Africa. AFSA is the first such formally registered body in Africa with independent oversight.

The goals of AFSA are to:

- Disseminate forensic science knowledge among the practitioners and institutions in Africa.
- Promote collaboration, partnership, and training in forensic sciences.
- Promote evidence based, innovative and multi-disciplinary forensic sciences practice.
- Promote relevant and impactful research.
- Develop appropriate standards and guidelines.

Establishment of a network for forensic science practitioners and institutions across Africa will facilitate optimal communication across countries, enabling the sharing of knowledge and information and collaborative initiatives that benefits all. This network has already yielded benefits and the strategy to scale this network will be presented.

In September 2024 AFSA hosted its inaugural conference with the theme “Forensic Science Ecosystem in Africa” with significant lessons learned and solutions proposed.

The practice of forensic science is not harmonized across Africa in terms of standards, quality assurance, training and education or legislative

frameworks, etc. One does not foresee the forensic science systems to operate on the same model across the 55 sovereign states in Africa. However, to enable forensic science to assist in the justice system, a level of harmonization is needed. Through AFSA this discussion has begun and progress to date will be outlined.

AFSA has a responsibility to generate solutions to Africa for the current challenges facing forensic science in Africa.

Infiltrating Encrypted Communication Platforms – A Useful Method Against Organized Crime (So Far) 17:15 - 17:30

B. Mészáros[1]

[1]Ludovika University of Public Service, Faculty of Law Enforcement, Department of Criminalistic Tactics and Methodics, Budapest, Hungary

Abstract Body: Criminal networks have a huge demand for encrypted communication platforms to facilitate their criminal activities. In the last decade, law enforcement agencies all over the world had managed several times to infiltrate encrypted communication platforms used by organized crime groups, successfully decrypted the intercepted messages about various crimes sent via those platforms, and used the gathered information and evidence to dismantle criminal syndicates. The criminal investigations against Ennetcom, Phantom Secure, PGPsafe, Ironchat, EncroChat, Sky ECC had all brought the same conclusion: organized criminals have strong trust in devices and service providers promising secure communication and they unsuspectingly share criminally relevant information with other members of their organization through this kind of networks. The top of the process described above was Operation Trojan Shield, where the FBI operated its own encrypted device company, called “ANOM”. The information coming from the ANOM devices was used openly to take down several criminal networks all over the world in 2021. In the paper I will introduce the aforementioned law enforcement operations and draw the conclusions from the aspect of criminalistics and criminal procedure law. I will examine the following question as well: is it still a tactical option to use the interception of internet-based clandestine communications against organized crime groups after the ANOM case, or will high-risk criminal networks turn to platforms that are physically separated from the internet. The paper suggests, that law enforcement has to be prepared for a potential shift in how clandestine communications are implemented by organized crime.

13: European Day
16:45 - 18:15 Wicklow Meeting Room 2

□□□□ European Day - Forensic Management and Quality Systems: Quality Systems and Accreditation

Broaden Your Horizon! A Multidisciplinary Exercise 16:45 - 18:15

A. Mattei[1], *F. Zampa*[2], *J. Buegler*[3], *A. Kneppers*[4], *M. Weddfelt*[5], *P. Maida*[1]

[1]Raggruppamento Carabinieri Investigazioni Scientifiche, Reparto

Investigazioni Scientifiche di Messina, Messina, Italy, [2]Raggruppamento Carabinieri Investigazioni Scientifiche, Reparto Investigazioni Scientifiche di Parma, Parma, Italy, [3]Bavarian State Bureau of Investigation, Munich, Germany, [4]Netherlands Forensic Institute, The Hague, Netherlands, [5] Swedish National Forensic Centre, Linkoeping, Sweden

Workshop Description: The learning objective of this interactive workshop is to provide insights into the design and realisation of a multidisciplinary collaborative exercise (CE). Interdisciplinary examination of forensic exhibits requires careful consideration of how forensic examinations can influence each other. This effect can be direct and obvious, or indirect and understated. A multidisciplinary CE should test the ability of a forensic laboratory to account for these difficulties. Therefore, the CE should be set up in a way that considers how the applied procedure can influence the ability to recover traces.

Building on lessons learned from previous successful experiences made through the ENFSI EU Direct Grants 2016-2022, this workshop summarises the concepts, planning, design, preparation, implementation, coordination and evaluation of a Multidisciplinary CE, covering a range of forensic disciplines. This means that experts designing the test material should assess sequential recovery plan scenarios. Attention will be given to developing a combination of traces on a test material where the analyses impact each other. These mutual dependencies are referred to as “critical points”. The level of difficulty of an exercise can be controlled at these “critical points” and on specific traces. The multidisciplinary CE is not meant to allow laboratories to benchmark themselves against other laboratories in terms of the outcome of laboratory results or the strength of conclusions, but primarily aims at determining the optimal sequence of examinations. Join us to learn how to make it work and give us valuable insights that will help us do even better in the future!

Thursday, May 29, 2025

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09:00 - 09:45 Auditorium

PLENARY SPEAKER 5

Plenary Talk 5 09:00 - 09:45

06: Education and Training: Other

09:45 - 13:00 Wicklow Hall 2 (A)

Forensic Management and Quality Systems: Other

ISO 21043 Forensic Sciences: Finally a Real Worldwide Forensic Standard 09:45 - 13:00

C. Berger[1,2], *D. Meuwly*[2,3]

[1]Leiden University, Faculty of Law, Leiden, Netherlands, [2]Netherlands Forensic Institute, Principal scientists, The Hague, Netherlands, [3]University of Twente, Faculty of Electrical Engineering, Mathematics and Computer Science, Enschede, Netherlands

Workshop Description: In the past 7 years an international technical committee (TC272) has developed the international standard ISO 21043 Forensic Sciences, which came out just before the EAFS2025 conference. This is the first international standard for forensic science, based on a worldwide consensus, and a unique opportunity to move forensic science forward.
The workshop facilitators were both lead editors of parts of the standard, which concerns 5 parts:
1) Vocabulary;
2) General requirements for the forensic process, and the recovery and management of items;
3) Analysis;
4) Interpretation;
5) Reporting.
They will offer their unique perspective and the inside story of how the ISO 21043 Forensic Sciences came to be.
Participants will be actively involved in the exchange of views related to the implementation of this worldwide standard.
Knowing the philosophy and reasoning behind every part of the standard the facilitators will help you get an overview of the standard, and how it can benefit your work.
The workshop is aimed at a wide audience, including quality managers, forensic scientists, management and even customers: anyone interested in improving the quality of forensic science, and/or making that quality demonstrable.

03: Digital Evidence: Forensic Visualisation (VR, AR, 3D)
09:45 - 11:15 Wicklow Meeting Room 2

Digital Evidence: Forensic Visualisation (VR, AR, 3D)

Digital Crime Scenes: Analyzing Forensic Evidence with 3D Technology 09:45 - 11:15

A. Recio[1]

[1]Universidad de Extremadura, Badajoz, Spain

Workshop Description: This workshop provides a comprehensive introduction to the Eyescloud3D platform, showcasing its capabilities in forensic investigations. Participants will learn how to recreate crime scenes and analyze evidence using advanced 3D visualization tools.
The session is divided into three key parts to give a thorough understanding of the technology and its practical applications.
First, we will introduce the Eyescloud3D platform and explain the fundamentals of photogrammetry, the process behind 3D scene generation. Participants will discover how this technology converts images into detailed 3D models, essential for analyzing forensic evidence and crime scenes.
In the second part, we will demonstrate hands-on scene creation. Using dummies, objects, and other crime scene elements, participants will observe the process of real-time scene reconstruction. You will learn how to efficiently gather data and generate accurate 3D representations that can be used to assess forensic evidence.
The final part of the workshop will focus on the analysis tools within the 3D viewer. We will show how to navigate through the models and interact with key features to interpret the data and draw conclusions.
By the end of the workshop, participants will have practical skills to recreate and analyze 3D crime scenes, helping to enhance forensic investigations and evidence evaluation using Eyescloud3D.

04: DNA and Body Fluids: Missing Persons Identification
10:00 - 11:00 Auditorium

DNA and Body Fluids: Missing Persons Identification

Strengthening Global Cooperation: Innovative Approaches to Missing Persons Investigations 10:00 - 10:30

F.-X. Laurent[1], *A. Nikolaeva*[1], *S. Hitchin*[1]

[1]INTERPOL, DNA Unit, Lyon, France

Abstract Body: The issue of missing persons extends beyond borders, underscoring the need for strong international cooperation to tackle this critical challenge. Effective collaboration between police forces worldwide relies on the seamless sharing of information and resources. However, this cooperation is often constrained by differences in data availability and accessibility across jurisdictions. To overcome these barriers, countries are encouraged to prioritize the submission of comprehensive biometric data, such as DNA profiles, to enhance the accuracy and efficiency of missing person investigations. Founded in 1923, INTERPOL serves as a bridge

connecting law enforcement agencies across its 196 member countries. It provides a platform for cooperation in areas such as counter-terrorism, human trafficking, organized crime, and missing persons investigations, leveraging international databases for biometric data comparison. Recently, INTERPOL launched I-Familia, a groundbreaking DNA database designed to assist in identifying missing persons through family DNA kinship matching. Additionally, the organization initiated Operation Identify Me, a public appeal to uncover the identities of 46 women believed to have been murdered in Belgium, France, Germany, Italy, Spain, and the Netherlands. These cases, many decades old, represent a poignant reminder of the importance of addressing unidentified remains.
This presentation will showcase real-life examples of successful international police collaboration involving multiple member countries. It aims to outline strategic approaches to strengthen partnerships within INTERPOL's network and encourage broader utilization of the organization's tools and expertise. Law enforcement agencies must accelerate the resolution of international missing person cases, providing crucial answers to affected families while advancing global justice.

For2-BioB: Optimizing the Management of the Belgian DNA Databases 10:30 - 10:45

T. Dorné[1], *L. Köhler*[1], *S. Steuve*[1]

[1]National Institute for Criminalistic and Criminology, Brussels, Belgium

Abstract Body: DNA databases in Belgium have rapidly evolved due to their increasing use in criminal investigations and international comparisons enabled by the Prüm Treaty. The For2-BioB project aims to optimize the organization and functionality of the Belgian DNA databases for criminal investigations (work packages 1-3), while ensuring compliance with ethical and legal standards (work packages 4-5). This abstract focuses on the first three work packages, addressing field practices, the integration of new technologies, their developmental potential, and the impact of demographic shifts on genetic evolution.
Current inclusion and comparison criteria for DNA profiles, based on the number of STR markers, are being evaluated alongside statistical methods such as random match probability and likelihood ratio. The goal is to optimize the balance between profile types and relevant matches, ensuring high-quality DNA databases. Additionally, the influence of allelic frequencies on statistical calculations is analyzed to identify the most suitable reference population and explore how variations in allelic distributions can serve as ethno-geographic estimators.
The research uses a CODIS test environment filled with in-house generated DNA profiles to determine the optimal criteria and investigates the effects of database size on adventitious matches. Additionally, an ethno-geographic estimation tool, which utilizes data from 166 populations to estimate the heritage of a DNA profile, demonstrates variations in allelic distribution across populations and enables ethno-geographic estimations based on STR markers.
These findings provide valuable insights that could enhance the management and optimization of DNA databases globally, ultimately strengthening their criminal investigation capabilities.

Identification of Harry Gleeson. 10:45 - 11:00

s. clifford[1]

[1]Forensic Science Ireland, DNA and Biology, Celbridge Kildare, Ireland

Abstract Body: Between 1923 and 1954, there were 35 executions within the Irish State. The majority were buried in unmarked graves in a prison yard, including Harry Gleeson, who was hanged for the 1940 murder of Moll McCarthy, but granted a posthumous pardon in 2015. In 2024, forensic archaeologists began excavations in the prison yard and 25 sets of remains were recovered. A select number of bones from each individual were sent for genetic analysis, with the aim to identify Harry Gleeson. Various DNA extraction methods were carried out on the skeletal remains including [1] complete demineralisation followed by organic DNA extraction and purification using EZ1 DNA Investigator Kit (Qiagen) and [2] demineralisation buffer and purification using DNA IQ chemistry (Promega). Yields of DNA ranged from 0.00ng/ml to 0.08ng/ml.
Whole mitochondrial genome (ForenSeq mtDNA Whole Genome) and Y-STR DNA profiles (PowerPlex Y23) were generated from each of the exhumed individuals. One of the exhumed individuals matched Harry Gleeson's next-of-kin for both mitochondrial (maternal line) and Y-STR (paternal line) markers. Allele frequencies from EMPOP and YHRD were used to determine Likelihood Ratios. The results of the genetic data contributed to the successful identification of Harry Gleeson. This presentation outlines the laboratory and genetic analysis parts of this project. Harry Gleeson was reburied in his home place of Holycross, Co. Tipperary on the 7th of July 2024.

12: Scenes of Crime: Implementing New Technologies at Crime Scenes
10:00 - 11:00 Liffey Hall 2

Scenes of Crime: Implementing New Technologies at Crime Scenes

The Suitability of Using Geomatic Techniques to Assess the Decompositional Phases of a Porcine Cadaver 10:00 - 10:15

V. Berezowski[1], *X. Conlan*[1], *D. Seckiner*[2], *I. Crebert*[3], *A. Taylor*[1], *X. Mallett*[3]

[1]Deakin University, School of Life and Environmental Sciences, Waurn Ponds, Australia, [2]University of New South Wales, School of Biomedical Sciences, Kensington, Australia, [3]University of Newcastle, School of Law and Justice, Newcastle, Australia

Abstract Body: Generating an accurate post-mortem interval (PMI), the time elapsed from death to discovery, is a vital, yet challenging, task in a death investigation. Inaccurate PMI's can result in a difficulty and potential inability to identify the victim as well as misinforming the police investigation. When faced with a deceased individual, there are numerous PMI calculation methods available. One such method is the 'Total Body Score' (TBS) which involves a visual assessment of the decomposition stage that an individual is in. The resulting TBS is then used in an 'Accumulated Degree Days' (ADD) calculation which results in an estimated PMI based on the amount of heat units required to reach that stage of decomposition. While a TBS score is typically generated at the scene, the increased

popularity of advanced scanning techniques, such as light detection and ranging (LiDAR) and photogrammetry, in death investigations has allowed for this assessment to be done virtually. As such, the purpose of this project was to compare the TBS scores generated from a full-sized pig cadaver on site to those of three-dimensional models created with LiDAR (generated using Recon-3D) and photogrammetry. To accomplish this, the TBS values generated on-site and virtually were compared to see how accurately the three-dimensional techniques can capture the nuances of decomposition. As an accurate ADD, and thus PMI, is contingent on an accurate TBS, this research aims to demonstrate the potential operationalisation of advanced scanning techniques for death investigations involving decomposed human remains.

Time-Since-Deposition Analysis of Bloodstains Deposited on Various Substrates Using Portable NIR Spectroscopy 10:15 - 10:30

L. Huard[1], C. Muehlethaler[1], A. Bécue[2]

[1]Université du Québec à Trois-Rivières, Trois-Rivières, Canada, [2]École des Sciences Criminelles (School of Criminal Justice), University of Lausanne, Lausanne, Switzerland

Abstract Body: Blood is one of the most encountered types of trace on crime scenes. However, from a forensic point of view, the potential of blood traces is not fully exploited yet. Despite the progress made over the last few years by different research groups, there is no reliable technique for the estimation of the time since the deposition of bloodstains that has been developed to this day. Research published on bloodstain dating has always faced the same difficulties: the physicochemical properties of the degradation are known and validated, but the traces found on crime scenes are never controlled samples. Previous studies have determined that several factors can influence the dynamic of the degradation, including the substrate onto which the blood is deposited. This project therefore aims to evaluate the influence that the substrate exercises on bloodstain degradation using MicroNIR spectroscopy. This portable near infrared instrument can be used directly on scenes, to avoid transport conditions that can alter the traces as well as the time elapsed before the laboratory analyses.

Decision Support for Crime Scene Investigation: On the Importance of Carefully Timed Information Provision 10:30 - 10:45

P. Russel[1,2], C. de Poot[1,3], T. Valkenburg[4], T. van Kleffens[5], R. Ypma[2], B. Kokshoorn[1,2]

[1]Amsterdam University of Applied Sciences, Amsterdam, Netherlands, [2] Netherlands Forensic Institute, The Hague, Netherlands, [3]The Netherlands Police Academy, Apeldoorn, Netherlands, [4]Dutch National Police, Amsterdam, Netherlands, [5]Netherlands Public Prosecution Service, Amsterdam, Netherlands

Abstract Body: There is a growing demand for decision support systems to assist forensic investigations in making complex decisions. By providing structured data and scientific insights, these systems can make

investigations more efficient and effective. However, reliance on support systems also has potential downsides, such as the risk of creating an echo chamber. Heavy dependence on such systems may limit alternative viewpoints and reduce objectivity. Despite these challenges, thoughtfully designed and applied decision support systems have the potential to enhance quality, transparency and reliability of forensic processes, helping investigators reach well-substantiated conclusions.

This study examines the knowledge requirements of crime scene investigators, with a specific focus on the moments when they require additional information to make complex decisions within a limited time frame. It also explores the impact of the timing of information provision on decision-making. In an experimental setting, 160 forensic professionals examined a virtual crime scene, prioritized the collected evidence for further analysis and completed a questionnaire about their information preferences. Participants received information either before, during or after the crime scene investigation. The questionnaire results indicate that investigators prefer to receive information during the crime scene investigation. The experiment reveals that information provided during the crime scene investigation also most strongly influences investigators' decision-making. However, this timing also entails the highest risk of biasing the investigation. These findings highlight the importance of carefully timed information provision in forensic investigations, balancing the benefits of decision support with the need to maintain impartiality and minimize risks of cognitive biases.

Holodeck: Advancing Virtual Crime Scene Investigation Using Novel Techniques 10:45 - 11:00

R. Breker[1], *C. Sommer*[1]

[1]Bavarian State Office of Criminal Investigation (BLKA), Forensic Media Technology, Munich, Germany

Abstract Body: The *Holodeck* project of the Bavarian State Office of Criminal Investigation (BLKA) is a unique and highly advanced police VR lab used for interactive 3D forensic investigations. Since its introduction in 2023, the Holodeck has been used for the reconstruction of numerous major crime scenes. Besides the actual physical installation - including a role concept, multiple VR headsets and a state-of-the-art motion capture system – it also offers a powerful software with tools for visualization, interaction and 3D reconstruction of crime scenes. Key functionalities include the ability to measure distances and angles between objects, simulate ballistic trajectories or visualize bloodstain patterns - all within a highly accurate 3D environment. Additionally, the tool supports the integration of various data sources, including autopsy reports, witness testimonies, and physical evidence, supporting comprehensive case analysis. The *Holodeck* software is continuously enhanced with new features such as motion recording, scene-freezing capabilities and 3D Gaussian Splatting. Motion recording allows investigators to track and revisit their own or others' movements within the virtual environment which supports collaborative work and detailed path analysis. The scene-freezing feature enables users to pause and examine specific moments, capturing complex or fleeting details for deeper analysis. Future work also includes the expansion of the application to educational and training scenarios

within law enforcement and forensic science. Our presentation at EAFS 2025 will dive into the project's latest developments and the potential impact of these innovative features on the future of forensic analysis.

02: Chemistry: Textile and Hair
10:00 - 10:45 Wicklow Hall 1

Chemistry: Textile and Hair

Can Textile Fibres in the Respiratory Tract Help to Determine the Cause of Death? 10:00 - 10:30

G. Massonnet[1], M. Yerly[1], J. Bonvin[1], Y.C. Lim-Hitchings[1], S. Schaufelbühl[1], K. Lunstroot[2], S. Hess[3]

[1]University of Lausanne, Ecole des Sciences Criminelles, Lausanne, Switzerland, [2]NICC National Institute for Criminology and Criminalistics, Laboratory Material Analysis, Brussels, Belgium, [3]Forensisches Institut Zürich, Zentrale Dienste, Ausbildung, Zurich, Switzerland

Abstract Body: Death from smothering often shows little in terms of evidence of the cause of death. A recent study [1] proposed how fibres found in the nasal cavity of a victim could aid in determining if a smothering occurred.

The present study further contributes to this approach by investigating the value of textile fibres recovered in the respiratory tract, including more organs such as the mouth and trachea in addition to the nostrils and nasal cavities. This was achieved by carrying out two parallel studies. Prior to both studies, an optimisation of the recovery methods on living individuals and cadavers for the different organs was carried out.

A population study focused on generic class and colours of textile fibres present in the different organs. The size of the background noise for non-differentiable fibres was assessed using microscopy and MSP.

Additionally, data were collected on fibre collectives transferred to the nose and mouth of volunteers using textiles of different shedding capacity. These transfers were carried out while volunteers were at rest or carrying out a physical activity to simulate a normal activity and a smothering respectively.

The data collected demonstrates the potential value of examining textile fibres recovered in airways in the aiding of inferring the type of activity that had occurred (legitimate or smothering).

[1] Glauser N., Lim-Hitchings Y.C., Schaufelbühl S., Hess S., Lunstroot K., Massonnet G. (2024) Fibres in the nasal cavity: A pilot study of the recovery, background, and transfer in smothering scenarios, Forensic Science International, 354 p. 111890

A Novel Method for Assessing the Shedding of Fibres in Forensic Science: Investigating the Effects of Washing 10:30 - 10:45

V. Galais[1], S. Wilson[2], P. Dugard[1], C. Gannicliffe[3], B. Murphy[2], N. Nic Daéid[1], H. Ménard[1]

[1]University of Dundee, Leverhulme Research Center for Forensic Science, Science and Engineering, Dundee, United Kingdom, [2]University of Strathclyde,Centre for Forensic Science, Department of Pure and Applied Chemistry, Glasgow, United Kingdom, [3]Scottish Police Authority Forensic Services, Aberdeen Laboratory, Aberdeen, United Kingdom

Abstract Body: The evaluation of the shedding capacity of a garment is crucial in forensic analysis to understand fibre transfer mechanisms during contact activities. While adhesive tapes are commonly used, the lack of standardised pressure application -often done manually- poses a challenge. In addition, while previous studies have examined the effects of washing on fibre evidence, there is a notable absence in the literature regarding its impact on garment shedding capacity. This study aims to address these gaps by proposing a practical method to assess garment shedding capacity. Conventional tape lifting experiments, involving manual pressure application, were conducted for comparison with the novel method proposed in this study. Controlled conditions for reproducible experiments were achieved using a cost-effective friction tester and automated data collection through photography and ImageJ image processing software. Through controlled simulations, this study seeks to examine the relationship between garment shedding capacity, fibre transfer dynamics, and the effects of textile washing during laundry cycles.

08: Forensic Medicine and Toxicology: Other
10:00 - 11:00 Wicklow Hall 2 (B)

Forensic Medicine and Toxicology: Other

Scoring Decomposition: Limitations and New Developments of the Total Body Score (TBS) Method 10:00 - 10:15

A. Petaros[1], A.-R. Rezaie[2], C. Alfsdotter[3,4]

[1]Swedish National Board of Forensic Medicine, Department of Forensic Medicine, Linköping, Sweden, [2]Swedish National Board of Forensic Medicine, Department of Forensic Medicine, Stockholm, Sweden, [3]Swedish Police Authority, National Forensic Centre, Malmö, Sweden, [4]Swedish National Board of Forensic Medicine, Department of Forensic Medicine, Lund, Sweden

Abstract Body: The estimation of the postmortem interval (PMI) in deceased individuals is an important question forensic experts address in their work. While PMI estimation in early postmortem period is often considered more reliable due to the predictable progression of postmortem changes shortly after death, it becomes increasingly challenging as decomposition advances.
Currently, PMI estimation in decomposed bodies heavily relies on correlating morphological decomposition changes with accumulated degree days (ADD) - a measure for total temperature exposure over time. In 2005, a method was developed that combined morphological traits (Total Body Score, TBS) with ADD (Megyesi et al. 2005) and has since been widely tested, but also modified to adapt to other environmental realities, and/or

including new scoring criteria. Originally developed in the Midwest US, the method has yielded varying results depending on the region/climate in which it was tested. Despite its widespread use and evaluations, few studies have addressed the issues related to the difficulties in scoring bodies whose decomposition changes do not align with the method's scoring system. The current study presents the challenges observed with the TBS system when used in Sweden's cool climate. It also proposes an alternative, 'single trait' scoring system which takes in account the progression of individual decomposition features and their correlation with ADD, in order to identify the most informative set of features for predicting ADD.

Wing Geometric Morphometrics as a Tool for Identification of Forensically Relevant Blow Flies in the Western Cape 10:15 - 10:30

O. Lewis[1], *E. Dinkele*[2], *C.G. Mole*[1]

[1]University of Cape Town, Forensic Medicine and Toxicology, Cape Town, South Africa, [2]University of Cape Town, Human Genetics, Cape Town, South Africa

Abstract Body: Correctly identifying insect species is important for accurately estimating the time since death of decedents (mPMI). While molecular techniques and visual assessments are commonly used to identify species there are some limitations, particularly for similar species. As such, further supportive methods are required. Geometric morphometrics using the wings of Calliphoridae species has emerged as a useful alternative method. However, limited research has investigated South African species using this tool. This study aimed to explore the utility of landmark-based geometric morphometrics for identification of forensically-relevant Diptera species. As a proof-of-concept, 150 individuals were investigated, evenly distributed by sex across three species: *Chrysomya megacephala*, *Chrysomya chloropyga* and *Calliphora croceipalpis* (n=50). A total of 17 landmarks were digitised on the right wing to analyse variation in size and shape. Significant differences in both wing size and shape were observed between the three species, however, greater similarity was found between the wings of the two *Chrysomya* species, relative to the *Calliphora* species. Landmarks along the outer wing margin demonstrated greater variation compared to those at the base of the wing. Sexual shape dimorphism was significant for all three species ($p < 0.0001$), however sexual size dimorphism was only detected between the sexes of *Ch. chloropyga* and *Ca. croceipalpis*. This study suggests landmark-based geometric morphometrics may provide a reliable alternative to species identification of Calliphoridae in South Africa. Future work will expand the database to include other relevant species.

Understanding Natural Mummification: Innovative Electronic Sensors for Quantifying Soft Tissue Drying in Forensic Taphonomy 10:30 - 10:45

K. Adams[1], *D. Finaughty*[2], *V. Gibbon*[1]

[1]University of Cape Town, Cape Town, South Africa, [2]University of Witwatersrand, Johannesburg, South Africa

Abstract Body: Precocious mummification is a unique phenomenon in Cape Town and is described as full-body desiccation occurring in less than one month. This research investigates the desiccation process of soft tissue in South Africa, examining its interplay with environmental factors and its implications for estimating the post-mortem interval (PMI). Across two summer seasons and one winter season, four decomposing porcine bodies were deployed. Custom-designed and constructed printed circuit boards (PCBs) were created and used to quantify desiccation patterns by measuring the moisture content of body tissue over time. Three PCBs were inserted in each porcine body and resistivity measures were collected every 15 minutes. Generalized additive models (GAM) were employed to identify the environmental factors influencing desiccation. Tissue resistivity was assessed against environmental variables (accumulated degree days, solar radiation, precipitation, and humidity) to gauge the extent of variation in tissue resistivity these variables explain. The findings reveal distinct desiccation trajectories between summer and winter, with summer conditions fostering precocious mummification, while winter conditions did not. Environmental factors, notably temperature and solar radiation, emerged as significant influencers of desiccation. This study represents the first quantitative analysis of deep tissue desiccation on an international scale, as well as the first quantitative evaluation of desiccation and natural precocious mummification in the Western Cape, South Africa. The results show promise for informing local PMI estimates in medico-legal death investigations. Moreover, the technology and methodology developed for this study demonstrates the value of a transdisciplinary approach to investigating and understanding complex, applied problems in forensics.

A Study on Body Decomposition and Insect Succession in the Winter and Summer Seasons of the Table Mountain Region, Cape Town, South Africa 10:45 - 11:00

A.D. Adetimehin[1], C.G. Mole[1], D.A. Finaughty[2], M. Heyns[3,1]

[1]University of Cape Town, Pathology, Division of Forensic Medicine and Toxicology, Cape Town, South Africa, [2]University of the Witwatersrand, Anatomical Sciences, Division of Biological Anthropology, Human Variation and Identification Research Unit (HVIRU), Johannesburg, South Africa, [3] Ulster University, School of Medicine, Derry/Londonderry, United Kingdom

Abstract Body: Seasonal and geographical variations on carrion decomposition rate and carrion-associated insect successional patterns exist and have inspired the generation of seasonal and regional baseline data globally. In the Table Mountain region, an environment of forensic interest in Cape Town, South Africa, no published studies exist on carrion decomposition rate and carrion-associated insect successional patterns. In this study, we investigated the decomposition rate and insect successional patterns on two ~60kg pig carcasses deployed in the winter and summer seasons (one per season) within Table Mountain National Park in Cape Town between 2022 and 2023. The summer season saw a fifteen-fold accelerated time to skeletonization (8 days) compared to the winter season (122 days). In both seasons, ADD explained over 80% of the changes in the total body scores of the pig carcasses. A total of 11,666 adult insects comprising 5 orders, 20 families and 33 species were recorded. Season had no significant effect on the number of insect species and total number of insect individuals recorded. In the winter season, *Ch. chloropyga* and

members of the families Staphylinidae (Subfamily: Silphinae) and Dermestidae deposited their eggs on the pig carcass. However, in the summer season, *Ch. chloropyga*, *Ch. albiceps* and Dermestid beetles utilized the pig carcass as a breeding site. The variations in results of this study and other studies in a different region and/or location in South Africa underscore the importance of generating location- and region-specific baseline data on carrion decomposition rate, carrion-associated insect assemblage and successional patterns**.**

10: Legal and Ethical Aspects: Management of Bias
10:00 - 11:00 Liffey Meeting Room 2

Legal and Ethical Aspects: Management of Bias

Preventing Wrongful Convictions: Lessons from DNA Exonerations 10:00 - 10:30

G. Hampikian[1]

[1]CompGenomics, LLC, Boise, United States

Abstract Body: DNA has freed hundreds of people from wrongful convictions, but DNA can also be misinterpreted or misrepresented leading to wrongful convictions. The presenter has worked for more than 25 years on DNA exonerations. He has helped to free more than three-dozen people from wrongful convictions, working on cases from Amanda Knox in Italy to Christopher Tapp in his home state of Idaho (USA), where he was professor of biology and the founding director of the Idaho Innocence Project at Boise State University. In Tapp's case, his lab trained police in forensic genealogy leading to the first genealogy exoneration, and the conviction of a new suspect 23 years after the rape and murder of his 19 year-old victim. The presentation will highlight methods used to reexamine old cases with novel DNA approaches, and will challenge participants to identify current practices that may lead to wrongful convictions. Topics covered will include presumptive testing, genealogical misses, statistical variance, biased language in DNA reports and testimony, and unequal access to DNA testing and experts. As science improves, old practices are discarded and better methods are adopted. The challenge is to find and correct errors in our time. Fortunately, there are critical approaches that can increase the pace of discovery.

Reflections on Cognitive Bias in Forensic Science 10:30 - 10:45

C. Kirchhuebel[1], *P. French*[2], *G. Brown*[1,3]

[1]Soundscape Voice Evidence, Lancaster, United Kingdom, [2]J P French International, York, United Kingdom, [3]Lancaster University, Lancaster, United Kingdom

Abstract Body: In his editorial published 10 years ago, Champod highlighted risks associated with research that is focused on cognitive bias only [1]. One of these is the *'risk of enforcing the view that the forensic scientists should be detached, blind and immune from any external influences (especially from the inquiry).'* By referring to case examples from forensic speech science, this talk demonstrates that 10 years on the

risk has become a practical reality. Bias is becoming an attractive swiping argument as part of defence strategy. In the context of voice comparison analysis, submissions that experts should not have any information at all have been successfully deployed by legal professionals, even going as far as to suggest that experts should not be told the prosecution proposition as this would introduce cognitive bias. This has had wide-ranging effects within forensic speech science casework, including experts not taking on certain types of cases (meaning that evidence is not appropriately analysed). For some, it has also shifted the focus and purpose of bias mitigation away from ensuring quality and reliability of analyses and towards ensuring protection in Court. Instead of jumping on the bandwagon and putting in place cognitive bias mitigation measures which serve no more than window dressing, we should approach cognitive bias as we do our forensic analyses: with logic, balance and transparency.

[1] Champod, C. Research focused mainly on bias will paralyse forensic science, Science & Justice, Volume 54, Issue 2, 2014, pages 107-109, https://doi.org/10.1016/j.scijus.2014.02.004.

We Need to Talk About Bias 10:45 - 11:00

D. Kerzan[1,2]

[1]National forensic Laboratory, Slovenian Police, Ljubljana, Slovenia, [2] University of Maribor, Faculty of Criminal Justice and Security, Department of Criminalistics, Ljubljana, Slovenia

Abstract Body: Bias in forensic science has become a common theme in scientific journals, with papers presenting sources and mechanism of bias and proposals for its mitigation. To encourage the application of mitigation mechanism and techniques into the daily work of forensic practitioners it is essential to explain reasons and sources of bias and particularly the fact that bias is not a personal decision but rather innate feature of human thinking and reasoning.
Despite bias being usually associated with so called subjective methods of forensic sciences, like toolmark, shoe mark, handwriting, bite examination, etc., the literature shows that even so-called objective, instrumental forensic analysis can be subject of bias when interpreted, particularly at the court. Furthermore, the over relying on IT solutions in forensic science is yet another possible source of problems, as it can lead to overestimation of the proposed results and some kind of algocratic bias based on possibly already biased computer models.
It is thus needed to understand the effect of psychological (cognitive) reasons for human biasability and how this is linked to different types of (voluntary) ignorance, which is somewhat paradoxically sometimes (understandably) highly undesired while sometimes (surprisingly). Subconscious nature of bias will be emphasized and learned ignorance and voluntary ignorance as concepts will be explored as a possible path towards further mitigation of bias.

06: Education and Training: Other
10:00 - 10:45 Liffey Meeting Room 3

Education and Training: Other

Research Mentorship Within an Academia-Practitioner Partnership 10:00 - 10:15

H. Earwaker[1], *A. De La Fuente Vilar*[1], *J.L Coulston*[1], *M. Buchan*[1]

[1]University of Portsmouth, School of Criminology and Criminal Justice, Portsmouth, United Kingdom

Abstract Body:

True impact is vital to the value of research within forensic science. The lack of a robust evidence base to support practice has been highlighted in a number of key reports and discussions. Academia-practitioner partnerships have been established across the UK. The mechanisms and priorities associated with these vary but tend to include shared resources or premises, the provision of teaching and resources, and participation or collaboration in research projects or bids. Achieving a truly collaborative and co-creative approach to research is challenging in a resource poor environment with dynamic operational priorities and high business-as-usual demands. A pilot novel process for conducting collaborative research was trialled within the Forensic Innovation Centre at the University of Portsmouth. Rather than the initiation of a research project by a student (often failing to meet dynamic operational requirement), project areas were scoped collaboratively through a Socratic approach taken within a workshop session with key research and constabulary stakeholders. Project areas were advertised to students on a competitive basis. Projects were developed and carried out by the student team with active mentorship from a forensic workplace mentor, providing operational context and ensuring real world relevance, and guidance from an interdisciplinary team of academic supervisors to provide a robust theoretical underpinning. Project outcomes were required to be delivered in usable formats that would include recommendations for change to policy and practice. The approach will be described and the impact outlined, along with best practice recommendations that include idea generation, workplace mentorship, and pathways to impact.

A Study Away Minimester Professional Ethics Course for Forensic Science Students to the UK and Ongoing Ethics Professional Development 10:15 - 10:30

K.M. Elkins[1]

[1]Towson University, Chemistry and Forensic Science, Towson, United States

Abstract Body: Ethics is an important component of a complete education and continuing professional development in forensic science. Forensic scientists are faced with myriad ethical decisions in their daily work. A study away minimester version of a professional ethics course for forensic science students was developed to bring the students to the United Kingdom and compare and contrast the American and British forensic and legal systems. The professional ethics for scientists course has dual roles as an advanced writing and ethics course. The initial topics are academic and professional codes of ethics and artificial intelligence (AI). Topics including

ethics in authorship, publications, access to chemical information, data sharing, innovation and IP, human subjects, lab safety, plagiarism, fabrication, data manipulation and reporting, processing forensic cases and human remains, and expert witness testimony are covered. Other topics include comparing and contrasting the legal, law enforcement, and forensic systems, the history of the US and UK chemical industries, forensic practice, and the application of new forensic technologies in both countries. It is important to discuss and understand differences between terms including legal, illegal, moral, right, just, and public trust. A strong emphasis is placed on role playing and practicing decision making. The final paper assignment is focused on international ethics and social justice through a case study. Other writing assignments focus on forensic investigative genetic genealogy, ethics infractions, and dual use research. Ongoing professional development for practicing forensic scientists and assessment will also be discussed.

Developing a Psychological Safe Laboratory for handling Explicit Child Sexual Abuse Materials (CSAM) 10:30 - 10:45

J. Ang[1], *T. Danker*[1], *B. Danni*[1], *H.F. Ho*[1]

[1]Singapore Police Force, Police Psychological Services Department, Singapore, Singapore

Abstract Body: Police investigators who handle explicit child sexual abuse materials (CSAM) face significant mental health challenges due to the nature of the content they are exposed to and the emotional toll of the cases they investigate. These challenges can be profound, affecting their psychological well-being, professional performance, and personal lives. Some of the key mental health impact on investigators handling CSAM includes vicarious trauma and secondary PTSD, burnout and compassion fatigue, moral injury, hyper arousal and anxiety, cognitive dissonance, depression and anxiety, emotional isolation and numbing, and even self-guilt and blame. Given the potential of adverse mental health impact on police investigators handling CSAM, police forensic psychologists in Singapore worked together with CID in developing a psychologically safe laboratory for investigators handling CSAM so as to prevent the negative impact of vicarious traumatisation through exposure to explicit aversive CSAM materials. The success,, impact and limitations of the CSAM laboratory are discussed in this paper.

11: Marks, Impressions and Biometric Traces: Firearms and Tools
10:00 - 11:00 Liffey Meeting Room 4

Marks, Impressions and Biometric Traces: Firearms and Tools

The Reliability of Character Recognition: A PhD Study Into the Interpretations of Chemically Recovered Serial Numbers 10:00 - 10:30

J. Waszczuk[1,2]

[1]Australian Federal Police, Firearms & Toolmark Identification, Canberra, Australia, [2]University of Technology Sydney, Centre for Forensic Science, Sydney, Australia

Abstract Body: Forensic disciplines have worked towards addressing the 2009 NAS and 2016 PCAST report criticisms in the years following their release. For firearm examiners those criticisms centralised around the verification of current practices and establishing of error rates. Serial number restoration is a practice undertaken by forensic firearm examiners to re-identify a defaced firearm, and although the practice is common, the verification of examiners interpretations of results had not previously been assessed.

To provide further support for the practice a number of studies were undertaken in serial number restoration, including an expert-novice comparison study, an online serial number verification survey, and serial number application study.
• The expert-novice comparison study involved the formation of 120 sample plates which had each been stamped with 6 randomised alphanumeric characters (A to Z, 1 to 9), to constitute a mock serial number. The markings were then obliteration, restored, and the results interpreted by trained and untrained participants at different time intervals.
• The online verification survey consisted of 30 images of restored or partly serial numbers presented in formats of either: unedited, enhanced contrast, or black and white. The survey, designed to assess the reliability of verifying restored serial numbers through imagery was completed by 264 participants.

Through the assessment of results, valuable data was collated in relation to the validity of the practice, methodology for confirmations, and the training of forensic examiners in the field. These studies, aimed at strengthening the foundations of the practice, and their results, will be presented to EAFS attendees.

Detection of Obliterated Traceability Elements in Polymers Through Strain-Induced Optical Variations 10:30 - 10:45

L. Skokan[1], *C. Muehlethaler*[2,3], *A. Ruediger*[1]

[1]Institut national de la recherche scientifique, Energy, Materials and Communications Center, Varennes, Canada, [2]Université du Québec à Trois-Rivières, Department of Chemistry, Biochemistry and Physics, Trois-Rivières, Canada, [3]Groupe de recherche en science forensique, Trois-Rivières, Canada

Abstract Body: Traceability elements, introduced notably in firearms, vehicle parts, orthopedic prostheses and implantable medical devices, guarantee a level of identification or individualisation of the object to which they are affixed. These alphanumeric characters can therefore provide investigative leads and become circumstantial evidence in legal proceedings. Consequently, criminal activity may prompt deliberate deformation of the depth profile of the impressions, usually by abrasion, to prevent them from being read, rendering the need for them to be reconstructed.

In recent years, our research group has studied strain detection by hyperspectral Raman imaging which has proven useful as a non-destructive technique for reconstruction purposes. This method exploits the inelastic

scattering of photons for the extraction of peak shift, full width at half maximum and peak intensity ratio variations from the vibrational spectrum of polymers. These parameters allow contrast maps to be generated following the imaging of a sample that has sustained partial strain despite being obliterated.

However, Raman spectroscopy experiments operate at the threshold of the hardware resolution. Furthermore, fluorescent signatures remain the main interfering factor in acquiring resolved spectra, as the former has an inherently greater cross-section.

This presentation aims to provide alternative non-destructive methods to overcome these limitations, namely by directly exploiting absorbance and emission changes resulting from structural rearrangements (e.g. conformational changes, aggregation, or bond-scission of chromophores) otherwise known as mechanochromic effects. Exploiting photoluminescence signatures enables wide-field imaging potential. This would decrease acquisition time and limit hardware requirements rendering the technique easily deployable to a larger scale (e.g. to laboratories worldwide).

Between the Pages and the Autopsy Room - A Comprehensive Literature Review and Multidisciplinary Survey on the Current State of Forensic Maceration Techniques 10:45 - 11:00

M. Kirbach[1], C. Kohlt[2], M. Weber[3], W. Ludvigsson Möller[4], M.A. Rothschild[1], A. Petaros[5]

[1]Institute of Legal Medicine, Faculty of Medicine, Cologne, Germany, [2] Federal Criminal Police Office, Wiesbaden, Germany, [3]Landeskriminalamt Nordrhein-Westfalen (LKA NRW) - Institute of Forensic Science, Marks, Düsseldorf, Germany, [4]National Forensic Centre, Linköping, Sweden, [5] Swedish National Board of Forensic Medicine, Linköping, Sweden

Abstract Body: Bones in human remains can be analyzed in a variety of scenarios. In cases of sharp force trauma, tool marks can be examined to assess the type of tool based on class and subclass characteristics and to identify a specific tool based on individualizing characteristics. Material traces in bone lesions or on contact surfaces resulting from the tool impact can provide further information and evidence on the tool used.
To ensure optimal analysis of bones in these scenarios the complete removal of soft tissue is often required, which is achieved through maceration. Maceration should aim to preserve bone integrity, while minimizing alterations to bone structures and traces. To date there is no clear overview of the maceration methods used in praxis, their impact on forensic investigations and how they are incorporated in forensic laboratories work. To address this, a comprehensive literature review was performed and an international survey was distributed to forensic medicine/anthropology institutes and forensic laboratories, focusing specifically on maceration, material trace and tool mark analysis. The review identified several preferred maceration methods, but highlighted a lack of knowledge regarding how these methods affect other forensic examinations. The survey, showed that many institutes still do not perform such examinations or include maceration in standard operation procedures, demonstrating a lack of standardization in this field. Based on these

findings, a research project is planned to evaluate maceration methods suitable for tool marks and material traces examination, with the aim of defining a standardized method for application in forensic casework.

09: Interpretation: Bayesian Approach and Bayesian Networks
10:00 - 11:00 Wicklow Meeting Room 3

Interpretation: Bayesian Approach and Bayesian Networks

Forensic Source ID Problems with Complex Evidence Forms 10:00 - 10:30

C. Saunders[1], J. Hanka[1], D. Ommen[2], J. Hietpas[3], J. Buscaglia[4]

[1]South Dakota State University, Mathematics and Statistics, Brookings, United States, [2]Iowa State University, Statistics, Ames, United States, [3]City University of New York, John Jay College of Criminal Justice, New York, United States, [4]Federal Bureau of Investigation Laboratory Division, Counterterrorism and Forensic Science Research Unit, Quantico, Va, United States

Abstract Body: The forensic identification of source problem is a fundamental question of interest in forensic science and is concerned with whether or not a set of traces with an unknown origin arose from a specified source of traces. This question is usually restated in the context of two competing propositions, one associated with the prosecution model that a specified source is the source of the traces, and one associated with the defense model that a source in some alternative source population is the actual source of the traces. This restatement of the question reframes the forensic identification of source problem as a non-nested model selection problem. Unfortunately for complex evidence forms, the likelihood structure to approach this problem in the original feature space is difficult to state, if it exists at all. Recent developments in forensic statistics have allowed an indirect likelihood structure to be stated in terms of the joint distribution of pairwise comparisons (scores) that have marginally normal distributions. This likelihood structure can be used to address the non-nested model selection problem; however, when the marginal distribution of scores is highly non-normal, it is unclear how to proceed. In this presentation, we will focus on our current statistical methodological research related to developing statistically rigorous approaches addressing these issues for complex, high-dimensional evidence forms that we are encountering in the analysis of aluminum powders in improvised explosive devices.

A Template Bayesian Network for Combining Forensic Evidence on an Item With an Uncertain Relation to the Disputed Activities 10:30 - 10:45

M. Vink[1,2], J.A. De Koeijer[1], M.J. Sjerps[1,2]

[1]Netherlands Forensic Institute, The Hague, Netherlands, [2]University of Amsterdam, Amsterdam, Netherlands

Abstract Body: In many case scenarios, a suspect is linked to a crime through an item containing forensic traces. For example, a sweater may contain DNA with a profile matching the suspect, and also fibers with

features matching the victim's top. However, the relation between the sweater and the offender during the activity may also be disputed in a case. We present a template Bayesian network (BN) for a fictive case scenario involving a strangling incident. First, we present the BN for evaluating DNA traces on a sweater that was assumed to have been worn by the offender during the incident. We then extend the case scenario by evaluating fiber evidence on the sweater, presenting a case BN that addresses two disputed elements: the relationship between the sweater and the alleged activity, and the actor of the strangulation (Vink et al., 2024). Finally, we demonstrate how the uncertain relation between the sweater and the activity affects the combined LR of the DNA and fiber evidence.

Key features of the proposed template BN:

- Extended version of a template model for the evaluation of any type of transfer evidence given activity-level propositions (Taylor et al., 2018 ; Vink & Sjerps, 2023)
- Combined evaluation of evidence given a disputed actor and/or activity (Kokshoorn et al., 2017) and/or item-activity relation using association propositions (Evett, 1993)
- Applicability in interdisciplinary forensic casework
- Flexibility for adaptation to more case variations

The Evaluation of Digital Evidence in Trojan Horse Defense Cases Using Bayesian Networks 10:45 - 11:00

M. Vink[1,2], R. Schramp[1], C.E.H. Berger[1,3], M.J. Sjerps[1,2]

[1]Netherlands Forensic Institute, The Hague, Netherlands, [2]University of Amsterdam, Amsterdam, Netherlands, [3]Leiden University, Leiden, Netherlands

Abstract Body: This presentation demonstrates the use of the Likelihood Ratio framework in cases of alleged possession of illegal material on electronic devices. The focus is on formulating propositions and modeling evidence evaluations using Bayesian networks (BNs). We discuss various options for formulating propositions about suspects' alleged activities, such as knowingly downloading or possessing illegal material. We also address formulating propositions considering alternative explanations for the presence of illegal material on electronic devices - for example, hacking activities or automated processes. These alternative explanations are commonly known as Trojan Horse defenses. We demonstrate how a BN can be used for evaluating digital evidence given these propositions through a fictive case example.

We argue that insights and methods developed for physical forensic evidence (e.g., Cook et al., 1998 ; Hicks et al., 2022 ; Taylor & Kokshoorn, 2023) are useful in the digital domain as well. The novelty lies in the formulation of a third 'standard' type of dispute - beyond "actor and/or activity" (Kokshoorn et al., 2017) - concerning whether an activity was performed knowingly or unknowingly. Such disputes appear to be more common in the digital domain than in the physical domain. We argue that such (close to) offense-level issues can be addressed by the digital forensic expert in a logical, balanced and structured manner, using BNs as tools to

support the probabilistic reasoning.

03: Digital Evidence: Forensic Visualisation (VR, AR, 3D)
11:00 - 11:45 Auditorium

Poster Session Thursday - Digital Evidence: Forensic Visualisation (VR, AR, 3D)

Multi-Format 3D Data to Enable Qualitative and Quantitative Analysis of Crime Scene Reconstructions 11:00 - 11:00

V. Rinaldi[1]

[1]University of Dundee, Leverhulme Research Centre for Forensic Science, Dundee, United Kingdom

Abstract Body: Crime scene investigation is a resource-intensive process, demanding significant time, equipment, and expertise. Current documentation practices rely on various sensors and tools to capture the scene's state, yet the absence of standardised protocols highlights both inter- and intra-national disparities. Moreover, available forensic tools are often underutilised, despite their potential to enhance data collection and streamline documentation processes.
This paper proposes Single-Source Multi-Format Derived Data (SSMDD), a new paradigm in crime scene documentation that creates multiple formats of data from one acquisition of ground truth data. Using a monocular full-frame camera, we capture a sequence of photographs or video frames to produce a point cloud, 3D mesh model, and radiance field. These formats collectively enable accurate measurements, high visual fidelity, and reliable spatial analysis, offering both qualitative and quantitative insights.
The SSMDD framework minimises the use of extra surveying devices, saving costs, and time, and reducing further contamination of the scene. It simplifies the workflow while maintaining robust standards for documentation by providing cross-modal data from a single sensor.
With the prospect of detailed digital twins, SSMDD will be a game-changing tool for forensic science in an operational way. Based on this conceptual framework, uncomplicated uses of available technology create new avenues for easy, time-saving, standardised documentation of a crime scene.

Back to Two Dimensions - Using 3D Point Cloud Data to Create Attachment Files for Investigation Reports 11:00 - 11:00

A. Myyrä[1], *J. Pihlajaniemi*[2], *S. Ketola*[3]

[1]National Bureau of Investigation, Vantaa, Finland, [2]Southeastern Finland Police Department, Pori, Finland, [3]Eastern Uusimaa Police Department, Vantaa, Finland

Abstract Body: Have we come full circle in 3D modeling? Sometimes, all you need to communicate investigation observations effectively, is a few good pictures. Laser scanning and photogrammetry provide effective ways to capture the crime scene in detail and in 3D. The 3D-models of scenes can be shared with investigators and prosecutors. Oftentimes, the end product from data is still a tradional, two-dimensional attachment to

preliminary investigation protocol document - a floor plan, an orthographic map, illustration of point of views, visualisation of bullet trajectories, measurement comparisons, and so on. 3D modeling methods provide a way to improve these 2D-attachments as well. Case examples demonstrate how to utilize different types of 3D models in technical investigation.

Digital Twin Technology in Forensic Science- A review 11:00 - 11:00

A. SRIVASTAVA[1]

[1]Teerthanker Mahaveer University, Department of Forensic Science, Moradabad, India

Abstract Body: The rapid evolution of digital twin and extended reality (XR) technologies is propelling industrial control systems (ICS) toward Industry 5.0. Digital twins—virtual models that mirror real-world systems—combined with XR applications, have shown promising applications in forensic contexts, particularly in enhancing drone accident investigations. Utilizing tools like Robot Operating System (ROS), Gazebo, and Rviz, digital twins offer a controlled environment for reconstructing crime scenes, analyzing evidence, and simulating potential scenarios with high precision. The integration of digital twin technology with extended reality (XR) tools and industrial control systems (ICSs) further enhances forensic applications, offering immersive experiences and real-time simulations. By employing digital twins, forensic professionals can visualize accident scenarios, analyze data with improved accuracy, and develop more effective investigative techniques. However, the connectivity of these systems introduces cybersecurity risks, underlining the importance of secure data management. This review underscores digital twin technology's transformative potential in the forensic sciences, enabling safer and more precise analytical techniques that support the demands of Industry 5.0.

Evidence-based Multi-view 3D Modeling Equipment 11:00 - 11:00

X. Jiang[1], *S. Ma*[2], *Y. Liu*[2]

[1]Institute of Forensic Science, Ministry of Public Security, China, Peking, China, [2]Camsonar Intelligent Technology R&D(Jiangsu) Co.,Ltd., Suzhou, China

Abstract Body: we present a multi-view 3D modeling device developed using standard optical cameras, designed to capture high-quality three-dimensional data without the potential risk of damage associated with laser-based systems. Unlike traditional laser scanning technologies, which can sometimes cause unintended harm to unlicensed or sensitive objects, our device leverages optical imaging from multiple viewpoints to reconstruct precise 3D models. This approach ensures both the preservation of the evidence and the integrity of the object being scanned, making it a valuable tool for applications in forensic investigations, archaeological studies, and other fields where object preservation is paramount. The device's efficiency and non-invasive nature provide a promising alternative to current 3D scanning technologies, offering improved safety and reliability in evidence-based modeling scenarios.

Poster Session 3 (Multiple Topics): All except 1 and 7
11:00 - 11:45 Auditorium

Poster Session Thursday

02: Chemistry: CBRN
11:00 - 11:45 Auditorium

Poster Session Thursday - Chemistry: CBRN

Molecular Forensics in Biothreat Scenarios – Chemical Profiling of Toxic Plant Materials Containing Ricin 11:00 - 11:00

L. Scharrenbroch[1], N. Scheid[1], T. Holdermann[1], T. Schäfer[1], B. Ahrens[2]

[1]Bundeskriminalamt (Federal Criminal Police Office), KT43-Central Analysis II, Wiesbaden, Germany, [2]Bundeskriminalamt (Federal Criminal Police Office), KT45-Toxicology, Wiesbaden, Germany

Abstract Body: Recent incidents in France, Germany, and worldwide highlight the global threat posed by biotoxins. Particularly the plant toxin ricin, found in the seeds of the castor oil plant *Ricinus communis* (*R.c.*), is of special forensic interest due to its worldwide availability, high toxicity, and lack of medical countermeasures. Analytical methods for the detection of ricin have already been established, but supplementary molecular forensic analysis is crucial to link evidences to a common origin or ricin extraction process. To raise the evidential value of forensic investigations, we developed orthogonal methods and chemometric models providing not yet available information.
Untargeted LC-HRMS analysis applying complementary CID and HCD fragmentation allows the detection and structural characterization of *R.c.* biomolecules also at low concentration levels. Diverse metabolite and lipid species, including *R.c.* specific biomarkers, were identified and included in a database. Semi-quantitative analysis of identified biomolecule profiles showed distinct patterns dependent on ricin purification method and *R.c.* cultivar.
Isotope ratio mass spectrometry is used as additional forensic signature. Combining C and N stable isotope ratios and respective total C and N mass concentrations allows for classification of unknown *R.c.* materials based on origin and ricin purification level for material comparison purposes.
1H NMR spectral fingerprint patterns of aqueous and organic *R.c.* extracts allow a differentiation between ricin extraction protocols and *R.c.* cultivars and can be used as orthogonal confirmative method.
Combining LC-HRMS, IRMS, and NMR data with subsequent chemometric analysis can be used in profiling strategies and is a comprehensive tool to support forensic intelligence.

Proactive Approach to CBRN Incident: Hazardous Materials Management 11:00 - 11:00

Y. Çatak[1]

[1]Ankara University, Graduate School of Healt Sciences/ Institute of Forensic Sciences/ Criminalistics, ANKARA, Turkey

Abstract Body:
This study aims to explain and examine current legal regulations and proactive approach methods regarding hazardous substances and hazardous chemicals.CBRN (Chemical, Biological, Radiological and Nuclear hazardous substances) are hazardous substances that spread to the environment where they are used and produced and create effects such as exposure and bioaccumulation on humans and the environment. The proactive approach regarding hazardous substances covers the measures taken especially during the production, classification, packaging, labeling, transportation, loading and unloading processes of chemicals. The classification, labeling, packaging and safe transportation procedures of these substances are carried out by chemical assessment experts and hazardous substance safety consultants, and the determination of existing risks and preventive measures against accidents are ensured. When it is necessary to transport hazardous substances, it guides the legal regulations regarding the transportation of hazardous substances on land, sea, air, rail and inland waterways.Emergency plans and security plans to be prepared against spills and leaks in CBRN incidents that may occur during the production, classification, packaging, labeling, transportation, loading and unloading of chemicals are important. In these plans, it is planned to intervene with substance-specific spill response equipment, personal protective equipment and to limit the area. In this way, it will be possible to prevent the incident from turning into a CBRN incident and to increase the workload of CBRN teams.When legal regulations regarding the production, safe use and transportation of hazardous substances and chemicals are followed and substance-specific proactive measures are followed, risk of accident and exposure risks will be reduced.

Introducing the JRC Border Security Laboratory: Enhancing EU Border Management Capabilities 11:00 - 11:00

L. Hintikka[1], *R. Jakopic*[1], *G. Ferraro*[1], *B. Meersman*[1]

[1]Joint Research Centre (JRC), European Commission, Geel, Belgium

Abstract Body: The European Commission's Joint Research Centre (JRC) is launching a Border Security Laboratory on 10th April 2025. This laboratory will support the development of new technologies and processes for integrated border management, with a focus on testing and demonstrating innovative solutions for border security, including the detection of explosives, narcotics, and radioactive materials. The laboratory will also provide training for border control officers and mobile expert support teams, as well as independent testing and integration of new equipment on the market.

The JRC's Border Security Laboratory will have a strong emphasis on scientific capabilities in areas such as drugs, explosives, counter drones, biometrics, and nuclear forensics. The laboratory will feature specialized facilities, including Explosives Trace Detection Laboratory, a Narcotics Laboratory, and a Nuclear and Trace Analysis facility, and will offer test facilities for innovative product development and realistic testing of border security solutions in a simulated environment.

We are excited to present the concept of the JRC's Border Security

Laboratory to the law enforcement community through this poster presentation at EAFS 2025. The laboratory will work closely with agencies, such as the European Union Drugs Agency (EUDA), Europol and Frontex, to ensure that its research and development activities are aligned with the needs of the law enforcement. The JRC's Border Security Laboratory will provide a unique platform for the development and testing of new technologies, and will contribute to the enhancement of border security and the fight against crime in the European Union

02: Chemistry: Explosives
11:00 - 11:45 Auditorium

Poster Session Thursday - Chemistry: Explosives

Towards Electrochemical Analysis for On-Site Explosive Identification 11:00 - 11:00

D. Vangerven[1], *J. Mazurków*[1], *K. De Wael*[1]

[1]University of Antwerp, Antwerp, Belgium

Abstract Body: The rise of (terrorist) attacks involving explosives form a threat to the well-being of our society. When there is a suspicion of an explosive material, it is crucial to identify the unknown compound on-site. Therefore, the demand increased for a field-deployable method for the detection of explosives. The project aims to develop such method using electrochemical analysis for a **fast** (<1 min), **highly accurate** (>95%), **cheap** (< €5) device for **on-site** explosive detection **usable by non-experts**. Electrochemical analysis allows us to examine the electrical properties of explosive compounds, particularly those with nitro groups, which undergo characteristic reduction reactions under specific potentials. These reactions generate unique voltammograms, providing distinct electrochemical fingerprints for each compound, enabling accurate explosive identification.

A Comparison Between the Post-Blast Analysis of TATP and TNT 11:00 - 11:00

L. Jeunieau[1], *S. Chantrain*[1], *B. Simoens*[1]

[1]Royal Military Academy, Forensic Laboratory for Analysis of Explosives, Brussels, Belgium

Abstract Body: The Forensic Laboratory for Analysis of Explosives (FLAX) carries out the analysis of all samples found on Belgian territory that might contain explosives. Some of these samples are bulk material, but most of them just contain post-blast traces on swabs. For this reason, it is necessary to have a well-characterised procedure for the post-blast analysis of explosives. This work is divided in two parts:

- The study of different parameters that can influence the analysis of swabs.
- The analysis of swabs taken after the combustion or detonation of the explosive in a controlled way. The aim of this part is to gain an

insight into what can be expected from a swabbing procedure.

Two explosives have been studied in this work, TATP and TNT. These two explosives differ in their vapour pressure, which is high for TATP and low for TNT. This should have an influence on the results of their post-blast analysis.
The different parameters under investigation which could have an influence on the swab analysis were:

- the time during which the swab remained in the ultrasonic bath before the chemical analysis of the methanol.
- swab storage before analysis: influence of storage time and storage conditions.

In the second part, the swabs were taken after the reaction of TATP and TNT under different conditions (different types of confinement, use of an igniter or detonator in the case of TATP…). The influence of the time between the explosive reaction and the swabbing procedure is also investigated.

Can We Identify Bomb Handlers? Proposition of a Bayesian Network (BN) to Model the Traceogenesis of Explosive Residues on Hands and Support Activity-Level Significance Assessment 11:00 - 11:00

I. Gavriilidi[1], T. Standley[2], C. Putruele[2], C. Kelly[2], J. Liechti[2], Z. Redshaw[2], N. Stephaniuk[2], N. Mai[3], M. Gallidabino[2]

[1]Polish Academy of Sciences, Hirszfeld Institute of Immunology and Experimental Therapy, Wrocław, Poland, [2]King's College London, Department of Analytical, Environmental and Forensic Sciences, London, United Kingdom, [3]Cranfield University, Centre for Defence Chemistry, Shrivenham, United Kingdom

Abstract Body: Identifying whether a person of interest has handled an explosive material is often an essential piece of evidence in the investigation of bomb-related incidents. Hand swabs are typically collected for this purpose. However, significance assessment of findings is still a challenging task. This is primarily due to a lack of both fundamental data on the transfer and persistence of explosive residues, as well as a proper interpretation framework. Herein, a hierarchical Bayesian model is proposed to model the traceogenesis (transfer and persistence) of explosive residue on people hands and, therefore, provide a logical framework for both supporting significance assessment of analytical findings in casework and guiding further experimental research in the field. The model, in particular, has been implemented through a Bayesian Network (BN) and include the key factors contributing to the explosive residue formation. An example of application to smokeless powder (SLP) residues is provided, after training with experimental data collected *de novo* and retrieved from published research. The proposed model aligns the significance assessment in explosive residue analysis to the ENFSI guidelines for evaluative reporting. Therefore, it is a promising approach that could deeply affect finding interpretation in the field. Benefits are countless and could even extend to other fields of forensic chemistry.

A „Non-soluble“ Method for TNT Profiling 11:00 - 11:00

S. Laanet[1]

[1]Estonian Forensic Science Institute, Tallinn, Estonia

Abstract Body: An overview of an alternative, detector and instrument friendly way to deal and analyse the samples of TNT for profiling purposes.

Instead of good solvents (like acetone), bad ones (like hexane) would be used. This creates the situation where the main component looses the effect of so-called „over-concentration“ and the minor additives, both specially added or synthesis
by-products or the compounds originating from synthesis precursors, have equal or even better tendencies to dissolve. The resulting chromatogram would show quite compearable peaks instead of one dominating main component peak. This method has already proved its good use in some real cases.

Rapid Detection of Explosive Residues: A Proof-of-Concept Study on the Synthesis and Application of Novel Luminescent Molecules for Nitroaromatic Sensing. 11:00 - 11:00

Z. Nowak[1]

[1]Technological University Dublin, Dublin, Ireland

Abstract Body: The ideal detection method for explosives is sensitive, selective, portable and capable of stand-off detection. However, few of the currently available methods fulfil all of the aforementioned criteria. Fluorescence detection has been named one of the most promising avenues for the detection of explosives. Most fluorescence tests focus on fluorescence quenching by nitroaromatic explosives, which they can do due to their structure.

Six novel donor-acceptor fluorophores based on imidazo[4,5-f][1,10]phenanthroline and 7H-acenaphtho[1,2-d]imidazole as the acceptors and benzene, naphthalene, anthracene, phenanthrene and pyrene as the donors will be synthesised. Donor-acceptor systems have been employed in many types of sensing applications and light-emitting molecules with tuneable wavelengths of excitation and emission. The novel fluorophores are expected to have high degrees of intrinsic fluorescence and to be selectively quenched by nitroaromatic explosives, due to the specific combination of donor and acceptor moieties. The fluorophores will be synthesised using a multicomponent microwave-assisted reaction, as well as a traditional reflux protocol, to compare and contrast these methods in terms of efficiency, yield and purity of products.

Once fully characterised using FTIR, NMR, LC-MS, UV-Vis and fluorescence spectroscopy, the degree of quenching of these novel fluorophores by increasing concentrations of nitroaromatic species (benzoic acid, phenol, 4-nitrophenol and 2,4-dinitrophenol) will be evaluated using Stern-Volmer plots. The intensity of fluorescence is expected to decrease with increasing concentrations of the nitroaromatics being added. The expected result of

this project is a sensitive and selective method for the detection of nitroaromatic explosives, contributing to a crucial area in forensic science.

02: Chemistry: Flammables
11:00 - 11:45 Auditorium

Poster Session Thursday - Chemistry: Flammables

SPME Fibers for the Recovery of Ignitable Liquids: How to Choose Them? 11:00 - 11:00

E. Vergalito[1]

[1]National Institute of Criminalistic and Criminology, Fire Investigation by Chemical Analysis, Brussels, Belgium

Abstract Body: During a validation in our lab, 8 SPME fibers were tested to see which one of them would give us the best result in the recovery of ignitable liquids components. Our goal was to detect the largest range of compounds, ranging from polar to apolar compounds, small to larger molecules. We tested absorbent and adsorbent fibers, porous and non-porous ones. This poster will show the graphs obtained for the different types of fibers and the interpretation of these results in order to enlighten our final choice.

A Summary of the Results From Cases Where Suspects' Hands Were Examined for Residues of Ignitable Liquids 11:00 - 11:00

C. Högberg[1], *M. Joge*[1], *A.-C. Enqvist*[1], *L. Hellman*[1]

[1]Swedish Police Authority, National Forensic Centre (NFC), Chemistry and Technology Unit, Linköping, Sweden

Abstract Body: Arson is a serious crime that causes major economic and social consequences. Besides other evidence types, the presence of ignitable liquid residues plays a crucial role in assessing the cause of the fire. A part of an arson investigation can be to examine whether the suspect has residues of ignitable liquids on their hands. The presence of such residues can be used along with other forms of evidence to link a suspect to the fire or scene of the crime. In 2017 NFC introduced a sampling method that is a development of an Israeli method based on passive adsorption using Activated Charcoal Strips (ACS). With this method the sampling can begin immediately upon arrest and no forensic skills are required. It should be performed within three hours after exposure to the ignitable liquid and thereafter the samples are sent to the laboratory for analysis. This poster presents a summary of results from Swedish cases during the years 2017-2024, including the method´s successes and potential challenges.

Analysis of Phenothrin and Span80 on Fire Debris to Determine an Explosion Caused by Bug Sprays 11:00 - 11:00

J. Jung[1], *S. Jeon*[1], *G. Nam*[1], *B. Gong*[2]

[1]Gwangju Institute, National Forensic Service, Forensic Toxicology and Chemistry, Jeollanam-do, Korea, Republic of, [2]Seoul Institute, National Forensic Service, Chemistry, Seoul, Korea, Republic of

Abstract Body: Sometimes unexpected fire accidents happen when they use a bug spray and an electric flyswatter to swat mosquitoes in summer season of South Korea. The propellant is mainly LPG(liquefied petroleum gas, propane, isobutane and butane) in the aerosol mixture with the active ingredient such as insecticide. The aerosol mist can ignite to form an explosion mixture with oxygen in air and this explosion can be achieved by only one spark of electric flyswatter. Accidents are most likely to occur if LPG and air mixture which is within explosion range come into direct contact with an ignition source, such as a flame, pilot light or spark from electrical appliance that cycle on and off (e.g. refrigerator, air conditioner, vacuum cleaner, electric flyswatter).
Therefore we had to research to find major analyte from evidence (e.g. fire debris) gathered from the scene of these accidents. We collected several kind of commercial bug sprays in Korea and looked around their ingredients. Phenothrin and span80 were picked out as analytes because they were included among the sprays and analyzed by GC-MSD easily. Phenothrin is a cyclopropanecarboxylate ester used as a pyrethroid insecticide and span80(sorbitan monooleate) is one of the nonionic surfactants.
The fire debris was extracted by hexane and carried out transesterification reaction by adding methanolic potassium hydroxide solution and ultrasonication. Then reaction mixure were vaporized with nitrogen and carried out silylation reaction by adding BSTFA(with TMCS) and heating. The residue was analyzed by GC-MSD.

02: Chemistry: Textile and Hair
11:00 - 11:45 Auditorium

Poster Session Thursday - Chemistry: Textile and Hair

Microscopic and Spectroscopic Analysis of Clothing at Fibre, Yarn, and Fabric Levels After Exposure to Corrosive Substances 11:00 - 11:00

T. Whitton[1], B.J Jones[1], S. Blidi[1], D. Phillips[1]

[1]Abertay University, Dundee, United Kingdom

Abstract Body: Crimes using corrosive substances, such as those commonly referred to as “acid/alkali attacks”, are a global issue, with cases documented across several European countries. The UK has the highest number of reported offences worldwide, with 1,244 occurring in 2023 alone, although it is believed that globally many incidents go unreported. Corrosive substances can cause damage to the clothing of both the victims and perpetrators involved in an incident. The form of damage may be of evidential value, especially as the advised first aid measures involve dousing any affected areas with water, which could remove any residual corrosive. Textile damage analysis is established in forensic examinations for the determination of mechanisms and methods of attack from sources such as sharp-force weapons or projectiles, although there is currently very

little published literature regarding its use for chemical damage.
This research identifies and compares the physicochemical effects of different corrosive substances on various items of common clothing using microscopic and spectroscopic analyses such as polarising light microscopy, atomic force microscopy, and infrared spectroscopy. Corrosives at legally obtainable concentrations have been used to increase relevance. Damage morphology was identified at fibre, yarn, and fabric levels, and verified through repeat testing. Damage is found to be affected by the corrosive used and influenced by fabric properties such as fibre type (e.g., cotton, polyester), weave structure, and absorbency. It is intended that the results contribute to developing comparative databases that aid forensic practitioners in identifying and differentiating corrosives used in crimes.

03: Digital Evidence: Vehicle Forensics
11:00 - 11:45 Auditorium

Poster Session Thursday - Digital Evidence: Vehicle Forensics

Uncovering Hidden Traces of Open Source UAV Autopilots 11:00 - 11:00

A. Hoyer[1], K. Lohre[1], M. Schmidt[1], L. Hardi[1], A. Attenberger[1]

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Abstract Body: The development of Unmanned Aerial Vehicle (UAV), commonly referred to as drones, into cost-effective consumer products results in an omnipresent usage of UAVs which could be misused for various criminal offences. In this context research has focused on the forensic analysis of commercial products while the area of open source autopilots is neglected. To tackle this issue, we built several UAVs with open source autopilots in order to perform a digital forensic analysis.
In this work we provide insights into Ardupilot's low level data formats and memory layers. Ardupilot is a versatile and widely used open source autopilot offering similar features to commercial UAVs. Its users range from hobbyists to professionals to build custom UAVs. We examined all available memory of the flight controller for forensic traces. Aside from reconstructing flight controller logs in order to reconstruct flight events, traces were found in unexpected locations. We uncovered a data structure in which parameters, flight missions and other data are stored. To understand the data structure, we leveraged the availability of the Ardupilot source code. The data is encoded in an Ardupilot-specific format on the physical layer and must be decoded to virtual memory layers to retrieve any valuable information. By applying this knowledge historic mission waypoints and their GNSS positions can be restored to gain additional insights into the UAV's usage.

Research on Extraction and Application of Vehicle Digital Data 11:00 - 11:00

W. Bo[1], K. Yanrong[1], G. Lili[1], Z. Lu[1], J. Xianbo[1]

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Abstract Body: The increasing popularity and continuous development of intelligence in automobiles have enabled them to penetrate into various scenarios of people's lives. At the same time, during the use of automobiles, various onboard electronic devices also synchronously record more and more different information: vehicle information, driver information, and surrounding road environment information. There are various types of electronic data in cars, with complex extraction and diverse application scenarios. It is crucial to obtain and standardize the use of this information.
This study extracts, researches, and summarizes the electronic data of the vehicles involved in the incident. Firstly, different extraction and analysis methods are studied for the data recorded by electronic devices such as EDR, VDR, T-BOX, dash cams, and sensors in automobiles, in order to extract the corresponding electronic data of the vehicles; Secondly, based on the characteristics of different data, research will be conducted on the application scenarios of Vehicle Digital Data, and standardized methods for Vehicle Digital Data in the field of forensics will be proposed; Finally, in response to the most important issues of responsibility allocation and accident cause inference in the case of a car accident, a hash based accuracy verification scheme for car electronic data is proposed based on research results. This scheme can clarify the responsibility allocation between drivers and car companies based on facts after a car accident occurs, and promote the research, application, and development of car electronic data.

03: Digital Evidence: Computer, Cybercrime, Malware and Database Forensics
11:00 - 11:45 Auditorium

Poster Session Thursday - Digital Evidence: Computer, Cybercrime, Malware and Database Forensics

Transnational Investigations on Encrypted Platforms: The Italian Experience 11:00 - 11:00

D. Curtotti[1], W. Nocerino[2], O. Murro[1], G. Giliberti[3]

[1]University of Foggia, Law, Foggia, Italy, [2]University of Foggia, Social Sciences, Foggia, Italy, [3]Italian National Police, Rome, Italy

Abstract Body: The abstract aims to disclose the study experience conducted by researchers from the University of Foggia and the Italian National Police on investigation of encrypted platforms, recently used by criminal organisations to conduct their trafficking.
From a technical point of view, this involves investigating platforms equipped with significant degrees of encryption with servers often located in different parts of the world, exploiting the potential offered by so-called big data.
From a legal point of view, critical issues emerge in relation to: a) the impact on fundamental rights; b) the correct legal framework; c) the diagnosis of the procedural usability of the data; d) the transmission of the mass of information to other law enforcement authorities.
These are critical issues found in all the European countries involved in the investigative operations under review. It is no coincidence that, in addition to the many rulings of the higher courts of France, Germany, the Netherlands and Norway, the Court of Justice of the European Union has also expressed its opinion. In Italy, the United Sections of the Court of

Cassation addressed the issue in two 'twin' rulings. The Court declared the legitimacy of the operations conducted and, therefore, the usability of the data collected through the European Investigation Order, but did not clarify the legal nature of platform investigations. The purpose of the paper is to present the results of the research conducted at national level, so that it can be a stimulus for other European countries facing the same threats.

03: Digital Evidence: Other
11:00 - 11:45 Auditorium

Poster Session Thursday - Digital Evidence: Other

A Hungarian Automatic Speaker Recognition Pilot Software 11:00 - 11:00

A. Fejes[1], *D. Sztaho*[2]

[1]Special Service for National Security Institute for Expert Services, Budapest, Hungary, [2]Faculty of Electrical Engineering and Informatics, Department of Telecommunication and Media Informatics, Budapest University of Technology and Economics, Budapest, Hungary

Abstract Body: The continuous development of expert evidence methods is a fundamental requirement in forensic science, as advances in technology provide us with ever more accurate and reliable methods of investigation. In addition, modernity is a prerequisite for the scientific and technical soundness of the expert method. there is more room for improvement in segments that rely more on informatics and data processing methods, such as biometric identification, but innovation is also important in the classical forensic identification branches.

A new biometric speaker recognition software has been developed in Hungary as part of a university research collaboration. The pilot software uses ECAPA-TDNN technology and is designed to identify Hungarian speakers. The results was evaluated in the likelihood-ratio framework by Cllr and EER metrics using the BIO-METRICS software. The pilot software was tested on Hungarian speech corpus with voice samples of different lengths. The results were compared with those of four commercially available biometric speaker identification systems. The evaluation found that the pilot software performs well on short voice samples, in some cases outperforming the other four. In further development of the pilot software, additional voice sample databases will be used to train the models in order to test language independence. The pilot software will be introduced into the Hungarian audio forensics methodology.

04: DNA and Body Fluids: Investigative Genetic Genealogy (IGG)
11:00 - 11:45 Auditorium

Poster Session Thursday - DNA and Body Fluids: Investigative Genetic Genealogy (IGG)

Adopting Forensic Investigative Genetic Genealogy in Sweden: An Implementation Journey 11:00 - 11:00

S. Aili Fagerholm[1], *R. Ansell*[1,2]

[1]National Forensic Centre, Swedish Police Authority, Biology unit, Linköping,

Sweden, [2]Linköping University, Department of Physics, Chemistry & Biology, Linköping, Sweden

Abstract Body: In Sweden, hundreds of unsolved cases including murders, sexual assaults, and
unidentified human remains persist, despite ongoing investigative efforts.
Some of these cases contain DNA evidence that could potentially be analysed using
forensic investigative genetic genealogy (FIGG). Since the initial trial of this method
2018 in Sweden, which was followed by a pilot study in 2019 to 2020, the Swedish Police
Authority has actively worked toward implementation of this important method. As of July 1st, 2025, new legal provisions under the Swedish Police Criminal Data Act will allow the use of FIGG in serious crimes such as murder, aggravated rape and aggravated rape against a child. To prepare for this change, the Police Authority has taken several steps, including developing a national policy document that outlines the mandatory procedures, the different functions involved within the Police Authority as well as the role of the case prosecutor (as stated by the law). Since FIGG involves the handling of sensitive personal data, the method must be evaluated by the Swedish Authority for Privacy Protection (IMY) in a so-called pre-counselling process, prior to its full implementation. An overview will be given of the implementation process of FIGG and recent progress, highlighting milestones and key steps as well as remaining actions to be taken before further use of FIGG in criminal cases.

Internal Validation of a High Throughput Targeted Single Nucleotide Polymorphism (SNP) Sequencing System for Kinship Analysis of Unidentified Human Remains From a Mass Grave 11:00 - 11:00

O. Fox[1], X. Huber[1], K. O'Connor[1], S. Clifford[1]

[1]Forensic Science Ireland, DNA, Kildare, Ireland

Abstract Body: To enable long-range kinship analysis for the identification of human remains found in a mass grave site at The Mother and Baby Institute in Tuam Co. Galway, a high throughput targeted SNP multiplex kit, ForenSeq Kintelligence HT, was internally validated in Forensic Science Ireland using Next Generation Sequencing (NGS) technology. The selectively targeted 10,230 SNP panel, including 9867 SNPs for kinship association, was designed specifically to deal with sensitive low input and low quality forensic samples for the emerging application of Forensic Investigative Genetic Genealogy (FIGG). The internal validation was conducted according to the Scientific Working Group on DNA Analysis Methods (SWGDAM) guidelines, focussing on evaluation of low input post-mortem and reference samples, comparable to those expected to be submitted as part of the Identification Program associated with the Tuam mass grave excavation. The workflow was optimised for a high throughput library preparation and sequencing workflow with the intention of meeting the ISO 17025 Accreditation Standard. Sensitivity studies were carried out to evaluate the dynamic range of total DNA inputs and inform ideal target input range, limit of detection and stochastic range. Precision and accuracy

studies of known and mock samples were carried out to evaluate known genotypes for repeatability and reproducibility as well as concordance and expected performance of various sample types. Additionally, SNP profiles from a volunteer family group of ten related individuals were sequenced during validation to assess accuracy in predicting biological relationships from 1st to 4th degree relatives using the ForenSeq Universal Analysis Software.

04: DNA and Body Fluids: Missing Persons Identification
11:00 - 11:45 Auditorium

Poster Session Thursday - DNA and Body Fluids: Missing Persons Identification

DNA Evaluation in Teeth Subjected to Various Thermal Conditions: A Preliminary Study 11:00 - 11:00

A.M. Salazar Roa[1,2], P. Huerta[3], L.F. Montoya[4], V. Coliboro[5], A. Castro[5], A. Barbaro[6,7]

[1]University of Concepción, Department of Pathology and Diagnosis, Faculty of Dentistry, Concepción, Chile, [2]University of Alcalá de Henares, PhD Student in Forensic Sciences, Madrid, Spain, [3]University of Concepción, Department of Public Health, Faculty of Medicine, Concepción, Chile, [4] University of Concepción, Department of Chemical Engineering, Concepción, Chile, [5]University of Concepción, Department of Biochemistry and Molecular Biology, Faculty of Biological Sciences, Concepción, Chile, [6] Studio Indagini Mediche E Forensi (SIMEF), Calabria, Italy, [7]University of Alcalá de Henares, University Research Institute in Police Sciences, Madrid, Spain

Abstract Body: In tragic events that require the analysis of highly degraded tissues, DNA analysis is sometimes the only option for identification. Due to their characteristics, teeth are a valuable source of DNA in these cases. However, this process is not always successful, as it is influenced by various factors. Temperature is considered a key factor; at high temperatures, the chemical structure of DNA is altered, making identification more complex. This is directly proportional to the temperature and exposure time.
The objective of this study is to determine the performance of DNA recovery from teeth subjected to extreme degradation temperatures at different exposure times.

Fifteen healthy permanent molar samples are collected with informed consent, from the Emergency and Maxillofacial Surgery Clinic (Faculty of Dentistry, University of Concepción, Chile) recording the donor's age, sex, and type of tooth. The samples divided into 3 groups of 5 are burned at 400°C for 15, 30, and 60 minutes.
A dental pulverization technique is used prior to DNA extraction and quantification. Finally, a statistical analysis of quantification data is performed in order to evaluate the maximum time for successful DNA extraction under these conditions. The data obtained will help to carry out targeted and accurate sampling based on the situation we face.

04: DNA and Body Fluids: Other
11:00 - 11:45 Auditorium

Poster Session Thursday - DNA and Body Fluids: Other

Analysis of Cellular Adhesion on Single Cotton Fibres 11:00 - 11:00

M. Nunnenkamp[1], *H. Gardeniers*[1]

[1]University of Twente, Mesoscale Chemical Systems, Enschede, Netherlands

Abstract Body: The collection of samples from crime scenes through investigators is commonly performed by wiping areas of interest with cotton-fibre swabs. The serological fluids remain in the dense fibre matrix and need to be extracted for further DNA analysis. Cell residence and attachment inside the matrix, as well as consecutive detachment and release by washing, lysis and or centrifugation are yet unknown. Unveiling said dynamics potentially improves recovery of evidence from the swab heads. Single cotton fibres were dip-coated with fluorescently labelled five µm PS-microparticles and placed inside a microfluidic channel. Fluorescent imaging and scanning electron microscopy exposed that particles mostly attached inside valleys on the fibre surface. Continuous counting of particles during increasing shear flow in the channel displayed a decreasing exponential particle number. Studies to reveal the specific adhesion mechanism are still ongoing. Next, white blood cells will be used as replacement for the microparticles, potentially leading to enhanced understanding of release dynamics.

Innovations in Forensic Science: The Role of Diamond™ Nucleic Acid Dye in the Past Ten Years 11:00 - 11:00

A. Haines[1]

[1]University of Technology Sydney, Centre for Forensic Science, Broadway, Australia

Abstract Body: Over the past decade, Diamond™ Nucleic Acid Dye has become a crucial tool in forensic science, particularly for visualising DNA on surfaces and items of interest. This fluorescent dye binds externally to DNA, facilitating the visualisation of nucleic acids in various forensic applications. The use of fluorescent dyes for DNA visualisation in forensic contexts was first established in 2013 by Haines et al., focusing on SYBR® Green and GelGreen™ [1]. However, it wasn't until 2015 that Diamond™ Dye was introduced by Haines et al., in a study comparing six different dyes, their properties, and sensitivities [2]. Since then, research involving Diamond™ Dye has expanded, continually developing this fluorescence-based detection technique.

Key advancements include its application in DNA localisation, enhancing the detection of DNA left by skin contact on surfaces, which aids in identifying individuals through short tandem repeat (STR) analysis. Additionally, the dye has been used to analyse hair samples, visualising cell nuclei within hair roots and assessing the fluorescent signal on shed hairs to determine their suitability for STR analysis.

As we mark ten years since the first publication involving Diamond™ Dye, this study will review the key advancements in the technique and its applications and explore future directions for this promising technology.

[1] Haines, A.M., et al., *Detection of DNA within fingermarks.* Forensic Science International: Genetics Supplement Series, 2013. **4** (1): p. e290-e291.
[2] Haines, A.M., et al., *Properties of nucleic acid staining dyes used in gel electrophoresis.* ELECTROPHORESIS, 2015. **36**(6): p. 941-944.

Comparative Study Between EZ2® Connect Fx and the Maxwell Instrument on the Processing of Touch DNA Samples 11:00 - 11:00

Y.Y. Ho[1], K.J. Loh[1], C.K.C. Syn[1]

[1]Health Sciences Authority, Applied Sciences Group/Biology Division, Singapore, Singapore

Abstract Body: Forensic DNA casework in our laboratory often involves analysis of exhibits that have been ‘touched’ in the course of an illicit drugs offence, e.g. plastic or paper wrappings. Cell/DNA recovery from such samples with large surface areas usually involves the use of multiple swabs. The current DNA extraction platform in our laboratory (Maxwell FSC) has a sample input capacity limitation of 0.6 ml. As such, the multiple swabs are processed separately, with the purified DNA subsequently pooled and re-concentrated. This process, however, leads to extensive losses.

The ability to handle large sample volumes during DNA extraction, especially when working with low levels of cells/DNA recovered from large surface areas may, therefore, be a solution towards enhancing DNA recovery. The EZ1&2 DNA Investigator Kit on the EZ2 Connect Fx instrument has an extra-large volume protocol that enables input sample volumes of up to 2 mL with elution options as low as 20 µL. This flexibility allows the processing of up to 3-4x more starting material in a single reaction, while maintaining a small elution volume to ensure a more concentrated purified DNA solution without the need for downstream pooling and/or concentration steps which lead to DNA loss. The present study seeks to evaluate the performance of the extra-large volume protocol of the EZ1&2 DNA Investigator Kit on the EZ2 Connect Fx instrument with respect to the quantity and quality of DNA recovered from touch samples.

Reducing False Positives in Kastle-Meyer Testing With the Addition of Ethylenediaminetetraacetic Acid 11:00 - 11:00

Z. Thong[1], B. Heng[1], R. Koh[1], C.K.C. Syn[1]

[1]Health Sciences Authority, DNA Profiling Laboratory, Singapore, Singapore

Abstract Body: The Kastle Meyer (KM) test is widely used in the presumptive testing of potential blood stains because it is simple to apply, cost-effective and able to detect blood as diluted as 1:10,000. It detects blood through a redox reaction involving iron-containing haem group of haemoglobin (Hb) and phenolphthalein, producing pink colour in the

presence of hydrogen peroxide. However, non-blood positive (false-positive) can occur with oxidizing agents or Hb homologs. The addition of ethylenediaminetetraacetic acid (EDTA) can potentially mitigate non-blood positives by chelating metal ions that interfere with phenolphthalein. In the present study, we evaluated whether the addition of EDTA will impact the sensitivity of KM test on various dilutions of blood stains with and without EDTA. We also investigated whether the addition of EDTA reduces the non-blood positive result with and without the addition of EDTA on plant materials. Our results showed comparable KM positive result with and without EDTA on blood stains with various dilutions, indicating the EDTA does not compromise the sensitivity of KM test. Amongst the different plant extracts tested, the addition of EDTA successfully prevented the occurrence of non-blood positive results. Taken together, these results suggest that the addition of EDTA successfully chelated the oxidising ions present in plant extracts. Overall, this study provides an opportunity to prevent non-blood positive results on crime evidence with simple inclusion of EDTA during KM testing for blood, which may be especially useful for crime evidence recovered with certain heavy metal substrates or plant materials.

Investigating the Seasonal Dynamics of Environmental DNA Within Crime Scenes: Implications for Trace Evidence Analysis 11:00 - 11:00

H. Kelman[1], K. Ralebitso Senior[2], R. Symonds[1], R.M Morgan[3], K. Scott[1]

[1]Liverpool John Moores, School of Biological and Environmental Sciences, Liverpool, United Kingdom, [2]Liverpool John Moores, School of Pharmacy and Biomolecular Sciences, Liverpool, United Kingdom, [3]University College London, Department of Security and Crime Science, London, United Kingdom

Abstract Body: Environmental traces (e.g., soil, dust, water) serve as useful evidence during crime investigations, reconstructing links between persons and scenes of forensic interest. Massively Parallel Sequencing (MPS) is a promising method of extracting biological signatures from low-biomass DNA samples, enabling rapid characterisations of environmental trace evidence. However, temporal and spatial variability of environmental DNA within potential crime scenes and the subsequent impact for forensic discrimination is to be determined. This study assesses environmental DNA within potential terrestrial and aquatic crime scenes and evaluates profile stability over seasonal intervals spanning 12 months.

Eleven freshwater, marine, and soil sites across Northwest England were sampled seasonally (spring 2023 – spring 2024). Different land use types were incorporated, including woodland, parkland, rivers, lakes, and tidal beaches. Samples were collected from the surface of each soil site and a disturbed water sample was filtered at each aquatic site. To assess any seasonal environmental changes for trace evidence comparisons, three clothing swatches were immersed at four locations during the autumn and spring. DNA was extracted using commercial kits and amplified using barcoded primers prior to sequencing via MPS and bioinformatic analysis.

The findings demonstrate the effect seasonality has on the diversity and species richness of microbial community structures within crime scene environments, and how this supports the comparison and exclusion of questioned clothing samples following evidential transfer. Furthermore, the

study highlights the efficacy of environmental DNA analysis to resolve geographic locations and determine the provenance of environmental trace materials following transfer to exhibits during forensic investigations.

Spatial Variability in Soil Necrobiome Communities has a Limited Effect on Post-Mortem Interval Estimation 11:00 - 11:00

L. Hewett[1,2], C. Rimok[2], S. Forbes[3,4], A. Shafer[1,2]

[1]Trent University, Environmental and Life Sciences Graduate Program, Peterborough, Canada, [2]Trent University, Forensic Science Program, Peterborough, Canada, [3]University of Windsor, Department of Chemistry and Biochemistry, Windsor, ON, Canada, [4]Université du Québec à Trois-Rivières, Département de Chimie, Biochimie et Physique, Trois-Rivières, QC, Canada

Abstract Body: Necrobiome community succession patterns have been successfully modelled as a means of predicting the post-mortem interval (PMI). Many sample types have been investigated for this purpose, with soil being a common source. Soil samples for necrobiome analysis are collected from within the cadaver decomposition island (CDI), a nutrient-rich area surrounding decomposing remains created by the release of cadaver fluids into the environment. This study examined the variability of the necrobiome communities within the CDI and explored whether sampling location impacted the accuracy of PMI estimation.

Soil samples were collected at regular intervals from the CDIs of two human body donors in advanced stages of decomposition. At one time point during this period, samples were collected from multiple sites within each CDI to assess intra-CDI necrobiome community variability. Microbiome sequencing libraries of the V4 region of the 16S rRNA marker were built, followed by paired-end sequencing on an Illumina MiSeq. Intra-CDI necrobiome community membership did not vary significantly between samples and regression models developed using community data from each sample showed negligible differences in performance. These findings support the predictive potential of temporal necrobiome data in the late post-mortem period and indicate that sampling location within the CDI has a limited effect on the accuracy of PMI estimation.

Utilizing DNA Metabarcoding and Next-Generation Sequencing for Accurate Detection of Species in Complex Mixtures 11:00 - 11:00

S. Kim[1], M.J. Kim[1]

[1]Supreme Prosecutors' Office, Forensic Genetics and Chemistry Division, Seoul, Korea, Republic of

Abstract Body: DNA metabarcoding is a molecular approach that enables the simultaneous identification of multiple species by sequencing short DNA fragments from standardized genomic regions and comparing them to reference databases. This technology has demonstrated significant utility in verifying the authenticity of food products and detecting mislabeling, substitution, and contamination, addressing critical safety concerns in global markets. Additionally, DNA metabarcoding has been applied to

wildlife crime investigations, including identifying protected or endangered species involved in illegal trade, often concealed in processed forms such as capsules, powders, and pills. This study applied DNA metabarcoding using Next-Generation Sequencing (NGS) with short-read sequencing (SRS) to evaluate species composition in plant-based commercial products and forensic samples. We assessed the accuracy and specificity of species identification in complex mixtures by analyzing multiple gene regions, including 18S rRNA, ITS, rbcL, and psbA-trnH. This study aimed to determine whether the detected biological species corresponded to the declared raw material names, providing insights into the applicability of DNA metabarcoding for verifying product authenticity and combating fraudulent practices. Future work will focus on enhancing detection accuracy and reliability for non-human species by integrating advanced molecular techniques such as Unique Molecular Identifiers (UMI) and long-read sequencing (LRS).

Risk vs. Reality: Using Fluorescein Dye to Visualise the Potential for DNA Transfer Within Forensic Biology Workflows and Consumables 11:00 - 11:00

C. Hymus[1], *P. Cooper*[1], *M. Rye*[1]

[1]PathWest Laboratory Medicine, Forensic Biology Department, Nedlands, Australia

Abstract Body: Within Forensic Biology, maintaining sample integrity is crucial to ensure they meet the highest levels of quality assurance and allow stakeholders to rely on the evidence and intelligence generated by routine workflows. Operational laboratories minimise the potential for contamination through robust anti-contamination protocols to reduce DNA transfer potential. However, with ever-increasing sensitivity of DNA workflows, it is imperative these protocols are routinely assessed to demonstrate they remain fit for purpose.

Fluorescein is a readily available non-toxic dye used in many commercial industries as a visualisation tool due to its visible fluorescence. Within forensic biology, fluorescein has been used to successfully detect DNA transfer in automated DNA processes, however no expanded testing to asses routine consumables under different scenarios has been performed thus far.

This project utilised fluorescein to investigate key consumables involved in core DNA processes including lysis, extraction and amplification by testing tubes, plates and sealing methods under multiple environmental conditions that replicated routine workflows. The utility of this testing was demonstrated when fluorescein, visualised with alternative light sources, identified instances of transfer that would not have been readily visible to the naked eye. By replicating the routine workflow, these findings directly highlighted the effectiveness of existing contamination minimisation methods as well as identifying opportunities for further development and investigation.

Development of DNA Quantitation and STR Typing Systems for *Panthera leo* Species Determination and Individual Identification in Forensic Casework 11:00 - 11:00

D. Vaněk[1,2], *L. Vankova*[3,2]

[1]Charles university in Prague, Institute for Environmental Sciences, Prague, Czech Republic, [2]Forensic DNA Service, Prague, Czech Republic, [3]Charles University in Prague, Institute for Environmental Sciences, Prague, Czech Republic

Abstract Body: The aim of this presentation is to provide an overview of methodical approaches used to develop molecular systems for species determination/DNA quantification called *Pleo Qplex* and individual identification called *Pleo STRplex* of *Panthera leo* samples. Both systems will help to combat the illegal trade of endangered species and create a worldwide shared database of DNA profiles.

Nonhuman DNA typing for forensic purposes was initially focused on species determination (Bataille et al. 1999) and identification of individual domestic animals, such as cats (Menotti-Raymond et al. 1997) and dogs (Hellmann et al. 2006), because animal hair serves as evidence in criminal cases (Pfeiffer et al. 2004). STR profiling of animal species has a wider range of applications, such as wildlife preservation (Sastre et al. 2009), veterinary public health protection (Workman et al. 2005) and food safety (Vallejo-Cordoba and González-Córdova 2010). The application of forensic genetics is specifically useful to track poaching and illegal wildlife trades.

Shaping the French Forensic Genetic Units to Deal With Massive Analyses 11:00 - 11:00

I. Marcon[1], *M. Grau*[2], *S. Lopez*[1], *L. Burban*[1], *A. Thébaut*[1], *E. Suzanne*[2], *E. Siné-Hiver*[2,1], *T. Soto*[1,2]

[1]Service National de Police Scientifique, Laboratoire de Police Scientifique de Lyon, Section Individus, ECULLY, France, [2]Service National de Police Scientifique, Laboratoire de Police Scientifique de Lyon, Section Délinquance de Masse, ECULLY, France

Abstract Body: The FNAEG is the French police DNA database that stores genetic profiles of individuals involved in criminal acts and crime scene evidence.
Initially focused on sexual assault cases, the database's scope significantly expanded in 2003 by French laws to include a wider range of offenses, such as burglaries (more than 290,000 cases in 2021 in France).
To deal with massive amount of samples, two highly automated genetic units have been created in the laboratory of Lyon:

1. **The SI Unit:** Processes samples from individuals collected on FTA® cards, using direct multiplex PCR of 21 STRs and 24-capillary electrophoresis for analysis.
2. **The SDM Unit:** Handles low-impact criminal cases, employing magnetic bead extraction, quantification, multiplex PCR, and capillary electrophoresis for separation.

Both accredited units utilize a LIMS for data transfer at each process step.

Profiles are validated with GeneMapper™ software, and the analysis reports are generated automatically. Genetic profiles are electronically transmitted to the FNAEG regularly.
In 2023, the SI unit processed over 220,000 references, while the SDM unit investigated about 43,000 low-impact criminal cases, analyzing more than 77,000 samples.

Exploring DNA Methylation Post-Mortem in Human Cadavers 11:00 - 11:00

I. Badell[1], *A. Shafer*[1,2], *S. Forbes*[3]

[1]Trent University, Environmental and Life Science (ENLS), Peterborough, Canada, [2]Trent University, Forensics Department, Peterborough, Canada, [3] University of Windsor, Chemistry and Biochemistry, Windsor, Canada

Abstract Body: DNA methylation (DNAm) has been used as a marker of age and sex, due to age correlating with a general decrease in 5-methylcytosine throughout the genome and differential methylation patterns between sexes. Thus, methylation can be used to estimate an individual's biological age and sex from samples obtained in forensic investigations. DNAm changes also show potential as a marker of time post-mortem, or the Post-Mortem Interval (PMI). Consequently, the purpose of this study is to monitor the post-mortem changes in DNAm from 15 human cadavers donated to the human taphonomic facility in Québec, Canada, to determine how long after death, age and sex can be accurately estimated, and whether there are predictable post-mortem changes. Decomposition was monitored with photos, weather data was collected, and DNA methylation was quantified from soft tissue samples in 930k CpG sites with the MethylationEPIC microarray. Here we show how age and sex can be predicted using methylation data post-mortem, and build a machine-learning model to predict the PMI from the methylation data.

Construction of A Dual-stage Segmented Age Prediction Framework for Whole Blood 11:00 - 11:00

X. Chu[1], *W. Teng*[1], *M. Chen*[1], *Z. Wang*[1], *A. Huang*[1], *X. Liu*[1]

[1]Academy of Forensic Science, Forensic Biology, Shanghai, China

Abstract Body: Age estimations based on biological material discovered at crime scenes are crucial in forensic investigations. DNA methylation has emerged as one of the most promising and informative age-related (AR) markers for forensic age prediction. In this study, 17 AR-CpG markers, comprising both CpG sites and CpG clusters, were selected from two published age prediction models and two public microarray datasets. The correlations between chronological age and the DNAm level of these markers were validated on pyrosequencing and next-generation sequencing platforms. Linear regression models and a nonlinear regression model were established to optimize age prediction performance. The Elastic Net model achieved an R^2 value of 0.960 with a MAD of 3.331, while the SVR model attained an R^2 value of 0.962 with an MAD of 3.053. Furthermore, we investigated whether the nonlinearity of DNAm patterns across age groups may lead to low predictive performance in the elderly age group. DNAm patterns were analyzed in blood samples from different

age groups, and a knee point was identified at 55 years. A dual-stage segmented age prediction framework for whole blood samples was then proposed in which individuals were classified based on the established knee point. The segmented Elastic Net model achieved an R^2 value of 0.959 with an MAD of 3.280, while the segmented SVR model achieved an R^2 value of 0.965 and an MAD of 2.781. Overall, the segmented SVR model significantly improved the accuracy of age prediction, especially for samples from older individuals.

Action Protocol for the Collection of Reference and Unidentified Body Samples for DNA Testing for Identification and Kinship Investigation Involving Situations of Self-Perceived Gender Identity 11:00 - 11:00

F. Bustos[1], R.D. Motrich[1], I. De la Luz-Martinez[2,3]

[1]Universidad Nacional de Córdoba, Cordoba, Argentina, [2]identidADN, Cuernavaca, Mexico, [3]Latin American Society for Forensic Genetics, Santiago, Chile

Abstract Body: **INTRODUCTION:** The correct selection and documentation of both reference and unknown samples, is closely related to the success of a genetic analysis. The appropriate register of the sample donors' biological sex, as male or female, is essential. Biological sex and gender are handled as synonyms within genetics, which can lead to critical errors in judicial processes. Sex and gender are not equivalent or interchangeable terms. Gender involves a self-definition of femininity and masculinity, this will always be self-perceived and may or may not correspond to the biological sex, generating a diversity of possible situations. It's necessary to adapt current protocols to the diversity of situations with respect to gender self-perception that can lead into human identification errors.
OBJECTIVE: To provide comprehensive knowledge about the complexity and challenges in this area, intervening and befitting the documentation process for the selection of reference sample donors, the collection of reference and unidentified bodies samples, the sample labeling and tagging, and the preparation of the chain of custody and informed consent forms, among others.
METHODS: A literature review of the current state of the criteria applied for the selection of reference sample donors was carried out in order to highlight the main problems that arise in cases of self-perceived identity, both in the documentation and analysis of information, as in the ways of representing.
RESULTS: A proposed action protocol was provided, so that it can be included as a routinary practice when evaluating, selecting and collecting samples in the framework of forensic investigations.

Design and development of a DNA Application for Sample Handling (DASH) 11:00 - 11:00

C.S. Lee[1], M. Wright[1], C. Burke[1], H. Clarke[1]

[1]Forensic Science Ireland, DNA and Biological Analysis, Celbridge, Co. Kildare, Ireland

Abstract Body: Forensic Science Ireland (FSI) processes more than 10,000 forensic samples per year in DNA casework that historically relied heavily on in-house designed Excel workbooks which were seen as arduous and monotonous to use and maintain. DASH (**D**NA **A**pplication for **S**ample **H**andling) is a bespoke web-based application which was developed to replace this system and more, commissioned by the Department of Justice, and involves collaboration between FSI, Justice IT and other trusted partners.

DASH was primarily designed to manage and track the real-time processing of samples through each step of DNA profiling that uses NGMSElect (ThermoFisher Scientific), PowerPlexY23 (Promega), and Investigator HDplex (Qiagen) chemistries. In particular, DASH plays a vital role in volume casework by streamlining time-consuming manual data transfer tasks such as drafting, formatting and parsing complex machine and software input/output files in a user-friendly environment, allowing activities to stay focused on the DNA profiling process. The sample metadata, DNA profile and scientific interpretation are captured and linked to their associated sample IDs, allowing FSI to identify expectations of obtaining results that can assist in case assessment.

In addition to the above capabilities, DASH: ensures that records for forensic DNA samples can be accessed digitally on a single, centralised platform to authorised users; eliminates paper-based workflows; has configurable security permissions to view/action items; provides sample/batch audit logging; supplements the quality management system through comprehensive traceability of kits/reagents and machine/instrument use; increases user capacity and productivity; is scalable and adaptable to the needs of FSI as our services grow.

ForensicPro Software: A Tool for Match Probability and Paternity Index Calculations based on Population-Specific STR Allele Frequency Tables 11:00 - 11:00

S. Kim[1], *H.C. Lee*[1], *U. Chung*[1]

[1]Supreme Prosecutors' Office, Forensic Genetics and Chemistry Division, Seoul, Korea, Republic of

Abstract Body: ForensicPro is an advanced computational tool developed for precision in forensic genetics that is specifically designed to enhance the accuracy and efficiency of match probability (MP) and paternity index (PI) calculations based on Short Tandem Repeat (STR) markers. Utilizing population-specific allele frequency tables, ForensicPro incorporates national-specific genetic variation to reduce bias in forensic probability estimates, thereby providing a refined framework for human identification in forensic casework. This tool supports length-based STR typing and sequence-based STR data generated through massively parallel sequencing (MPS), enabling a more granular assessment of allelic variation, particularly in populations with diverse genetic backgrounds. ForensicPro also integrates microvariant adjustments, accounting for rare alleles and sequence polymorphisms, thereby significantly enhancing the accuracy of forensic STR analysis. ForensicPro enables forensic practitioners to perform rigorous and validated MP and PI calculations efficiently, promoting standardized forensic interpretations across diverse criminal, civil, and

paternity testing applications. This tool is accessible scientific software to enhance the reliability of forensic DNA analysis, meeting the need for precise and user-friendly bioinformatics solutions.

Forensic eDNAir – Environmental DNA in the Air – in Argentina 11:00 - 11:00

L.M. Díaz Nieto[1], M. Emadi[1], M. Moghadaszadeh Kermani[2], H.R. Braig[1]

[1]National University of San Juan, Institute and Museum of Natural Sciences, San Juan, Argentina, [2]University of Reading, School of Biological Sciences, Reading, United Kingdom

Abstract Body: Currently, research and case work (collection and analysis) on trace DNA are developing independently of each other for human trace DNA and non-human trace DNA. This is not sustainable in the future. Classically, human traces are mainly dispersed through blood, saliva, sweat, vomit, sperm, bodily fluids, … . These are obvious trace samples. But there are also latent, hidden trace samples. Human touch DNA is latent trace sample. Touch DNA is a form of human environmental DNA (eDNA). DNA contains human DNA, animal DNA, plant DNA, microbial DNA, everything. eDNA is not limited to surfaces or water. eDNA is also in the air, and most of what settles in dust originates from the air.
In San Juan, Argentina, as part of the Horizon Europe Marie Skłodowska-Curie Actions Doctoral Network *Natural Traces in forensic investigations - how the analysis of non- human evidence can solve crime*, we try to combine the collection and analysis of human and non-human eDNA.
Air Forensics faces various challenges. Most often, there is more than one person present. How far is individualization possible in mixed air samples? How can non-human DNA be linked to humans and the sampled environment? How can long-distance transport of airborne DNA be recognized in samples? Is the forensic application limited to indoor crime scenes? Outdoor macrobial airborne DNA is increasingly important in ecology.
Will in the future the first forensic sample being taken at a crime scene be air?

04: DNA and Body Fluids: Transfer, Persistence, Prevalence and Recovery
11:00 - 11:45 Auditorium

Poster Session Thursday - DNA and Body Fluids: Transfer, Persistence, Prevalence and Recovery

The Persistence of Human Semen on Decomposing Piglet Cadavers 11:00 - 11:00

A. Clarke[1], K. Brown[1]

[1]University of Portsmouth, School of Criminology and Criminal Justice, Portsmouth, United Kingdom

Abstract Body: Rape and serious sexual assault statistics continue to increase within England and Wales. This is further demonstrated by the media reporting high-profile cases which typically include a biologically male offender and results in the death of the victim. Whilst much literature pertains to the persistence of semen on living victims, the persistence of semen on decomposing skin remains an under-researched area.

This study aimed to assess the persistence of human semen on decomposing porcine skin and full piglet cadavers across varying temperatures. Several strips of fresh pig skin or cadavers were placed in controlled environment and brushed with 0.6ml of fresh human semen. Additionally, two cadavers each had an uncontrolled volume of human semen (approximately 3 ml) placed on the surface of their skin and left exposed to natural conditions in a rural environment during April and July 2024. One presumptive test for the presence of Acid Phosphatase (AP) and one confirmatory test for the presence of sperm cells were performed every 3-7 days.

The results demonstrated that both AP and sperm cells were present up to and including day 162 on the pig skin in controlled conditions. From the cadavers, samples were only recoverable up to day 16 due to advanced decomposition. However, sperm cells were identified from the recovered skin swabs up to and including day 16.

Early indications suggest that DNA recovery is possible from samples with confirmed sperm cells. However, further research is required to understand the levels of degradation and ability to profile an offender.

Enhanced Recovery of Semen From Exhibits Containing Superabsorbent Polymers 11:00 - 11:00

J. Finnis[1], G. Davidson[2], A. Galvez Cueva[1]

[1]Cellmark Forensic Services, Forensic Operations, Abingdon, United Kingdom, [2]Cellmark Forensic Services, Forensic Operations, Chorley, United Kingdom

Abstract Body: Disposable hygiene products, such as sanitary pads and nappies, typically contain superabsorbent polymers (SAPs) which are designed to absorb significant amounts of fluid. The current enhanced semen extraction method (Sperm Elution) employed by Cellmark Forensic Services (CFS) causes hydrogelling of the SAPs layer, such that no examination for sperm cells or DNA analysis is possible. Therefore only the upper, non-SAPs containing layers of such exhibits are examined for semen. Any semen drawn into the SAPs layer will therefore not be recovered. Whilst methods exist in the literature for the recovery of sperm cells from SAPs containing material, these are not based on enhanced semen recovery methods and often only recover a very low percentage of any semen present.

CFS have undertaken work to develop an enhanced semen recovery method based on the Sperm Elution method that can be used to recover sperm cells from the SAPs layer. Following development, testing of multiple brands and types of sanitary products, demonstrated that significantly more sperm cells are recovered when using the new method compared to sampling the non-SAP layers alone, particularly in relation to nappies where often only a trace/low levels of sperm cells were recovered from the top layer but moderate-to-high levels of sperm cells were recovered from the SAP layer.

The development of the method and results are presented.

Evaluation of Possibilities to Obtain Forensic Evidence From Objects Retrieved From Lake Water 11:00 - 11:00

M. Nilsson[1], *G. Ali Salih*[2], *M. Allen*[2]

[1]Swedish Police Authority, Forensic Section, Stockholm Police Region, Stockholm, Sweden, [2]Uppsala University, Department of Immunology, Genetics and Pathology, Uppsala, Sweden

Abstract Body: Trace recovery from evidence objects found in aquatic environments is often challenging. Several factors are supposed to affect the possibilities to recover forensic traces, such as the time in water, method for recovery and transport as well as the storage conditions applied. The effects on successful trace recovery have been evaluated of three different time periods in water (2, 7 and 21 days) and four different storage conditions (air-drying at room temperature, freezing at 30 °C, nitrogen gas or kept in lake water). The evidence submerged in lake water were bloodstains, touch DNA, fingerprints and hairs, initially deposited on knives, smartphones, packing tapes, duct tapes and garbage bags. The submersion time were found to strongly affect the amount and degradation of recovered DNA, illustrating that retrieval from water is recommended as soon as possible. The storage conditions used after retrieval were found to affect the traces differently, mainly recommending storage of DNA traces using air-drying or freezing before DNA sampling and analysis. Moreover, the results from an additional study show that the storage conditions also affect the possibility of identifying fingerprints and testing the shooting of weapons differently. Thus, by optimising the handling of evidence objects and forensic traces retrieved from aquatic environments, the outcome of valuable information can be improved for DNA, fingerprint and ballistics analyses in crime scene investigations. The project was performed in collaboration with the Marine Police, National Forensic Centre and Uppsala University.

Improving DNA Recovery From Fire Scenes: A Novel Post-Extraction Purification Method for Use on Highly Sooted or Charred Surfaces 11:00 - 11:00

H. Arsenault[1], *V. Rinaldi*[1], *N. Nic Daeid*[1], *A. Gray*[1]

[1]University of Dundee, Leverhulme Research Centre for Forensic Science (LRCFS), Dundee, United Kingdom

Abstract Body: Difficulty recovering DNA from fire scenes is a poorly understood issue. In response, we have developed a novel post-extraction purification aimed at removing soot and other contaminants from DNA samples. This method consists of a five-step workflow: liquid latex application (bulk soot removal), sample swabbing (DNA collection), DNA extraction from swabs, adapted phenol-chloroform purification (residual soot removal), and SPRI bead clean-up (final purification and concentration). Liquid latex treatment of a sooted surface effectively removes most soot, decreasing contamination of the swab. The adapted phenol-chloroform purification effectively separates residual soot from the extracted DNA; without this step, SPRI bead clean-up alone was found to be insufficient at removing soot contamination, resulting in qPCR inhibition.

Additionally, challenges in obtaining DNA profiles from arson samples may not only be due to difficulties in DNA recovery but also the potentially damaging effects of high temperatures. Initial results from DNA samples retrieved from two fire scenes demonstrate that the use of liquid latex lifting before swabbing and the adapted phenol-chloroform purification enables successful DNA recovery from highly sooted/charred surfaces exposed to high temperatures. When latex soot removal is omitted, less DNA was recovered, suggesting that both steps may be essential for optimal DNA recovery. Highly charred samples are typically not sent for DNA testing, as useful profiles are rarely obtained. However, our method may successfully recover DNA at forensically relevant amounts. Ongoing investigations are examining the effect of the amount and composition of soot and temperature on DNA recovery and persistence from fire scenes.

Barking Up the Forensic DNA Tree: Investigation of Human DNA Transfer During Mock Dog Kidnapping 11:00 - 11:00

H. Monkman[1], *R. van Oorschot*[2,3], *M. Goray*[1]

[1]Flinders University, College of Science and Engineering, Adelaide, Australia, [2]Victoria Police Forensic Services Department, Melbourne, Australia, [3]La Trobe University, School of Agriculture, Biomedicine and Environment, Bundoora, Australia

Abstract Body: Recent studies have shown that household pets can serve as reservoirs and vectors for human DNA transfer at crime scenes. This study expands on previous research by examining transfer of human DNA when dogs are mock kidnapped and placed into a car.
Five dogs were put into separate, previously unvisited cars, not related to dog owners or handlers, for 20 minutes, and returned home for subsequent sampling 1 hour later. Dog transfers were performed by a single handler on different days. Several areas of the car (based on researcher's observations of the contacts an animal made with the surfaces) and 4 predetermined areas of the handler's shirt (based on contacts the handler made with an animal) were taken 4-8 hours after contact with the dog. Overall, 70 samples were collected and profiles generated as per our standard laboratory procedures.
Results of this study show that bi-directional DNA transfer can occur during a relatively short contact between an animal, the car and the handling individual. Dog owner's DNA was detected on the holder's clothing (2/5) and inside of the car (3/5), while the holder was detected on the dogs (3/5) and inside the car (3/5), sometimes in multiple samples. Further, car owners were detected on the dog (1/5) and the holder (1/5). These findings emphasize the ease with which DNA can transfer during brief contacts, demonstrating that animals can act as vectors for this transfer. This underscores the importance of considering such transfers in investigations involving animals.

Washing Away the Evidence? Investigating DNA Transfer and Persistence Through Washing Activities 11:00 - 11:00

A. Kuffel[1], *V. Galais*[1], *N. Nic Daeid*[1]

[1]University of Dundee, Leverhulme Research Centre for Forensic Science, Dundee, United Kingdom

Abstract Body: The impact of washing activities on the transfer and persistence of DNA is an important aspect to consider in forensic casework, particularly when analysing clothing as evidence. This small-scale study investigates how different washing conditions, such as the type of detergent (biological or non-biological) and the presence of fabric softeners, affect DNA recovery from laundered garments. Controlled experiments were conducted to simulate realistic washing scenarios and mimic using standard washing machines. Three types of small fabric swatches, including plain white woven cotton, blue cotton denim and red jersey-knit fabric cotton, were seeded with blood and known quantities of cellular and cell-free DNA. Each of these swatches (donor), along with three DNA-free white cotton swatches (receivers), was washed under various conditions and subsequently tested for DNA recovery using quantitative PCR (qPCR).
Results demonstrate that biological detergents containing enzymes such as lipases and proteases reduce the quantity of recoverable DNA when compared to non-biological detergents, which lack enzymatic activity. The amount of recovered DNA was also influenced by the type of fabric the source had been deposited on. The findings from this study highlight the significance of washing conditions on DNA persistence and transfer of DNA from one garment to another during washing.

Catching Clues From Thin Air: Novel Air Collection Method Investigations for Human DNA Identification 11:00 - 11:00

E. Bibbo[1], *D. Taylor*[1,2], *R. van Oorschot*[3,4], *M. Goray*[1]

[1]College of Science and Engineering, Flinders University, Adelaide, Australia, [2]Forensic Science SA, Adelaide, Australia, [3]Office of Chief Forensic Scientist, Victoria Police Forensic Services Department, Macleod, Australia, [4]School of Agriculture, Biomedicine and Environment, La Trobe University, Bundoora, Australia

Abstract Body: With increased sensitivity in DNA detection, a wider range of evidentiary samples can now produce informative DNA profiles. However, challenges persist when generating profiles from trace and touch DNA samples, due to an inability to visualise where to sample as well as attempts by forensically aware criminals to remove contact traces. Therefore, the emerging field of environmental DNA (eDNA) collection which focuses on detection of genetic material shed by organisms into their environment, presents a novel approach to bypass these issues. While its utility has been explored in species identification, its application in forensic investigations is still in the early stages. Recovery of human DNA from the air presents a novel evidence source of forensic relevance, potentially aiding in retrieval of DNA from recent occupants of crime scenes, to provide investigative leads. It can also enhance our understanding of DNA movement in the air, offering insights needed to answer questions of "how" DNA arrived within areas of a crime scene and improving knowledge of contamination risks. This study reports on the results of research into the prevalence and persistence of human DNA in the air aiming to optimise collection methods. Human DNA was collected using an AirPrep Cub Sampler ACD220 within different commonly used environments, whereby a number of factors were demonstrated to have an influence on the quantity and quality of DNA recovered. These findings provide valuable insights into

the utility and optimal conditions for air sampling of human DNA in forensic applications.

06: Education and Training: Academic Courses
11:00 - 11:45 Auditorium

Poster Session Thursday - Education and Training: Academic Courses

Application of Mini Bandes Dessinées for Enhancing Learning in Forensic Science Education 11:00 - 11:00

R. Li[1]

[1]John Jay College of Criminal Justice, The City University of New York, New York, United States

Abstract Body: **Over the years, studies have indicated that using bandes dessinées (BD, or graphic novels) in teaching can lead to better engagement in classrooms. However, there are some potential obstacles of this approach. First, there is a limited selection of BDs available for higher education. Additionally, available collections of BDs lack variety for covering a wide range of desired topics, especially for forensic science education. Furthermore, BDs are usually full-length, which is a bit too long to be used for a single class module. The goal of this pilot study is to address these issues to design and create case-specific BDs so that each of them would be suitable for weekly modules. Such BDs should be short (less than 10 pages); thus they would be defined as a mini BD in this study. We can use them to 1) provide students with visual information as part of engaging narratives to explain complex concepts, principles, or particularly case studies and 2) provide students with visual information to explain laboratory exercise processes. In this pilot study, a small trial evaluating the potential effectiveness of mini BD in enhancing student learning has been carried out. During this presentation, the outcome of the pilot study will be discussed.**

Student Use of GenAI for Research Project Outputs: Problem or Opportunity? 11:00 - 11:00

F. Carlysle-Davies[1]

[1]University of Strathclyde, Centre for Forensic Science, Glasgow, United Kingdom

Abstract Body: The growing use of generative artificial intelligence (GenAI) by students has caused concern for those working in higher education. Concern centres specifically around the use of GenAI in written assessments where there are fears that as the technology progresses students could use (or are already using) it to generate entire assignments rather than producing their own work. While many universities are developing policies on when GenAI can and can't be used by students, whether the students are following these policies is unknown as there is still no truly effective way to determine if a piece of work has been written

by GenAI. There is also some confusion over what does and doesn't 'count' as the use of GenAI and if there are ways to make assessments 'AI proof'. This presentation will discuss a piece of research conducted into student use of GenAI within an MSc research project module and delve into the wider debate as to whether the use of GenAI is a problem or opportunity within higher education particularly for assessments involving extended pieces of writing.

Operation Enigma: A Novel Tri-Modal Case Study Investigation 11:00 - 11:00

J. Able[1], *L. Nichols-Drew*[1], *A. Russell*[1], *G. Donovan*[1]

[1]De Montfort University, Forensic Science, Leicester, United Kingdom

Abstract Body: De Montfort University is the only UK university to be a United Nations Academic Impact SDG (Sustainable Development Development) Hub for SDG16: Peace, Justice, Strong Institutions. We embrace the SDG16 ethos within the Chartered Society of Forensic Sciences accredited BSc Forensic Science undergraduate degree. Experiential/Participatory learning is integral to our curriculum, aligned to the Criminal Justice System: Crime Scene, Forensic Laboratory, and Court. We implement a Tri-modal approach for student active learning experiences: **physical** (utilising on campus facilities such as the crime scene house and non-residential space, industry specification laboratory facilities, vehicle and the former Leicester Crown and Magistrate courtrooms), integrating **contextual** information (provided by academic colleagues from our practitioner casework experience and research informed teaching portfolios), with the **virtual** world (embracing innovative and immersive technologies; asynchronously within our VLE, and synchronously; in timetabled sessions).
Here, we showcase **Operation Enigma** – a unique organised crime group case study created in a cross-Faculty and interdisciplinary partnership, involving a County Lines criminal investigation, incorporating crime scenes, seminars, and practical laboratory classes. Linking the entirety of Operation Enigma is digital technology (mobile phone, CCTV, social media, and background intelligence).
This is a transformative heutagogy, integrating professional expectations, via co-creation, peer feedback, reflection, and problem-based learning to enhance students' Graduate Attributes, with development of 21st century employability skills (collaboration, critical analysis, communication, creative thinking).
Operation Enigma demonstrates the paramount importance of authentic real-world learning. Ultimately, this will interest global Criminal Justice educators (academics, practitioners, trainers) as to innovative and immersive learning opportunities.

Student Perspectives on Fostering Engagement in Forensic Science Modules for Non-Scientists Undertaking UK Forensic Investigations Degrees 11:00 - 11:00

P. Tarttelin Hernandez[1]

[1]University of Technology Sydney, Sydney, Australia

Abstract Body: Fostering student engagement in higher education (HE) can result in wide-ranging positive experiences for students e.g. it can create transformative learning experiences and increased motivation, tenacity to complete university studies and increased success beyond university. As such, ample research has centred on understanding how educators can entice students to 'engage'. Increasing in popularity in the UK, are BSc courses in Forensic Investigations for students without a science background, suitable for individuals who seek future investigative roles. Nevertheless, these courses contain mandatory Forensic Science modules that students have historically struggled to understand and engage with in terms of lectures, knowledge acquisition, and assessment. This study reports on the perspectives of 13 third-year Forensic Investigations students on what engaged them during lectures, practical sessions, assessments, and beyond. A student-staff partnership was developed to foster engagement through 4 iterations of this module. This partnership led to significant improvements in the way Forensic Science was taught to and for non-scientists e.g. students were engrossed through an immersive simulated high-profile crime scene investigation that progressed through the course of the module, and a range of small-group active learning workshops helped students consolidate learning. Module changes led to increased attendance, participation in classroom discussions and requests for one-to-one meetings with lecturers to further learning. It is thought that these results may be valuable to HE teachers, as well as those involved in the education and training of the young generation of new recruits in the UK's Police Uplift Programme to encourage their retention and engagement.

08: Forensic Medicine and Toxicology: Forensic Archaeology
11:00 - 11:45 Auditorium

Poster Session Thursday - Forensic Medicine and Toxicology: Forensic Archaeology

The Correlation Between Cranial Fractures and Intracranial Lesions Due to Blunt Force Trauma 11:00 - 11:00

C. Mole[1], *S. Sakambane*[1]

[1]University of Cape Town, Forensic Medicine and Toxicology, Observatory, South Africa

Abstract Body: Globally, head injuries are a significant contributor to cause of death. In forensic anthropology and pathology, a common question arises regarding the role cranial fractures play in the ultimate cause of death. Presently, answering this question is limited by a lack of literature regarding the correlative relationship between the presence of cranial fracture and brain trauma. This study aimed to investigate the relationship between skull fractures and intracranial lesions through a five-year retrospective review of autopsies conducted at Salt River Mortuary, Cape Town, South Africa. Cases of blunt force trauma with the presence of head injury associated with assault or falls were included in the study. Cases with extensive cranial trauma (e.g. crush injuries) were excluded. A total of 719 cases were included, of which 471 (66%) had cranial fractures and 681 (95%) had brain injuries. Co-occurrence of cranial fractures with intracranial lesions occurred in most cases (64%). Age and sex were significantly associated with the presence of brain trauma and the presence

of cranial fractures. A significant association was found between the presence of cranial fractures and brain trauma to the frontal, parietal and temporal lobes. Basal fractures had an increased risk of brain injury compared to fractures in other regions. Notably, all cases of hinge fractures had associated brain trauma. The data presented in this study can be used for the prediction of the presence of brain trauma, where the presence of cranial fracture is noted.

Implementing Advanced Geophysical Survey and Forensic Archaeological Methods to Locate and Identify Unmarked Graves of Victims of Operation Condor, Paraguay 11:00 - 11:00

J. Harris[1], A. Sartorio[1], R. Goiburú[2], K. Bolhofner[1]

[1]Arizona State University, School of Interdisciplinary Forensics, Glendale, United States, [2]Ministry of Justice, Asunción, Paraguay

Abstract Body: Operation Condor was a 1970s-era campaign of political repression that led to the disappearance and murder of an estimated 60,000 individuals in South America, the majority of whom lie in unmarked mass graves. As of 2019, only 37 bodies out of around 400 of the murdered individuals have been recovered in Paraguay, and among these, only four have been identified. Many of the survivors of Operation Condor, and their families, are still living in fear of reprisal and have been reluctant to come forward with information regarding the whereabouts of unmarked graves related to Operation Condor. In 2024, we conducted ethnographic interviews with local Paraguayan informants regarding the locations of eight burial sites, including single and mass graves. We conducted minimally-invasive aerial and ground survey of four sites. To detect the presence of subterranean disturbances and identify possible clandestine graves at two locations, we performed ground penetrating radar (GPR) surveys using a system with dual channel ultra-wideband frequencies (>120%, fractional, -10 dB) centered around 400MHz and 800MHz. Here we present the results of our preliminary survey and report on our initial GPR findings. Geophysical survey techniques such as GPR, have been underutilized in South America and our study represents one of the first forensic archaeological application of these techniques in Paraguay. Our study represents a significant scientific advancement in supporting justice on an international scale, presenting a valuable search-and-mapping model to guide similar efforts.

An Analysis of the Effect of Postmortem Burning on Skeletal Sharp Force Trauma 11:00 - 11:00

L. Chonyera[1], E. Chang[1], Z. Maharaj[1], C. Mole[1]

[1]University of Cape Town, Forensic Medicine and Toxicology, Cape Town, South Africa

Abstract Body: Fire-related mortalities are a major cause of death globally. While most of these fatalities are accidental, there are instances were burning in conjunction with dismemberment is used to conceal a crime. Heat-induced changes to bone can affect pre-existing damage caused by an implement as such more research is needed to determine the

extent of alteration under controlled conditions. Ninety sheep (Ovis aries) femora were subjected to sharp force trauma and subsequently burned under different temperatures (400 ºC, 600 ºC and 800 ºC) and durations (20min 30min and 40min) in a muffle furnace. Three cuts (false start, incomplete, complete transection) were made to the shaft of each bone using a back saw. Saw mark characteristics were examined pre- and post-burning using photography, stereomicroscopy and scanning electron microscopy. A comparison of the characteristics, pre and post burning was conducted using a two-way ANOVA to analyse the effects of temperature on the bone samples. The effects of temperature and duration were not significant; however, differences were observed in the kerf depths of the lesions between burned and unburned samples. Kerf widths increased in size at lower temperatures and decreased in size as temperatures increased. Similar findings were observed for kerf width in incomplete cuts. The preservation of morphological characteristics differed between the temperature and burn duration groups. Trauma characteristics varied based on the temperature and duration applied. Although each attribute responded differently, saw mark traits could be identified in all groups. More research is needed to investigate longer duration burns.

A Study Investigating Search and Rescue Dogs' Ability to Detect Human Odor in Historical Graves Pre-1919 and Unmarked Burials 11:00 - 11:00

B. Arnould[1], *M. Davis*[2], *R. Morris*[3]

[1]University College Dublin, School of Medicine, Belfield, Dublin 4, Ireland, [2] University College Dublin, Diagnostic Imaging, School of Medicine, Belfield, Dublin 4, Ireland, [3]Wexford Search, Rescue, and Recovery, Adamstown, Enniscorthy, County Wexford, Ireland

Abstract Body: Search and Rescue (SAR) dogs can be trained to detect the odor of decomposing human remains due to their unique olfactory capabilities. The composition of this odor is complex and not fully understood. Research on the ability of SAR dogs to detect historic graves and unmarked burials is limited. Therefore, this study aimed to investigate the ability of two SAR dogs to detect the odor of human decomposition in graves pre-1919 and unmarked burials in various cemeteries, and the effect of differing environmental contexts on their ability to do so.

Three cemeteries in Wexford County, Ireland, were selected. The dogs used are active SAR dogs, also trained in human remains detection. The dogs were video-recorded as they individually searched, and their indications were described as either “visible” or “non-visible”, referring to a known grave site or a possible unmarked burial. A digital anemometer was used to measure the average temperature and wind speed at the start and end of each search unit, and wind direction was recorded.

The study found that both dogs could detect odor in historical graves, as they indicated at a variety of marked and possibly unmarked gravesites. The amount of odor present at a cemetery, however, proved overwhelming, evident from the dogs’ body language. The effect of environmental conditions was unclear as the total number of indications at each cemetery did not change.

While the study’s results are encouraging, they emphasize the need for

further research in this field to better train SAR dogs.

05: Drugs: Emerging Technology
11:00 - 11:45 Auditorium

Poster Session Thursday - Drugs: Emerging Technology

Smart Detection of Illicit Drugs by Handheld NIR Device: One Year of Practical Experience From a Police Forensic Lab 11:00 - 11:00

P. Maida[1], *G. De Grazia*[1], *V. Grisolia*[1]

[1]RaCIS - RIS Carabinieri Messina, Messina, Messina, Italy

Abstract Body: The analysis of illicit drugs faces many challenges, particularly in terms of the reliability of results within a reasonable time. The development of portable instruments represents a useful tool for law enforcement organisations and forensic laboratories; however, the robustness of conventional methods, i.e. chromatographic analysis, represents a valuable technique. The aim of this work is the comparison of quantitative data obtained using an ultra-portable near-infrared instrument and a gas chromatographic method (GC-FID). The device, connected to a mobile application, allowed a rapid screening of the illicit drugs analysed. Such an approach allowed a low-cost analysis within a few seconds and proved to be highly efficient thanks to a chemometric data processing study. This poster describes one year of experience in a police forensic laboratory, highlighting the advantages and practical limitations of this technique.

05: Drugs: Inter Agency Cooperation
11:00 - 11:45 Auditorium

Poster Session Thursday - Drugs: Inter Agency Cooperation

The EU project "NETZWERK ADEBAR" 11:00 - 11:00

S. Hamer[1], *F. Westphal*[1], *M. Pütz*[2]

[1]State Bureau of Criminal Investigation (LKA) Schleswig-Holstein, Toxicology and Narcotics, Kiel, Germany, [2]Federal Bureau of Criminal Investigation (BKA), Toxicology, Wiesbaden, Germany

Abstract Body: The NETZWERK ADEBAR project is a German cooperation project funded by the EU between the Federal Criminal Police Office (BKA), several state criminal police offices, the German Customs and three universities. NETZWERK ADEBAR continues the work of the successful predecessor projects.

In this project, analytical data of recently emerging substances on the drug market is continuously being collected to supplement national, European, and world-wide databases. Unknown substances can be sent in from all police and customs forensic departments for the structural elucidation and characterization to the headquarter of the project. Analytical and synthetic

capacities of the partners in the network are combined for the centralized processing and quality assurance.

Several sub-projects are carried out by partners as the assessment of pharmacological data (a.o. receptor binding affinity) and metabolism data, the prospective synthesis of new designer drug variants to support and enforce NPS legislation and the expansion of the internationally accessible, web-based database platform NPS DataHub (https://nps-datahub.com/, developed within the ADEBAR projects). Additional aims of the project are the provision of reference material for all police and customs laboratories in Germany, accompaniment of legislative projects and amendments in the fields of NPS and narcotics and a close cooperation with the EUDA.

Over the last seven years, over 1000 samples have been sent in to the project, 600 data sets have been published in the databases, 300 reports have been filed for the EUDA among which were 100 first identifications in Europe (and around 280 first identifications in Germany).

06: Education and Training: Continuous professional development
11:00 - 11:45 Auditorium

Poster Session Thursday - Education and Training: Continuous professional development

Glossary of Technical Terms in Document Fraud 11:00 - 11:00

D. Sánchez Criado[1]

[1]Spanish National Police, Basque Country Headquarters, Bilbao, Spain

Abstract Body: Since document fraud is the key to many other illicit activities, it is considered that everybody involved in security and validating or in contact with all kinds of documents, should have advanced knowledge that allows them to detect a counterfeit, false or altered document. To this end, it is essential to acquire certain knowledge of what kind of security features are incorporated into security, travel or other documents, to know how they are implemented in the substrate, how they are validated and how they act under certain conditions.

This classified glossary is no more than a visual display with brief explanations of all these elements and printing techniques that can be incorporated into security documents, and is intended to be used as a technical reference for consultation. This detailed glossary of technical terms also standardises the terminology used in expert or technical reports issued as a result of fraudulent detection.

It is in line with the FADO glossary with an increased number of terms and high quality images and illustrations to make it understandable at a glance. Diagrams, charts and designs have also been incorporated to make it easier to understand the implementation and analysis of these security features.

Having all the information classified in one place as a poster makes searching for it very efficient and contributes to an understanding and awareness of the importance of observing and analysing the substrate of the documents to check the authenticity of all the security features of the

security document.

05: Drugs: Legislation
11:00 - 11:45 Auditorium

Poster Session Thursday - Drugs: Legislation

Legal Compliance of Forensics into Clinical Trials: A Critical Study 11:00 - 11:00

A. Nidhi[1]

[1]MAHINDRA UNIVERSITY, LAW, Hyderabad, India

Abstract Body: Clinical trials are systematic processes designed to evaluate the safety, efficacy, and reliability of new drugs, vaccines, and medical treatments. Developing countries have become preferred locations for clinical trials due to a diverse genetic populace, abundant manpower, and less stringent regulatory frameworks. Developing new drugs and medical devices involves extensive testing phases, including preliminary safety assessments, pivotal trials, and post-marketing evaluations. The integration of forensic methodologies and strict legal compliance into clinical trials has emerged as a critical approach to maintaining research integrity and ethical standards. Forensic audits are crucial in detecting inconsistencies and enhancing trial outcomes' credibility and legal validity. Additionally, compliance with national and international regulatory frameworks is vital to ensuring the reliability of clinical studies.
The involvement of Contract Research Organizations (CROs) is particularly critical, as they must adhere to stringent regulatory requirements and demonstrate robust quality and performance records to minimize risks. Further, forensic methods safeguard data integrity by verifying the accuracy of data collection, storage, and reporting and assessing the security of electronic systems. However, CROs have encountered significant challenges, including compliance with Anti-Bribery and Anti-Corruption laws, risks of improper financial incentives, and ethical breaches by third-party vendors. These challenges resulted in false reporting and financial irregularities. This paper explores challenges, issues, and practices related to data accuracy, regulatory compliance, and fraud detection in clinical trials. It also proposes strategies to mitigate these risks through rigorous compliance verification and forensic auditing, ensuring ethical and reliable trial outcomes.

09: Interpretation: Scientific Examination Strategies
11:00 - 11:45 Auditorium

Poster Session Thursday - Interpretation: Scientific Examination Strategies

The Need for Contextual DNA Samples in Activity Level Evaluative Reporting 11:00 - 11:00

Y. Goedhart[1,2], *J. de Koeijer*[3], *I. Jullens*[4], *A. de Ronde*[1], *C. de Poot*[1,5], *B. Kokshoorn*[1,3]

[1]Amsterdam University of Applied Sciences, Amsterdam, Netherlands, [2]VU University Amsterdam, Amsterdam, Netherlands, [3]Netherlands Forensic Institute, The Hague, Netherlands, [4]Dutch National Police, Assen,

Netherlands, [5]Police Academy of the Netherlands, Apeldoorn, Netherlands

Abstract Body: Activity level evaluative reporting (ALER) is a crucial tool to determine the diagnostic value of latent DNA traces with regards to alleged activities. However, ALER poses a challenge for forensic experts, due to the growing need to understand latent DNA trace dynamics to aid in reconstructing alleged criminal events. When it comes to probability assignment in Bayesian network construction, the reliable use of experimental data can be troublesome, as few studies actually reflect the case-relevant scenarios that forensic experts are looking for. This problem becomes most apparent when considering the presence, and especially the quantity, of prevalent DNA. The variables affecting DNA prevalence are highly specific and case-dependent, making them difficult to evaluate based on literature alone. Therefore, it would be preferable to assess DNA prevalence using data collected directly from the crime scene. Here, we propose collecting additional samples of a target's surroundings during the investigation, a process we refer to as contextual sampling. Within this concept, different categories of contextual samples are identified. Using case examples, it is shown how these categories can guide sampling strategies and how contextual samples can be incorporated in Bayesian network construction. Furthermore, practical considerations for casework practice are discussed, such as determining the required amount of contextual samples and identifying cases where they add value. Contextual samples can be collected in anticipation of alternative scenarios and, if done properly, will provide forensic experts with case-relevant information that can be used in ALER.

10: Legal and Ethical Aspects: Presentation of Evidence
11:00 - 11:45 Auditorium

Poster Session Thursday - Legal and Ethical Aspects: Presentation of Evidence

Towards an Ethical Use of Evidence in the Italian Criminal Proceedings 11:00 - 11:00

D. Curtotti[1], *C. Pallante*[1], *M.G. Rutigliano*[1]

[1]University of Foggia, Department of Law, Foggia, Italy

Abstract Body: The abstract presents a study conducted by researchers from the University of Foggia in collaboration with the Court of Foggia. The aim of the research was to analyse trial dynamics and timelines, as well as the role of scientific evidence, in order to better understand the causes of delays and dysfunctions in the criminal trials.
The study examined 100 court files over a five-year period (2015–2019). The analysis revealed that evidence had a significant impact on the progression of cases. In 85% of instances, evidence was a key factor in the decision to impose pre-trial measures, with 90% of these cases justifying pre-trial detention.
As the trials advanced, evidence continued to play a crucial role in judicial decision-making. In 28% of cases, it led to acquittals, while in 72%, it resulted in convictions.
Interestingly, only 46% of cases followed the traditional trial process, while

the remaining 54% were resolved through alternative procedures, which shortened the trial duration.
Specifically, in murder cases, the trials lasted 15 months less than the average of 48 months.
In terms of outcomes, standard trials showed a high acquittal rate of 67%, while accelerated procedures were associated with a higher conviction rate of 65%.
The study emphasizes the significant influence of evidence on the timeliness and efficiency of judicial proceedings. It highlights the need for integrated training for both technical and legal professionals, focusing on the ethical and accurate use of evidence to minimize the risk of errors and misuse.

The Effects of Expert Conclusions and Additional Forensic Evidence on Listener Perceptions in a Voice Comparison Task 11:00 - 11:00

V. Hughes[1], *C. Llamas*[1], *T. Kettig*[2]

[1]University of York, York, United Kingdom, [2]York University, Toronto, Canada

Abstract Body:

Forensic voice comparison involves the analysis of recordings of unknown and known voices to assess the likelihood that they are of the same or different speakers. In this paper, we examine how lay peoples' (i.e. potential jurors') judgments about voices interact with expert conclusions and the extent to which judgments can be biased by additional forensic evidence in a case.

We used a novel jury-based game to elicit data from lay people about whether pairs of voice samples belong to the same or different speakers. One cohort of listeners was given a consistent-with-fact likelihood ratio (LR)-based conclusion of low, medium, and high magnitude, expressed either as a verbal statement or a numerical value. A second cohort of listeners was presented with additional forensic DNA, fingerprint, or footprint evidence in the case, but was given no indication about the direction or magnitude of the evidence.

Results show that verbal LRs shifted listener judgments in a consistent way relative to the strength of the conclusion presented. Less consistent patterns were found for numerical LRs, suggesting that participants struggled to interpret numerical values, particularly those of the highest magnitude. When primed with the suggestion of other forensic evidence, participant responses shifted towards the voices being more likely to be from the same speaker with the effect being strongest for footprint and fingerprint evidence. We discuss the implications of these findings for the presentation of conclusions in forensic voice comparison cases, and for forensic science more generally.

11: Marks, Impressions and Biometric Traces: Fingerprint Development
11:00 - 11:45 Auditorium

Poster Session Thursday - Marks, Impressions and Biometric Traces: Fingerprint Development

The Use of Subjective Scales vs Comparative Scales in Fingermark Quality Assessments – What Do the Numbers Tell Us? 11:00 - 11:00

E. Scott[1]

[1]Swedish National Forensic Centre, Fingerprint Development, Linköping, Sweden

Abstract Body: When conducting fingermark quality studies at the Swedish National Forensic Centre (NFC) a subjective scale of 0-10 (Likert scale) is most often utilised. The subjective scale relies on fast and intuitive assessment of fingermark clarity and detail. No predefined standards are set and the method relies on personal judgement. Comparative scales utilise specific criteria and enable a relative assessment of fingermark quality when comparing two or more methods. Until now, no studies have been conducted at the Swedish National Forensic Centre to evaluate the scale generated data in relation to fingermark quality. Furthermore, ninhydrin development is normally conducted at 62% relative humidity and it´s unknown how much a reduction in relative humidity would lead to reduced fingermark quality, and if this can be distinguished using different scales. In this study, quality of fingermark halves developed with ninhydrin at two different humidity levels (40% and 62% relative humidity) were assessed using both a subjective scale and the University of Canberra comparative scale (UC). The results showed that although the Likert scale is subjective, the UC scale is a blunter scale and has difficulty showing the finer details of the data. The study also showed that the fingerprint experts assessing the quality of the fingermarks did not make consistent assessments across the scales and that the results of the experiments could be interpreted differently depending on which scale is utilised. Even though both scales have their benefits, the importance of consistent assessments and interpretation has to be further addressed and studied.

Examining Grain Packaging in Latent Fingerprint Detection with Porous Materials 11:00 - 11:00

C.L.S Da Fonseca[1], *C. Ferreira*[2], *M. Albuquerque*[3], *M. Altoé*[3], *E. Jesus*[3], *R. Vieira*[3], *G.J. da Silva*[4]

[1]Federal Police Of Brazil, Expert Fingerprint, Brasília, Brazil, [2]Universidade de Brasília, Physics, Brasilia, Brazil, [3]Federal University of Espírito Santo (UFES), Department of Chemistry and Physics, Espírito Santo, Brazil, [4] Universidade de Brasília, Department of Physics, Brasilia, Brazil

Abstract Body: The present study seeks to highlight important aspects of grain deposition within sebaceous latent fingerprints. Microscopic evidence obtained from scanning electron microscopy measurements is used to characterize the deposition of four powders, three of which are clays: Laponite RD, sodium montmorillonite, potassium montmorillonite, and a commercial pap powder called PRB240. Factors such as the fraction of grain area within the ridges, the average lengths of the ridges and furrows,

the total length from ridge to furrow are estimated to elucidate the formation of the revealed fingerprint. Results indicate significant differences in particle deposition within the fingerprint identified when using each powder, compared to a pure fingerprint, which elucidates the macroscopic patterns of the post-develop fingerprint.

Pseudo Operational Trial Comparing Vacuum Metal Deposition and Superglue Fuming for Visualising Fingerprints on Synthetic Leather 11:00 - 11:00

C. Rampulla[1], *G. Gervasi*[1], *A. Melinato*[1]

[1]European Forensic Institute, Malta Life Sciences Park, San Gwann, SGN, Malta

Abstract Body: The goal of the research project was to tackle the difficulties encountered by the police forces while conducting fingerprint analysis in the forensic field, particularly when the exhibit to examine for latent prints is synthetic leather. This study explored the recovery of marks deposited by five donors on new synthetic and eco leather samples. The deposition of the marks included depletion series, and the marks were aged indoors for 48 hours.The project was focused on 11 material types of synthetic leather. Two main different techniques were applied for analysis: vacuum metal deposition (VMD) and superglue/cyanoacrylate fuming (CNA). The resulting samples were analysed using Foster and Freeman® DCS-5 photographic system and Crime-lite Auto, which uses different lighting to enhance the visibility of fingerprints.
Vacuum Metal Deposition on its own has developed some results in which prints could be identified as good for comparison, but on the majority of the surfaces it was found that the technique had to be combined with CNA fuming following other enhancement techniques. It always needs to be combined with another process. CNA fuming and Vacuum Metal Deposition can be effective in developing fingerprints on these difficult surfaces, especially if they are processed consecutively.

DavinciQD2.0 11:00 - 11:00

A.I. Gergely[1,2], *R. van Oostrom*[1]

[1]Saxion University of Applied Sciences, Applied Nanotechnology, Technologies for Criminal Investigations, Enschede, Netherlands, [2] Netherlands Forensic Institute, Research and development, Den Haag, Netherlands

Abstract Body: This research project aims to develop a method for the age determination of latent fingermarks and blood traces at the crime scene. Fingermarks and blood are the most encountered forms of physical and biological evidence, respectively. A reliable, on-site method for dating these traces would extremely benefit forensic investigators in timeline reconstructions, scenario building, and sampling strategies.

Proteomics is applied in a forensic context to identify biomarkers in blood and fingermarks that are origin related but degrade differently. This involves assessing the dynamic changes of proteins during the aging of traces with liquid chromatography coupled to quadrupole time-of-flight

tandem mass spectrometry (LC-QToF). Some biological components are expected to be relatively stable, with the potential to act as internal standards in traces, while others will degrade with time. Subsequently, the biomarkers are used in modelling the aging process of fingermarks and bloodstains using the concentration ratio of both the stable and degrading components. The concentration will be measured at the crime scene by visualising fluorescence intensity which occurs when the carbon quantum dots, functionalised to specifically target either the stable or degrading biomarker, bind to the target molecule.

The impact of environmental factors, such as substrate type, temperature, and light exposure, on the aging process must be investigated for the method to be applicable in forensic practice. Moreover, the biomarker's origin should be tested to account for intra- and inter-variability between donors. For instance, protein concentrations may be influenced by the donor's sex, age, or geographical origin.

08: Forensic Medicine and Toxicology: Other
11:00 - 11:45 Auditorium

Poster Session Thursday - Forensic Medicine and Toxicology: Other

An Investigation Into the Bioaccumulation and Biomagnification of Trace Metals From Gunshot Residue (GSR) Within *L. sericata* and *C. rufifacies* 11:00 - 11:00

M. Storen[1], *M. Harvey*[1], *X.A Conlan*[1]

[1]Deakin University, Life and Environmental Sciences, Waurn Ponds, Australia

Abstract Body: Forensic entomotoxicology involves the application of toxicological principles to forensic investigations by utilizing the analysis of necrophagous insects to detect and identify toxins in decomposing remains, thereby providing valuable insights into cause of death (COD) and circumstances surrounding a crime. Where a bullet wound is present, the dispersion of GSR is localised around the bullet's point of impact, and the identification of GSR can inform COD investigations.
Whilst some studies have investigated the detection of GSR within some larvae (Calliphoridae), knowledge regarding the bioaccumulation of GSR heavy metals beyond immediate ingestion is limited.
Larvae may be exposed to GSR-contaminated organic matter for only a brief period during their active feeding stages, and the potential for GSR bioaccumulation could provide valuable information for COD investigations.
This study investigated the bioaccumulation of GSR in *Lucilia sericata* larvae subjected to contaminated food sources over different exposure intervals. In addition, the biomagnification of the GSR amongst the opportunistic predatory species Chrysomya rufifacies feeding on these *L. sericata* larvae may also provide an avenue for GSR detection.
Pork mince was shot four times at close range, and first instar *Lucilia sericata* larvae were then placed on the GSR contaminated mince, as well as on a control sample. The larvae were subsequently removed after varying time intervals and transferred to fresh control mince or fed to predatory species *Chrysomya rufifacies*. Samples were analysed using inductively coupled plasma mass spectrometry (ICP-MS). This investigation

can inform the timeframe for the utility of entomotoxicology for assisting COD investigations.

In Silico and In Vitro Metabolite Identification of the Synthetic Opioid Thiophene Fentanyl 11:00 - 11:00

M. Popławska[1], *A. Błażewicz*[1], *S. Flis*[2], *B. Daniszewska*[1], *K. Janicka*[3]

[1]National Medicines Institute, Department of Falsified Medicine and Medical Devices, Warsaw, Poland, [2]Warsaw University of Life Sciences, Center of Translational Medicine, Warsaw, Poland, [3]University of Warsaw, Faculty of Chemistry, Warsaw, Poland

Abstract Body: The ever-changing market of new psychoactive substances (NPS) and increasing numbers of overdose deaths are still current social problems and health threats in the EU. Rapid diagnostic tests, commonly used for classical drugs, are not specific for novel psychoactive compounds, so their identification can be challenging for forensic and clinical toxicologists. Furthermore, in the case of biological samples, the metabolites can be present at much higher concentrations than their parent compound.
Because little information is available about the metabolism of NPS, the main goal of this study was to determine metabolic pathways of the selected synthetic opioid – thiophene fentanyl, which has emerged on the Polish market and the characteristic of which is poly-routes of administration and which caused intoxications. The results were achieved by in silico prediction of potential metabolites. Then, in vitro incubation of thiophene fentanyl with human liver and lung microsomes was performed to evaluate metabolic stability and assess pharmacokinetics. Generated metabolites of thiophene fentanyl were detected and identified by high-resolution mass spectrometry (HRMS) with a hybrid system of quadrupole-time-flight analyzers, additionally coupled with ultrahigh-performance liquid chromatography (LC-QTOF-MS/MS). In the end, *in vitro* and *in silico* results were compared, metabolic pathways of the selected synthetic opioid were proposed, and the most reliable metabolites as distinctive markers of intoxication were suggested. The results of the study facilitate the detection and identification of thiophene fentanyl in samples of intoxicated patients.
This research was funded in whole by National Science Centre, Poland (Grant number: 2020/39/D/NZ7/03091)

TBA 11:00 - 11:00

The Utility of Ubiquitin Carboxy-Terminal Hydrolase L-1 (UCH-L1) as a Potential Biomarker in Predicting the Severity and Prognosis in Cases of Traumatic Brain Injury (TBI) 11:00 - 11:00

P. Setia[1], *D. Mathew*[2], *R. Sharma*[3], *P. Purohit*[4]

[1]All India Institute of Medical Sciences, Department of Forensic Medicine and Toxicology, Jodhpur, India, [2]Jawaharlal Institute of Postgraduate Medical Education and Research, Forensic Medicine and Toxicology, Puducherry, India, [3]All India Institute of Medical Sciences, Department of Neurosurgery, Jodhpur, India, [4]All India Institute of Medical Sciences, Department of Biochemistry, Jodhpur, India

Abstract Body: **Introduction**
Traumatic Brain Injury (TBI) is primarily caused by direct impact to the head, as well as by secondary injuries caused by activation of microglia, astrocytes, and immune cell infiltration. GFAP is a class III intermediate filament protein abundant in the astrocytes.
Methods
In the present study, 120 cases of head injury and 40 controls were enrolled. 40 cases each of mild and severe cases of head injury assessed using the Glasgow Coma Scale (GCS) and their blood samples were collected at 8 hours post injury. 40 cases of death due to head injury, who died within 24 hours of the incident, were enrolled, and their blood samples were collected within 6 hours of death. UCH-L1 levels have been measured using sandwich ELISA.
Result
The values of UCH-L1 (in pg/ml) were significantly increased in patients with mild TBI [161.46 (IQR: 119.35–258.77)], severe TBI [189.61 (IQR: 162.25 – 271.05))] and patients who died of TBI [475.95 (IQR: 359 – 573.68)] when compared to healthy controls [154.78 (IQR: 90.25 – 192.98)]. In cases with a favorable outcome, the median UCH-L1 level was [164.61 pg/ml (IQR: 123.98 – 262.72)], whereas in cases with an unfavorable outcome, the median UCH-L1 level was [187.72 pg/ml (IQR: 161.04 – 263.48)].
Discussion and conclusion
The current study is an attempt to assess the role of UCH-L1 as a diagnostic and prognostic marker in TBI. The results are in conformation with previous studies The current study adds to existing knowledge by comparing three categories of severity of TBI.

The Effect of Temperatures on the Developmental Rate of Lucilia sericata (Meigen, 1826) in the Western Cape of South Africa 11:00 - 11:00

D. Naiker[1], *W. Uys*[1], *C.G Mole*[1]

[1]University of Cape Town, Forensic Medicine and Toxicology, Observatory, South Africa

Abstract Body: In the context of medico-legal forensic entomology, a vital component of the investigative process is determining minimum post-mortem intervals (minPMI). Insect succession patterns and developmental data can vary due to temperature, humidity and geographical location. Therefore, despite the availability of developmental data, region-specific data cannot be applied to the same species from different geographical regions as it may result in inaccurate minPMI estimations. This study aimed to establish developmental data for *Lucilia sericata* (Meigen, 1826) (Diptera: Calliphoridae) for the Western Cape Province of South Africa. *L. sericata* is a widely distributed blowfly and their tendency to be the first insect to colonise a carrion after death makes them pivotal in estimating minPMI. Developmental curves were established at six different constant temperatures (15°C, 18°C, 22°C, 25°C, 30°C, 34°C) using developmental landmarks and body length as measures of age. Measurements were collected every four hours for the higher temperatures (30°C and 34°C) and every eight hours for the lower temperatures. The experimental process was replicated three times for each temperature interval. Isomegalen and isomorphen charts were constructed to aid in PMI estimation. The total

developmental times decreased as temperature increased, however, at 34°C, an increase in the total developmental time was observed. The results from this study vary from other developmental studies, suggesting that temperature and geographical region effect the development times of *L. sericata*, and these results can help improve the estimation of minPMI within the Western Cape.

09: Interpretation: Case Assessment and Interpretation (CAI) Model
11:00 - 11:45 Auditorium

Poster Session Thursday - Interpretation: Case Assessment and Interpretation (CAI) Model

Can Forensic Science Counter Miscarriages of Justice? 11:00 - 11:00

C. Senechal[1], *F. Crispino*[2]

[1]University of Ottawa, Education, Ottawa, Canada, [2]UQTR, Biochimie, chimie, physique et science forensique, Trois-Rivières, Canada

Abstract Body: Institutional controls allowing for a complete presentation of all relevant evidence and limiting errors of assessment are crucial to ensure a correct decision-making process in the judicial context. Our communication focuses on some of the limiting factors that hinder a correct assessment of the evidence, and that are the least likely to be flagged upon judicial control (appeal). Following a critical review of literature in criminology and social sciences on the sources of errors which affect the rationality of judgments, we will present some issues of understanding and interpretation peculiar to scientific evidence, including expert opinions as well as results obtained by statistical, actuarial and technological tools. Finally, considering that the judicial control of errors of fact by trial judges turns out to be quite limited in Canada, we will be inspired by the Bayesian formula and the Sydney Declaration for forensic science in proposing an approach to “rationalize” the process of assessing evidence in order to limit errors in understanding the scope and limits of expert evidence.

09: Interpretation: Likelihood Ratios
11:00 - 11:45 Auditorium

Poster Session Thursday - Interpretation: Likelihood Ratios

Understanding of Bayes’ Theorem by Medical Professionals in Case Reports of Potential Child Abuse 11:00 - 11:00

N. Onkenhout[1], *E. van de Putte*[2], *R. van Rijn*[3], *R. Pilgram*[4], *C. Berger*[5]

[1]Dutch Expertise Centre for Child Abuse / University of Utrecht, Utrecht, Netherlands, [2]University Medical Center Utrecht, General Pediatrics, Utrecht, Netherlands, [3]Academic Medical Center Amsterdam, Department of Radiology and Nuclear Medicine, Amsterdam, Netherlands, [4]Leiden University, Center for Linguistics, Leiden, Netherlands, [5]Netherlands Forensic Institute, The Hague, Netherlands

Abstract Body: The Dutch Expertise Centre for Child Abuse (DECCA) is a

national expertise centre that advises doctors when they have findings that lead them to consider child abuse. The advice from DECCA, based on the interpretation of a paediatrician and a forensic physician both with experience in child abuse, is presented in written reports. Bayes' theorem is used to formulate a conclusion about the probability of the medical findings given certain hypotheses. It is logically correct to interpret findings and come to opinions this way, but some knowledge is required to understand such opinions. This study aims to evaluate how well medical professionals (non-statisticians/non-forensic experts) understand the conclusions in the DECCA reports, and how they self-assess their comprehension. A survey with two fictitious DECCA case reports was created with 10 statements about the interpretation of the conclusion. Participants were asked to classify these statements as "correct" or "incorrect". They were also asked to indicate how many statements they thought to have classified correctly. In the pilot study, 65 participants completed the survey (88% female, median age 52 years). Participants included forensic physicians, child safeguarding doctors, and paediatricians. Overall, a mean of 7.1 out of 10 statements were classified correctly. Participants (as a group) accurately self-reported having classified an average of 7.0 statements correctly. Participants most often misclassified variations of the prosecutor's fallacy.

Score-Based Likelihood Ratio With Quantum 3D Microscope™: An Automated Ballistic Probabilistic System 11:00 - 11:00

S. Lévesque[1], A. Beauchamp[1], D. Roberge[1], D. Werner[2]

[1]LeadsOnline, Research and Prototypes, Saint-Laurent, Canada, [2]Université du Québec à Trois-Rivières, Department of biochemistry, chemistry, physics and forensic science, Trois-Rivières, Canada

Abstract Body: In 2015, ENFSI published guidelines concerning the use of the likelihood ratio (LR) when reporting forensic findings, regardless of the field of expertise. According to these guidelines, the expert must explicitly evaluate the probabilities of observing forensic findings according to opposing hypotheses. This approach is naturally appropriate when a physical property can be measured on a trace collected at a crime scene, such as DNA profiles extracted from biological traces or refractive indexes of glass fragments. It may seem natural to extend this approach to areas of expertise such as toolmarks comparison, where the similarity between two signals is measured, by producing a score-based likelihood ratio (SLR). However, detailed numerical simulation and analysis shows that the similarity score used for the SLR must satisfy certain properties to conform to LR expectations.
The aim of this presentation is to show that the quantitative analysis tool contained in the Quantum 3D Microscope™ (Q3M) virtual comparison microscope, initially designed with individualisation/exclusion in mind, generates a similarity score with properties that are compatible with the calculation of SLRs in line with forensic expertise. The universal distribution of similarity scores for toolmarks from different sources included in Q3M proves particularly useful in the context of SLR calculation, as it avoids the need to define a reference population for each class of firearms.

09: Interpretation: Other
11:00 - 11:45 Auditorium

Poster Session Thursday - Interpretation: Other

Knowledge Graph Representation of Criminological Theories for Homicide Investigations 11:00 - 11:00

S. Bhandari[1], E. Ramos[1], R. Rupert[1], M. Elkayal[1], A. Elhabashy[1]

[1]University of Twente, Enschede, Netherlands

Abstract Body: Information about homicides can be found extensively from open information sources such as government websites, news portals, blogs, social media sites. Over the years, intelligence derived from open-source information (OSINF) aka open-source intelligence (OSINT) has shown some potential in aiding law enforcement during homicide investigations. An underlying challenge for investigators is to organise and represent the complexity associated with OSINF into a structured format to facilitate effective homicide investigation. Knowledge graphs (KG) have already demonstrated to be a powerful tool in representing complex interaction between different entities and relations across various domains. However, only few available studies have explored the potential of KGs in the domain of serious crime investigations such as homicides.
This study explores the possibility of representing criminological theories using KGs by using open-source homicide data. The dataset used in the study consists of details regarding nine homicide cases in the Netherlands. First, python data processing libraries were used to pre-process the existing data into ontologies consisting of classes, instances and relationships. In the next step, a tool called Protége with OntoGraf plugin was used to render KGs for each case alongside representations of routine activity theory (RAT), strain and opportunity theories.
Findings reveal that simpler theories such as strain and opportunity theories can be successfully represented using KGs whereas the available dataset lacked key features to fully represent complex criminological theories such as RAT. Overall, the findings signify the potential of KGs in representing criminological theories to aid investigators in conducting effective homicide investigations.

11: Marks, Impressions and Biometric Traces: Firearms and Tools
11:00 - 11:45 Auditorium

Poster Session Thursday - Marks, Impressions and Biometric Traces: Firearms and Tools

Lunge's Reagent for the Detection of Nitrites From Gunshot Residue 11:00 - 11:00

L. Ihnát Rudinská[1], V. Gebauerová[1], T. Švecová[1], J. Mertová[1], P. Ihnát[2]

[1]University Hospital Ostrava, Department of Forensic Medicine, Ostrava, Czech Republic, [2]University Hospital Ostrava, Department of Surgery, Ostrava, Czech Republic

Abstract Body: **Background**
This study aimed to evaluate the effectiveness of Lunge's reagent in

detecting nitrites in entry and exit gunshot wounds based on our institution's experience.
Methods
A prospective autopsy cohort study was carried out at the University Hospital Ostrava. During the study period, all individuals who died from gunshot injuries and were brought to the Department of Forensic Medicine (University Hospital Ostrava) were considered for inclusion in the study.
Results
The study included 80 cases of perforating gunshot wounds. Handguns were the most frequently used firearms (85% of cases), followed by rifles (15%). Gunshot wounds were predominantly located on the head (90%), with fewer cases involving the neck (7.5%) and chest (2.5%). Nitrite detection using the Lunge test was positive in 41 (51.3%) entry wounds and negative in 39 (48.7%) cases. For exit wounds, the Lunge test was positive in 21 (26.3%) cases. Among the 21 cases with positive Lunge tests for exit wounds, only 12 (57.1%) also had positive results for entry wounds.
Conclusions
The Lunge test for detecting nitrites in gunshot wounds demonstrates low accuracy and reliability. The differentiation between entry and exit wounds based on nitrite presence is outdated, as ballistic principles are more complex. Therefore, the Lunge test should no longer be used routinely by forensic pathologists.

Appearance, Variation, and Origin of Heat Seal Features 11:00 - 11:00

M. Ledin[1], *C. Hallin*[1]

[1]Swedish Police Authority, National Forensic Centre (NFC), Linköping, Sweden

Abstract Body: The use of heat-sealing devices to seal plastic bags containing items such as drugs or firearms is becoming increasingly common. These devices feature a heating element generally covered by a strip of woven glass fibre with a PTFE coating. The resulting heat seals can be considered tool marks, and as such can be compared to a suspected heat-sealing device. However, there is scarce literature on useful features and methodologies for such a source attribution.

This study contributes to this emerging forensic field by examining A) the variation of weave features in the glass fibre structure and B) how these features transfer from the strip to the heat seal.

A) Weave densities and thread properties were analysed in 12 different heat sealers, along with several spare strips provided by manufacturers. The results show that while similarities in general appearance allowed for broad categorization of heat sealers, significant differences were found between the strips at a detailed level.

B) The transfer of features from the strip to the heat seal was studied by making test seals using a defined method. Heat seals were compared to replica casts of the strips. The poster will present a discussion of feature resolution and transfer variability to the heat seals.

This study aims to establish a foundational approach at our laboratory for selecting heat seal features based on their prevalence, transferability, and

ability to discriminate between heat sealing devices.

The Enhancement of Altered or Damaged Stamp Marks on Wooden Surfaces due to Environmental Effects and Time. 11:00 - 11:00

E. Sarikaya[1], *B. Tetiker*[1]

[1]Forensic Department of Gendarmerie, ANKARA, Turkey

Abstract Body: Forest crimes are one of the important crimes all over the world as they they cause vital damages to nature and natural resources. The states take legal measures and establish their own control systems in order to avoid this crime. One of these measures taken by the authorities is to create a unique stamp marks on the trees. Thus illegally cut trees can be identified more easily. Once there is a doubt on the crime and the stamp marks, it is needed to have a forensic marks examination.However, due to enviromental effects, weather conditions and time, there are some alterations and obliterations on wooden surfaces. Sometimes these changes makes impossible to handle forensic comparison and examination. In order to find out the the effects of enviromental conditions and time on stamp marks and also to establish an examination technique, it was held out an experimental study. In this study, appications made on 2 different wooden surfaces(pine Tree and Fir Tree) with 3 different solvents (Water vapor,Ethanol and Ammonia) in order to have an enhancement on stamp marks. In this presentation it will be explained the study process with visual results to all experts working in forensic marks field.

3D-Printed Toolmarks 11:00 - 11:00

V. Andersson[1]

[1]Swedish national forensic centre, Linköping, Sweden

Abstract Body: In recent years, the need for forensic investigations of 3d-printed firearms has grown. One goal with these investigations may be to find a connection between 3d-printed firearm parts, from different locations, or between parts and printers. A toolmark examination is one way of linking manufactured or altered parts with tools or with each other. In this work, the possibility to use toolmarks found on 3d-printed firearms, or parts thereof, for this purpose has been examined. The emphasis has been on toolmarks made by the nozzle and build plate of the printers. Both of these parts were found to be able to produce informative toolmarks. The quality and variation of the marks, together with the occurrence and appearance of features within, have been studied. How the variation of parameters and settings during the printing process, such as temperature and print quality, affect the toolmarks have been of interest in the study. The results add to the knowledge of toolmark investigations of 3d-printed firearms.

Differentiation of 9 mm LUGER ammunition by trace metal analysis 11:00 - 11:00

W. Greibl[1], *T Mairhofer*[1], *C Gruber*[1], *A Chelariu*[1], *M Lisica*[1], *A. Girod-Frais*[1]

[1]Forensic Science Office, Criminal Intelligence Service Austria, Federal Ministry of Interior, Vienna, Austria

Abstract Body: In forensic investigations of shooting incidents, identifying the weapon or ammunition responsible for a discharged projectile is critical. This task becomes challenging when projectiles lack characteristic impression marks, as is often the case with shotgun ammunition or airgun pellets. This study presents a new analytical method for differentiating lead projectiles based on their chemical composition, aiming to assign questioned projectiles to specific ammunition or production batches. Using inductively coupled plasma mass spectrometry (ICP-MS), trace elements accompanying lead, including antimony, bismuth, silver, thallium, arsenic, nickel, tellurium, and cadmium, were quantified in samples dissolved in nitric acid. Statistical analysis employing t-tests revealed that even production batches manufactured within close temporal proximity could be distinguished. The results demonstrate the potential of this new method to enhance forensic ammunition identification, offering a reliable tool for attributing projectiles to their sources and strengthening the evidentiary value of projectile analyses in criminal investigations

11: Marks, Impressions and Biometric Traces: Footwear and Garment
11:00 - 11:45 Auditorium

Poster Session Thursday - Marks, Impressions and Biometric Traces: Footwear and Garment

Footwear Marks Comparison: How an Intelligence Database Is Supporting Evaluation 11:00 - 11:00

J. Pasquier[1]

[1]Police Neuchâteloise, Forensic and Intelligence Unit, Neuchâtel, Switzerland

Abstract Body: Since 2020, a regional database has been used by several police laboratories in Western Switzerland to record and share footwear marks. The main objective of this database is to generate forensic intelligence by linking marks between cases.
It also contains the prints of footwear seized on persons of interest by the police. In order to find relevant comparisons to be made, marks and prints are classified according to their general pattern.

But all this material recorded in the database is also extremely valuable for the evaluation process of comparisons results as it helps assessing the relative frequency of multiple characteristics.
As evaluative reporting through likelihood ratio is applied by a growing number of agencies, such a tool is a precious support for examiners.

This presentation will give insights on how pattern classification and linked footwear marks are helping assessing pattern relative frequency while evaluating comparison results. The range of frequencies that can be expected will also be presented and discussed along with the effect the considered timeframe.

Footwear Information Construction and Application in China 11:00 - 11:00

J. Yifeng[1], *J. Xuemei*[1]

[1]Forensic Science of Ministry of Public Security of China, Beijing, China

Abstract Body: Footwear evidence is one of the most frequently encountered evidence at crime scene. In order to give full play to the role of scene footwear in cross-province series of cases, China has carried out a series of research and exploration in the application of footwear information construction. Nowadays, China has constructed different kinds footwear information systems and achieved very good practical results. For example, Automatic Shoeprint Identification System, National Criminal Case Footwear Collaborative Application System, National Criminal Case Footwear Collaborative Application System, National Footwear Information Comprehensive Application System.

When All is Tread and Done! 11:00 - 11:00

M. Needham[1], *C. Gwinnett*[1], *S. Reidy*[2], *R. Harris*[2]

[1]University of Staffordshire, Health, Education, Policing and Sciences, Stoke on Trent, United Kingdom, [2]Yorkshire and the Humber Regional Scientific Support Services, Identification Bureau, Wakefield, United Kingdom

Abstract Body: Information held within CCTV footage used to assist the identification process can include clothing comparison, facial comparison, height analysis and gait analysis. However, there is little literature documenting the analysis and comparison of footwear captured in CCTV, body worn video (BWV) or mobile downloads. This highlights the underuse of this form of evidence for identification purposes. The footwear unit at Yorkshire and the Humber Regional Scientific Support Services has identified footwear comparisons of uppers caught on camera as a growth industry following the observed increase in ad hoc casework, including requests from other forces and the National Crime Agency. Without promoting this area of business, the unit has seen 10% growth in evidential submissions, this excludes screening requests and intelligence reports. As of 2019, there has been a steady increase in the number of enquiries and comparisons performed. However, forensic practitioners have limited resources to help identify the make and model of footwear recorded in footage. Therefore, the project aimed to develop a searchable database of 360-degree footwear images (uppers and treads) under visible and near infrared light. In part, this involved method development of an image capture method to be cost-effective, efficient and capable of producing 360-degree models in white and near infrared light that can be uploaded to a database. This poster will explain the image capture method created and present examples of models produced. This project was funded by Police STAR fund 23/24.

11: Marks, Impressions and Biometric Traces: Fingerprint Recognition
11:00 - 11:45 Auditorium

Poster Session 3 - Topic 11: Marks, Impressions and Biometric Traces: Fingerprint Recognition

Is There a Pattern to Fingerprint Patterns? A Study of the Fingerprint Pattern Classifications of the Irish National Fingerprint Database 11:00 - 11:00

C. Doherty[1], *K. Connick*[1], *A. Power*[1], *A. Slevin*[1]

[1]Forensic Science Ireland, Fingerprint Section, Celbridge, Ireland

Abstract Body: The classification of fingerprint patterns plays a fundamental role in the overall fingerprint analysis, and is one of the primary steps of the ACE-V process. Individual fingers are assigned a classification of either loop, whorl or arch when first added to the Fingerprint Database. Examiners also assign these patterns when analysing latent marks in order to narrow down the list of respondents when a search is launched.
This study has analysed the prevalence of fingerprint patterns in the Irish National Fingerprint Database for the first time with a view towards answering the following questions. Anecdotally fingerprint examiners have always claimed that arches are the rarest fingerprint pattern, followed by whorls and then loops- but does this ring true for the Irish Fingerprint Database? Is there a definitive link between fingerprint patterns and specific fingers – are you more likely to have an arch on a little finger than a thumb? How rare are left loops on right thumbs, or vice versa?
This study seeks to answer these questions by taking a deep dive into the Irish National Fingerprint Database, which contains over 10 million individual fingers.

Minutiae, the Devil Is in the Detail – An Analysis of the Distribution of Minutiae Counts on the Irish National Fingerprint Database 11:00 - 11:00

A. Downes[1], *K. Connick*[1], *A. Power*[1], *A. Slevin*[1]

[1]Forensic Science Ireland, Fingerprints, Celbridge, Ireland

Abstract Body: An essential part of the process of comparing finger marks is the comparison of minutiae. Minutiae is the term given to points where fingerprint ridges end, start, crossover or split in bifurcations. The number of minutiae differs per finger due to the size differences between each digit. In recent times however studies have shown differences in minutiae counts between dominant and non-dominant hands and also differences due to how fingers lie naturally flat. This presentation studies the distribution of minutiae per finger type of the Irish National Fingerprint Database, Forensic Science Ireland. Are ring fingers more likely to have more or less minutiae than little fingers? Do left thumbs have more than right thumbs?

12: Scenes of Crime: Implementing New Technologies at Crime Scenes
11:00 - 11:45 Auditorium

Poster Session Thursday - Scenes of Crime: Implementing New Technologies at Crime Scenes

Developing a Methodology for Collecting and Digitizing Data From Land Border Violation Sites Using Unmanned Aircraft Systems as Admissible Evidence 11:00 - 11:00

A. Puhk[1], *A. Raketski*[2], *T. Pärn*[2], *V. Gudkova*[2], *A. Mumma*[2], *M. Stern*[2], *Ü. Kustala*[3], *V. Randma*[3], *M. Ritari*[1]

[1]Estonian Forensic Science Institute, Technical Department, Tallinn,

Estonia, [2]The Estonian Academy of Security Sciences, Tallinn, Estonia, [3] Estonian Police and Border Guard Board, Tallinn, Estonia

Abstract Body: The project for developing of the collecting and digitalising methodology of the data from the land border violation places using Unmanned Aircraft Systems which is suitable as evidence was carried out within the Frontex research grants programme from 1st of September 2023 to 31st of August 2024.

The project was focused on the development of a new methodology for collecting evidence from crime scenes of land border violation in circumstances where communication with neighbouring country is limited or absent with respect to sovereignty of the neighbouring country. This research activity based on a drone, as the top-down view allows you to look further into a neighbouring country than terrestrial photography.

Experiments or scenarios were created as close to life as possible, at the same time as simple as possible - person(s) cross the border, leaving different traces (shoeprints, impression of backpack and bottle) and using different aids (e.g. a ladder).

During the data colletion processes two methodology were used: data collection with drones and classical forensic methodology (photography). After that data was processed and analysed. In later stages, classical evidence and drone-based collected evidence were compared.

Different aerial vehicles and sensors were tested to gather data under various weather and light conditions in experiments simulating different scenarios of border violation. Tests took place in winter and summer time, from the daytime (maximum light) to the nighttime (low light) and in different locations such as border strip, forest and swamp or bog, for winter also on a frozen lake.

Knowledge-Driven Decision-Making at the Crime Scene 11:00 - 11:00

P. Russel[1,2], C. de Poot[1,3], T. Valkenburg[4], T. van Kleffens[5], R. Ypma[2], B. Kokshoorn[1,2]

[1]Amsterdam University of Applied Sciences, Amsterdam, Netherlands, [2] Netherlands Forensic Institute, The Hague, Netherlands, [3]The Netherlands Police Academy, Apeldoorn, Netherlands, [4]Dutch National Police, Amsterdam, Netherlands, [5]Netherlands Public Prosecution Service, Amsterdam, Netherlands

Abstract Body: Decisions made during forensic investigations are commonly based on personal knowledge, experiences and assumptions. However, forensic professionals generally do not receive feedback on the outcomes of their decisions, resulting in a deficient learning system. An imperfect individual knowledge base can lead to suboptimal decisions without professionals in the criminal justice chain being aware of it. In practice, this has led to considerable variation and lack of well-founded knowledge in the first phases of the forensic investigation process.

The desired situation is that forensic professionals can make decisions based on substantiated knowledge, with transparency about the choices made, so that these decisions can be reflected upon by themselves and other actors in the criminal justice process.

The aim of the project is to develop an interactive decision support tool that can assist complex decision-making within the forensic domain. This support tool can enable crime scene investigators to access and utilize data on historic cases, supplemented with results from scientific research. This knowledge can help address questions related to the likelihood of obtaining a DNA profile and its relevance to the crime. In this way, the crime scene investigation will become 'experience-and-evidence-based', meaning that both the valuable experience of crime scene investigators and the rich scientific knowledge derived from historical case data and experiments can be taken into account when making decisions.

The RISEN Project – A Novel Concept for Crime Scene Documentation and Trace Qualification 11:00 - 11:00

R. Chirico[1]

[1]Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), Diagnostic and Metrology Laboratory, Frascati (Rome), Italy

Abstract Body: Forensic investigations need to be conducted efficiently and accurately, especially in situations where time is a scarce resource. Novel technologies, like 3D re-construction and forensic sensors, can aid investigators in trace detection, visualisation, identification and interpretation on site. In this paper, we present the Real-tIme on-site forenSic tracE qualificatioN (RISEN) H2020 project (grant agreement No. 883116), an innovative concept in forensic investigations (e.g., homicide, clandestine laboratory, sites affected by a terrorist attack with chemical or biological threats). The aim of RISEN is to enhance forensic analyses, allowing investigators to capture data safely, without contaminating the scene, provide timely and completely objective analyses based on highly credible evidence, without missing latent ones, communicate and visualize information securely among relevant stakeholders and have a complete digital record of the scene available for subsequent analyses. An important aspect of documenting a crime scene is to capture all relevant traces and accurately record the measurements of objects within the scene to establish their precise location and relationship. This helps to reconstruct the sequence of events and raise hypotheses about occurred events. It is therefore essential that such information is accurately recorded and visualized. RISEN has developed a set of network-enabled real-time contactless sensors for handling traces on site and accurate 3D recreation mechanisms of the entire crime scene, providing an immersive environment for investigators to evaluate hypotheses and conduct highly detailed investigations. Results from the final RISEN trials will be presented.

12: Scenes of Crime: Other
11:00 - 11:45 Auditorium

Poster Session Thursday - Scenes of Crime: Other

Decision Making in Trace Processing, From Crime Scene Attendance to Trace Analysis: A Systematic Literature Review 11:00 - 11:00

J. Divoy[1], *I. Lémans*[1], *S. Bitzer*[1]

[1]UCLouvain, School of Criminology, Louvain-la-Neuve, Belgium

Abstract Body: Trace processing in forensic investigations involves key decision-making steps, starting with the decision to attend a crime scene to the analysis of a trace. Each stage is shaped by a combination of human, organisational, and contextual factors, and involves various stakeholders with diverse backgrounds and priorities, acting as decision-makers at different points in the process. However, the complexity of decision-making in trace processing remains underexplored, with limited studies offering a comprehensive review of the entire workflow.

This study presents the results of a Systematic Literature Review of 363 studies examining the decision-making process throughout trace processing. The review investigates four key stages: (1) crime scene attendance, often influenced by the offense type, policies, and case specifics; (2) trace detection, determined by physical and environmental conditions, prior knowledge, and search methods (3) trace selection, notably shaped by case priorities, triaging, and expected utility; and (4) trace analysis, guided by trace characteristics, resources, and investigative goals. A broader focus on the process as a whole highlights how human factors, including expertise and cognitive biases intersect with decision-making.

The findings underscore significant variability in practices, notably driven by jurisdictional policies and training disparities. Additionally, the review identifies persistent gaps in procedural consistency, resource allocation, and forensic awareness. As early stages of the process shape subsequent steps, deficiencies in knowledge and practices at these stages can adversely affect the criminal justice process. By synthesizing current practices and identifying research gaps, this study offers an integrative overview of the factors shaping decision-making in trace processing.

NATURE FIRST - Wildlife Crime Scene Investigations and Training to Tackle Biodiversity Decline in Natura 2000 Areas 11:00 - 11:00

C. Gwinnett[1]

[1]University of Staffordshire, Forensic Science, Stoke-on-Trent, United Kingdom

Abstract Body: Funded by the European Commission, Nature FIRST (Forensic Intelligence and Remote Sensing Technologies) is a collaborative project that is developing predictive, proactive and preventative capabilities for nature conservation stakeholders by combining principles from ecology and environmental forensic sciences with empirical environmental observations (satellite-based & on-site).
Wildlife crime is a key driver in biodiversity loss. Human-wildlife conflict, such as poaching of species, unauthorised entry in protected areas, activities that directly affect food chains (such as illegal commercial fruit

picking) all negatively impact ecosystems. Due to the large, dynamic environments that these crimes occur in, it is extremely challenging to police and investigate. This invariably means that wildlife crimes are not detected quickly. This delay in detection has negative consequences on the crime scene itself; transient evidence can be lost easily in the outdoor environment and evidence, such as impressions from footwear and tyres may degrade in quality such that it is no longer of value. This project, now in its final year, has investigated current challenges in wildlife crime investigations in Romania, Bulgaria, Ukraine and Spain and identifying key priorities, including species of interest. This presentation will provide an overview of the Nature FIRST project, its outputs, including a new wildlife crime scene investigation training programme and a Digital Twin model that provides a means for learning and creating context to translate environmental observations into actionable information for those working to protect natural spaces; this includes data that can provide intelligence information for wildlife crime investigators.

12: Scenes of Crime: Trace Evidence and Interpretation
11:00 - 11:45 Auditorium

Poster Session Thursday - Scenes of Crime: Trace Evidence and Interpretation

Estimating the Long-Term PMI via FTIR-Spectroscopic Data of Blow Fly Puparia 11:00 - 11:00

L. Thümmel[1,2], *L. Lutz*[1], *J. Amendt*[1]

[1]Institute of Legal Medicine, University Hospital, Goethe University Frankfurt, Forensic Entomology, Frankfurt am Main, Germany, [2]Faculty of Biological Sciences, Goethe University Frankfurt, Frankfurt am Main, Germany

Abstract Body: Estimating the postmortem interval (PMI) of several months or even years is challenging or usually a mission impossible. One trace of insects that can still be found months or years later are empty blow fly puparia. In these, the metamorphosis from larva to pupa to fly has taken place. Determining the age of these puparia could make it possible to estimate long PMI's.
One way to accomplish this is by Fourier transformed infrared (FTIR) spectroscopy, a well established technique in forensic sciences, where the recorded spectra act like a species and age specific molecular fingerprint. We created a database of FTIR spectra of four of the most common blow fly species found on cadavers in Frankfurt/Main, Germany, *Lucilia sericata, Calliphora vicina, Protophormia terraenovae* and *Chrysomya albiceps.* They were exposed up to 9 months to two different environmental conditions: "dry" at room temperature or buried up to 6 cm in soil outdoors. Puparia were collected and cleaned monthly, and their spectra recorded. The data were then analysed using supervised machine learning algorithms.
Species identification was still possible after 9 months based on their spectral properties and yielded high accuracies for the indoor puparia, while it decreased for puparia buried outdoors. Moreover, the spectral properties changed over time, which allowed the development of regression models to predict the weathering time of puparia. To our knowledge, this is the first study to focus not only on species identification, but also on estimating the age of empty blow fly puparia using FTIR-

spectroscopy.

Identification and Characterisation of Taxonomically Informative Peptides by High Resolution Mass Spectrometry for Source Identification of Trace Hair Samples. 11:00 - 11:00

R. Keane[1,2], J. Gummer[1], G. Parker[3], R. Tidy[1,2]

[1]Chemcentre, Forensic Science, Bentley, Australia, [2]Edith Cowan University, School of Science, Joondalup, Australia, [3]University of California Davis, Environmental Toxicology, Davis, United States

Abstract Body: Hair fibers, a valuable form of biological evidence, are continuously shed, chemically stable, persistent, and easily transferred. Taxonomic classification of hair recovered during a criminal investigation provides crucial forensic intelligence and aids in evidence prioritisation. Traditional classification methods rely on the analysis of hair shaft morphology, a practice that's been heavily scrutinised in recent years. The rise of mass spectrometry-based proteomics provides a molecular alternative, leveraging genetic identifiers that exist in the proteome of each species in the form of amino acid sequence variants, for taxonomic classification of biological material.
Here we developed a proteomic workflow for identifying taxonomically diagnostic peptides extracted from digested telogen hair shafts of forensically relevant sample amounts. Using a data-driven approach, this workflow identified and validated a panel of 226 taxonomically informative peptides, many of which are novel contributions to the literature. This peptide panel provides genus-level discrimination across fifteen species commonly encountered in forensic case work.
The panel of taxa-discriminating markers was subsequently integrated into a forensic workflow, optimised for universal sample preparation and standardised data processing with a combined keratin database (compiled in-house), requiring no prior source knowledge. The developed workflow was used to analyse hair samples, approximately two cm in length from four individuals from each of the 15 species of interest, achieving genus-level identification for more than 100 hairs.
The implementation of this panel of diagnostic peptides identified and characterised using a mass spectrometry-based proteomics workflow introduces a robust and novel biomolecular approach for forensic analysis of trace biological material.

Assessing Fingermark Quality Over Time: A Study on Outdoor Surfaces in a Dutch Environment 11:00 - 11:00

A. de Ronde[1], R. Waalkens[1], D. Karsch[1], G. Langenburg[2], D. Pater[1], C. de Poot[3]

[1]Amsterdam University of Applied Sciences, Amsterdam, Netherlands, [2]Elite Forensic Services, LLC, Minnesota, United States, [3]Amsterdam University of Applied Sciences, VU Amsterdam and Police Academy of the Netherlands, Amsterdam, Netherlands

Abstract Body: Fingermarks are valuable traces for individualization purposes in forensic investigations. While their origin is seldom debated in court proceedings, the time of deposition is frequently questioned. Determining the time of deposition directly from a fingermark has proven to be challenging. However, experimental data on the persistence of fingermarks can help in evaluating fingermarks given activity level propositions questioning the time of deposition.

This study examines the persistence of fingermarks on exterior surfaces relevant to the investigation of residential burglary cases. A proof-of-principle study was conducted to assess fingermark quality over time on outdoor surfaces in a Dutch environment. For this experiment, natural fingermarks from four donors were deposited on five distinct locations outside a residential property (window, window frame, windowsill, door and car). Control samples were placed inside. The fingermarks were visualized using the labino NOVA 2.0 Alternate Light Source (ALS) kit, to enable to track the quality of each individual fingermark over time, with observations recorded at regular intervals for up to 60 days.

In this presentation, we discuss the results of this experiment and demonstrate how the resulting data can be used for an evaluation of fingermarks in relation to activity level propositions that concern the time of deposition.

Forensic Soil Analysis to Discriminate Between Sites of Special Scientific Interest (SSSIs) in Support of UK Rural Crime Investigations 11:00 - 11:00

A. Stevens[1,2], K. Ralebitso Senior[2,3], N. Dawnay[2,3], L. Dawson[4,5], K. Scott[1,2]

[1]Liverpool John Moores University, School of Biological and Environmental Sciences, Liverpool, United Kingdom, [2]Forensic Research Institute, Liverpool, United Kingdom, [3]Liverpool John Moores University, School of Pharmacy and Biomolecular Sciences, Liverpool, United Kingdom, [4]James Hutton Institute, Centre for Forensic Soil Science, Aberdeen, United Kingdom, [5]Robert Gordon University, School of Pharmacy and Life Sciences, Aberdeen, United Kingdom

Abstract Body: Sites of Special Scientific Interest (SSSIs) are protected areas in the UK, designated under the Wildlife & Countryside Act (1981). Despite their legal protection, these sites often suffer environmental damage from off-roading and other criminal activities. Addressing and preventing illegal off-roading has been identified as an urgent regional issue within North Wales, requiring targeted interventions including forensic support.

Soil analysis may serve as a valuable forensic tool within SSSI illegal off-roading investigations. Due to their diverse and highly localized chemical, biological, and physical properties, soils can provide valuable geolocation and reconstruction intelligence by comparing transferred evidence to questioned crime scenes. The application of forensic soil analysis to rural crime investigations has not previously been considered; this study therefore aimed to assess the efficacy of six soil analysis techniques to support the characterization and discrimination of soil samples collected

from legally protected and publicly accessible locations in North Wales.

Thirteen SSSI and non-SSSI locations where off-roading frequently takes place were sampled in North Wales, UK. Bulk soil samples were recovered, accounting for local and regional variability. Sub-samples were analysed using organic and inorganic approaches including Scanning Electron Microscopy-Energy Dispersive X-ray (SEM-EDX), Gas Chromatography-Mass Spectrometry (GC-MS), X-ray Fluorescence (XRF), particle size, quartz grain surface textures, and microbial DNA analysis. The findings highlight the most discriminatory approach for soil comparisons, recommending the use of two or more independent techniques to corroborate and enhance the reliability of forensic conclusions. Additionally, practical considerations including cost, time, and resource efficiency for forensic investigations will be explored.

Studies of the Entomofauna of Carcasses and Corpses in Arid Environments of Argentina Applied to the Estimation of the Post-Mortem Interval 11:00 - 11:00

F.H. Aballay[1], F.N. Jofré[2], A.R. Cortez Vega[1], M. Moghadaszadeh Kermani[3], M.A. Perotti[3]

[1]National University of San Juan, Institute and Museum of Natural Sciences, San Juan, Argentina, [2]Argentine Institute for Research on Arid Zones (IADIZA, CCT-CONICET Mendoza), Entomology Laboratorium, Mendoza, Argentina, [3]University of Reading, School of Biological Sciences, Reading, United Kingdom

Abstract Body: Cadaveric decomposition experiments and sampling with baited traps in different arid environments provide information that allows answers to forensic questions of post-mortem interval (PMI) and location or relocation of corpses. Entomofauna from pig carcasses was sampled daily during the entire process of decomposition, from experiments in Mendoza and in San Juan, Argentina.
Human corpses were sampled at the discovery sites as well as in the judicial morgues, following authorization by the directors of the Public Prosecutor's Office of San Juan and Mendoza. The study of environmental variables was carried out at the discovery sites and at the meteorological stations closest to the site where the bodies were found.
Case 1: the corpse was found in an urban-rural environment in summer, recording *Chrysomya albiceps*, *Cochliomyia macellaria* (Calliphoridae), *Piophila casei* (Piophilidae) (Diptera); *Dermestes maculatus*(Dermestidae) (Coleoptera) etc., the estimated PMI is 12 days.
Case 2: the body was found in summer in a natural mountain environment, recording *D. maculatus*, *Omopheres* sp (Tenebrionidae), *Necrobia rufipes* (Cleridae) (Coleoptera) and *Piophila casei* (Piophilidae), the estimated PMI is 21 days and the entomofauna suggest relocation of the body.
Case 3: bone remains were found in a dry river in a rural environment in summer, recording *Anthrenus verbasci* (Dermestidae), *Acromyrmex* sp. (Formicidae) (Hymenoptera) and *Uroobovella* mites (Urodinychidae, Mesostigmata, Acari); and the entomofauna suggest relocation of the body as well.
The composition and abundance of cadaveric entomofauna changes in different environments and seasons of the year.

12: Scenes of Crime: Training and Education for Crime Scene Investigators
11:00 - 11:45 Auditorium

Poster Session Thursday - Scenes of Crime: Training and Education for Crime Scene Investigators

Revisiting Crime Scene Examiners' Decision-Making Through a Sociological Perspective: Systems of Knowledge and the Search for Traces 11:00 - 11:00

V. Mousseau[1,2], *R. Boivin*[3,4]

[1]University of Technology Sydney, Centre for Forensic Science, Broadway, Australia, [2]Forensic Science Research Group, Trois-Rivières, Canada, [3] Université de Montréal, School of Criminology, Montreal, Canada, [4] International Centre for Comparative Criminology, Montreal, Canada

Abstract Body: As the critical role of crime scene examiners (CSEs) in the forensic process has become increasingly recognized, their decision-making and prioritization processes have attracted a growing body of empirical research to better understand how their judgment is exercised. To date, research has consistently highlighted the high degree of variability in CSEs' practices and performance. While some studies have focused on the cognitive mechanisms that might explain these differences, so far, only few examined the phenomenon from a sociological perspective. Drawing on qualitative data from 18 semi-structured interviews and 165 hours of participant observation conducted both at the office and at incident scenes with 19 Quebec CSEs (2020-2022), this presentation explores how CSEs negotiate the application of occupational knowledge in their search for traces on crime scenes.

Our findings show that the orientation of the search for traces relies on an often ambiguous, and at times contradictory, system of occupational knowledge. This system allows considerable latitude for CSEs to interpret mandates, norms, methods, and working rules to make and justify their decisions. Thus, the observed variability in CSEs' practices and performances is shaped not only by cognitive factors, but also by cultural and power dynamics. Such finding underscores the value of interdisciplinary collaboration between forensic science and social sciences, aligning with Julian et al.'s (2021) call for more research grounded in critical forensic studies.

11: Marks, Impressions and Biometric Traces: Friction Ridge Comparison and Identification
11:00 - 11:45 Auditorium

Poster Session Thursday - Marks, Impressions and Biometric Traces: Friction Ridge Comparison and Identification

Reeling in the Years – A Study of the Trends in Fingerprint Tenprint Submissions to the Irish Fingerprint Database From 2007–2024 11:00 - 11:00

G. Walsh[1], *K. Connick*[1], *A. Power*[1], *A. Slevin*[1]

[1]Forensic Science Ireland, Backweston Science Campus Fingerprint section, Celbridge, Ireland

Abstract Body: The Fingerprint Section of Forensic Science Ireland, over the course of the COVID19 pandemic noted that the number of fingerprint tenprint submissions to the Irish database fell as global lockdown measures were put into place. This unexpected trend prompted an investigation into the effects of other world events on the number of tenprint submissions at that time. Additionally, it raised the question if world events or even individuals routines, such as holidaying in Summer, could be used to trend fingerprint submissions. To explore these possibilities, this study analyses the numbers of fingerprints submitted to the Irish Database from 2007 to 2024 and the effects of the COVID19 pandemic, the Russian Invasion of Ukraine and other global events on the numbers of fingerprints submitted to the database.

Lying in Wait – The Increase in Reverse Hits Following the Launch of a New AFIS in Fingerprints 11:00 - 11:00

A. Power[1], *K. Connick*[1], *A. Slevin*[1]

[1]Forensic Science Ireland, Fingerprints, Dublin, Ireland

Abstract Body: In 2024, a new Automated Fingerprint Identification System (AFIS), Idemia's Multi Biometric Information Solution (MBIS), went live in the Fingerprint Section of Forensic Science Ireland (FSI). The launch of the system marked the culmination of a three year long project between FSI, An Garda Síochána, Idemia and Accenture to replace the outdated Idemia Morphotrak BIS system in place since 2007. When the new system went live, operators noticed a surge in the numbers of reverse hit identifications they were receiving from the system. A reverse hit occurs when a set of tenprint fingerprints is uploaded to the system and is searched against the unsolved latent mark database, a database made up of marks previously searched but not identified. Anecdotally fingerprint bureaus all say when they upgrade instruments, reverse hits increase due to the change in searching algorithms. This poster will analyse the number of reverse hits seen since go live of the Irish MBIS system compared to previous years.

11:00 - 11:45 Auditorium

MORNING COFFEE BREAK & POSTER SESSION 3

04: DNA and Body Fluids: Investigative Genetic Genealogy (IGG)
11:45 - 12:45 Auditorium

DNA and Body Fluids: Investigative Genetic Genealogy (IGG)

FIGG Application in French Forensic Cases 11:45 - 12:15

M. Bougerie[1], *S. Hubac*[2]

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Abstract Body: Advancements in forensic genetics include applying next-generation sequencing (NGS) techniques to overcome the limitations of traditional short tandem repeat (STR) analysis, especially with degraded or low-concentration DNA samples common in forensic investigations. Forensic Investigative Genetic Genealogy (FIGG) has resolved many cases involving violent crimes and unidentified remains, mostly in the USA, with limited application in Europe.
The French Gendarmerie's institute for criminal research evaluated a new method combining targeted amplification of thousands of single nucleotide polymorphisms (SNPs) with NGS for FIGG investigations. A study was performed using the ForenSeq Kintelligence kit and MiSeq FGx. Results demonstrated that high-quality SNP profiles could be obtained, even with low DNA concentrations (2 pg/µL). Samples from cold cases involving severely degraded bone DNA were analyzed, and the resulting genetic profiles met GEDmatch PRO upload criteria. Match results are currently awaited to help resolve these cases.
This technology offers significant promise for advancing forensic investigations, aiding in complex kinship cases, and identifying unknown individuals. While direct-to-consumer genetic testing is banned in France, about 2% of the French population is included in databases like GEDmatch and Family Tree DNA. This suggests that FIGG could be highly effective in France, matching or exceeding its success in neighboring countries. If successful, this method could represent a turning point in French criminal investigations, despite the current restrictions on genetic genealogy testing by companies like MyHeritage and 23andMe.

The Assessment of Background Identical-by-Descent (IBD) Within and Between Artificially Assembled Pedigrees 12:15 - 12:30

J. Whitney[1], *K. Morris*[1]

[1]West Virginia University, Forensic and Investigative Science, Morgantown, United States

Abstract Body: Investigative genetic genealogy (IGG) uses genealogical research and single nucleotide polymorphism (SNP) analysis for human identification. Between individuals, segments of shared SNPs greater than seven centimorgans are classified as identical-by-descent (IBD) and are used to determine the relationship class. Closer genetic relationships are typified by greater proportion of IBD. In instances of inbreeding within a pedigree (*i.e.*, pedigree collapse) or population (*i.e.*, endogamy), shared IBD is elevated, potentially resulting in relationship misclassification such that measured relationship are closer than the actual relationship. Such effects were reported as a potential limitation in the identification of two participants in a 2020 IGG study by Thomson *et al*.

Many IGG tools assume a lack of pedigree collapse or endogamy in their comparisons, and limited literature exists assessing the impact that elevated IBD has on IGG searches. The purpose of this study is to assess these effects in IGG. More than 2,000 artificially generated SNP profiles were used to assemble pedigrees with and without inbreeding. All profiles were categorized into two groups, *viz.*, external contributors (*i.e.,* founder and spousal profiles) and direct descendants. External contributors were selected from a previously generated dataset, and descendants generated by simulating genetic recombination. To induce inbreeding, relatives were

selected as founders, and familial pairing within the same generational level (*e.g.*, first and third cousins) was permitted. Shared IBD was compared within and between pedigrees using chromosome mapping and IBD graphing techniques to provide an assessment of the extent to which inbreeding increased IBD.

TBA 12:30 - 12:45

05: Drugs: Emerging Technology
11:45 - 12:30 Liffey Hall 1

Drugs: Emerging Technology

The NARCOSIS Project - A Non-Targeted Forensic Multidisciplinary Platform for Investigation of Drug-Related Fatalities 11:45 - 12:00

R. Chirico[1]

[1]Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), Diagnostic and Metrology Laboratory, Frascati (Rome), Italy

Abstract Body: The rapid changes and increasing number of unknow new psychoactive substances (NPSs) make nowadays early warning activities even more challenging than before. Instruments with up-to-date libraries allow for the rapid identification of drugs of abuse, but they still face limitations. The EU-funded NARCOSIS project aims to develop a reliable and collaborative approach to support the EU Early Warning System for a rapid detection of NPSs and fast response to investigators. The project will create an advanced diagnostic platform that can adapt and update as needed. It will be pivotal for both on-site and laboratory screening, establishing a shared reference spectra database for faster illicit drug identification by means of heuristic AI-driven tools trained on chemical features instead of names and illicit drug categories. The NARCOSIS approach and first results will be presented.

Rapid and Accurate Detection of Illicit Drugs Based on Electrochemical "Super-Fingerprinting" and Machine Learning 12:00 - 12:15

A. Stratulat[1,2], *J. Mazurków*[1,2], *K. De Wael*[1,2]

[1]University of Antwerp, Antwerp engineering, photoelectrochemistry and sensing (A-PECS), Department of Bioscience Engineering, Antwerp, Belgium, [2]University of Antwerp, NANOlight Center of Excellence, Antwerp, Belgium

Abstract Body: In 2022, thousands of seizures of cocaine (84000), amphetamine (31000), methamphetamine (9900), MDMA (14500), heroin (19000) and ketamine (3000) were reported in the EU. It is though estimated that only a tenth fraction is actually detected. Current techniques used for on-site detection of drugs lack accuracy and sensitivity, while chromatographic laboratory techniques are time-consuming and expensive. In this regard electrochemical sensors are particularly promising due to their high sensitivity, low cost, portability and independence from

the color of the samples. Unfortunately, previous electrochemical studies generally focused on detecting one drug at one specific pH, while there is a great need for a multi-drug screening tool. Moreover, most drugs, and especially cocaine and heroin, are usually encountered in complex mixtures with their cutting agents/adulterants, which greatly impedes their detection, due to overlap and suppression of the electrochemical peaks at certain pH, giving false results. Amphetamine causes an additional challenge, requiring derivatization for its electrochemical detection (*e.g.* use of Naphthoquinone Sulfonate (NQS)).
In this work, all these challenges are overcome for the first time by detecting the six illicit drugs as well as >25 cutting agents/adulterants simultaneously at four different conditions (pH 5, pH 7, pH 10 + NQS and pH 12). Combination of the four recorded electrochemical fingerprints into a “super-fingerprint”, with the use machine learning (*i.e*. support vector machine and random forest algorithms) coupled with principal component analysis allowed very specific (100%), very sensitive (>95%) and very accurate (>95%) identification of the street samples of the six target drugs

Compact NMR and Databases to Identify and Quantify NPS in Forensic Laboratories 12:15 - 12:30

V. Ladroue[1], *A. Siberan*[2], *M. Maugan*[1], *W. Lallemand*[1], *T. Castaing-Cordier*[2,3], *D. Jacquemin*[2], *P. Giraudeau*[2], *C. Charvoz*[1], *F. Besacier*[1], *J. Farjon*[2]

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Abstract Body: In 2022, EU Member States seized a record 30.7 tonnes of new psychoactive substances (NPS) and every year new molecules are detected [European Drug Report 2024, EUDA], causing a major risk to public health.

In France, a proactive legislation, which regulates all derivatives from known active moieties and defuses future illicit manufacturing, has been in place since 2012. However, characterization of molecules by forensic laboratories remains decisive to determine their legal status. Quantifying these new molecules is also crucial to evaluating their toxicity. Among available analytical techniques, Mass Spectrometry (MS) and Infra-Red (IR) spectroscopy are widely used but rely on up-to-date spectral databases, while Nuclear Magnetic Resonance (NMR) has the advantage to directly access both structural and quantitative information on complex mixtures.

In the DEVIL_INSID project, an academic partner (CEISAM) and the Police Forensic Laboratory of Lyon (SNPS) have developed a novel analytical approach based on miniaturised low-field NMR (LF-NMR) for identifying NPS, which relies on advanced 2D NMR workflow experiments, and predicted and empirical spectral databases, complemented by other analytical data. Since its transfer to the SNPS, this platform has allowed identification of NPSs despite the analytical limitations of LF-NMR thanks to the integration of NMR, MS and IR workflows. Quantitative NMR has been successfully applied to seized samples with no need of reference material. Quantification of ketamine is about to be validated. In order to make mobile NMR more useful for forensic laboratories, there is a need to develop more robust

methods and enrich databases.

12: Scenes of Crime: Trace Evidence and Interpretation
11:45 - 12:45 Liffey Hall 2

Scenes of Crime: Trace Evidence and Interpretation

Bioinformatics Workflow for Proteomic Genotyping of Single Human Hairs 11:45 - 12:00

J.J. Sia[1], L. Chen[1], N. Prabhu[1]

[1]Home Team Science and Technology Agency, Forensics Centre of Expertise, Singapore, Singapore

Abstract Body: Hair shafts are a common type of biological evidence found at crime scenes. Unlike bodily fluid evidence such as bloodstains which can be confounded by multiple contributors, a single hair shaft can be reliably attributed to one person. Although hair typically contains insufficient nuclear DNA for genotyping, it is abundant in proteins. These proteins can be extracted and analysed with liquid chromatography–mass spectrometry (LC-MS) to detect variant peptides, from which single amino acid polymorphisms (SAPs) can be identified and used to infer the person's genotype. Typically, the variant peptides are detected by matching the LC-MS spectra to a reference sequence database. Generating a complete reference sequence database of variant peptides with all possible combinations of informative SAPs is necessary when the population haplotype information is not available, but this can be combinatorially challenging when there are many SAPs or when some of the SAPs affect protease digestion sites. We have developed a python package that can generate a complete reference database of variant peptides for database searching and applied this in our bioinformatics workflow for calculating random match probabilities based on hair samples.

Determination of Relevant Sampling Locations for Burglary Investigations 12:00 - 12:15

Y. Goedhart[1,2], K. Draxel[1,2], N. Katsikis[1], I. Jullens[3], A. de Ronde[1], B. Kokshoorn[1,4], C. de Poot[1,5]

[1]Amsterdam University of Applied Sciences, Amsterdam, Netherlands, [2]VU University Amsterdam, Amsterdam, Netherlands, [3]Dutch National Police, Assen, Netherlands, [4]Netherlands Forensic Institute, Division of Human Biological Traces, The Hague, Netherlands, [5]Police Academy of the Netherlands, Apeldoorn, Netherlands

Abstract Body: Residential burglaries are common and impactful crimes. As such, there is an urgent need to prevent and solve burglary cases. However, collected traces like DNA traces and fingermarks are often ineffective as most originate from residents, leading to low clearance rates. For this reason, it is important to know how to specifically target sampling locations that relate to the burglary event. Currently, there is no data available that helps to assess the likelihood of a burglar touching a certain surface, and, consequently, leaving trace evidence. Instead, forensic

examiners mostly rely on their personal experience and expertise to determine where burglary-related traces are most likely to be found. Here, we aim to close this knowledge gap by determining the areas that are specifically contacted during different types of interaction with points of entry. In order to do so, an experiment was carried out at a Dutch music festival, in which participants simulated both a legitimate and burglary scenario. Using paint, the points of contact between the hands and the experimental set-up was recorded. Contact locations of all participants were combined to reveal general patterns of contact. It was found that different burglary methods lead to distinct patterns of contact, indicating specific areas where traces are most likely to be deposited. These results can support forensic examiners in making evidence-based decisions during search strategies in burglary investigations.

Overseeing the Handling of Technical Evidence by Police and Prosecution in Denmark 12:15 - 12:30

M.S. Graversen[1]

[1]The Danish Independent Evidence Oversight Board, Aarhus C, Denmark

Abstract Body: The Danish Independent Evidence Oversight Board is a public authority, which independently oversees how police and prosecution in Denmark handle technical evidence. The Board was established in 2022 in order to strengthen the public's confidence in technical evidence being handled appropriately. The Board defines technical evidence as evidence when it undergoes some form of technical analysis before it can be included in criminal proceedings. This is the case for e.g. cell-site data, data from mobile devices, or DNA evidence, all of which are subjected to (digital) forensic analysis, the results of which in turn can be applied in criminal proceedings. The Board examines specific types of evidence on its own initiative in so-called thematic oversights, where evidence is selected based on an assessment of associated risk factors and significance for legal certainty. Moreover, Danish police and prosecution must notify the Board when they encounter (potential) errors in their handling of technical evidence, which may be of systematic nature and affect legal certainty. In such cases, the Board will examine whether the authorities take appropriate action to counter the issue at hand. In its current first thematic oversight, the Board examines how police and prosecution handle DNA evidence, focusing on factors that may affect the quality and integrity of DNA evidence. Depending on the status at the time of the conference, the authors would like to present non-confidential findings alongside experiences from and recommendations for future oversight processes.

A Mobile Workstation for On-Site Forensic Analysis: Species and Sex Identification From Bloodstains 12:30 - 12:45

H. Zhou[1,2], *W. Hu*[1,2], *J. Zhang*[3], *X. Zhang*[1,2], *X. Liu*[1,2], *J. Yan*[1,4]

[1]Shanxi Medical University, School of Forensic Medicine, Taiyuan, China, [2] Shanxi Key Laboratory of Forensic Medicine, Jinzhong, China, [3]Northwest University, College of Life Sciences, Xi'an, China, [4]MOE Key Laboratory of Coal Environmental Pathogenicity and Prevention, Jinzhong, China

Abstract Body: Bloodstains are the most common biological specimens at forensic scenes. Rapid and sensitive species and sex identification from bloodstains can expedite crime investigation. Nevertheless, time-consuming protocols and specialized equipment are often required in forensic practice. Taking advantages of speediness and conveniences, loop-mediated isothermal amplification (LAMP) has been used for bloodstains analysis. However, only a single characteristic gene can be targeted per reaction, leading to specimens consuming and limited throughput. Herein, a portable biosensor is first developed for on-site simultaneous species and sex identification from bloodstains without DNA purification. By combining multiplex LAMP and a triple lateral flow device (LFD), minute amounts of specimen can be identified while avoiding any sophisticated apparatus. Using gold magnetic nanoparticle as a nanoprobe for amplicon hybridization, the results can be interpreted with naked eye. Meanwhile, the filtration of LFD effectively prevents interference from pigments of bloodstains on the tinctorial signal. Besides, carryover contamination from uncapping is thoroughly prevented by the uracil-DNA glycosylase-based anti-aerosol strategy while holding consistent temperature. Furthermore, a mobile workstation is customized for on-site detection. A compact and high-performance heater is fabricated and integrated into this workstation to perform amplification under isothermy. The simplicity of the whole “sample to result” workflow renders this biosensor competent in various scenarios. As a demonstration, species and sex can be identified within 1 hour by targeting cytochrome b gene and Y-chromosomal amelogenin gene. Even bloodstains stored for over 6 years can be accurately identified, indicating the significant potential of this biosensor for forensic nucleic acid analysis.

02: Chemistry: Explosives
11:45 - 12:30 Wicklow Hall 1

Chemistry: Explosives

Characterization and Comparison of Nitrocellulose in Smokeless Powders 11:45 - 12:00

R.S. van den Hurk[1,2], N. Abdulhussain[1,2], A.S. van Beurden[1], M.E. Dekker[1], I.B. Lemmink[1], J.R. van Schaik[1], A.W. Hulsbergen[3], R.A. Peters[4], A.C. van Asten[1,5]

[1]University of Amsterdam, van ’t Hoff Institute for Molecular Science (HIMS), Amsterdam, Netherlands, [2]Centre for Analytical Sciences Amsterdam (CASA), Amsterdam, Netherlands, [3]Netherlands Forensic Institute (NFI), Den Haag, Netherlands, [4]Covestro (Netherlands) B.V., Group Innovation & Sustainability, Testing, Analytics and Physics group, Waalwijk, Netherlands, [5]Netherlands Center for Forensic Science and Medicine, Co van Ledden Hulsebosch Center (CLHC), Amsterdam, Netherlands

Abstract Body: Smokeless powders (SPs) are one of the most-commonly used propellants for ammunition but are also abused as energetic material in improvised explosive devices. When reporting forensic explosives investigations to a court of law, the chemical characterization of SPs is critical. SPs comprised of nitrocellulose (NC) and additives. Conventional analytical strategies focus on characterizing the additives that are present in SPs. The nitrocellulose, which is the main explosive component, is often discarded.

In this study, a two-dimensional liquid chromatography (2D-LC) system was developed which combines size-exclusion chromatography (SEC) and reversed-phase liquid chromatography (RPLC). In the first dimension, the NC is separated from the additives and characterized by its molecular-weight distribution (MWD). The additives are then transferred to the second-dimension separation to be separated and quantified. A discriminating power of 90.53% was obtained for the NC MWD, and 99.47% for the additive profile. Additionally, no extensive sample preparation is required.

Besides MWD, Nc's nitration degree is another parameter of interest. Therefore, SEC combined with ultraviolet (UV) and refractive index (RI) detection was used separately. The ratio between the signal intensity of the UV and that of the RI detector is shown to be directly correlated with the nitration degree of NC. Characterizing the nitrocellulose demonstrated discriminating powers of 98.95% for the MWD and 92.65% for the nitration degree using a set of 20 SP products. Combined, all sample pairs in our sample set could be distinguished by either one or both chemical properties of only the nitrocellulose.

Elemental and Isotopic Profiling of Perchlorate Salts for Source Comparisons in Forensic Explosives Investigations 12:00 - 12:15

I. van Damme[1], F. Linzey[1], H. Brust[2], K. Hassler[1], K. Bezemer[3], E. de Rijke[1], A. Hulsbergen[3], A. van Asten[1]

[1]University of Amsterdam, Amsterdam, Netherlands, [2]Wageningen University and Research, Wageningen, Netherlands, [3]Netherlands Forensic Institute, The Hague, Netherlands

Abstract Body: Sample-to-sample comparisons can play an important role in forensic explosives investigations by reinforcing or refuting suspected connections between suspects and/or improvised explosive devices (IEDs). The presented study examined the feasibility of using isotopic and elemental signatures for the source attribution of potassium perchlorate ($KClO_4$), a strong inorganic oxidizer frequently used in IEDs. A total of 42 laboratory-grade $KClO_4$ samples were analyzed using isotope ratio - mass spectrometry (IRMS) and inductively coupled plasma - mass spectrometry (ICP-MS) to evaluate within- and between source variability. The presentation will outline the key findings of this study as well as some interesting challenges encountered, such as dealing with informative features (elemental impurities) that are not consistently detected across all reference samples. A score-based likelihood ratio (LR) system for source comparisons was built and cross-validated using the collected reference data. Four $KClO_4$ samples from forensic casework were also analyzed to assess the applicability of the reference data.

From Detection to Decision: Enhancing On-Site Explosives and Precursors Detection With Advanced Machine Learning and Cloud-Based Spectroscopy 12:15 - 12:30

A.-F. Prior[1], O. Delémont[1], B. Simoens[2]

[1]University of Lausanne, Ecole des sciences criminelles, Lausanne, Switzerland, [2]Royal Military Academy, Brussels, Belgium

Abstract Body: Recent advancements have made spectrometers more portable, affordable, and integrated with cloud-based systems, supporting broader deployment and reinforcing the trend toward decentralized forensic capabilities. These interconnected solutions unlock unprecedented opportunities for explosives and precursors detection, by using advanced machine learning algorithms —which is not possible with traditional offsite systems.

We explored those new possibilities by developing various detection models tailored to specific scenarios involving portable devices used by first responders, Explosive Ordnance Disposal (EOD) experts, and within the framework of European Regulation 2019/1148 on explosive precursors.

For first responders, rapid and reliable detection and identification of explosives are crucial. We acquired thousands of near-infrared (NIR) spectra of explosives, precursors, and non-explosive substances. Analysis of these spectra using several models has been studied and showcases very promising results.

For EOD experts, the ability of NIR to determine water content of homemade explosives like triacetone triperoxide (TATP) has been demonstrated. This added layer of information enables experts to make informed on-site decisions on subsequent procedures, such as phlegmatization.

In alignment with EU regulations, which classify a product as legal or restricted based on specific concentration thresholds, we achieved high accuracy in classifying explosive precursors, helping end-users to determine the legality of a product and providing on-site information for future regulatory actions.

Combining affordable, portable, rapid, non-destructive techniques, with advanced machine learning, opens up new opportunities for explosives/precursors detection. This not only enhances on-site decision-making but also enables cloud-based forensic intelligence, providing real-time detection alerts and location information to specialists.

11: Marks, Impressions and Biometric Traces: Fingerprint Development
11:45 - 12:45 Wicklow Hall 2 (B)

Marks, Impressions and Biometric Traces: Fingerprint Development

Statistical Estimation of the Age of the Fingerprint Donor using Atomic Force Microscopy: A Prospective Study Using Non-Destructive Method 11:45 - 12:15

K. U[1], *R.B. G*[2]

[1]National Forensic Sciences University, Forensic Sciences, Tripura, India, [2] National Forensic Sciences University, School of Medicolegal Studies, Gujarat, India

Abstract Body: Dactylography is a highly advanced scientific discipline that focuses on the analysis of fingerprint patterns for the purpose of

individual identification. Fingerprints are one of the few forms of concrete evidence that investigators can get from the crime scene, demonstrating a direct connection between the perpetrators and the crime scene. Amidst the current period of scientific progress in fingerprint sciences, experts remain cautious about some unresolved matters that need scientific scrutiny, such as accurately determining the age of the individual based on fingerprint samples obtained from crime scenes. This study focuses on the specific issue with an optimistic viewpoint. A total of 200 fingerprint samples, belonging to five different categories based on age and sex, were collected. These categories include: (a) individuals aged 10-20, both male and female, (b) individuals aged 20-30, both male and female, (c) individuals aged 30-40, both male and female, (d) individuals aged 40-50, both male and female, and (e) individuals aged 50-60, both male and female. The samples were placed on clean glass slides and examined using the Atomic Force Microscope (AFM), a precise tool for studying the detailed characteristics of the samples at the nanoscale. The quantitative data and graphical depiction of the unprocessed latent fingerprints obtained from the AFM equipment effectively demonstrated the distinctions among the five age groups. This study demonstrates the possibility of using instrumentation approaches to determine the age of the fingerprint donor in a way that is non-destructive and non-invasive.

Objective Finger Image Quality 12:15 - 12:30

G. Fiumara[1]

[1]National Institute of Standards and Technology, Information Technology Laboratory, Gaithersburg, United States

Abstract Body: Is that fingermark of sufficient quality to be used for searching in an Automated Biometric Identification System (ABIS)? What about the fingerprint you just captured on the live scan—will enrolling that image improve or hinder future recognition? While the fingermark detection field has traditionally relied on various subjective quality scales, these assessments can vary significantly based on the evaluator’s perspective. In contrast, the international biometric standards community has focused on developing objective quality measurements—assessments that remain consistent regardless of who conducts the evaluation or any external factors. This presentation will explore why objective quality metrics are crucial, the importance of standardization, and how these metrics are assessed. We will also review the latest developments within the international standards community regarding both tenprint and fingermark quality measurements, offering insights into how these objective standards are shaping the future of biometric recognition.

Investigation of Iron Oxide Powders for Use in Powder Suspension Formulations in Fingermark Development 12:30 - 12:45

M. Maroon[1], *L. Clover Ree*[1], *S. Chadwick*[1]

[1]University of Technology Sydney, Sydney, Australia

Abstract Body: Iron oxide powder suspensions (FePS) are a fingermark development technique recommended for use on wetted light nonporous

and adhesive surfaces. Overall, there is limited literature available that focuses on comparing different types of iron oxide powders for developing latent fingermarks using powder suspensions. Similarly, the majority of powder-focused research has utilised the surfactant solution Triton X-100, which has now been removed due to environmental hazards and are therefore less operationally relevant. This study aimed to examine various iron oxide powders to investigate the impact variations can have on fingermark development with FePS using the current recommended surfactant 10% Tween 20. Five iron oxide powders were selected to ensure differing brands, oxidation states, and particle sizes were represented. A red iron (III) oxide, which has not been previously examined in literature, produced the best developed fingermark quality on all substrates assessed and outperformed both old and new recommended iron oxide powders. When the optimised iron (III) oxide was compared to the current recommended FePS formulation, it was found to be more effective on non-porous surfaces however produced heavier background development on adhesive surfaces. The use of FePS on wetted and aged fingermarks was also examined and found to not greatly impact fingermark quality. This research demonstrates that the type of iron oxide powder used in FePS dramatically influences the quality of developed fingermarks. The iron (III) oxide should be further investigated for use in FePS formulations on nonporous surfaces.

03: Digital Evidence: Forensic Visualisation (VR, AR, 3D)
11:45 - 12:45 Liffey Meeting Room 2

Digital Evidence: Forensic Visualisation (VR, AR, 3D)

Prototype of 3D Scanner Dedicated to Forensic Practice 11:45 - 12:00

P. Hamrikova[1], L. Capek[2], J. Vitvar[2]

[1]Regional Hospital Liberec, Department of Forensic Medicine, Liberec, Czech Republic, [2]Regional Hospital Liberec, Clinical Biomechanics, Liberec, Czech Republic

Abstract Body: The integration of 3D scanning technology in forensic pathology represents a significant advancement in the documentation and analysis of crime scenes and post-mortem examinations. Traditional 2D imaging methods often fail to capture the complexity of spatial relationships and details vital for thorough investigations and its presentation during court proceedings. As such, the use of dedicated 3D scanner, specifically designed for forensic applications, is essential to mitigate inaccuracies and open tools in forensic practice. Our newly developed prototype of 3D scanner offers superior accuracy and reliability in capturing intricate details during autopsy. It is dedicated specifically to forensic practice due to closed software circuit without need for open tools, proposes any place reproducibility and has easy to use facilities - users friendly manipulation. Now days commonly used LiDAR scanners have gained popularity in various fields between professionals and laymen as well. Nevertheless, their limitations in precision were not studied yet. Another problem might arise due to inaccuracies in point cloud data recovery which can lead to significant misinterpretations with adverse consequences especially in legal contexts. Moreover, the security of legally liable scanned data on open clouds seems to be at least disputable. This

talk will discuss the advantages of employing high-resolution dedicated custom designed 3D scanner over the use of commercially accessible well promoted device.

Assessment of Accuracy and Measurement Uncertainty of Immersive Virtual Reality 3D Reconstructions of Indoor Crime Scenes 12:00 - 12:15

V. Rinaldi[1]

[1]University of Dundee, Leverhulme Research Centre for Forensic Science, Dundee, United Kingdom

Abstract Body: Scanning and surveying technologies are becoming increasingly affordable and portable, facilitating the process of data acquisition in forensic science. Similarly, virtual reality systems allow for immersive and intuitive visualisations of crime scenes. While immersive technologies are being predominantly used for visualisation, their potential for quantitative spatial analysis is still underexplored.
This research investigates the accuracy and reliability of measurements derived from meshed 3D models of crime scenes, addressing a critical gap in the application of VR systems. We perform comparative assessments of spatial data, using lidar-generated point clouds as reference datasets. Key analyses include computing mesh-to-cloud distances, estimating errors in repeated measurements via 2D displays and immersive VR headsets, and evaluating measurement repeatability.
We also discuss how measurement uncertainty and error vary between conventional 2D display systems and VR-based approaches to provide insight into the precision and usability of immersive tools in quantitative tasks. These evaluations will help in informing best practices for integrating digitalisation and visualisation tools in forensic science.
This study lays the groundwork for extending the use of VR systems beyond mere visualisation toward rigorous quantitative analysis by improving the understanding of measurement accuracy and repeatability inside immersive environments. The findings have wide-ranging implications for forensic applications, including scene reconstruction, evidence documentation, and training, that support a more reliable and effective adoption of emerging technologies in the field.

Forensic Digital Twin Methodology: Dubai Police's Innovative Approach to Spatial Reconstruction Techniques in Criminal Investigation 12:15 - 12:30

M. Alqassim[1], *A. Alali*[1], *M. Alali*[1], *A. Almaazmi*[1]

[1]Dubai Police, General Department of Forensic Science and Criminology, Dubai, United Arab Emirates

Abstract Body: The application of digital twin technologies in forensic investigations has revolutionized crime scene reconstruction, offering unprecedented precision and analytical capabilities. This interdepartmental study examines an innovative three-phase approach implemented by Dubai Police's crime scene, forensic medicine, and forensic engineering departments—since 2019, demonstrating a comprehensive digital

transformation of investigative methodologies.

The research delineates a strategic implementation across three critical phases: First, preparing detailed 3D and 2D sketches of crime scenes and linking physical evidence through advanced digital mapping. The second phase focuses on evidence preservation, including comprehensive autopsy documentation and facial reconstruction of unknown victims, enabling the creation of reliable and accurate incident reconstructions to support legal proceedings. The final phase establishes an extensive database of crime scenes, leveraging virtual reality (VR) and digital technologies to train new crime scene investigation officers.

Two case studies substantiate the approach's effectiveness: a detailed reconstruction of a fatal fall from height incident and a comprehensive simulation of a motorcycle collision accident. Utilizing cutting-edge hardware including the Leica RTC360 3D laser scanner, ARTEC Spyder, and ARTEC Leo handheld scanner, the Dubai Police Digital Twin team developed sophisticated forensic reconstruction techniques.

Advanced software platforms such as Vcrash, CYBID, and Cyclone enabled precise three-dimensional modelling and forensic analysis. The innovative methodology integrates technological advancements with comprehensive officer training, creating a holistic approach to forensic digital transformation.

The research demonstrates how collaborative digital twin technologies can revolutionize forensic investigative capabilities, providing law enforcement with powerful interdepartmental tools for evidence analysis, accident reconstruction, and judicial proceedings.

Development and Implementation of a 3D Mugshot System for Enhanced Forensic Documentation 12:30 - 12:45

L. Ebert[1], *S. Perfetto*[1], *D. Hänni*[1]

[1]Zurich Forensic Science Institute, Department of Biometrics, Zurich, Switzerland

Abstract Body: In criminal investigations, high-quality mugshots are crucial for suspect identification and forensic analysis. However, traditional 2D mugshots have inherent limitations, especially when comparing them to images captured at oblique angles by CCTV cameras. To address these challenges, we developed a robust 3D mugshot system designed for forensic use. The system captures high-resolution 3D models of a subject’s face using photogrammetry, overcoming the shortcomings of 2D imaging. The setup includes 26 synchronized cameras arranged in a 180° arc, with integrated flashlights and a height-adjustable chair, ensuring clear and uniform lighting without causing discomfort to the subject. A key feature is its seamless integration into existing biometric systems, allowing for simultaneous 3D and standard mugshot image acquisition, which supports efficient data management and reduces operator workload. The system has been deployed for routine use in Zurich, where it has been used thousands of times, demonstrating its reliability and scalability. In comparison to traditional methods, the 3D approach provides more detailed and accurate documentation, enhancing the potential for facial recognition and

comparison in forensic investigations. Moreover, the system's user-friendly interface and professional design make it easily operable while maintaining the dignity of the subject. Despite challenges related to cost and space, the system represents a significant advancement in forensic imaging, offering new possibilities for crime-solving and data analysis, including integration with virtual reality technologies for further forensic applications.

06: Education and Training: Operational Training
11:45 - 12:45 Liffey Meeting Room 3

Education and Training: Operational Training

Exploration Into the Establishment of a Forensic Entomology Service in Ireland 11:45 - 12:15

C. Tersaruolo[1], Y. Sun[2], S. Collis[3], L. Mulligan[3]

[1]Technologica University Dublin, Dublin, Ireland, [2]University of Strathclyde, Glasgow, United Kingdom, [3]Office of the State Pathologist, Dublin, Ireland

Abstract Body: The Office of the State Pathologist (OSP) plays a key role in the death investigation process. The use of insects found on a cadaver and at the scene of the death can be a vital component in the determination of an approximate post-mortem interval (PMI) and may contribute significantly to the death investigation process. At present in Ireland, there is no established forensic entomology service and the literature around necrophagous insects specific to Ireland’s climate and conditions are underrepresented.
A collaboration between the OSP and a forensic entomology expert at Technical University Dublin, with previous experience in the establishment of such a service in Italy, has led to this pioneering project focused on the possibility of establishing a forensic entomology service in Ireland. A comprehensive understanding around the legal and practical requirements of the State Pathologists’ role and well-established forensic entomological techniques led to the development of protocols and procedures to ensure collection of the relevant entomological data and samples in a pilot study. Elements around precise environmental temperature measurements, accuracy of witness timelines and scene analysis were identified as potentially resulting in variation in the interpretation of the entomological evidence. However, careful examination and discussion around the forensic entomological evidence in combination with the scene and post-mortem findings allowed for a more accurate PMI estimation, strengthening the investigative process and supporting more reliable forensic conclusions. Further collaboration between the two departments and ongoing data collection will build on the knowledge around insects specific to cadavers in Ireland.

Operator Training Model for Laser Scanning in Finnish Police 12:15 - 12:30

A. Myyrä[1], J. Pihlajaniemi[2], S. Ketola[3]

[1]National Bureau of Investigation, Vantaa, Finland, [2]Southeastern Finland Police Department, Pori, Finland, [3]Eastern Uusimaa Police Department, Vantaa, Finland

Abstract Body: Laser scanning in an effective tool for crime scene documenting and visualisation. In Finnish police, crime scene investigators are responsible for documenting the scene. They already have a demanding role, and implementing the method requires additional training on measurement technology principles, multiple software, and quality assurance. How to train complex technology effectively while avoiding feelings of overwhelm? The training model has succesfully lead to high utilization rate of hardware, and the operators can manage most of their casework independently without assistance from forensic laboratory. Presentation discusses two-level competence requirements for operators, training system, and observations for future development.

Improving Forensic DNA Analysis in Multi-Source Crime Scenes 12:30 - 12:45

A.K. Bhambara[1,2], *M.K. Thakar*[2]

[1]Galgotias University, Department of Forensic Science, Uttar Pradesh, India, [2]Punjabi University, Department of Forensic Science, Patiala, India

Abstract Body: The present research aims on improving the DNA analysis in cases involving multiple person(s) at the scene of crime. This involvement leads to the existence of mixed samples hindering the forensic scientist from investigating multi-person crime scenes. This research experiment involves multiple contributors, different types of contact (direct and indirect, including secondary and tertiary both) and different substrates (for example, garments, glass, metal etc.,) that simulate evidence from complex, real-time crime cases, such as burglary and assault. To assess the aims and objectives, 200 participants provided samples as per the experimental setup and samples then assessed using traditional DNA typing method, i.e., STR profiling and compared with novel forensic recovery methods, including bioaerosol sampling. Advanced DNA analysis using next-generation sequencing (NGS) and quantitative PCR was also employed to differentiate individual DNA sources within mixed samples. This innovative protocol is expected to establish innovative methods for optimizing the process of DNA transfer, persistence and recovery that could improve the accuracy of linking suspects to crimes in multi-person environments.

11: Marks, Impressions and Biometric Traces: Firearms and Tools
11:45 - 12:30 Liffey Meeting Room 4

Marks, Impressions and Biometric Traces: Firearms and Tools

Assessment of Subclass Characteristics Found on Consecutively Manufactured Breech Faces 11:45 - 12:00

V. Franklin[1], *K. Morris*[1]

[1]West Virginia University, Forensic and Investigative Science, Morgantown, United States

Abstract Body: Firearm examiners have been criticized for the lack of assessment of subclass characteristics in casework. The lack of training has

been identified as the cause. Firearm examiners should be cautious if subclass characteristics are found. A lack of caution may result in an examiner using subclass characteristics as identifiable characteristics which may lead to a false positive. If present, subclass characteristics are mostly found on consecutively manufactured parts.

Research on consecutively manufactured breech faces for a Thompson Center Contender® G2 pistol and the assessment of subclass characteristics for four different manufacturing methods using the NIST congruent matching cells (CMC) algorithm was performed. The effect of two common finishing methods and the persistence of subclass characteristics were evaluated.

Broaching, plunge milling, turning and face milling methods were used to produce 110 consecutively manufactured breech faces. Half of the breech faces manufactured by each method were finished with vibratory tumbling and the other half were finished with glass bead blasting. A 3D topographical image was collected from each breech face after the initial manufacturing and post-finishing using a confocal microscope. Pairwise comparisons were performed using the CMC algorithm within and between each manufacturing method and finishing method. Finished and non-finished breech faces were compared within each manufacturing method.

In this study, broaching and plunge milling were found to produce subclass characteristics more than face milling and turning. As far as finishing was concerned, glass bead blasting removed most, if not all, of the gross machining marks, including subclass, compared to tumbling.

An Interoperability Study of Firearm Forensic Systems Using X3P Ballistics Data 12:00 - 12:15

D. Werner[1,2], T. Rupp[3], S. Schaufelbühl[3], D. Wintermans[4], F. Riva[4], F. Crispino[1,2], S. Lévesque[5]

[1]University of Quebec at Trois-Rivières, Department of biochemistry, chemistry, physics and forensic science, Trois-Rivières, Canada, [2]Forensic Science Research Group (GRSF), Trois-Rivières, Canada, [3]Forensic Institute of St. Gallen, Cantonal Police St. Gallen, St. Gallen, Switzerland, [4]University of Lausanne, School of Criminal Justice (ESC), Lausanne, Switzerland, [5] LeadsOnline, Research and Prototypes, Montreal, Canada

Abstract Body: For several years, there have been numerous discussions about the potential benefits of developing and creating a file format for topographic images that could be exchanged between automated ballistic identification systems (ABIS), including BalScan, Evofinder, Ibis, and Quantum. Consequently, encapsulating a 3D image in an X3P container defined in ISO25178-72 with the addition of an OpenFMC extension (specific fields relate to the forensic case information and the description of the firearms) was chosen as an effective method for ensuring its readability and interoperability with equipment from another ABIS vendor. The OpenFMC standard has been implemented to varying degrees in all ABIS. Nevertheless, no study or demonstration of interchangeability, i.e., compatibility and interoperability between systems and its impact on scores, has been conducted. Accordingly, this research aimed to address this gap, and to demonstrate the feasibility and limitations of this approach.

A visual and quantitative analysis was conducted on the four main ABIS: Ibis, Quantum, Evofinder, and BalScan. The comparison and evaluation were conducted using the same projectiles and cartridge cases scanned by each system. The findings demonstrate that Virtual Comparison Microscopy enables the execution of a comprehensive ballistic identification process utilising the X3P file from an alternative scanning technology. Nevertheless, the quantitative analysis is interoperable between the three scanning technologies for some marks on the cartridge case, exhibiting near-interoperability for certain marks, yet exhibiting no functionality for bullets scanned with disparate systems.

Comparison of Firing Pin Impressions on 15,000 Consecutively Fired Cartridge Cases From 9 mm Pistol 12:15 - 12:30

A.N. Algül[1], *A. Yalçın Sarıbey*[1,2]

[1]Üsküdar University Institute of Addiction and Forensic Sciences, Forensic Science, İstanbul, Turkey, [2]Üsküdar University Faculty of Engineering and Natural Sciences, Forensic Science, İstanbul, Turkey

Abstract Body: When a firearm is discharged, components such as the firing pin, breech face, ejector, and extractor leave unique and identifiable impressions on the cartridge case. Connecting a particular fired cartridge case to a specific firearm using these markings is critical in firearm and toolmark examination. However, these firearm components may deform over time. Consequently, the characteristics of the marks left on cartridge cases may change during extended usage. It is, therefore, essential to assess the degree of change in the individual characteristics throughout extensive firing.

This study aims to examine the impact of 15,000 consecutive firings on the firing pin of a firearm, focusing on the resulting alterations in the firing pin impressions on the cartridge cases. The primary objective is to evaluate how these changes impact the comparison of matching cartridge cases and firearm identification.

The experiment was conducted with a TİSAŞ 9mm semi-automatic pistol and MKE (The Mechanical and Chemical Industry Corporation) 9x19mm Parabellum cartridges. 15,000 consecutive firings were carried out. The cartridge cases from the initial 10 firing were collected and labelled sequentially. A total of 10 cartridge cases were collected for every 600 firing, packaged, and labelled accordingly. The cartridge cases were examined with a Leica Z6 stereo microscope and a Leica FS C comparison macroscope.

In this study, the evolution of firing pin impressions between the first and the 15,000th cartridge case was examined, and the possible implications of the long-term wear effects on expert conclusions were discussed.

12:45 - 14:00 Auditorium

LUNCH BREAK

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14:00 - 14:45 Auditorium

PLENARY SPEAKER 6

Plenary Talk 6 14:00 - 14:45

04: DNA and Body Fluids: Body Fluid Identification
14:45 - 16:15 Wicklow Meeting Room 1

DNA and Body Fluids: Body Fluid Identification

Rapid and Reliable Forensics: Unlocking the Power of Lateral Flow Assays for Body Fluid Identification 14:45 - 16:15

N. Subhashini[1], A. Griberman[1]

[1]SERATEC GmbH, Research and Development, Göttingen, Germany

Workshop Description: An engaging workshop on the application of lateral flow assays in forensic science. Designed for researchers and criminalists, this session explores cutting-edge techniques for rapid body fluid identification at crime scenes and laboratories. Learn how lateral flow technology enhances forensic investigations with its portability, specificity, and speed. Through hands-on demonstrations and case studies, participants will gain practical insights into optimizing these tests for DNA extraction and forensic analysis. The workshop also explores the latest breakthroughs in body fluid identification using innovative DNA and RNA detection. Engage in hands-on demonstrations, understand the science behind nucleic acid based lateral flow assays, and collaborate with peers on applying this groundbreaking technology to forensic casework. Join us and advance your forensic toolkit!

04: DNA and Body Fluids: Investigative Genetic Genealogy (IGG)
15:00 - 16:00 Auditorium

DNA and Body Fluids: Investigative Genetic Genealogy (IGG)

The Battle of the Titans: Kintelligence vs Microarray vs Shotgun Sequencing 15:00 - 15:15

M. Stoljarova-Bibb[1], M.-L. Kampmann[2], J. Dyrberg Andersen[2], C. Børsting[2], S. Erg[1], M. Sadam[1]

[1]Estonian Forensic Science Institute, DNA, Tallinn, Estonia, [2]University of Copenhagen, Department of Forensic Medicine, Copenhagen, Denmark

Abstract Body: Forensic Investigative Genetic Genealogy (FIGG) has recently become a valuable tool for generating investigative leads in cold cases and cases involving unidentified human remains. Currently, three technologies — ForenSeq Kintelligence Kit (QIAGEN), microarray analysis (e.g. Global Screening Array, Illumina), and shotgun sequencing — are available for producing DNA profiles compatible with commercial databases used for FIGG. These technologies vary in the amount and quality of DNA required, as well as the number of SNPs analysed, which influences the

extent of relatedness they can infer. Forensic samples are often compromised in terms of DNA quantity and quality (e.g. degraded, small amounts of human DNA or contaminated with microbial DNA), which can significantly impact the success of these methods. Furthermore, in populations that are underrepresented in commercial DNA databases the sheer number of generated SNP genotypes may be important in generating actionable leads in FIGG.

Ten cases involving unidentified human remains that could not be solved using routine short tandem repeat typing were selected for FIGG analysis using the three aforementioned technologies. Bones, 20-year-old bloodstains on filter paper, and fresh blood were analysed using the ForenSeq Kintelligence Kit, the Global Screening Assay, and shotgun sequencing. The Quantifiler Trio degradation indexes (Thermo Fisher Scientific) ranged from 1 to 17. The quality of the profiles, including SNP call rates and heterozygosity ratios, will be assessed. Profiles generated from these methods will be uploaded to GEDmatch Pro and the number of actionable leads generated by each technology will be reported and compared.

How Did We Do It? The UNT Center for Human Identification's Journey of Implementing Forensic Genetic Genealogy in a Public Laboratory 15:15 - 15:30

N. Novroski[1,2]

[1]UNT Center for Human Identification, University of North Texas Health Science Center at Fort Worth, Fort Worth, Texas, United States, [2]University of Toronto, Forensic Science Program, Department of Anthropology, Toronto, Ontario, Canada

Abstract Body: Forensic genetic genealogy (FGG) has taken the forensic genetics and policing worlds by storm. Consequently, our scientific and legal communities are pivoting as quickly as possible, making use of all available tools to solve both historic and active violent crime and unidentified human remains cases. While FGG has proven tremendously successful, there is still much to learn about the best approach(es) forward, and how we, as a community of scientists and investigators, can maximize our existing laboratory operations and personnel, budgets, and access to public data to address the increasing demand of forensic genetic genealogy services in the public forensic laboratory.

The presentation herein will discuss initial best practice considerations and decisions that laboratories and investigators need to consider prior to in-house FGG work, the benefits and limitations of three unique yet invaluable scientific approaches (targeted SNPs, microarrays, and whole genome sequencing) to generating a DNA data file for genealogical searching, and describe the validation, accreditation, and implementation strategies for bringing FGG casework into the public laboratory.

We will also focus on how UNT Center for Human Identification (CHI) became the first public forensic laboratory in the United States to successfully come online with FGG, our biggest lessons learned, and how our free forensic services contribute to an increase in resolution of crimes across America.

Practical and Ethical Considerations for the Responsible Use of Forensic Investigative Genetic Genealogy (FIGG) 15:30 - 15:45

C.L. Glynn[1]

[1]University of New Haven - Henry C. Lee Institute of Forensic Science, Department of Forensic Science, West Haven, United States

Abstract Body: Forensic Investigative Genetic Genealogy (FIGG) is a rapidly advancing field that has gained widespread attention in recent years through its use in generating investigative leads in unresolved violent crimes and unidentified human remains cases. FIGG broadens the field of forensic genetics by combining advanced DNA technologies with genealogical research for the purposes of human identification in forensic investigations. It is estimated that FIGG has helped generate investigative leads in at least 1,200 cases in the United States (US) in recent years. FIGG traverses both the public sector and the private sector, with federal and state agencies and local departments in the US developing in-house FIGG units/programs, and private companies offering FIGG services. Robust training and education in FIGG should equip analysts/practitioners with the core competencies necessary to interpret complex genetic data, understand genealogical methodologies, and navigate the ethical and legal implications involved.
This presentation will address key steps in the FIGG workflow to include, but are not limited to, case qualification and triaging, use of public genetic genealogy databases, data security, case reporting, and oversight. This presentation will highlight the importance of comprehensive training and education, continuous professional development, and interdisciplinary collaboration to enhance the accuracy and integrity of FIGG investigations. Associated ethical and privacy concerns will be discussed, emphasizing the need to protect both public safety and individual privacy rights. Overall, this presentation aims to foster a balanced understanding of the scientific principles, key steps in the workflow, and guidance for the responsible use of FIGG in criminal investigations.

Classifying Distant Pairwise Relationships From Segments of Identity by Descent 15:45 - 16:00

H. Nordtorp[1], *A.E. Fonneløp*[1,2], *M.D. Vigeland*[1]

[1]Oslo University Hospital, Department of Forensic Sciences, Oslo, Norway, [2]University of Oslo, Centre for Ecological and Evolutionary Synthesis (CEES), Department of Biosciences, Oslo, Norway

Abstract Body: The use of public genetic genealogy databases in forensic genetics has revolutionized the way investigators approach unsolved cases, opening up the field of forensic investigative genetic genealogy. After uploading a trace DNA profile, for instance from a crime scene, to a genetic genealogy database, relatives of the trace are reported based on genomic segments shared identical by descent (IBD), that is, inherited from a common ancestor. However, predicting the true genealogical relationship from such matches is generally challenging, due to variation and overlap in IBD distributions between distant relatives.

In this study, we use detailed simulations of IBD sharing, to construct a Bayes classifier for genealogical relationships from a set of shared segments. The model can be used to predict and rank the likelihood of relatives in genealogical searching, facilitating such investigations in forensic casework.

05: Drugs: Emerging Technology
15:00 - 16:00 Liffey Hall 1

Drugs: Emerging Technology

Spectroscopic Techniques for Real-Time Chemical Profiling of Illicit Drugs: A New Way to Promote Its Operational Use in Investigations 15:00 - 15:15

M. Charest[1], *L. Gasté*[1], *P. Esseiva*[1]

[1]University of Lausanne, School of Criminal Justice, Lausanne, Switzerland

Abstract Body: Chemical profiling of illicit drugs is widely used to link different seizures and support investigations related to drug trafficking. Separative analytical techniques, such as gas chromatography-mass spectrometry (GC-MS), remain the standard for chemical profiling due to their ability to provide detailed insights into chemical composition. However, the valuable intelligence generated through this process often remains unexploited by investigators, because the associated analytical and administrative procedures cause delays in information availability. Since illicit drug profiling is most effective in guiding the first phase of the investigation, rapid responses are essential.

This study explores the feasibility and contribution of rapid and portable spectroscopic techniques in initiating the illicit drug profiling process earlier in investigations. To evaluate the pertinence and potential of deploying such an approach, a set of 298 cocaine specimens previously profiled using GC-MS and classified in their respective chemical classes was used in order to establish a reference framework. These specimens were then analyzed with portable near-infrared (NIR) and Raman spectrometers, and classification algorithms based on similarity measurements were applied.

The results demonstrate that these techniques effectively discriminate the cocaine specimens identified as either linked or unlinked by the reference method, providing valuable insights in the early stages of the investigation. This presentation outlines the implementation, added value, and limitations of these rapid analytical techniques in highlighting similarities between illicit drug samples. These methods are not intended to replace the traditional profiling approach, which can always be employed later if more detailed analysis is required.

A Proactive Approach: AI-Assisted Pre-Screening for Potential Cannabinoids 15:15 - 15:30

S. Ng[1], *Y.L. Yong*[1], *J. Tan*[1], *C.C. Lim*[1]

[1]Home Team Science and Technology Agency, Forensics CoE, Singapore, Singapore

Abstract Body: The emergence of novel psychoactive substances (NPS) poses a significant and ongoing challenge for the forensic science community, particularly with the increasing prevalence of synthetic cannabinoid receptor agonists (SCRAs). As these substances rapidly evolve, they demand continuous updates to forensic detection capabilities and the development of comprehensive analytical protocols, which can be time-consuming. To facilitate this process, our team has established the use of advanced machine learning models to predict bioactivity related to the CB1 receptor, integrating structural information with chemically meaningful explanations through Shapley values.

Using bioactivities from the ChEMBL open-source data repository, we developed and rigorously tested these models. Achieving high accuracies of up to 87% when tested with low-similarity molecules and up to 93% with molecules of higher similarity, the models not only deliver exceptional performance but also provide critical insights into molecular substructures influencing bioactivity. The application of Shapley values, in particular, has revealed significant chemical patterns, enhancing the interpretability and relevance of these predictions for forensic chemists. Importantly, ketone and ester linkages were identified as key predictors, aligning with known structure-activity relationships for SCRAs.

This innovative approach bridges the gap between predictive machine learning techniques and expert drug chemistry knowledge, greatly accelerating the identification of SCRAs. By offering reliable, interpretable, and scientifically robust predictions, this methodology strengthens our analytical reliability, and ability to respond swiftly to emerging NPS threats.

Transforming Fiction into Reality: The Role of Automation and Artificial Intelligence in Next-Generation Drug Testing 15:30 - 15:45

J.J.Y. Ng[1]

[1]Health Sciences Authority, Illicit Drugs Division, Singapore, Singapore

Abstract Body: The illicit drug testing landscape has undergone a remarkable transformation since the 1900s, evolving from simple colour tests and thin-layer chromatography (TLC) to highly sensitive and sophisticated analytical techniques such as liquid chromatography mass spectrometry and nuclear magnetic resonance spectroscopy. As we look to the future, a question emerges: What's next?

This presentation explores the potential future of illicit drug testing methodologies in light of global trends increasingly focused on automation and artificial intelligence (AI). We examine how these emerging technologies could revolutionise forensic practices, potentially transforming science fiction into reality. The presentation emphasises the rapid digitisation of manual processes and its potential to enhance efficiency, accuracy, and throughput in the face of growing workloads and resource constraints.

We delve into the integration of automation and AI in the forensic science, showcasing examples like automated TLC, sample preparation systems, deconvolution software and chatbots. We examine how these technologies

enhance the efficiency while maintaining high standards of scientific integrity crucial in forensic science. Additionally, we investigate the challenges of implementing these advancements and their implications for quality assurance and legal credibility, exploring how automated and AI-driven processes can be validated and accepted by the accreditation bodies and within judicial systems.

By anticipating both the challenges and opportunities presented by these technological advancements, this presentation aims to provide valuable insights into shaping a robust, technologically advanced future for illicit drug testing.

Drug Characterisation and Impurity Mapping Using R. 15:45 - 16:00

A. Saif[1], *H. Ménard*[1], *L. Nisbet*[1]

[1]University of Dundee, Leverhulme Research Centre for Forensic Science, Dundee, United Kingdom

Abstract Body: **Background:**
Limited research has been conducted on the presence of impurities in illicit drugs, primarily because these impurities are typically present in small concentrations, and detection requires significant manual effort. This study aims to develop and evaluate an automated approach to identify impurities in illicit drug samples using the R programming language.
Methods:
A dataset of fully characterised methamphetamine samples was manually processed and compared to the results generated by the R script. Additionally, a total of 107 synthetic cannabis samples were analysed by GC-MS in full-scan mode. The output data were processed directly in R to detect the presence of peaks with signal-to-noise ratios exceeding three times the baseline. The mass spectra of the detected peaks were compared with those in a self-built reference library using spectral contrast angle measurements.
Results:
The developed R code was applied to extract peaks from all 107 test samples, resulting in the detection of 3,825 peaks of interest. Among these, 119 unique peaks were identified, representing 27 out of the 107 samples analysed. These peaks were sufficient to account for all compounds present across the entire dataset.
Each detected peak was compared against the reference library using spectral contrast angle measurements, which produced a matching ratio to indicate spectral similarity. Additional analyses incorporated both the matching ratio and the retention times of individual peaks to facilitate compound identification.
Conclusion:
This research demonstrates the feasibility of systematically detecting impurities in a large series of samples through an automated, targeted approach, significantly streamlining data analysis.

12: Scenes of Crime: Trace Evidence and Interpretation
15:00 - 15:45 Liffey Hall 2

Scenes of Crime: Trace Evidence and Interpretation

Soil as an Unconventional Substrate for IGSR Detection: Does Dirt Matter? 15:00 - 15:15

G. Tagliabue[1,2], G. Caccia[1], S. Tambuzzi[3], D. Redaelli[4], L. Trombino[2], C. Cattaneo[1]

[1]University of Milan, LABANOF (Laboratorio di Antropologia e Odontologia Forense), Department of Biomedical Sciences for Health, Section of Legal Medicine, Milan, Italy, [2]University of Milan, Department of Earth Sciences "Ardito Desio", Milan, Italy, [3]University of Milan, Department of Biomedical Sciences for Health, Section of Legal Medicine, Milan, Italy, [4]Polizia di Stato, Gabinetto Regionale di Polizia Scientifica per la Lombardia, Milan, Italy

Abstract Body: The analysis of gunshot residue (GSR) is commonly utilized in the field of forensic practice to ascertain the occurrence of a shooting event. This is particularly important when the wound is no longer macroscopically identifiable, as is often the case in instances of advanced decay and skeletonization of the victim. However, it should be noted that GSR can disappear during decomposition. Moreover, in the case of a buried body, the issue of putrefaction is compounded by the additional challenge of contamination and weathering of GSR, especially inorganic (IGSR), by soil, depending on the specific burial environment. This context, although not uncommon, has been the subject of insufficient investigation. For this reason, a simulation of clandestine burials was carried out at the Forensic Taphonomy Facility of the University of Milan (Ticino-LEAFs) using piglets that had died of natural causes as a model of human decomposition. The cadavers were each shot twice with a Walther PP caliber 7.65 mm Browning, with one shot fired into the maxillary and one into the neurocranial portion of the skull. At predetermined intervals, the piglets were exhumed and autopsied, and IGSR samples were collected and analyzed by SEM-EDS. In particular, the analyses were conducted on the soil in contact with the anterior wound (both entry and exit), directly on the skull portions affected by the posterior gunshot, and on background soil samples. The study emphasized the necessity of critically and cautiously considering IGSR analysis, always referencing the specific physicochemical characteristics of the burial environment.

Evaluation of the "DNA Category Table": A Mixed-Methods Analysis of the Strategy Proposed by the Present System in Judicial Investigations 15:15 - 15:30

I. Lemans[1], J. Divoy[1], S. Bitzer[1]

[1]UCLouvain, School of Criminology, Louvain-la-Neuve, Belgium

Abstract Body: In the context of the intervention of crime scene investigators (CSI) at the scene of a crime, a report of their intervention will be produced, including a list of the objects and traces collected. Triaging of traces in the early steps of the criminal justice process is essential for the overall process. Current forensic science practices face pressures of efficiency and resource limitations, making triage decisions crucial. The "DNA Category table" provided in the CSI report in Belgium aims at standardising this decision-step based on the analysis success rate and the potential source of the DNA trace, and thus the value of the link with the

person of interest.
By using a mixed-methods approach, combining quantitative analysis of closed cases (homicides and robberies) with qualitative data from interviews with CSIs, magistrates, and forensic practitioners, this study aims : (1) to evaluate the understanding and use of the "DNA Category table" by the actors involved in trace processing ; (2) to evaluate the effectiveness of the table and the decision-making factors involved in the analysis of DNA traces ; and (3) to determine which judicial cases would benefit from the strategy proposed by the table and to identify areas for improvement in its use.
This research examines three key questions: the model's simplicity and clarity for all users which might oversimplify a complex and context-dependent decision-making step, the understanding and use of the model by stakeholders, and the extent to which the table’s strategy enhances the effectiveness of judicial investigation.

Exploring the Transfer and Persistence of Diatoms to Support Crime Investigations in Marine Environments 15:30 - 15:45

K. Scott[1,2], A. Stevens[1,2], A. Dark[3], J. Walker[4], J. Egan[3]

[1]Liverpool John Moores University, School of Biological & Environmental Sciences, Liverpool, United Kingdom, [2]Liverpool John Moores University, Forensic Research Institute, Liverpool, United Kingdom, [3]Edge Hill University, Department of History, Geography, and Social Sciences, Ormskirk, United Kingdom, [4]PetroStrat, Conwy, United Kingdom

Abstract Body: Marine environments, particularly coastal sites, are frequently encountered within criminal investigations. Despite this, few forensic approaches, particularly trace evidence techniques, are available to support crime reconstructions. Diatoms, an abundant and species-rich group of microalgae prevalent within most waterbodies, can establish links between persons and scenes of interest following their transfer and persistence. Most previous research and casework has focused on freshwater environments; this study is the first to empirically assess the value of diatom analysis within marine forensic investigations.
Two experiments are presented. The first aimed to explore diatom transfer to clothing in coastal locations and whether this was impacted by clothing type, environmental variability, and species characteristics. The second sought to consider diatom transfer and persistence on footwear exhibits and whether trends vary spatially within different subsampling areas of a shoe. Various coastal sites in northwest England, including marine lakes and tidal beaches, were sampled, with diatoms extracted from environmental, clothing, and footwear samples using a H_2O_2 technique. The results highlight that transfer and persistence is influenced by recipient surface characteristics (e.g., clothing material), environmental conditions (e.g., tidal regimes), and species traits (e.g., valve shape). Crucially, a transferred species assemblage demonstrated similarity to the corresponding environment, supporting forensic comparisons and exclusions.
These findings highlight that marine diatoms offer useful circumstantial trace evidence during crime reconstructions involving coastal environments. Although clothing and footwear offers a useful repository of diatom trace evidence, the complexity of variables influencing the abundance and representativeness of questioned samples must be

carefully considered within forensic interpretations.

02: Chemistry: Explosives
15:00 - 15:45 Wicklow Hall 1

Chemistry: Explosives

Towards a Robust Activity-Level Assessment in Explosive Residue Analysis: Assessment and Modelling of the Primary Transfer of Smokeless Powder (SLP) Residues on People's Hands 15:00 - 15:15

T. Standley[1], C. Putruele[1], I. Gavriilidi[2], C. Kelly[1], J. Liechti[1], Z. Redshaw[1], N. Stephaniuk[1], N. Mai[3], M. Gallidabino[1]

[1]King's College London, Department of Analytical, Environmental and Forensic Sciences, London, United Kingdom, [2]Polish Academy of Sciences, Hirszfeld Institute of Immunology and Experimental Therapy, Wrocław, Poland, [3]Cranfield University, Centre for Defence Chemistry, Shrivenham, United Kingdom

Abstract Body: Supporting whether a person of interest has handled an explosive material or not may be an important piece of information in the aftermath of a bombing incident. To achieve this, hand swabs are typically collected to test for explosive residues. However, very little data is available in the literature to properly interpret related findings, thus also creating a serious knowledge gap. Focusing on smokeless powder (SLP), which is commonly used in improvised explosive devices, this project aimed to tackle this problem. In particular, the primary transfer of SLP residues on people's hands have thoroughly been studied through a series of simulated handling experiments involving actual bulk SLP samples. Results showed that the quantities recovered for some of the major SLP components were generally in the high ng – low µg range, with variations depending on their initial concentrations in SLPs. These quantities, furthermore, were found to be linearly dependent on the total mass of SLP handled and were influenced by the type of SLP handled, as well as by the handler. Identified relationships were tentatively modelled statistically, in order to allow predicting expected ranges in a specific situation and to better inform significance assessment in casework. Modelling strategies included a hierarchical Bayesian model. As a conclusion, collected data led to a better understanding of the underlying transfer mechanism of SLP residues and the application of the models developed is promising to allow a more robust activity-level assessment in explosive residue analysis.

A Scientometric Review of Explosives Research: Challenges and Opportunities 15:15 - 15:30

A. Bruce[1,2], M. Beardah[1], N. Nic Daéid[2], H. Ménard[2]

[1]Forensic Explosives Laboratory, Defence Science and Technology Laboratory, Porton Down, United Kingdom, [2]Leverhulme Research Centre for Forensic Science, University of Dundee, Dundee, United Kingdom

Abstract Body: It is well documented that the volume of scientific literature being published each year is increasing. As the body of literature

expands, so does the effort involved for both forensic science researchers and practitioners alike in understanding the breadth and depth of an area of interest. Given this challenge, there is a pressing need for a systematic approach to help identify relevant references to specific research or practical applications. A scientometric approach can be used to identify trends and opportunities, and its application to the discipline of forensic explosives investigation will be presented. Analysis was carried out by examining the references contained in the triennial INTERPOL International Forensic Science Managers Symposium (IFSMS) reports and through a search for “explosive” in the Scopus citation database. To enable searching for specific explosive compounds, a reference list was compiled containing commonly used names for a range of explosives. The abstract, title, and keywords of the IFSMS references were searched against this explosive reference list to investigate their incidence in these fields. This was compared to a further search for explosive compounds on the full text of a subset of documents through text mining. The findings of this scientometric review will be presented, and the effectiveness of this approach discussed. Recommendations to the community on how to improve the searchability of publications and the identification of relevant literature will be presented.

Source Discrimination of Aluminum Powders Used in IEDs 15:30 - 15:45

J. Buscaglia[1], A. Bhandari[2], M. Jordan[2], J. Hietpas[3], D. Ommen[4], J. Hanka[5], C. Saunders[5]

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Abstract Body: Aluminum (Al) is commonly used as a metallic fuel in improvised explosive devices (IEDs). Amateur bomb-makers use commercial Al-rich products (e.g., foil, cans, spray paint, etc.) because they are readily accessible, inexpensive, and can provide the starting material to produce IEDs using simple techniques. Discrimination of Al sources can provide investigative and intelligence leads beyond mere identification of the presence of Al.
A method to accurately and precisely measure the trace elemental (TE) concentrations of Al materials by inductively coupled plasma mass spectrometry (ICP-MS) was previously developed and reported. This report evaluates the use of this developed method for the discrimination potential among various sources of Al through the comparison of their TE profiles. Building on our prior work, this presentation reports a more robust determination of the discriminatory power of Al TE profiles through increased sampling/sources, sample diversity, and novel statistical approaches for handling this large, multidimensional dataset.
The within-source variation of the measured TE concentrations of rolls of Al foil and powders produced from those rolls, as well as powders extracted from commercial products, was assessed using a statistical design for sampling and analysis; this design allowed heterogeneity due to sample position (vertical and horizontal) and day analyzed to be assessed. Sources

of variation were measured throughout the sampling and analytical processes for Al foils and powders. Within- and between- source distributions of TE concentrations were used to develop criteria to compare Al sources using several statistical approaches.

08: Forensic Medicine and Toxicology: Forensic Archaeology
15:00 - 15:45 Wicklow Hall 2 (A)

Forensic Medicine and Toxicology: Forensic Archaeology

Self-Inflicted, Criminal, or Accidental? Facial Fractures Associated With Fatal Blunt Force Trauma 15:00 - 15:15

C. Mole[1]

[1]University of Cape Town, Forensic Medicine and Toxicology, Observatory, South Africa

Abstract Body: Fatal injuries caused by blunt force are frequently observed in forensic casework. Often there is a need to ascertain the circumstances surrounding death and whether injuries were self-inflicted, criminal or accidental in nature. This is even more challenging when analysing skeletal remains. The aim of this study was to determine the prevalence and pattern of blunt force skeletal injury to the facial bones and associated sinuses. This was achieved through a five-year retrospective review of fatal assaults, falls and suicide by jumping, examined at Salt River Mortuary, Cape Town, South Africa. Where facial fractures were present, the location and extent of fracturing was recorded based on autopsy reports and digital radiographs (Lodox Statscan) obtained at the time of autopsy. Clustering of fractures based on mechanism of injury were assessed using a GIS-based approach. During the study period, a total of 19 488 autopsies were conducted. Facial fractures were present in 228/1080 (21.1%) blunt force assault cases, 26/390 (6.7%) accidental falls and 8/29 (27.6%) suicides by jumping. Most individuals sustained fractures to the upper face followed by the middle and lower face. Significant associations were observed in the location of fractures and extent of fracturing between mechanisms of death. Community assault cases typically resulted in extensive fracturing of the mandible and maxilla. Fractures extending into the anterior cranial base were more prevalent in falls from a height and suicide by jumping.

Substance Exposure Through Dental Hard Tissues: A Forensic Perspective 15:15 - 15:30

A. Vijayakumar[1], *S. Manica*[1], *H. Pandey*[1], *A. Chiu*[2]

[1]University of Dundee, Centre of Forensic and Legal Medicine and Dentistry, Dundee, United Kingdom, [2]University of Dundee, Centre for Anatomy and Human Identification, Dundee, United Kingdom

Abstract Body: Dental hard tissues own a unique property of sustaining traces in susceptible conditions that are valuable for forensic identification due to their resistance to physical, chemical, and biological effects. Addressing the global challenges of substance abuse, this study intersects

public health, forensic science, and education. The two-fold study aimed to evaluate the effectiveness of dental hard tissues for identifying drugs, chemicals, and other elements in forensic contexts through a mixed-methods approach inclusive of an online survey and scoping literature review followed by the development of an innovative digital tool. The global survey engaged 160 respondents across 37 countries, assessing their knowledge gaps and experience in recognising substance-related dental changes. Among the respondents, only 35.6% had formal education on this topic, and just 14.4% felt confident in their identification abilities, with a mere 8.12% accurately identifying conditions from image analysis tasks. The scoping review identified 24 studies published between 1980 and 2024, emphasising the forensic implications of substance-induced dental changes predominantly drug detection from teeth. A change in tooth colour was the most common hard tissue alteration, with minimal images depicting dental variations that aid forensic casework. This research highlights the forensic significance of teeth as a durable matrix and a resource for continuous education. The key outcome is a web-based 3D educational tool, designed to assist healthcare and forensic professionals worldwide in identifying substance exposure patterns, enhancing public health responses to substance misuse. Teeth remain a promising non-invasive biological matrix in biomedical analysis for both clinical and forensic purposes.

The Distinctive Injury Patterns of the Italian “Fourth Mafia”: A Retrospective Analysis on Crime Scene Investigations and Autopsy Records of Homicide 15:30 - 15:45

A. Procaccino[1], L. Cipolloni[2], S. De Simone[3], D. Curtotti[4], W. Nocerino[5]

[1]University of Foggia, social sciences, foggia, Italy, [2]University of Foggia, Medicine, Foggia, Italy, [3]University of Foggia, Medicine, foggia, Italy, [4] University of Foggia, Law, Foggia, Italy, [5]University of Foggia, Social Science, Foggia, Italy

Abstract Body: The Italian Mafia encompasses various criminal organizations that engage in violent and intimidating activities. besides Cosa Nostra, Ndrangheta and the Camorra, there is this the so called Fourth Mafia, on wich this study focuses. This Mafia is primarily active in three areas within the Foggia province: Foggia city, the Gargano, and Cerignola town. In contrast to other criminal organizations, “Fourth Mafia” has been linked to numerous homicides characterized by distinctive levels of violence towards the victims. We analyzed the specific injuries inflicted by the Foggia Mafia in comparison to those inflicted by other criminal organizations. We conducted retrospective analysis on crime scene investigations and autopsy records of homicide cases between January 2001 and December 2020. The study considered the victims; sex and age, the duration of survival until death, the location, environment, and method of the murder, as well as the anatomical distribution of injuries. From January 2001 to December 2020, 262 homicides were reported, with 84 attributed to the “Fourth Mafia”. The analysis of injury patterns reveals that the so-called “Fourth Mafia” is an aggressive criminal organization seeking to assert its presence to the world: murders are carried out with by skilled gunmen, often to disfigure the victim as a sign of disrespect, in some cases in front of witnesses or in public locations, as a demonstration of the group’s intimidating power. In conclusion, the study illustrates that the

Foggia Mafia, differing from other Mafia groups. The identification of distinctive injury patterns is crucial for investigating mafia-style homicides.

11: Marks, Impressions and Biometric Traces: Fingerprint Development
15:00 - 16:00 Wicklow Hall 2 (B)

Marks, Impressions and Biometric Traces: Fingerprint Development

Development of Conductive Fingermarks for Forensic Applications 15:00 - 15:15

L. Vera Stimpson[1]

[1]Canterbury Christ Church University, School of law, policing and social sciences, Canterbury, United Kingdom

Abstract Body: Biometrics, specifically fingerprint recognition, play a vital role in various aspects of daily life, from societal applications to criminal investigations. Fingerprint recognition, as a form of biometric identification, has gained significant importance in technology and biosecurity. Biometric sensors, particularly those utilizing fingerprint recognition systems, have gained widespread popularity in authenticating users in various daily applications including financial transactions, border security, and unlocking personal devices. However, this increased utilization has led to the emergence of methods aimed at circumventing these systems, commonly referred to as ‘presentation attacks’.
These attacks involve intentional alterations to fingerprint patterns or the use of artificial fingerprints (spoofs) with the aim of exploiting the registered user’s information or establishing a new identify on the device. Such attacks have been achieved utilizing cadaver fingers, 2D or 3D printed fingerprints, or gummy fingerprints created from materials like silicone, playdough, and gelatine. The success of these attacks has been found to be dependent upon various factors such as the quality of ridge detail captured during the molding process and the durability of the casting materials. Factors which have limited the application of these techniques in Forensic Science where the preservation of evidence is of vital importance. Research conducted by the authors aimed to address this gap. This paper presents an innovative approach for the non-destructive development, recovery and preservation of latent, patent and plastic fingermarks allowing for these to be used both as spoofs for biometric sensors as well as allowing ridge detail comparison for forensic examination purposes.

Exploring the Return Rate of Fingermark Development From Live Exhibits 15:15 - 15:30

C. Mullen[1], *B. Gaynor*[1]

[1]Forensic Science Ireland, Kildare, Ireland

Abstract Body: Fingerprint development laboratories accept and process a large variety of exhibits, ranging from plastics to paper, and firearms to knives. However, there is no guarantee that exhibits will develop a fingermark after they have been examined. The process of developing a mark can be affected by various factors including the amount of material deposited from a finger on the exhibit or the condition in which the exhibit

was found.

This paper summarises a study conducted at a national forensic laboratory, which is the sole recipient of all crime scene exhibits in the country. The study examined over 5600 exhibits which were processed in the laboratory for a six month period in 2021 and in 2024. Exhibits were tracked by exhibit type, the processes used, whether a mark was developed, and what crime was associated with the case. The return rate for mark development was determined, identifying what processes were more successful than others, as well as what exhibit types yielded more finger marks.

Ammunition (0%) and tools (7%) were the least successful exhibit types for mark development, while paper (30%) demonstrated higher levels of success. Of the processes, powders were poor at developing marks (2%), while Ninhydrin (23%) was the most effective method. Knowledge of the return rate of marks can help to inform laboratory protocols, such as process selection by exhibit type and the introduction of sampling policies. Drawing on this research, this paper discusses the implications of a data-driven approach to mark development for laboratory work.

Environmentally Conscious Latent Marks Development- Changes Made and Green Ground Gained 15:30 - 15:45

N. Ó Claonadh[1], O. Coughlin[1], A. Downes[1], I. Pascu[1], S. Doherty[1], B. Gaynor[1]

[1]Forensic Science Ireland, Fingerprint Section, Dublin, Ireland

Abstract Body: The Stockholm Convention on Persistent Organic Pollutants (POPs) recommended restrictions on the use of per- and polyfluoroalkyl substances (PFAS). Two PFAS solvents commonly utilised for the development of latent marks on porous substrate, HFE7100 and HFE701DE, are being phased out with manufacture ceasing in 2025.

The Fingermark Visualisation Laboratory at Forensic Science Ireland, has trialled, validated and subsequently introduced alternative solvents for the 1,2-indanedione/zinc and ninhydrin process . We have demonstrated that Promosolv DR3 and Precision V 3710, are suitable carrier solvents for these procedures. We have validated and externally accredited, in line with the IS017025 standard, the use of Promosolv DR3 for these techniques. Subsequently the use of DFO (1,8-Diazafluoren-9-one) has been discontinued, eliminating the need for PFAS with ozone depletion or high global warming potential in our laboratory.

The reduction of solvent use is ubiquitous in laboratory green initiatives. In order to further develop this initiative, we have also demonstrated that substituting ethanolic dyes with fluorescent powders or fluorescent cyanoacrylate mixtures can develop marks to an equivalent level of detail. These procedures have also been validated, externally accredited and are now in active use for casework.

Triton X-100, a component of powder suspension formulations, is deemed a substance of very high concern (SVHC) by the European Chemical Agency’s REACH regulation (Registration, Evaluation, Authorisation and Restriction of Chemicals). We envision the replacement with an alternative surfactant.

An Investigation Into the Effectiveness of Fingermark Development Techniques on Eco-Friendly Plastic Bags. 15:45 - 16:00

O. Akande[1], L. Gautam[1], K. Georgiou[2], P. Pugh[1], L. Ferguson[1]

[1]Anglia Ruskin University, Cambridge, United Kingdom, [2]University of West London, London, United Kingdom

Abstract Body: In the UK, the shift towards eco-friendly plastic bags, such as compostable, biodegradable, and 100% recycled types, has raised concerns about their impact on forensic investigations, particularly fingermark development. This study evaluated the effectiveness of techniques including cyanoacrylate fuming, basic yellow 40, and wet powder suspension on these substrates. Preliminary findings showed that cyanoacrylate fuming was the most effective across all bag types, with FTIR analysis identifying polyethylene in most bags, except compostable ones, which contained polylactic acid (PLA).
As these eco-friendly bags are designed to degrade more quickly in the environment than conventional (non-recycled) bags, it was important to investigate the influence of environmental conditions and ageing timelines. Chemometric tools such as Principal Component Analysis (PCA) were employed to analyse these effects. PCA scatter plots revealed patterns showing that environmental exposure alters the chemical composition of the bags. These changes are critical for understanding the degradation pathways and assessing the performance of fingermark development techniques on such surfaces over time.

03: Digital Evidence: Other
15:00 - 16:00 Liffey Meeting Room 2

Digital Evidence: Other

“Show Me Your Data Layers, and I Will Reconstruct Your Story” – Applications of Stratigraphy in Digital Forensic Investigations. 15:00 - 15:15

C. Vanini[1], T. Bollé[2], T.R. Souvignet[1]

[1]University of Lausanne, École des Sciences Criminelles, Lausanne, Switzerland, [2]Université du Québec à Trois-Rivières, Québec, Canada

Abstract Body: In the 2020 World Anti-Doping Agency (WADA) v. Russian Anti-Doping Agency (RUSADA) case, WADA’s independent forensic experts investigated a laboratory forum message database, believed to contain incriminating exchanges between two former employees. During the investigation, they discovered several discrepancies in the sequential order of message entry identifiers (IDs) when messages were sorted by their creation timestamps. For example, message 309 appeared to have been created after message 310, raising concerns about the reliability of said timestamps and IDs. This observation motivated a deeper analysis of the database using *digital stratigraphy*. Inspired by archaeological stratigraphy, digital stratigraphy is a method for reconstructing historical events on digital devices by examining the “layers” of data stored systematically. It operates on the principle that data – such as messages in a database – is stored according to predefined allocation rules. Just as archaeologists

interpret the layering of sediments and artifacts, digital investigators analyze these data structures using knowledge of these rules to reconstruct the ordering of events. This presentation describes the concept of stratigraphy within digital forensics and explores its application through examples, illustrating when and how it is most beneficial. While earlier research primarily focused on using digital stratigraphy to date file fragments lacking temporal metadata, this presentation explores its broader potential. For instance, digital stratigraphy can help interpret the causes of inconsistencies, provide contextual understanding surrounding a digital trace, or evaluate the proper functioning of a system during a relevant period.

Clarus Project: Building Clarity and Preventing Bias in Digital Forensic Examination, Interorganizational Communication and Interaction 15:15 - 15:30

A. Retzepi[1], *A. Valvis*[1]

[1]Center for Security Studies (KEMEA), Athens, Greece

Abstract Body: Digital crimes transcend geographical borders, yet the field of digital forensic examination lacks standardised terminology and practices. This fragmentation has led to sector-specific and country-specific methodologies which potentially make effective communication challenging and impacts on collaboration across borders. The Clarus project is addressing this challenge by developing a unified lexicon and a bias checking tool for digital forensic examination. Additionally, the project critically evaluates current forensic science procedures to assess the effectiveness of communication methods in investigations.
The project's ultimate goal is to enhance objectivity, neutrality, and fairness in the pursuit of justice, with a focus on complex cases such as terrorism and serious crimes exploiting digital technologies. This presentation will outline the methodologies used to assess existing practices and share initial findings. Key emphasis will be placed on the requirements for the lexicon and the bias-checking tool under development, as well as the training outputs being designed specifically for end users.
The Clarus project is a collaborative effort involving 12 partners, including academic research institutions, forensic agencies and police agencies from Greece, the United Kingdom, Norway, Finland, the Czech Republic, and Portugal. These partnerships ensure a multidisciplinary approach to tackling the challenges of digital forensic examination.

Chain-of-Custody and Chain-of-Evidence in Digital Forensics Using Trusted-Third-Party Timestamping and Explicit Visual Watermarking 15:30 - 15:45

P. De Smet[1], *L. Bonetto*[1]

[1]NICC/INCC, DIN, Brussels, Belgium

Abstract Body: This work presents an overview of the current state-of-the-art for various chain-of-custody (CoC) and chain-of-evidence (CoE) methods that have been proposed and/or used in digital forensics to accurately log

and track digital evidence processing. We discuss how to advance this field by applying a secured database and so-called trusted-third-party time stamping tools to act as a digital notary for confirming and securely archiving the data handling and processing history. As this approach applies cryptographically secure signatures it enables court-proof and guaranteed, verifiable bookkeeping on all evidence transactions that are logged. A discussion on querying and auditing of the CoC/CoE database is then presented. Finally, the proposed approach is extended and complemented by a framework which allows for adding explicit visual watermarks to forensic analysis results such as audio, image, video and text documents or reports. These watermarks apply 2D QR codes which allow for independent verification of the authenticity of the watermarked files so that their origin and tamper-free nature can also be guaranteed.

The NRGD: A New Division of Digital Forensics 15:45 - 16:00

H. Hoitzing[1], *N. Laan*[1]

[1]NRGD, Utrecht, Netherlands

Abstract Body: Digital forensic experts play a critical role in modern criminal investigations, analyzing electronic evidence such as data from computers, mobile devices, and networks. However, both hardware and software technology evolves rapidly and the demands placed on these experts change constantly and grow more complex. The Standards the Netherlands Register of Court Experts (NRGD) set for this field seven years ago are now outdated. These Standards made a division of six sub-fields within Digital Forensics.

To ensure that expert contributions remain reliable and legally robust, it is essential to adapt existing standards to meet future challenges. The NRGD is revising its Standards for Digital Forensics to create a future-proof framework. Through collaboration with legal professionals, technical specialists, and academic stakeholders, the NRGD seeks to provide a robust foundation for evaluating digital forensic expertise.

This revision aims to better reflect the dynamic nature of digital evidence and the growing specialization within the field. The updated Standards will focus on clearly defining expertise areas, enhancing methodological rigor, and ensuring that experts can effectively communicate their findings in judicial contexts.

The NRGD is currently investigating a possible new division, in which the area of Digital Forensics is split into three phases: Data Collection, Data Examination and Data Analysis. This is based upon a NIST-publication, which demarcates the different phases based on the forensic expertise required.

During this presentation we will talk about our investigation, our findings so far and our plan for the future.

06: Education and Training: Academic Courses
15:00 - 16:00 Liffey Meeting Room 3

Education and Training: Academic Courses

Why Teach Crime Scene Management to Forensic University Students? 15:00 - 15:15

F. Crispino[1,2]

[1]Université du Québec à Trois-Rivières, Biochemistry, chemistry, physics and forensic science, Trois-Rivières (QC), Canada, [2]Forensic Science Research Group, Biochemistry, chemistry, physics and forensic science, TROIS-RIVIERES (QC), Canada

Abstract Body: Despite enhanced forensic collaborations between law enforcement agencies and universities, crime scene management remains, at least in Quebec, a domain seen more as technical than scientific, largely carried out by sworn police officers qualified as scene of crime officers (SOCOs). Hence, forensic graduates are confined to specialized expertise fields in laboratories. Under such circumstances, why and how should academics provide a crime scene management dedicated course to such academic pupils who are not primarily intended to join crime scene units ? This presentation aims at explaining why such an academic course is still of high importance to develop soft skills, its rationale within its academic curriculum, its goal and its implementation, thanks building a brand-new forensic curriculum from scratch centered on the trace as the scientific subject of interest as carried by the Sydney Declaration. Challenges are still to be considered, but feedbacks from students who understood the objective of this course, which can't be qualifying crime scene officers, encourage such an approach.

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A Pyramidal Model for Integrating Digital Forensic Science into Forensic Education and Promoting Interdisciplinary Design 15:15 - 15:30

T.R. Souvignet[1], *O. Ribaux*[1], *Q. Rossy*[1]

[1]University of Lausanne (UNIL), School of Criminal Justice (ESC), Lausanne, Switzerland

Abstract Body: The Sydney Declaration (SD) offers a comprehensive framework for forensic science. It combines a definition centered on the concept of trace with seven principles guiding the search and logical treatment of traces in a large diversity of processes.

Following this framework, we propose a pyramidal visual model that display the components underlying the SD, from trace production to its analysis and use. Inspired by Charles Sanders Peirce's logical system, this model shows how digital forensic science can seamlessly integrate into the broader concept. Examples will demonstrate that, beyond considering the legal context, it stresses the importance of incorporating knowledge of

modus operandi into the interpretation process and underscores the crucial role of the trace in understanding crime mechanisms.

This presentation will introduce this model, which places the trace centrally, as a guide for designing the core of a forensic science curriculum. It helps select relevant aspects from fundamental disciplines (criminology, law, and scientific disciplines), opens new research avenues, and prepares individuals for interdisciplinary forensic work.

Cracking the Case: Development, Implementation, and Evaluation of the Online Serious Game 'Murder Mystery' for Forensic Education 15:30 - 15:45

B. Pierreux[1], B. Bekaert[2,3]

[1]National Institute of Criminalistics and Criminology (NICC), Brussels, Belgium, [2]KU Leuven, Forensic Biomedical Sciences, Department of Imaging & Pathology, Leuven, Belgium, [3]UZ Leuven, Laboratory of Forensic Genetics, Leuven, Belgium

Abstract Body: The increasing number of enrolments in the Master's programme in forensic biomedical sciences at the University of Leuven has led to a shortage of forensic internship placements for first-year Master's students, highlighting the need for alternative learning tools. This study presents the development, implementation, and evaluation of the serious game 'Murder Mystery' as a potential alternative. In this serious game, students, divided into five groups, are challenged to solve a fictional forensic case using the provided information and evidence. Over the course of five weeks, students work on their investigation, after which they report and present their findings. The study assessed the serious game's effectiveness and analysed the time spent by participants. Additionally, it examined whether gender had an impact on effectiveness and time allocation. Both quantitative and qualitative analyses were conducted. The results demonstrated that participation in 'Murder Mystery' led to a significant increase in knowledge. Furthermore, no gender-related advantages were observed in the game's effectiveness. These findings suggests that 'Murder Mystery' is a promising alternative to traditional forensic internships and contributes to the growing understanding of how serious games can enhance knowledge and skills in the forensic field. Building on the experience gained, there is consideration of developing a module aimed at the training of magistrates by the National Institute of Criminalistics and Criminology (NICC) in Belgium.

Delivering Inclusive Teaching of Sensitive Topics in Forensic Science 15:45 - 16:00

C. Mullen[1], S. Gallacher-Graham[2], H. Tidy[3], K. Hammond[2], H. Myles[2]

[1]University of the West of Scotland, School of Computing, Engineering and Physical Sciences, Paisley, United Kingdom, [2]University of the West of Scotland, School of Education and Social Sciences, Paisley, United Kingdom, [3]Teesside University, School of Health and Life Sciences, Middlesbrough, United Kingdom

Abstract Body: Teaching emotionally charged topics is vital in forensic science education to prepare students for the realities of casework. However, balancing these essential topics with student wellbeing presents a complex challenge for educators. Our team from the University of the West of Scotland and Teesside University conducted an educator survey to explore trauma-informed practices that support effective, inclusive teaching of sensitive content.
This presentation examines the politics and practices of teaching sensitive subjects in forensic science. We begin with an overview of common sensitive topics, progressing to introduce trauma-informed strategies that foster supportive learning environments and build emotional resilience in students. Drawing from our survey findings and best practices from related fields, we demonstrate how principles such as safety, choice, empowerment, collaboration, and trust can be integrated into forensic science education. These approaches help students engage more fully with challenging material, improving both academic success and emotional preparedness for their future careers.
Attendees will leave with actionable insights and practical strategies to create trauma-informed, inclusive learning spaces that support student engagement, retention, and wellbeing. By equipping educators with these tools, we aim to enhance student success and emotional readiness, ensuring they are well-prepared for the unique challenges of working in forensic science.

11: Marks, Impressions and Biometric Traces: Firearms and Tools
15:00 - 16:00 Liffey Meeting Room 4

Marks, Impressions and Biometric Traces: Firearms and Tools

Exploration of Striation-Based 3D Print Source Attribution 15:00 - 15:30

M. Clifton[1], T. Hanna[1], C. Devlin[1], M. Bolton[2], S. Chadwick[1]

[1]University of Technology Sydney, Centre for Forensic Science, Ultimo, Australia, [2]Australian Federal Police, Sydney, Australia

Abstract Body: Since their emergence in early 2010's, 3D printed firearms have developed in sophistication and functionality, with international police witnessing a steady growth in related criminal activity and seizures of components, whole 3D printed firearms and 3D printers over the last decade. Investigators have determined traditional firearm examination techniques are insufficient to facilitate source attribution of 3D printed firearms, instead requiring foundational research and adapted forensic methodologies that will better suit the novel toolmarks.
The current study aimed to bridge the gaps in the understanding of 3D print to printer relationships. Performing a comprehensive exploration into 3D printed items, identifying deposited toolmarks and examining their suitability to offer information to identify 3D printer brands as well as differentiate between individual 3D printers of the same make and model. Within the study five UltiMaker S5 printers were examined to establish features of interest, observing their presence and persistence between 3D printers of the same make and model, as well as varying Creality and Flashforge 3D printer brands.
The study identified drag marks from the printer nozzle as potential source attributors. The feature exhibited a strong potential to discriminate

between brands, models and the ability to individualise to specific UltiMaker S5 printers. The current study has narrowed the gap in our understanding regarding the presence of 3D printed toolmarks, successfully laying the foundations for the application of toolmarks in individualising to a 3D printer source.

Analysis of Features Produced by 3D Printers during the Production of Privately Made Firearms 15:30 - 15:45

D. Werner[1,2], S. Schaufelbühl[3], O. Delémont[3], S. Moret[4]

[1]University of Quebec at Trois-Rivières, Department of biochemistry, chemistry, physics and forensic science, Trois-Rivières, Canada, [2]Forensic Science Research Group (GRSF), Trois-Rivières, Canada, [3]University of Lausanne, School of Criminal Justice (ESC), Lausanne, Switzerland, [4] University of Derby, School of Science, Derby, United Kingdom

Abstract Body: 3D printing, or additive manufacturing, is a technology that is increasingly being exploited by criminals around the world to produce privately made firearms (PMFs), lock-picking tools, skimmers, and contraband drug concealment devices. In Canada, for instance, this is a worrying trend, as 20 % of firearms seized in criminal cases having been manufactured using this technology. The aim of this research was to investigate the feasibility of establishing a link between a 3D printer and a 3D-printed object, with a particular focus on the vertical marks (perpendicular to the print), which can be characterised as a « barcode » imprinted by the 3D printer on flat surfaces. These marks have been observed on 3D-printed firearm components and were studied to understand their genesis. It was observed that this « barcode » is dependent on the 3D printer itself, the polymer used, and the selected command file (G-Code), which holds the print job's instructions and all printing parameters, resulting in a physical signature that is contingent on these three elements. An automated visual comparison of object surfaces was developed to analyse the signatures left by different 3D printers, polymers, and printing parameters. The forensic analysis demonstrated that these marks are reproducible and can serve as distinguishing features for a comparative process linking a 3D-printed object to its source. Ongoing research aims to further evaluate the evidentiary value of this « barcode » in establishing a reliable connection between the 3D-printed object and the specific 3D printer used in its production.

Multidisciplinary Forensic Process for Examinations of 3D-Printed Firearms 15:45 - 16:00

J. Bengtsson[1]

[1]Swedish Police Authority, Swedish National Forensic Centre (NFC), Linköping, Sweden

Abstract Body: Swedish National Forensic Centre (NFC) has developed a multidisciplinary forensic process aimed at the examination of 3D printed firearms and related spare parts.

The process covers multiple workflows, and involves various forensic

disciplines and aspects; firearms, tool marks, photography, DNA, fingerprint, and digital forensics. Besides coverage of traditional digital forensics, the work also contributes with digital forensic aspects related to plastic filament based additive manufacturing, or 3D printing. However, this work is not limited to 3D printed firearm components; it is also applicable on various forensic analyses that involves questioned printers, objects, and printed waste materials.

Moreover, digital forensics and tool mark forensics combined may also conclude correlations between the print instructions in the semi-unique g-code files, and 3D printed objects and artefacts. This can be done with 1) any g-code simulator software, and 2) volume reconstruction of the 3D printed object from an industrial computer tomography (CT) scanner, or 3D CT scanner.

Here, 1) a g-code simulator visualises print instructions given in a g-code file that is created for the specific object and printer model, e.g. nozzle movement sequences, support structure, infill pattern, layers, filament thickness, wall thicknesses, and relative bed orientation, while 2) a non-invasive digital 3D CT volume reconstruction can further support or reject assumed correlations between g-code file information and a printed object.

This presentation will focus mainly on digital forensic aspects of forensic 3D print analysis, 3D CT scan imaging, and outcomes from the internal collaborations with the tool mark forensic expertise at NFC.

16:00 - 16:45 Auditorium

AFTERNOON COFFEE BREAK

04: DNA and Body Fluids: Kinship/Familial DNA
16:45 - 17:45 Auditorium

Familial DNA and Population Genetics

Familial Searches Carried out at the Swedish National Forensic Centre 2019-2024 16:45 - 17:00

C. Widén[1], *R. Ansell*[1,2]

[1]Swedish Police Authority, The Swedish National Forensic Centre, Linkoping, Sweden, [2]Linköping University, Department of Physics, Chemistry & Biology, Linkoping, Sweden

Abstract Body: DNA analyses and forensic DNA databases are, since many years, well established and successful tools used to identify criminals. Identifying a perpetrator via a close relative in law enforcement forensic DNA databases, using familial searches, is a slightly younger approach that has received a lot of attention following its first use in the United Kingdom in 2002. Since then, more countries have started to carry out familial searches in their law enforcement forensic DNA databases. In Sweden, familial searches were not possible until legal provisions were provided in 2019. More than 150 DNA profiles, left at different crime scenes by unknown perpetrators, have been searched. These DNA profiles have mainly been obtained from various serious crimes such as murder,

attempted murder, rape, arson and public dangerous devastation**.** Also, a few DNA profiles from serial crime cases of less violent nature, such as writing threatening letters, have been searched. The legal basis for familial searches in Sweden will be explained and discussed, as well as the familial search process. The outcome of the familial searches carried out in Sweden during 2019-2024 will be presented together with future perspectives.

Recent Advances in Identifying Distant Relatives Using Shared Genomic Segment Lengths 17:00 - 17:15

S. Cho[1], S. Lim[2], H.Y. Lee[1,2], S.D. Lee[1,2]

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Abstract Body: The need to identify distant relatives has grown with the increasing complexity of modern society. In forensic genetics, traditional methods have sought to address this by analyzing a larger number of STR loci and incorporating SNP markers. However, expanding the number of loci poses challenges for interpreting data in a classical statistical approach such as the likelihood ratio (LR), as it becomes increasingly difficult to validate the independence of each genetic marker – a key assumption in LR calculations.
As alternative and promising approach involves leveraging the lengths of shared genomic segments between individuals, rather than relying on allele frequency-based calculations. This concept has been long recognized for its potential but has not been widely adopted in practical applications. Building upon this idea, the authors developed a framework that distinguishes genetically related individuals from unrelated ones by defining threshold values for the *Index of Chromosomal Sharing (ICS)*, a key measure of this approach. In previous studies, this methodology was validated using the AxiomKORV1.1 array, tailored to the Korean population.
For broader applicability, further investigation is needed into factors such as the impact of SNP marker selected, and population-specific variations. This presentation will provide a comprehensive overview of the latest findings in the area, including the effects of key variables on threshold determination and the influence of SNP quality and quantity. By addressing these factors, the study aims to enhance the practical utility and accuracy of shared genomic segment length analysis in identifying distant relatives across diverse populations.

DNA Methylation Based Age Estimation Using Droplet Digital PCR- Every Droplet tells a story! 17:15 - 17:30

S. Tyagi[1], B. Nayak[2]

[1]Galgotias University, Greater Noida, Uttar Pradesh, India, Forensic Science, delhi, India, [2]AIIMS-Delhi, Gastroenterology, delhi, India

Abstract Body: In forensic science when traditional records are unavailable, age estimation using DNA methylation (DNAm) patterns can prove to be of potential help in narrowing down the number of individuals

involved in a crime scene. DNAm based age estimation is a method used to estimate an individual's age based on the epigenetic modifications with the help of various methods such as pyro sequencing. As the field of age estimation continues to evolve, Droplet Digital PCR (DDPCR) may play an important role for age estimation as age related biomarkers like ELOVL2 are discovered in Indian Population. DDPCR is known for its high precision and sensitivity in absolute quantification of targeted DNA sequences. Additionally, it can work with limited amount or degraded DNA samples, making it suitable for forensic applications. To measure the DNAm levels at the CpG sites of the ELOVL2 gene, we designed a duplex droplet digital PCR based experiment. The reference gene C-LESSC1 and the selected CpG sites of ELOVL2 gene were analyzed after bisulfite conversion of DNA samples obtained from peripheral blood of 100 healthy subjects (aged 25 to 65; 56 Females). Simple linear regression revealed a strong correlation between DNAm simultaneous captured from five CpG sites of ELOVL2 gene and chronological age (R = 0.56; P = 0.053). The obtained mean absolute deviation (MAD) between predicted and chronological ages was ±5.15 years. We describe a DDPCR based assay to assess DNAm in ELOVL2 gene as a biomarker of age for its potential use in forensic age prediction.

05: Drugs: Emerging Technology
16:45 - 17:45 Liffey Hall 1

Drugs: Emerging Technology

Go Big or Go Home – Spectroscopic Solutions to the Sampling of Large and Inhomogeneous Drug Seizures 16:45 - 17:00

S. Dunne[1]

[1]Swedish Police Authority, National Forensic Centre (NFC), Drug Analysis Unit, Linköping, Sweden

Abstract Body: As drug seizures become larger and more complex, a strain is placed upon sampling methodology where the balance between statistical accuracy and laboratory analysis capacity is often compromised. Chromatographic methods can be time-consuming and thus are not particularly well suited to seizures necessitating large sample sets. Spectroscopic techniques such as Raman and hyperspectral NIR have opened new doors to the non-destructive investigation of homogeneity within large seizures. NFC is currently working on hybrid strategies where spectroscopic homogeneity analysis is used to probe larger samples (or even entire seizures) on a scale not possible with TLC or GC-MS due to resource constraints. This spectroscopic probing facilitates the grouping of identical materials and thereby reduces the number of individual items which need to be submitted for confirmatory analysis with traditional chromatographic methods.

According to the SWGDRUG guidelines, two independent criteria are required for identification, which leaves spectroscopic methods one criteria short if unequivocal identification is the goal of the analysis. However, the application of chemometrics and machine learning techniques on spectroscopic data from illicit materials challenges the standard praxis of spectral matching against libraries generated from pure substances. Libraries based on composite spectra (containing features from all of the

sample´s components) facilitate the matching of individual spectra against populations of both reference materials and other characterized seized materials. This allows the procurement of additional metadata such as diluent type and purity, further enhancing the level of forensic intelligence which can be obtained from a single measurement.

Interlaboratory Studies to Support Implementation of Ambient Ionization Mass Spectrometry for Illicit Drug Screening 17:00 - 17:15

E. Sisco[1], *D. Leber*[1], *A. Moorthy*[2]

[1]National Institute of Standards and Technology, Gaithersburg, United States, [2]Trent University, Forensic Science, Peterborough, Canada

Abstract Body: Over the last decade, the need for tools to rapidly and comprehensively screen drug samples has become apparent due to higher case volumes and more complex, dynamic samples. One way labs may address this is to implement ambient ionization mass spectrometry (AI-MS) since it can provide near-instantaneous, comprehensive chemical information with minimal sample preparation. AI-MS does produce more complex spectra than traditional techniques due to lack of chromatographic separation and variability with sample introduction.

Due to its relative recent incorporation into seized drug workflows, and its inherently higher variability, little is known about the reproducibility of spectra and results across laboratories. To address this, a series of three interlaboratory studies have been conducted to better understand five questions:

1. What is the current state-of-the-art for AI-MS analysis in drug screening?
2. How reproducibility are AI-MS spectra of illicit drugs and drug mixtures analyzed by the same examiner, multiple examiners in the same laboratory, or across laboratories?
3. What implications does mass spectral variability have on the utility of centrally curated spectral libraries?
4. How reproducible is the competitive ionization phenomena across laboratories?
5. How are laboratories reporting AI-MS results and how consistent is reporting of identical data?

Initial results show that mass spectral variability across laboratories and methods is lower than was expected. In this presentation we will discuss the key results from each of the three studies as well as how these efforts could be used to develop documentary standards to support increased adoption of AI-MS in the field.

The Potential of Electrochemistry to Overcome Current Drug Screening Challenges 17:15 - 17:30

L. Dennany[1]

[1]University of Strathclyde, Department of Pure and Applied Chemistry, Glasgow, United Kingdom

Abstract Body: Within a forensic environment, the need for rapid, portable, sensitive and selective detection is one of the fore front challenges within current sensor development, particularly for emerging or new psychoactive drugs. Electrochemical approaches including electrochemiluminescence (ECL) offers a unique option to fulfil these demands.
ECL uses redox reactions to generate light at an electrode surface is gaining increasing attention for biosensor development due to its high sensitivity and excellent signal to noise ratio. Through modulation of the ECL luminophore and the energetics of the reaction, different luminophores can be used for the detection of multiple analytes for rapid and portable detection. Simple manipulation of pH's as well as multiplexed detection offer solutions to unique problems including mixed illicit drug samples. In addition, new data analytics can offer the ability to discriminate between multiple drugs in street samples and also between drugs and metabolites in toxicological samples.
Within this contribution, we report on the simple operations that can be utilized to examine and interpret electrochemical data so a single electrochemical system can be used for the screening of new psychoactive substances in street samples as well as within complex biological matrices for toxicological samples where current presumptive tests are limited. The real-world impact of these approaches will be elucidated through the comparison with more standard electrochemical and ECL materials as how these approaches might integrate into current investigative processes. The potential for multiple applications will also be examined within this contribution.

An Exploration of P-Type Metal Oxide Semiconductor Gas Sensors for the Detection of Security-Related Vapours 17:30 - 17:45

P. Tarttelin Hernandez[1], *I.P. Parkin*[2]

[1]University of Technology Sydney, Centre for Forensic Science, Sydney, Australia, [2]University College London, Chemistry, London, United Kingdom

Abstract Body: The sensitive, selective, and reliable detection of vapours relevant to the security field (e.g. illicit drugs, explosive materials and their associated precursors) with portable and inexpensive sensor technology remains a significant challenge. P-type metal oxide semiconductor gas sensors are an attractive alternative to more commonly used n-type semiconductors for vapour detection as they are reported to be more stable at lower operating temperatures - thus reducing power demands - and they are less susceptible to humidity interference. However, little is known on how the sensitivity and selectivity of Cr_2O_3-based sensors towards security-related gases can be improved through zeolite incorporation. In this study we exploit the high surface area and catalytic properties of zeolites with contrasting properties (H-Y, Na-A, H-ZSM-5) to assess whether superior sensor performance could be attained upon gas exposure. Sensors were fabricated through a screen-printing process, creating thick-film sensing materials on 3x3 mm alumina substrates. Physico-chemical characterisation techniques were performed on sensors to ensure fabrication did not affect the materials' crystalline structure and morphology. Vapours targeted are commonly used as inhalants or used in illicit drugs or explosives manufacture (e.g. toluene, acetone, ammonia) or

reported as lacing agents in alcohol (e.g. methanol). It was found that H-Y and Na-A-based sensors significantly improved the sensitive and selective detection capabilities of Cr_2O_3 towards toluene, and the H-ZSM-5-based sensor was a great candidate for amphetamine detection in methanol. These results are encouraging for the practical application of zeolite-modified p-type semiconductor sensors for the detection of illegal drugs or precursor substances.

02: Chemistry: Flammables
16:45 - 17:30 Wicklow Hall 1

Chemistry: Flammables

Supporting Fire Debris Analysis with Machine Learning for Detecting Ignitable Liquid Residues: Initial Insights 16:45 - 17:00

K. Buffaz[1], *O. Delémont*[1]

[1]Université de Lausanne - Ecole des Sciences Criminelles, Lausanne, Switzerland

Abstract Body: Determining whether a fire is deliberate often hinges on detecting and identifying ignitable liquid residues in debris collected from the fire scene. Traditional fire debris analysis workflows involve extraction techniques followed by GC-MS analysis, producing complex chemical profiles whose interpretation relies heavily on the strategies and expertise of trained forensic analysts.

Although multivariate data analysis and, more recently, Machine Learning (ML) applications have shown promise in aiding result interpretation, most research initiatives have concentrated on classifying ignitable liquids into categories, typically aligned with ASTM classification schemes. This focus overlooks the more fundamental and challenging question: is an ignitable liquid residue present?

This doctoral research addresses this gap by shifting the ML focus toward detecting ignitable liquids, a task with greater practical relevance for forensic investigations. The study leverages an extensive dataset encompassing over 20 years of casework analyses conducted in our laboratory under varied operational conditions and using diverse instrumentation. By relying on authentic case data, this approach minimizes biases introduced by artificial data augmentation and captures the true variability encountered in real-world forensic contexts.

The presentation will outline the research methodology; discuss challenges related to real-world datasets, and present initial findings. These insights underscore the potential for integrating ML into forensic fire debris analysis, offering enhanced reliability, efficiency, and decision support for forensic fire debris analysts.

Optimization of Sample Preparation Methods for Forensic Fire Debris Analysis 17:00 - 17:15

B. Capistran[1], *M. Gregg*[2], *E. Sisco*[1]

[1]National Institute of Standards and Technology, Surface and Trace

Chemical Analysis Group, Gaithersburg, MD, United States, [2]National Institute of Standards and Technology, Applied and Computational Statistics Group, Boulder, CO, United States

Abstract Body: Following submission to a forensic laboratory, fire debris samples are often prepared according to one of several ASTM sample preparation methods and analyzed by gas chromatography-mass spectrometry. Currently, five active preparation methods are available for analysts to choose from, four of which are headspace-based. To better inform decision-making and better understand the full capabilities and limitations of these methods relative to one another, a quantitative comparison is warranted. However, many methods list wide ranges of settings for analytical parameters (*e.g.*, oven temperature, extraction volume). An important first step is to understand the effects, if any, that changes in these settings could have on the resulting extract. Due to the inherent variability of headspace samples, this need is especially critical for the headspace preparation methods.

This work presents an optimization of the four headspace ASTM sample preparation methods (E1388, E3189, E1413, E1412) to understand what parameters, if any, significantly affect extraction, and the optimal settings for these parameters. Each method was performed according to an experimental design and a uniform test mixture. The results were assessed in terms of compounds detected, compound abundance, and degree of preferential adsorption. Preliminary results indicate that responses are proportional to oven temperature and inversely proportional to heating time. Additionally, extraction volume significantly affects responses for some methods, particularly E1388 (static headspace). Overall, these results can be used to better inform analysts when choosing parameter settings for a given method. Ultimately, the optimized parameters determined in this work will be used to quantitatively compare these methods.

Investigating the Potential Contribution of Emollients in Fire Fatalities 17:15 - 17:30

G. Shajan[1], *S. Hall*[1], *K. Farrugia*[1]

[1]De Montfort University, Leicester, United Kingdom

Abstract Body: The risk of increased fabric flammability when contaminated with dried emollients lacks worldwide awareness despite the prevalent use of emollients for skin conditions. Between 2015 and 2022, 78 fire related deaths and 6 serious incidents, where emollients contributed to the fire development were reported. Individuals with limited mobility are at higher risk due to slower reaction times to accidental ignition of fabrics like clothing and bedding. Therefore, the fire behaviour and the removal of emollient residues from fabrics has been investigated with the development of a novel detection method for emollient residues, aiding fire investigation.

Previous research has indicated an increased flammability with cotton contaminated with a common cream and lotion. However, the continuous innovation in emollient formulation and flame-retardant materials raises

questions on how the flammability is affected.

This research utilises vertical flammability test using both direct and indirect ignition to investigate these risks across 5 different fabrics, including flame-retardant materials for the first time, and 17 different emollients.
The effectiveness of a typical domestic laundry procedure was investigated (using 3 wash temperatures) on emollient removal effectiveness with persistence analysed using FTIR and RAMAN spectroscopy with subsequent flammability tests.
Presently, there is no standard procedure for emollient identification at fire scenes. Investigators employ visual approaches to establish presence of an emollient. The development of a novel analytical method thereby provides a stronger scientific link to fire contribution.
While emollients are essential for managing skin conditions, effective communication of fire risk and safer use is crucial to prevent fatalities.

11: Marks, Impressions and Biometric Traces: Fingerprint Development
16:45 - 17:30 Wicklow Hall 2 (B)

Marks, Impressions and Biometric Traces: Fingerprint Development

Illuminating the Unseen: The Use of UV-C Imaging for the Detection of Latent Fingermarks 16:45 - 17:00

K. Farrugia[1], W. Stoddart[1], P. Deacon[2], K. Georgiou[3], L. Nichols-Drew[1], K. Williamson[1], D. Rodriguez Alvarez[1]

[1]De Montfort University, Leicester, United Kingdom, [2]Independent Researcher, Dundee, United Kingdom, [3]University of West London, London, United Kingdom

Abstract Body: The use of UV radiation has been used in forensic science since the early 20th century for the analysis of various types of evidence, including the detection of latent fingermarks. Imaging and visualising evidence with UV (UV-C 100–280 nm; UV-B 280–315 nm; UV-A 315–400 nm) can take place by absorption, reflection or fluorescence to create a contrast with the background. A number of previous studies demonstrated that UV-C was the most effective wavelength range for the detection of latent fingermarks on various substrates. Nonetheless, the uptake of UV-C in forensic science has been limited due to health and safety concerns, its potential effects on DNA recovery and availability/cost of the technology required to image and capture the evidence.

Recent technology, such as the Full Spectrum Colour Imaging System (FSIS-II), allows for the imaging and capture of evidence from 254 nm up to 1100 nm and can capture a full handprint at 1000 PPI or smaller areas up to 4800 PPI. This research presents an assessment of the FSIS-II for the detection of latent fingermarks with UV-C on a variety of substrates such as aluminium cans and glossy papers. The use of UV-C was assessed before and after cyanoacrylate fuming by means of Phase 2 laboratory trials and Phase 3 pseudo-operational trials as recommended by the UK Home Office and the International Fingerprint Research Group.

Latent Fingerprint Enhancement by Ag Nanoparticle 17:00 - 17:15

Electrodeposition on Metal Surfaces

M. S. Alves[1], J. C.S. Melo[1], C. V. Costa[1], M. Ula[2], J. Tonholo[1], A. M.L. de Assis[1,3], A.R. Hillman[2], A. S. Ribeiro[1]

[1]Federal University of Alagoas, Maceió, Brazil, [2]University of Leicester, School of Chemistry, Leicester, United Kingdom, [3]National Institute of Criminalistics, Federal Police, Technical and Scientific Section of Alagoas, Maceió, Brazil

Abstract Body: Fingerprints are central to criminal investigations as the most common physical evidence for identification of an individual. However, visualising latent fingerprints is a challenge, particularly on metallic surfaces. In this work, silver nanoparticles (AgNPs) were deposited on fingermarked metal surfaces (stainless steel, copper, brass) by electrochemical reduction of silver ions in aqueous $AgNO_3$/KNO_3. This methodology permits a spatially selective AgNP deposition on the bare regions of the fingermarked surface, then producing an image “in negative”. The effectiveness of this methodology and the quality of the developed fingermark images were assessed by scanning electron microscopy (SEM), the UK Home Office grading system, automated forensic analysis software and a novel quantitative contrast evaluation methodology. The analysis of the developed fingerprint images showed that a finer level of spatial resolution (focusing on so-called second and third level detail) were readily recognised using forensic software. Together, these methods signal the power of AgNP deposition to reveal latent fingermarks and readily pick out the features within the ridge pattern (the “minutiae”) that are the basis of an identification according to internationally accepted criteria. Therefore, the images clearly permit identification of the ridge patterns and minutiae of the fingermark, even for aged samples and metallic substrates with complex background colour and/or texture, typified by cartridge cases, keys and coins. Based on the data presented, we propose that this methodology is useful for latent fingermark development on diverse metals by using a controllable, efficient and robust protocol, producing high fidelity images of quantifiable contrast.

Cleaner, Greener and Leaner - The Development of Latent Fingermarks Using a Solventless Amino Acid Technique 17:15 - 17:30

M. Needham[1,2], R. King[2], K. Farrugia[1], I. Harris[2], J. Able[1], A. Horvath[2]

[1]De Montfort University, Faculty of Health and Life Science, Leicester, United Kingdom, [2]West Technology Forensics, Research and Development, Bristol, United Kingdom

Abstract Body: Amino acid sensitive reagents, such as ninhydrin and 1,2-indandione, have served as dependable workhorses for the fingermark enhancement laboratory for several decades. Their effectiveness on porous evidence types remains unparalleled, with techniques having been refined over many years to provide well-established and trusted wet processes that rely on a solvent delivery mechanism to carry the chemical reagent(s) across latent residues. Carrier solvent selection has played a crucial role in research efforts and process optimisation, with HFE 7100 emerging as the preferred option.

HFE solvents have been under regulatory scrutiny for many years given their high Global Warming Potential (GWP) and PFAS (perfluoroalkyl and polyfluoroalkyl substances) categorisation. They have become increasingly more difficult to acquire and will soon be phased out from mainstream manufacture. A necessary and timely intervention is therefore required to facilitate seamless transition between wet (inaccessible) chemistry and an alternative delivery mechanism that mitigates the need for solvent application, whilst ensuring effective and reliable fingermark sensitivity and enhancement.
Herein, we report a novel vacuum-based approach for the effective deployment of amino acid sensitive reagents, using a turnkey, automated process. Phase 2 comparison study results are also presented and indicate the vacuum method is as effective as the wet process across all aging periods tested. Moreover, vacuum processing benefits from significantly less background staining and developed fingermarks appear to be more resistant to fading over time. The process is inexpensive, reduces the laboriousness and inconsistencies of solvent dissolution, dipping and drying, and is more amenable to subsequent DNA processing.

03: Digital Evidence: Other
16:45 - 17:45 Liffey Meeting Room 2

Digital Evidence: Other

Reconstructing Romance Scam Networks: The Role of Language Traces 16:45 - 17:00

C. Degeneve[1], *J. Longhi*[2], *Q. Rossy*[1]

[1]Université de Lausanne, Ecole des Sciences Criminelles, Lausanne, Switzerland, [2]CY Cergy Paris université, Cergy-Pontoise, France

Abstract Body: Can language traces help to reconstruct criminal networks involved in romance scams on the Internet? Utilizing a corpus of 180 cases consisting of instant messages exchanged between researchers at the Institute of Economic Crime Investigation (ILCE, Neuchâtel, Switzerland) and fraudsters (see Zbinden et al., 2023), we apply computational linguistics techniques to detect connections among scammers. The analysis of repeated text segments has revealed commonly used "template" sentences, suggesting that fraudsters may share these sentences via the Web. Identifying these template sentences aids in hypothesizing potential communication and coordination among fraudsters. Indeed, such templates appear in only a subset of cases, indicating that sub-groups of offenders may rely on shared scripts in their interactions with victims. A part of the remaining text segments mainly consists of “small talk,” which does not serve as a strong indicator of links between individuals. Google searches were made based uncategorized sentences, enabling us to locate online platforms where other templates are shared. From these platforms, further templates were then extracted to enhance the analysis of the detected links and infer distinct groups of scammers.

What If the Key Was in Timing? Timing and Power Glitch Attacks Applied on MultiMedia Cards 17:00 - 17:15

N. Hugget[1,2], *T. Heckmann*[3], *D. Naccache*[2]

[1]Gendarmerie Nationale, Pontoise, France, [2]Ecole Normal Supérieur PSL, Dépatement Informatique, Paris, France, [3]Laboratoire d'Innovation et de Recherche Appliquée de la Gendarmerie Nationale, Chaire de Recherche Humanités Numériques, Melun, France

Abstract Body: MultiMedia Cards, regardless of their packaging, have been used since the late 1990s to store data in embedded electronic systems. Examining the various standards governing these memory components, it is evident that they can be locked by passwords, making it theoretically impossible to extract the data they contain. A few years ago, during DEFCON, it was demonstrated that one of the oldest packaging of this component, the SD card, was vulnerable to a timing attack. With the evolution of formats and standards associated with these components, the question arises: are these attacks still effective today?

Leveraging the widespread availability of hardware attack vectors, we attempted to reproduce the original attack within a forensic context. In doing so, we ensured that the data remained unaltered and suitable for investigative purposes. We then extended these experiments to various chip formats (Micro-SD and eMMC) produced by different manufacturers to determine whether it was still possible to bypass the password.

This research demonstrates that methods from the field of hardware security can be effectively applied in digital forensics. Furthermore, it has led to the development of a process that adheres to the stringent requirements of digital forensics, ensuring the integrity of the digital devices under examination.

"Who Can Tell if You're Lying?-Acoustic and Linguistic Analysis of True and Deceptive Stories in Croatian Language" 17:15 - 17:30

S. Kuzmić[1], A. Ledić[1], I. Jerković[2]

[1]Forensic Science Centre "Ivan Vučetić", Zagreb, Croatia, [2]University of Split, University Department of Forensic Sciences,, Split, Croatia

Abstract Body: This study investigates the acoustic and linguistic features associated with deception by analyzing speech from the participants. Each participant narrates three stories: one fabricated, one truthful with a negative emotional tone, and one truthful with a positive emotional tone. The study aims to identify patterns in vocal and linguistic cues that distinguish deceptive speech from truthful speech across varying emotional contexts. Acoustic parameters such as pitch (fundamental frequency), intensity (loudness), speech rate, and pauses will be measured to detect potential vocal stress and cognitive load differences. Linguistic analysis will focus on sentence complexity, word choice, and the use of personal pronouns and affective language.
Preliminary hypotheses suggest that deceptive speech will exhibit increased pitch variability, reduced speech rate, and more frequent disfluencies compared to truthful speech. Additionally, stories with negative emotions may display unique vocal stress markers, while those with positive emotions may show increased fluency and fewer vocal markers of stress. Data will be analyzed using machine learning algorithms to

determine whether these features can reliably predict deception. This work aims to enhance our understanding of how emotional context influences deceptive speech and contribute to the development of more accurate, voice-based lie detection systems. The results are expected to provide insights into how emotional states modulate speech characteristics in both deceptive and truthful contexts, highlighting the interplay between emotional arousal and cognitive load during deceptive behavior.

Spread of Hate Speech in Social Networks: Concepts and New Approaches for the Determination of the Static and Dynamic Toxicity 17:30 - 17:45

F. Meyer[1], *M. Siegel*[2], *D. Labudde*[1]

[1]Hochschule Mittweida - University of Applied Sciences, Forensics, Mittweida, Germany, [2]Hochschule Darmstadt, Information Science, Darmstadt, Germany

Abstract Body: Hate speech and toxic harmful content on the internet continue to pose a serious threat to the free democratic exchange of ideas online. Although European legislation obliges digital platforms to act faster when it comes to reporting and deleting such content, the apparent number of posts does not decrease noticeably. On the contrary, targeted deletions of such posts make it more difficult to investigate the phenomenon of hate speech, as the data basis for investigating hate speech continues to decline. This dissertation project aims to highlight the current challenges in the study of hate speech in an academic context and to identify new possibilities for future research approaches outside of the already existing,
automated classification methods. The aim is to expand existing research techniques used to detect hate speech by examining the dissemination of it and defining concepts for its impact. To this end, the terminology of static and dynamic toxicity is introduced as a measure for evaluating hate comments. Furthermore, the current challenges in the study of hate speech are addressed. In general, new approaches to the study of hate speech are presented, which mainly focus on the dissemination of hate in a temporal and spatial context. To achieve this, the required data and challenges are defined.

Friday, May 30, 2025

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09:15 - 10:00 Auditorium

PLENARY SPEAKER 7

Plenary Talk 7 09:15 - 10:00

10:00 - 10:30 Auditorium

MORNING COFFEE BREAK

12: Scenes of Crime: Other

10:30 - 11:45 Liffey Hall 2

Scenes of Crime: Other

Exploring Key Stressors and Their Impact on the Wellbeing of Forensic Practitioners 10:30 - 10:45

N. Rashid Bedwi[1], *H. Earwaker*[1], *P. Smith*[1], *F. Wadie*[1]

[1]University of Portsmouth, Criminology and Criminology and Criminal Justice, Hampshire, United Kingdom

Abstract Body: Workplace stress has emerged as a critical issue within policing and forensic science, with a rise in mental health cases among professionals in this field. Research has shown that stress is multifaceted and can affect an individual both psychologically and physically, and can also be impactful at an organisation level in relation to performance and staff retention. In the forensic science sector, this issue has become particularly pronounced, given the change in the forensic science landscape, such as the global move toward mandatory accreditation, austerity measures, changing crime patterns, and an increasing number of women entering the field. These factors have placed additional pressure on forensic practitioners, potentially exacerbating stress levels. However, previous studies have predominantly focused on police officers and other first responder roles, with limited attention paid to forensic science practitioners working in scientific support services within forces in England. This study explored the key causes of stress among forensic practitioners and the impact of specific stressors on their mental and overall well-being. Utilising an explorative mixed methods approach of a survey and interviews, the research combined both quantitative and qualitative data analysis. The findings highlight key stressors and offer a deeper understanding of the personal experiences of forensic practitioners, particularly regarding the pressures of accreditation and the challenges of shift work, and how these factors affect their overall wellbeing. These finings are presented alongside interdisciplinary recommendations for strategies and approaches to improve the wellbeing of forensic practitioners.

The Decision-Making Process of Crime Scene Investigation From Scene Attendance to On-Site Traces Collection: Process Analysis, 10:45 - 11:00

Traces Utility, and Contribution in the Judicial Process

J. Divoy[1], *I. Lemans*[1], *S. Bitzer*[1]

[1]UCLouvain, School of Criminology, Louvain-la-Neuve, Belgium

Abstract Body: In the context of the intervention at the scene of a crime, crime scene investigators (CSIs) are expected to deliver quick and useful results with limited resources (time and money). Forensic science is strongly affected by these constraints, as it often entails costly and (sometimes) time-consuming analysis steps. The reasoning at the crime scene for the search, detection, collection and analysis of traces is rarely explicit, and scarcely studied. As initial step in the criminal justice process, it is however of utmost importance for the production of evidence for court.

By analyzing relevant literature through a systematic review, this study aims at examining the different steps of crime scene examination (intervention request, attendance, examination, traces identification, triaging, selection and collection) and the different factors and policies that have relevant impact on this process. Furthermore, the reasoning scheme, the hypothetico-deductive reasoning model, will be assessed in order to examine the use and understanding of the utility dimensions of forensic science by CSIs when processing a crime scene. Through a case study of judicial decision and cases, based on corpus from 2021 to 2023 where forensic analysis was requested or supplied, the reasoning and traces' contribution to case processing through the judicial process will be evaluated.

This research aims to provide a deeper understanding of the reasoning and decision-making processes at crime scenes, highlighting their critical role in shaping the effectiveness of forensic contributions throughout the judicial process.

Flying Evidence: First Insights into the Forensic Investigation of DIY Drones 11:00 - 11:15

M. Schmidt[1], *A. Hoyer*[1], *K. Lohre*[1], *L. Hardi*[1], *A. Attenberger*[1]

[1]Central Office for Information Technology in the Security Sector, Research Unit Digital Forensics, Munich, Germany

Abstract Body: The market for Unmanned Aerial Vehicles (UAVs), better known as drones, has technologically evolved and grown. Due to the wide range of their potential applications, drones have become popular across various user groups from industry to hobbyists. This increasing use has been accompanied by accidents involving these devices, as well as the misuse of UAVs in criminal activities. Given the need to investigate such incidents, there has already been research in the field of drone forensics, but has mainly focussed on commercially available UAVs.
As a contrast to these commercial off-the-shelf drones, do-it-yourself (DIY) drones have emerged as well. Purchasable separate components or even 3D-printed components and a selection of different autopilots with open source firmware give users the freedom to assemble, program and configure customized drones according to their individual requirements.

This further extends the variability of the possible drone models to be analysed by investigators.
For our research we assembled several DIY drones with different components and autopilots. We then used these models to generate flight data and carry out forensic analysis. Our presentation will focus on the challenges as well as the opportunities that arise especially for the forensic investigation of DIY drones from the above-mentioned aspects.

Using the Microbiome to Locate the Origin of Soil Samples: How Stable Is It Over Time? 11:15 - 11:30

A. Hofsvang[1,2], E. Natås Hanssen[1], E. Jacques de Muinck[2], A.E. Fonneløp[1,2]

[1]Oslo University Hospital, Department of Forensic Sciences, Oslo, Norway, [2]Oslo University, Department of Biosciences, Oslo, Norway

Abstract Body: Using microbiomes in soil could be an accurate tool for determining where a suspect or an object has been. Soil microbiomes are very specific as the community composition of the bacteria is influenced by factors such as environment and geographic location. This suggests that soil microbiomes may serve as a reliable indicator of the origin location of soil samples.
One of the main challenges that needs investigation before this method can be implemented is that, unlike DNA profiles, the microbial signature of a location is not constant. An important aspect that needs investigation is therefore under which timeframes this method may be used.

This study explores how the microbiome at a location varies over time, within two weeks and over several months. We investigated this by collecting soil samples from 13 sites across the Oslo area once a week for two weeks. To investigate seasonal variations some sites were sampled in the summer in addition to the main sampling in the fall. The microbial composition in the samples was determined with amplicon sequencing of the ribosomal 16S gene. Differences in the microbiomes between locations was assessed, and it was showed that samples from the same site were similar. Machine learning was used to predict the origin of soil with 93% accuracy for samples taken within two weeks of each other and with 53% accuracy for samples taken months apart. For some locations the accuracy was 100%, while for others it was 0%, indicating that there is room for improvement.

DVI (Disaster Victim Identification) Processes and Structural Analysis in Türkiye 11:30 - 11:45

S. Kalfoglou[1], A.N. Algül[2], A.O. Elmas[3], E.H. Yükseloğlu[4], E. Kalfoglou[5]

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Abstract Body: Türkiye's geographical location and climate make it highly

susceptible to natural and human-induced disasters. Managing these crises requires a coordinated approach, led by the Disaster and Emergency Management Authority (AFAD) alongside public institutions, NGOs, and volunteers. A critical component of disaster response is Disaster Victim Identification (DVI), a task essential for both justice and healing when significant loss of life occurs.

DVI efforts in Türkiye rely on specialized teams like the Disaster Criminal Investigation (AKİ) units under the General Directorate of Security and the Council of Forensic Medicine (ATK). AFAD enhances these efforts through digital tools like the Türkiye Disaster Response Plan (TAMP) and the Disaster Decision Support Management System (AYDES), ensuring organized and efficient operations. Additionally, the Disaster Site Forensic Medical Intervention Team (AYATME), introduced by ATK, underscores the need for national standards. Supported by AKİ vehicles and mobile units, this structure facilitates rapid identification in disaster areas.

However, challenges persist. AYATME requires full operational capacity, infrastructure improvements are necessary, and inter-agency coordination must be strengthened. Addressing these gaps is vital for building faster, more effective victim identification processes, which not only fulfill forensic requirements but also aid communities in recovering and rebuilding after tragedies.

This study examines the current state of DVI in Türkiye, exploring inter-agency collaboration and the technical systems used while proposing practical solutions to enhance these critical efforts.

02: Chemistry: CBRN
10:30 - 12:00 Wicklow Hall 1

Chemistry: CBRN

Responding to CBRN Threats: Ukrainian Action Plan in War Condition 10:30 - 11:00

A. Svintsytskiy[1], *O. Agapova*[2]

[1]Scientific Research Center of Independent Forensic of the Ministry of Justice of Ukraine, Director, PhD, Kyiv, Ukraine, [2]Scientific Research Center of Independent Forensic of the Ministry of Justice of Ukraine, Doctor of Law, Scientific Secretary, Kyiv, Ukraine

Abstract Body: Strengthening international guarantees of nuclear safety and enabling an effective national response to such threats through independent, objective, and innovative expert support for pre-trial investigations of crimes related to CBRN threats is one of the key pathways to achieving justice for Ukraine.

In the context of the use of chemical weapons, asphyxiating or toxic gases, and other prohibited means of warfare, the urgent need arises for documenting these international crimes committed by Russia on Ukrainian territory. This hinders the investigation of crimes, the collection of evidence, and its submission to international organizations or institutions, primarily the OPCW.

However, in extraordinary circumstances, particularly in areas where weapons of mass destruction have been deployed, conducting procedural actions such as crime scene examinations and involving forensic specialists from investigative teams becomes highly challenging or nearly impossible. This hampers crime investigations, evidence collection, and submission to international bodies like the OPCW. Collecting forensic samples of chemical agents or the full spectrum of highly dangerous biological pathogens must occur immediately during or right after the deployment of such weapons to avoid the loss of their impactful properties.

Given that in cases involving the use of CBRN weapons, access to the scene of the incident may be restricted or pose risks to investigation participants, a rational solution is the involvement of military personnel who have undergone specialized training. Such personnel can participate in the procedural action of "crime scene examination" as specialists, ensuring the timely and safe collection of evidence.

Rapid On-Site Identification of Chemical Warfare Agents With Portable Near Infrared Spectroscopy (pNIR) Using a Customized 3D-Printed Liquid Cell 11:00 - 11:15

J.C de Koning[1,2], M.J van der Schans[1], S. Samanipour[2], G.I. Salentijn[3,4], G. Bon[5], A.C van Asten[2,6]

[1]TNO, CBRN Protection, Rijswijk, Netherlands, [2]University of Amsterdam, Van 't Hoff Institute for Molecular Sciences, Amsterdam, Netherlands, [3] Wageningen University & Research, Laboratory of Organic Chemistry, Wageningen, Netherlands, [4]Wageningen University & Research, Wageningen Food Safety Research, Wageningen, Netherlands, [5]University of Amsterdam, Faculteit der Natuurwetenschappen, Wiskunde en Informatica Technologie Centrum FNWI, Amsterdam, Netherlands, [6] Netherlands Center for Forensic Science and Medicine, Amsterdam, Netherlands

Abstract Body: Chemical warfare agents (CWAs) are very toxic chemicals, with deadly doses in the microgram per kilogram bodymass range. When dealing with such agents, fast and confident on-site detection is crucial to avoid exposure and to take the correct countermeasures immediately. Currently, spectroscopic techniques such as IR and Raman, or other portable techniques such as mass spectrometry (MS) and ion mobility spectrometry (IMS) are applied. Such methodology is facing limitations in on-site analysis, where instruments require a laboratory infrastructure to achieve good performance.

Near-Infrared (NIR) spectroscopy is rapid and portable and has shown to be a promising technique for homeland security-related tasks. Excellent results have been obtained in drugs and explosive analysis. NIR in these applications is performed in the diffuse reflectance mode. The limitation for CWAs is that most agents exist as clear liquids in their pure state, providing little to no diffuse reflectance. In this study, a low cost, 3D printed liquid NIR cell has been developed, allowing the measurement of extremely dangerous chemicals in a safe and reliable way. This liquid cell has been applied to different classes of chemical warfare agents. Our work shows

excellent chemical selectivity for NIR-based identification of CWAs, demonstrating the added value of in-theatre use of pNIR.

Outclassing Emerging Threats with Emerging Technology 11:15 - 11:30

J. van auker[1], J. Kenneweg[1]

[1]908 Devices, BOSTON, United States

Abstract Body: The term “emerging threats” is used to define relatively new chemical substances such as fourth generation agents (FGAs) and pharmaceutical based agents (PBAs) which are extremely toxic at trace levels and have the capacity to be used for chemical attacks. Following the lethal use of an FGA in Salisbury, UK in 2018, the US Department of Health and Human Services published a safety awareness bulletin for on-scene responders about FGAs which noted that hazmat teams have limited detection capabilities for these substances. Indeed, their complexity requires an emerging detection approach which can identify an agent by name when needed to drive decon considerations (for FGAs) but also classify an agent by type when thousands of novel analogs can exist and evade a library-based approach (for PBAs). Learn how chemical agents have evolved since WWI into the FGAs and PBAs of today and how handheld mass spectrometry addresses the field detection problem using a combination of targeted libraries to identify threats by name and broader classification algorithms to detect threats which have been newly synthesized. Hands-on exercises will be conducted to illustrate scenarios such as trace residue detection on contaminated surfaces and post-event decon verification.

Laboratory Processing of Forensic Evidence Contaminated by Chemical and Biological Warfare Agents 11:30 - 11:45

A. Previero[1], K. De Meulenaere[1], I. Radgen-Morvant[2], B. Augustyns[1]

[1]Belgian Defence Laboratories, Vilvoorde (Peutie), Belgium, [2]University of Lausanne, School of Criminal Justice, Lausanne, Switzerland

Abstract Body: Following an incident involving chemical or biological agents, it is essential to examine forensic evidence to help identify those involved. However, the highly toxic nature of the contaminants prevents forensic laboratories from analysing contaminated items according to standard procedures. As for CBRN facilities, they are not equipped to perform traditional forensic analysis. To address this gap, the Belgian Defence Laboratories (DLD) are currently investigating two possible approaches to the forensic examination of chemical/biological contaminated exhibits. The first is to neutralise the hazardous agents on the object without compromising the integrity of forensic evidence. The decontaminated item could then undergo state-of-the-art processing in a forensic laboratory. The second is based on the modification and adaptation of forensic techniques for direct use in a specialised CBRN infrastructure. This would ensure safe handling and eliminate the risk of trace degradation caused by the decontamination phase. Fingerprints, DNA and digital traces are being investigated for their ability to provide valuable information for the identification of both perpetrators and victims. The

experiments are conducted at the Federal Orientation Laboratory of the DLD, which serves as the designated Belgian facility in charge of receiving CBRN-related samples, screening for CBRN agents and sorting items to the appropriate reference laboratories.

Verification of Exposure to Chlorine Gas Through Analysis of Selective Markers in Concrete 11:45 - 12:00

M. de Bruin-Hoegée[1], M. van der Schans[1], A. van Asten[2]

[1]TNO, CBRN Protection, Rijswijk, Netherlands, [2]University of Amsterdam, Amsterdam, Netherlands

Abstract Body: Chlorine gas has extensively been used as a chemical weapon in the World War I and it is still applied in modern war zones. After a release of this toxic chemical, confirming its use is difficult because of its reactivity and quick evaporation. Another challenge is the lack of unambiguous markers. Consequently, this study aims to use high resolution mass spectrometry together with machine learning methods to identify selective markers for chlorine gas exposure in concrete. Several types of concrete originating from the Middle East or Europe were exposed to household bleach, pool bleach, and concentrated sodium hypochlorite, and three different concentrations of chlorine gas. After the analysis of concrete samples with gas chromatography tandem mass spectrometry (GC-MS/MS) and liquid chromatography tandem mass spectrometry (LC-MS/MS), more than 150 chlorinated markers were tentatively identified. Distinct grouping of the samples exposed to chlorine gas or bleach was visible after applying principal component analysis (PCA) and linear discriminant analysis (LDA) models. For forensic classification, a Bayesian likelihood ratio (LR) model was implemented with limited rates of misleading evidence. Maximum LRs of 0.038 to 93 were obtained after correction for the limited sample size. Chloroacetone, dichloroacetone, tetrachlorophenol, and 5-chloro-8-quinolinol were identified as selective markers and their identity was verified in comparison with commercially available reference standards. To conclude, this study demonstrates the utility of chemical profiling in concrete to differentiate between various chlorinating agents to facilitate forensic investigations.

04: DNA and Body Fluids: Transfer, Persistence, Prevalence and Recovery
10:30 - 12:00 Wicklow Hall 2 (A)

DNA and Body Fluids: Transfer, Persistence, Prevalence and Recovery

The Persistence of Trace DNA: A Long-Term Study Investigating the Influence of Surface Type and Environmental Condition 10:30 - 10:45

H. Arsenault[1], A. Kuffel[1], P. Dugard[2], N. Nic Daeid[1], A. Gray[1]

[1]University of Dundee, Leverhulme Research Centre for Forensic Science (LRCFS), Dundee, United Kingdom, [2]University of Dundee, School of Humanities, Dundee, United Kingdom

Abstract Body: Forensic biologists require empirical data to help guide their expectations for potential outcomes from different evidence types

when prioritising exhibits for DNA analysis. The work presented here is a large-scale persistence project aimed at identifying trends in trace DNA persistence and identifying how different environmental conditions and surface characteristics influence persistence. Samples were collected and analysed from 15 different surfaces stored under three different environmental conditions over one year. Results of this study indicate that environmental conditions have a significant effect on DNA persistence more often on non-metals than on metals. Surface characteristics, however, seem to significantly affect DNA persistence. Our results show that cell-free DNA persists for longer than cellular DNA on metals and is highly dependent on the metal, persisting for up to one year on lead or as short as four hours on copper. On non-porous surfaces, cell-free DNA persists at higher levels for longer, but on porous surfaces, cellular DNA persists best. Additionally, lone deposits are favoured on non-metals and mixtures on metals. Regarding non-metal surfaces, variation was also found in DNA persistence among items within the same porosity category. DNA was found to persist for up to one year more often on non-metal surfaces. This study aimed at highlighting trends in DNA persistence, specifically to identify where trace DNA is likely to persist and for how long, which can help inform propositions at the activity level.

Human eDNA: Charting a New Frontier in Crime Scene Investigations 10:45 - 11:00

C. Fantinato[1], *P. Gill*[1], *A.E. Fonneløp*[1,2]

[1]Oslo University Hospital, Department of Forensic Sciences, Oslo, Norway, [2]University of Oslo, Centre for Ecological and Evolutionary Synthesis (CEES), Department of Biosciences, Oslo, Norway

Abstract Body: Environmental DNA (eDNA) – human DNA dispersed into the air, settled in dust, or transferred to surfaces – is a ubiquitous yet underexplored resource in forensic science. For the first time, we demonstrate how human eDNA can be used to reconstruct occupant history and detect intrusions, paving the way for novel forensic applications.
This pioneering study evaluates eDNA's potential in a simulated burglary scenario. Air, dust, and surface samples were collected from households under two conditions: immediately after regular occupants vacated and shortly following a simulated intrusion. Air samples were captured using the AirPrep ACD220 Electret filter sampler, while dust and surface samples were recovered using moistened cotton swabs from undisturbed areas (e.g., door ledges) and those interacted with during the intrusion (e.g., drawer handles). DNA results were analysed considering the identities of regular household occupants and the intruder, along with information about household occupancy history.
We have previously demonstrated detection of recent occupants by air sampling. Interestingly, our latest findings reveal the unprecedented capabilities of human eDNA: air samples detected intruders after interactions as brief as 15 minutes, surface samples contained mixtures of intruder and occupant DNA, and dust samples uncovered the long-term history of household occupants over months or even years.
Characterised as the "invisible witness", we have shown that human eDNA has the potential to be a novel investigative tool, capable of generating leads in cases where conventional biological traces are absent.

Decision Support Tool for Detection and Collection of Invisible Biological Traces. 11:00 - 11:15

M. Bastat[1,2], M. Récipon[1], S. Nozownik[3], J. Gibert[2], R. Agniel[1], F. Carreiras[1], O. Gallet[1], S. Hubac[2], V. Castella[3], S. Kellouche[1], J. Leroy-Dudal[1], C.R. Picot[1], F. Hermitte[2,1]

[1]Equipe de Recherche sur les Relations Matrice Extracellulaire-Cellules, ERRMECe, Team Matrice Extracellulaire et physiopathologie (MECuP), CY Cergy Paris Université., Neuville sur Oise, France, [2]Institut de Recherche Criminelle de la Gendarmerie Nationale, Pontoise, France, [3]Centre Universitaire Romand de Médecine Légale, Lausanne, Switzerland

Abstract Body: Collecting biological traces in criminal investigations is essential for genetic identification of individuals. Individuals transfer biological material onto substrates through skin contact leading to the creation of touch DNA. However, DNA analysis of these traces frequently fails to give exploitable genetic profiles. For example, in France, thousands of touch DNA are performed annually, but half fail to yield usable genetic profiles. One reason could be related to their invisible and undetectable nature making difficult for investigators to both detect and collect them. Second reason is due to the low amount and quality of DNA that is susceptible to be amplified. Thus, an “hypothetico-deductive” approach is carried to collect touch DNA at crime scenes. In this context, decision support systems could help in detecting biological markers to visualize touch DNA on substrates and prioritize swabs likely to contain biological material, thereby optimizing forensic investigations. Our previous studies have identified relevant cell-derived-fragment targets that persist on shedded corneocytes over two months in outdoor conditions, and are detectable by fluorescence-based techniques[1]. Nevertheless, the solely fluorescence could be insufficient if the support displays autofluorescence. In this study, we proposed a complementary colorimetric detection approach as a decision support tool to improve the detection and collection of biological material from touch DNA. Especially, we demonstrate that the colorimetric approach allows detection of biological material from *in vitro* skin models or simulated traces deposits directly on substrates before the collection or/and on swab after the collect. It also helps to prioritize swabs for genetic analysis.

DNA: The Unseen Trail on Everyday Items 11:15 - 11:30

G.E. Meakin[1], A. Kidd-Smith[1], J. Raymond[2]

[1]University of Technology Sydney, Centre for Forensic Science, Broadway, Australia, [2]NSW Police Force, Forensic Evidence & Technical Services Command, Surry Hills, Australia

Abstract Body: Evaluation of DNA findings given activity level propositions requires not only consideration of the various transfer routes comprising those activities, but also the background DNA that might have been present on an item/surface of interest prior to the crime occurring. When using a Bayesian network to facilitate this evaluation, root nodes can be included for the probabilities of the presence of background DNA. Here, we present the results from tapelifting used everyday items and surfaces that

can be commonly encountered in casework. These include personal items (T-shirts, jackets, tote bags), residence items (pillowcases, hand towels, throw cushions) and vehicle surfaces (headrest, backrest, seat edge). For the residence items and vehicle surfaces, a 10cm x 10cm square of the centre of the surface was sampled. For the jackets and T-shirts, a 10cm length of the inner surface of the collar was sampled, and for each tote bag, a 10cm length of one handle was sampled. DNA was extracted from the tapelifts, and quantified and profiled, according to our jurisdiction's laboratory protocols. Reference DNA profiles from buccal swabs of the users were also obtained. DNA profiles from the items/surfaces were analysed for minimum number of contributors, and relative proportions of the user's DNA, providing insight into the types of DNA profiles that are present on such items/surfaces through everyday use. An initial dataset of frequencies of different DNA profile types is provided, which can contribute to informing assignment of probabilities for background DNA nodes in activity level evaluations.

Utility of Trace DNA for Investigative and Intelligence Purposes 11:30 - 11:45

R. Hoffmann[1], M. Morelato[1], G. Meakin[1], A. Sears[2], A. Nadort[2], J. Daubney[2], C. Roux[1]

[1]University of Technology Sydney, Centre of Forensic Science, Broadway, Australia, [2]New South Wales Police Force, Science & Research Unit | Forensic Evidence & Technical Services Command, Surry Hills, Australia

Abstract Body: The assessment and further improvement of forensic trace effectiveness has always been a key consideration. Trace DNA is not visible to the eye and specimens are collected based on where the scene examiner chooses, informed by their education, training and experience. Much research has focussed on improving the recovery of trace DNA. However, the *utility* of a profile (the added value to the investigation from the use of the trace) once recovered has often not been considered. The utility of profiles allows for another layer of information, which could increase our knowledge for trace selection and analysis.

This project aimed to investigate the utility of trace DNA by comparing profile recovery rates across exhibit and crime types to the utility of those profiles by analysing historical casework data (New South Wales Police Force, Australia). Recovered trace DNA profiles were categorised according to the value they added to investigations. Cold links from the profiles were also catalogued, where a person of interest was identified purely through the DNA profile and not through other investigative avenues.

Results show that items that have high profile recovery rates such as clothing, did not add value to investigations 59% of the time, whereas items with lower recovery rates such as weapons, added value to investigations 88% of the time. However, persons of interest were identified only through a trace DNA profile more frequently from clothing exhibits than weapons. Results from this study demonstrate how considerations of utility can improve exhibit targeting and increase investigative outcomes.

Leaving No Stone Unturned: Next-Generation DNA Decontamination for the Fingermark Enhancement Laboratory 11:45 - 12:00

R. King[1,2], K. Farrugia[3], U. Krzeminska Ahmadzai[3], K. Hussain[3]

[1]University of South Wales, Forensic Science, Pontypridd, United Kingdom, [2]West Technology Forensics, Research and Development, Bristol, United Kingdom, [3]De Montfort University, Faculty of Health and Life Science, Leicester, United Kingdom

Abstract Body:
Advances in forensic technologies since the turn of the century have significantly enhanced trace evidence detection and identification. Modern methods for latent fingermark enhancement and DNA processing are now highly sensitive and extremely effective, serving as essential tools worldwide. However, increased sensitivity necessitates strict procedures to prevent cross-contamination, especially given the critical role of DNA evidence in forensic casework.
In fingermark enhancement laboratories, two main DNA decontamination methods are used to keep instruments 'DNA-clean' between processing cycles: chemical cleaning and UVC irradiation. Both methods face challenges with irregular instrument surface topographies and non-removable hardware components. UVC decontamination is ineffective in shadowed areas due to its line-of-sight nature, while chemical cleaning requires meticulous manual effort without visible indicators of cleaned areas. Complex instrument parts, like those behind heating stages or between processing racks, are particularly hard to clean due to limited access.
This presentation introduces the innovative use of non-thermal plasma for degrading and decontaminating trace DNA sources within a forensic Vacuum Metal Deposition (VMD) chamber. The novel plasma method effectively decontaminates the entire working volume, overcoming both line-of-sight and distance from source limitations. As an automated, user-friendly process, plasma cleaning has the potential to revolutionise sequential processing capacity for forensic practitioners and reduce the risk of DNA cross-contamination during investigations.

11: Marks, Impressions and Biometric Traces: Fingerprint Development
10:30 - 12:00 Wicklow Hall 2 (B)

Marks, Impressions and Biometric Traces: Fingerprint Development

CS1.1 **Recent Developments in Artificial Fingermarks – How Far Can We Go Without Human Donors?** 10:30 - 11:00

R. Steiner[1], *A. Bécue*[1]

[1]University of Lausanne, École des Sciences Criminelles, Lausanne, Switzerland

Abstract Body: In recent years, there has been increasing interest in using artificial secretions to address the uncertainty caused by the inherent variability in fingermark residue composition. Intra- and inter-donor variability can result in significant differences in the composition and quality of deposited latent fingermarks, while the need for large numbers of donors and marks in research creates important logistical challenges.

Research has shown that synthetic secretions with known and controlled compositions, combined with reproducible deposition methods, offer significant potential in education, research, and quality control, while also reducing reliance on human donors. These approaches provide greater consistency in the latent material distributed to forensic science students or laboratories involved in collaborative exercises or proficiency tests. This presentation will explore recent advancements in artificial fingermarks developed at the École des Sciences Criminelles, University of Lausanne. Highlights include the use of modified inkjet printers to produce highly reproducible fingermarks and test strips for quality control applications, as well as the development of stamping techniques to deposit latent and bloody marks on a variety of porous and non-porous surfaces, enabling better control over the deposition. Ongoing work is also focusing on further optimizing artificial secretions to better mimic the chemical and physical properties of real residues for better reactivity with detection techniques. Practical applications will also be discussed, including the successful implementation of stamped bloody and latent marks in the 2023 and 2024 Collaborative Exercises of the ENFSI Fingerprint Working Group.

CS1.2 **Fluorophore Functionalized Hierarchically Structured Mesoporous Silica Nanoparticles as Novel Latent Fingerprint Development Agents** 11:00 - 11:15

N. Ross[1], L.F. Oliveira[2], L.V. da Silva[2], A. Sonsin[2], M. Alves[2], C. Costa[2], J.C. Melo[2], P. Wady[3], T. Zinn[3], E.J. Fonseca[2], T. do Nascimento[2], A.M. de Assis[2,4], A.R. Hillman[1], A. Santos Ribeiro[2], M. Navarro[5]

[1]University of Leicester, School of Chemistry, Leicester, United Kingdom, [2] Federal University of Alagoas, Campus A. C. Simões, Maceió, Brazil, [3] Diamond Light Source, Harwell Campus, Didcot, United Kingdom, [4]Technical and Scientific Section of Alagoas, Federal Police, Maceió, Brazil, [5]Federal University of Pernambuco, Recife, Brazil

Abstract Body: This presentation describes the use of a novel nanostructured fluorescent material for the visualisation of latent fingermarks on chemically diverse, and forensically relevant surfaces. The nanoparticles are fabricated by the functionalization of mesoporous silica (MCM-41) with chitosan (Ch) and a fluorophore. Chitosan is able to bind to the fingerprint lipid residues by both electrostatic and lipophilic interactions, while the fluorophore functionality provides visual contrast, optimized via selection of excitation and imaging wavelengths. The parent nanoparticle, functionalised with dansylglycine as the fluorophore (designated MCM-41@Ch@DnsGly) was applied as a latent fingerprint developer for marks on surfaces of diverse chemical composition (stainless steel, brass, glass, polymer), topography, optical characteristics, and spatially variant nature, typical of forensically challenging evidence. Further derivatives have explored to use of alternative fluorophores, exploiting their photophysical properties to provide improved sensitivity on certain optically challenging surfaces. Data will be presented for latent marks visualized on stainless steel (knives), brass cartridge cases, glass and polymer banknotes. Aspects of fingermark and nanoparticle characteristics on different length scales will be presented: macroscopic (millimetre) by high resolution photography, mesoscopic (micrometre) by SEM imaging, and nanoscopic (nanometre) by TEM imaging. Enhanced fingermark image quality, assessed using the UK Home Office scale and commercial forensic

software, indicates that this family of reagents holds significant promise for the investigation of violent and acquisitive crimes.

CS1.5 **Identifying an Alternative Solvent for Use in Indandione for Fingermark Development** 11:15 - 11:30

A. Pulker[1], *G. Cornell*[1], *L. Hussey*[1], *D. Cutler*[1]

[1]Defence Science and Technology Laboratory, Counterterrorism and Security, Salisbury, Porton Down, United Kingdom

Abstract Body: The supply of 3M's Novec™ HFE 7100 will be ceasing by the end of 2025 due to a decision by the manufacturer based on its detrimental environmental impact. Additionally, the family of substances that HFE 7100 falls into (per- and polyfluoroalkyl substances (PFAS)) are proposed for restriction under the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulation. These restrictions to supply could have a huge impact on fingermark visualisation capability in the United Kingdom as HFE 7100 is the carrier solvent in the main amino acid reagents recommended in the Fingermark Visualisation Manual for porous and semi-porous surfaces. The Defence Science and Technology Laboratory (Dstl) have identified chemically equivalent replacements for 3M's Novec™ HFE 7100 to provide a short-term resolution. Research into both flammable and non-flammable non-PFAS alternatives is also underway. Studies have been executed to contend with ink diffusion and the safe use of flammable solvents for the process. This presentation will outline the promising options being taken forward for further exploration.

CS1.3 **Non-Invasive Forensic Identification of Excavated Human Remains: Capturing Surface and Internal Fingerprints Using Optical Coherence Tomography** 11:30 - 11:45

L.S. Wilk[1], *T.N. Stölting*[2], *L. Klok*[3], *M.C.G. Aalders*[1]

[1]Amsterdam UMC, location University of Amsterdam, Biomedical Engineering & Physics, Amsterdam, Netherlands, [2]Landeskriminalamt Hamburg, Dactyloscopy and Identification of Persons, Hamburg, Germany, [3]Radboudumc, Nijmegen, Netherlands

Abstract Body: Unidentified human remains are frequently found in missing person cases, necessitating identification for forensic purposes and to inform the next of kin. Traditional postmortem fingerprinting methods depend on intact surface fingerprints, which are often compromised by decomposition. A viable alternative is to use internal fingerprints (a blueprint of the surface fingerprint located just below the epidermis) instead. This study assessed the utility of Optical Coherence Tomography (OCT) as a means to record internal fingerprints from excavated human fingers. Conducted at the Amsterdam human taphonomic test site, the investigation comprised two longitudinal studies and two in situ burial scenarios. Human fingers were buried, excavated, and scanned using OCT at various time intervals. Findings indicated that internal fingerprints could

be recorded up to 7 days longer than surface fingerprints, with a maximum of 10 days post-burial. These internal fingerprints provided higher minutiae counts, suitable for Automated Fingerprint Identification System (AFIS) searches. Additionally, in one case, fingerprints were successfully extracted after 13 weeks and 10 months of in situ burial. This demonstrates OCT's potential to enhance postmortem fingerprinting for identifying human remains in forensic investigations.

CS1.4 **Citric Acid and Urea Carbon Dots for Fingermark Development** 11:45 - 12:00

D. da Silva Carvalho[1,2], A.O. da Silva[3], A.S. Santos[4], M.H. Sousa[5], S.W. da Silva[4]

[1]University of Brasília, Institute of Biology, Brasília, Brazil, [2]Brazilian Federal Police, National Police Academy Education Board (DIREN-ANP), Brasília, Brazil, [3]University of Brasilia, Nanoscience Complex, Brasília, Brazil, [4] University of Brasília, Institute of Physics, Brasília, Brazil, [5]University of Brasília, Nanoscience Complex, Brasília, Brazil

Abstract Body: Carbon dots are organic nanomaterials less than 10 nm in size that can be produced from a variety of raw materials and synthesis routes. They are the youngest of the carbonaceous nanomaterials, which also include graphene, carbon nanotubes, carbon anions, nanodiamonds, and fullerenes. Since their first mention in the literature in 2004, CDs have attracted considerable interest in various fields, such as biological detection, drug delivery, photodynamic therapy, photocatalysis, and solar cells. In particular, due to their excellent electronic, biocompatibility, and optical properties, CDs have attracted increasing attention for applications related to fingermark development. Without the addition of organic solvents, a well-known microwave-assisted heating method was adapted to prepare CDs from citric acid and urea. The synthesis product was applied to fingermark development under the solution and powder approaches. The CD solution was preliminarily tested on glass (natural fingerprints, sebaceous fingerprints, and natural fingerprints developed with cyanoacrylate) and on paper (natural fingerprints), while the powder developers were preliminarily tested on glass (natural and sebaceous fingerprints). The absolute CAST scale was used to evaluate the quality of the obtained developments, and the optical properties of the CDs were investigated by UV-Vis and photoluminescence spectroscopy. Using inexpensive and readily available precursors, it was possible to synthesize CDs in a few minutes that easily adhered to fingermarks. Furthermore, the observed photoluminescence behavior and the obtained developments indicate the feasibility of the technique when compared to the standard operating routine.

03: Digital Evidence: Computer, Cybercrime, Malware and Database Forensics
10:30 - 12:00 Liffey Meeting Room 2

Digital Evidence: Computer, Cybercrime, Malware and Database Forensics

Exploring Relationships in Digital Forensic Traces: A Framework for Enhanced Analysis 10:30 - 10:45

H. Henseler[1,2], H. van Beek[3,2], L. Aronson[2], L.v. Rijn[2]

[1]University of Applied Sciences Leiden, Department of Computer Science,

Leiden, Netherlands, [2]Netherlands Forensic Institute, Hansken, The Hague, Netherlands, [3]Open University of the Netherlands, Faculty of Science, Heerlen, Netherlands

Abstract Body: The investigation of digital evidence often involves analyzing vast datasets of digital traces. Identifying relationships among these traces is critical for uncovering meaningful patterns, yet the classification and visualization of these relationships remain underexplored. This presentation introduces a novel framework for classifying and analyzing relationships within digital forensic traces, developed as part of ongoing research using the Hansken digital forensics platform.

We begin by defining digital traces and their properties, emphasizing the importance of relationships in forensic investigations. The proposed classification organizes trace relationships into distinct categories, including intrinsic, heuristic, and user-defined connections. Intrinsic relationships, such as parent-child links or email communication chains, arise directly from trace properties, while heuristic relationships, such as grouped traces or consecutive activities, require additional analysis or user input.

Using real-world examples, we demonstrate how these relationships can be systematically modeled and visualized, enhancing an investigator's ability to analyze complex evidence networks. The framework is grounded in practical use cases, such as email traffic patterns, shared locations, and cryptographic dependencies, and supports future development within the Hansken platform, including deeper graph analysis and visualization tools. This presentation highlights the potential of relationship-based analysis to improve the accuracy, efficiency, and depth of digital forensic investigations, offering insights into how structured frameworks and advanced tools can address the growing complexity of digital evidence.

Investigative Competition between Administrative and Criminal Authorities in the Italian Cybersecurity Protection System 10:45 - 11:00

G. Colaiacovo[1], F.N. Ricotta[2], A. Valenti[1]

[1]University of Foggia, Law, Foggia, Italy, [2]Consiglio Nazionale delle Ricerche, Istituto di informatica giudiziaria e sistemi giudiziari, Firenze, Italy

Abstract Body: The panel will analyze the dynamics of investigative competition between administrative and criminal authorities operating in the context of cybersecurity incidents, with particular attention to the Italian system of prevention and repression of "cybercrimes." In this field, the investigation conducted by the National Cybersecurity Agency (ACN), which must promptly intervene at the crime scene to quickly reconstruct the causes of the incident, restore the system, and prevent further security risks, coexists with the investigative activities of the Public Prosecutor, who must collect and secure evidence for criminal proceedings, aiming to provide elements usable in court. This investigative competition risks compromising criminal investigations, as strengthening the field of digital crime prevention, without adequate measures, may dangerously undermine the repressive function of the judicial process. However, the investigations by administrative authorities have become an essential tool

in the fight against cybercrime. Thus, legal experts are called to identify suitable solutions to overcome the impasse, finding ways that allow authorities involved in cyber investigations to operate concurrently without compromising each other's institutional objectives. One initial proposed solution is to apply the most innovative investigative protocols during security investigations, particularly those of Digital Forensic and Incident Response (DFIR). An alternative could be the introduction of institutional coordination mechanisms into the law, inspired by new mechanisms implemented in Italy in the field of civil aviation security investigations. These and other solutions to the impasse will be discussed during the meeting.

Forensic Analysis of AnyDesk: Artefacts, Challenges, and Investigative Techniques 11:00 - 11:15

R.D. Thantilage[1], *R. Genoe*[1]

[1]University College Dublin, UCD Centre for Cybersecurity and Cybercrime Investigation, Belfield, Dublin 4, Ireland

Abstract Body: Remote access applications, such as AnyDesk, are invaluable tools for legitimate remote administration but are increasingly exploited for malicious purposes, including unauthorised access, data exfiltration, financial fraud, and cybercrime. This study explores the forensic implications of AnyDesk, focusing on the digital artefacts it generates and their role in uncovering evidence during investigations. The study examines key forensic artefacts, including log files and network traces, which can reveal session details, remote connections, file transfer activities, and execution timelines. AnyDesk's primary log files, stored under %programdata%\AnyDesk\ and %appdata%\AnyDesk\, are analysed to extract remote client IDs, timestamps, and session metadata. Additionally, the research explores the correlation of these artefacts with operating system logs to reconstruct user activity and establish a comprehensive timeline of events.
Challenges such as log obfuscation, data integrity issues, and the brief nature of volatile data are addressed, with strategies proposed to mitigate these issues. This work contributes to the forensic community by providing a structured framework for investigating AnyDesk misuse, supporting legal proceedings, and improving digital investigative methodologies. The findings aim to aid forensic practitioners in navigating the complexities of remote access forensics, enhancing their ability to effectively identify and preserve critical evidence.

Cybersecurity Incident Management Using the Forensic Inference Model for Identity of Source 11:15 - 11:30

B. Lathoud[1], *D. Meuwly*[2]

[1]Luxembourg House of Cybersecurity, Cybersecurity Competence Center, Luxembourg, Luxembourg, [2]Netherland Forensic Institute, The Hague, Netherlands

Abstract Body: We will define cybersecurity, forensic science, incident and crisis, and explain how the forensic inference model for identity of

source can benefit cybersecurity incident and crisis management. We will describe the current cybersecurity model for “source attribution”, which is based on assigning categorical decisions or probabilities about the relevant hypotheses about the source, and explain its limits through two examples of cybersecurity incidents: TV5 monde (2015) and Olympic destroyer (2018). We will in particular highlight the limitations of this approach.
Then we will introduce the forensic inference model for identity of source, that is based on assigning diagnostic values to the relevant observations about the source, explain how this model can be applied to the cybersecurity incident and crisis management and use this inference model to revisit the two examples (TV5 monde and Olympic destroyer).
Finally we will argue that the forensic inference model used for the identity of source can be extended to the higher level forensic questions of reconstruction, that are also relevant in the cybersecurity domain. The reconstruction questions are defined in the forensic ISO 21043 standard on forensic science as focusing on activity (what), location (where), time (when) and timeline (in which order). We will also argue that other cybersecurity fields of applications such as prevention, monitoring, risk management can benefit from this model.

Fault Repair and Data Recovery of Damaged HDD: A Case Study from a Fire Incident 11:30 - 11:45

G. LILI[1], *J. XIANBO*[1], *K. YANRONG*[1], *Z. LU*[1], *W. BO*[1], *X. GUIDONG*[1]

[1]Institute of Forensic Science. P.R.C, Division of Digital Forensics, Beijing, China

Abstract Body: The repair and data recovery of damaged HDD remains a significant technical challenge in digital forensics. This study comes from a real fire case. The ramp for the HDD read-write head melted due to high temperatures and firmly adhered to the disk platter, causing the hard drive to fail, which became the main obstacle to data extraction. This paper aims to explore an effective method through experiments that can remove the attachment of the melted ramp without causing secondary damage to the platter, thereby achieving the goal of fault repair and data recovery.

First, the authors used infrared spectrometer to analyze the materials of the ramp, identify the material composition and examine any changes before and after melting under high temperatures. Then, by reviewing relevant literature, the authors identified an organic chemical solvent capable of dissolving the ramp and conducted dissolution experiments, confirming that the solvent could completely dissolve the melted ramp under heated conditions. Following this, based on experimental data, the authors performed soaking tests on a disk platter to ensure that the solvent, appropriate heating temperature, and heating time would not adversely affect the platter and its stored data. Finally, the authors conducted experiments on a simulated disk platter with the melted ramp attachment, completing the repair and data extraction process.

This series of experiments demonstrates the effectiveness and feasibility of this method and provides a valuable repair reference for similarly damaged hard drives extracted from fire scenes.

Reverse Engineering and Forensic Analysis of ASIC Cryptocurrency 11:45 - 12:00

Miners

T. Heckmann[1], *T.R. Souvignet*[2], *N. Hugget*[3,4], *F. Thomas-Brans*[4,1]

[1]Laboratoire d'Innovation et de Recherche Appliquée de la Gendarmerie Nationale, Chaire de Recherche Humanités Numériques, Melun, France, [2] Université des Sciences Criminelles, Lausanne, Switzerland, [3]École Normale Supérieure Ulm, Paris, France, [4]Gendarmerie nationale, Pontoise, France

Abstract Body: Cryptocurrency miners play a critical role in the decentralised economy, serving as the backbone for transaction validation and blockchain integrity. However, while the investigation of cryptocurrency transactions is well covered by the forensic examination of blockchains, the activities of miners remain unexplored. Through advanced forensic methodologies, this research aims to trace transactions executed by the miner, identify associated cryptocurrency accounts, and track their activity within the blockchain. In addition, efforts are directed at extracting cryptographic keys stored within the system, which can provide critical insight for legal and investigative purposes.

This work focuses on the reverse engineering and forensic analysis of cryptocurrency mining hardware associated with the Kaspa blockchain, which operates using the kHeavyHash algorithm. The primary objective is to dissect the system's architecture, retrieve data from non-volatile memory, and evaluate the legally actionable information that can be used in legal investigations.

The results of this analysis could establish a framework for understanding miner operations from a forensic perspective, providing blockchain investigators and law enforcement with valuable tools to combat illicit activity within the cryptocurrency ecosystem. In addition to the technical findings, we present an overview of the current cryptocurrency mining market on other blockchains, highlighting differences in miner architectures and forensic challenges. Future research will extend this work to other mining devices and blockchain technologies, with the aim of generalising the methodology and improving forensic capabilities in the rapidly evolving landscape of decentralised technologies.

06: Education and Training: Continuous professional development
10:30 - 11:30 Liffey Meeting Room 3

Education and Training: Continuous professional development

Teaching Forensic Science to Experts : A Study Case 10:30 - 10:45

P. Davadie[1]

[1]Inedix, Paris, France

Abstract Body: In the french Gendarmerie, the Pôle Judiciaire de la Gendarmerie Natioanle (PJGN) is composed of an analytical laboratory and a criminal intelligence unit. Since the Sydney declaration has been published, this unit has striven to implement it. Its implementation is seen as mandatory if PJGN wants to keep being in touch with the forensic

developments.
Consequently, it has been decided to teach forensic science to young experts recently assigned to PJGN. The aim of this tuition, performed with Université du Québec à Trois Rivières (UQTR, Canada), is to explain experts what forensic science is and how their own expertise is embedded in this science.
11 days have been dedicated to this course and about 20 people had been chosen to participate in it. The results have not been homogeneous, and if some people have been very interested, others did not notice the interest of this education program.
Hence, different lessons may be learned from this experience.
First, even if it is a classical one, every education program must be strongly supported by the hierarchy.
Second, the most interested people were those who already had an experience in an expertise, even if recently appointed to PJGN.
So, the conclusion may be counter intuitive: to be successful, it could be more fruitful teaching forensic science and Sydney declaration to confirmed experts than to the recently appointed experts.
But it is not so paradoxical: doing so, the aura of most confirmed experts will be useful to spread the Sydney declaration.

Advanced Training in Fire Investigation for Crime Scene Investigators 10:45 - 11:00

F. Jonsson[1]

[1]Swedish Police, NFC, Linkoping, Sweden

Abstract Body: **The Swedish police's crime scene investigators handle a wide range of crime scenes, with fire investigations being particularly common. Each year, approximately 1000 fire scene investigations are conducted. Determining the point of origin and cause of a fire is often challenging due to potential evidence destruction in a fire scene. While all forensic technicians receive basic training in fire scene investigations, there has been a recognized need for more advanced training for crime scene investigators across the Swedish police regions.**
To address this need, the National Forensic Center (NFC), in collaboration with Lund University, has developed a comprehensive training program that integrates both theoretical and practical components. This program aims to provide participants with an in-depth understanding of fire phenomena and various aspects of fire investigations. One of the key challenges is to establish a solid foundation in fire behavior for students who may not have a background in science.

The training program includes modules (for instance) on the use of electronic traces to aid fire investigators, in-depth sessions on the causes of fires, the identification of traces from burnt bodies, and collaboration with the fire brigade and other stakeholders.

This presentation will provide an overview of the training program, detailing its content, planning process, success factors, and lessons learned.

An Interdisciplinary Effort to Define Forensic Competence Requirements and Identify Shared Training Needs Within the Swedish Police Authority and Other Concerned 11:00 - 11:15

A. Nilsson[1], *M. Almén*[1], *O. Fagerström*[1], *K. Fagéus Bergh*[1]

[1]National forensic centre (NFC), Process and development, Linköping, Sweden

Abstract Body: The Swedish National Forensic Center (NFC) has initiated an effort to address the need for a holistic and interdisciplinary approach to outlining and defining the forensic competence within the Swedish Police Authority. This encompasses the whole process from the initial response by police officers, investigators, crime scene investigation, forensic experts, digital forensic experts, forensic laboratory work to legal practitioners in court proceedings. The ultimate goal is to create an overall view of the forensic workflow, enabling the identification of shared training needs as well as areas for forensic dialogue between initiators, performers and receivers of forensics. This will enable the development of modern educational packages with common basic training modules and shared platforms for digital information dissemination. In addition to the efficient use of resources allocated for education and communication this will facilitate and enhance collaboration by means of a common training foundation that fosters mutual understanding and further development when in place.

A Comprehensive Analysis of Postgraduate Theses on Forensic Document Examination in Turkey (1994-2024) 11:15 - 11:30

O. Simsek[1]

[1]Üsküdar University, Faculty of Engineering and Natural Sciences, Department of Chemical Engineering, Istanbul, Turkey

Abstract Body:

Forensic science education in Turkey began with the establishment of Istanbul University's Institute of Forensic Medicine in 1982, which admitted its first students in the 1986-1987 academic year. This marked a foundational step for forensic education and research, paving the way for further academic development in this field. Subsequently, various institutes were established at different times, supporting postgraduate studies and contributing to the advancement of forensic sciences in Turkey.

This study presents an analysis of 52 postgraduate theses specifically focused on forensic document examination, obtained from the National Thesis Centre of the Council of Higher Education. These theses, completed between 1994 and 2024, reflect the evolution of academic research in forensic document analysis. The primary topics explored in these theses include handwriting examination, changes in signatures over time, combating passport and identity fraud, and the methods used in forensic document examination.

The analysed theses consist of 71.2% utilising physical examination

methods, while 28.8% employed chemical methods. The research findings highlight the effectiveness of both physical and statistical examination techniques in combating document fraud, underscoring the importance of forensic document examination in the broader context of forensic sciences. This analysis demonstrates the diversity and depth of research conducted in forensic document examination and emphasises the critical role that these developed methodologies play in advancing the field of forensic science in Turkey. It also highlights the interdisciplinary nature of forensic document examination, encompassing aspects of chemistry, statistics, and law, which collectively contribute to the reliability and validity of forensic investigations.

11: Marks, Impressions and Biometric Traces: Friction Ridge Comparison and Identification
10:30 - 12:00 Liffey Meeting Room 4

Marks, Impressions and Biometric Traces: Friction Ridge Comparison and Identification

Use of Automated Algorithms to Assess the Quality of Fingermarks in a Detection Context: An Opportunity for a Methodological Shift? 10:30 - 11:00

B. Bonnaz[1], C. Champod[2], A. Bécue[1]

[1]École des Sciences Criminelles (School of Criminal Justice), University of Lausanne, Lausanne, Switzerland, [2]Université de la Lausanne, Lausanne, Switzerland

Abstract Body: Fingermark quality assessment counts among the critical steps forensic scientists must address when developing/improving detection techniques or when interpreting the results of a visualization collaborative exercise. Traditionally, such assessment is performed by human graders who are asked to assign a score to fingermarks by using a provided scale. This system has been in place for decades, mostly because it is straightforward and easy to setup. However, it suffers from several limitations: (i) graders are limited by their subjectivity and availability, (ii) fingermark sets are usually limited to avoid excessive workload, and (iii) grading scales may require several parameters to be considered at once (contrast, ridge clarity, background staining, etc) and be difficult to interpret properly.
We recently proposed an alternative to this approach: using the quality assessment algorithms of AFIS-like systems to provide quality scores on which forensic scientists in the detection field may rely to express conclusions. This approach offers several advantages over the conventional one: (i) each fingermark can be characterized by several scores/metrics, (ii) the reproducibility of the assessment process is improved, and (iii) large sets of fingermarks can be analysed in a timely manner. This contribution will be the opportunity to share with the community the results obtained with detection techniques for which a consensus does exist in the literature. We will also discuss about the application frame and the consequences for the field. If proven efficient, this approach could indeed result in a methodological shift in the way projects dealing with fingermark detection are designed.

Blatant Prints: Identifying Pictures and Videos of Hands 11:00 - 11:15

J. Sjöqvist[1]

[1]Swedish Police Authority, Swedish National Forensic Centre, Stockholm, Sweden

Abstract Body: Over the last few years, international collaborations between police forces have led to the infiltration of a number of encrypted chat services used by criminals. The chat logs made available to investigators contain a wealth of image and video material which can serve as valuable evidence if it can be tied to an individual. While criminals are often careful about hiding their faces, they don't show the same caution regarding their hands, frequently sending close-up pictures of themselves holding drugs, weapons and other things. With the increase in quality of mobile phone cameras, these pictures often capture the friction ridge skin of the hand in enough detail to make an identification possible.

These pictures and videos come with unique challenges compared to traditional latent prints, but also certain advantages. This presentation will go through these as well as explore other lessons learned by the fingerprint department of the National Forensic Centre of the Swedish police when dealing with such cases. Using examples, we will show what investigators should be looking for when sifting through digital evidence as well as what latent print examiners should keep in mind while performing the actual analysis of the images.

Strengthening the Fingerprint Training Program in the National Bureau of Investigation 11:15 - 11:30

I. Hourula[1]

[1]National Bureau of Investigation, Vantaa, Finland

Abstract Body: Fingerprint experts are trained in Finland only at the Forensic Laboratory which is located at the National Bureau of Investigation. Training is organized through a structured, module-based training program. The training program was created in 2011 to be equivalent to an academic program and is now being updated to respond to current challenges. The aim is to strengthen the scientific base of the program and improve its structure to ensure that the program is more effortlessly reproducible when necessary. At the same time the goal is to ensure that the training program stays adaptive to react to any needs and issues faced in the future. The purpose of the updated program is also to enable ten print experts' proficient transition to the fingermark training program and vice versa should the need arise. During the recruitment process emphasis is placed on sufficient visual perception skills and on the academic background of the new trainees to ensure they have the qualifications to work as a fingerprint expert and to participate in science-based development work in the future. The training program focuses on fingerprint comparison and includes only an overview of fingerprint visualization. In addition to a strong fingermark expertise, the training program aspires to deliver general knowledge of the history and ethical considerations of forensic sciences, generate an understanding of laboratory quality management systems as well as to offer tools for maintaining and developing the expertise of the trainee.

NIST Friction Ridge Image and Features Technology Evaluations 11:30 - 11:45

G. Fiumara[1]

[1]National Institute of Standards and Technology, Information Technology Laboratory, Gaithersburg, United States

Abstract Body: The National Institute of Standards and Technology (NIST) plays a crucial role in advancing the field of friction ridge verification and identification by continuously evaluating state-of-the-art algorithms through its Friction Ridge Image and Features Technology Evaluations (FRIF TE) program. This program now consolidates all NIST's key friction ridge evaluations, including the Evaluation of Latent Friction Ridge Technology (ELFT) and the Fingerprint Vendor Technology Evaluation (FpVTE). This presentation will highlight the latest results from FRIF TE participants, discuss recent changes to the evaluation methodology, and offer a preview of upcoming changes in the series. We will also examine common failure cases across algorithms to help you optimize the performance of your Automated Biometric Identification Systems (ABIS). Attendees will gain insight into the key performance metrics used in these evaluations—what they measure, how they are assessed, and why they matter—empowering you to navigate vendor claims and make informed decisions. Whether considering a new ABIS or analyzing existing system performance, understanding NIST’s FRIF TE results will provide a clearer picture of your algorithm’s true capabilities.

The Validation and Implementation of a New Automated Fingerprint Identification System in Forensic Science Ireland 11:45 - 12:00

K. Connick[1], *A. Power*[1], *A. Slevin*[1], *D. Daly*[1]

[1]Forensic Science Ireland, Fingerprints, Dublin, Ireland

Abstract Body:
The Automatic Fingerprint Identification System in Forensic Science Ireland (FSI) was upgraded in 2024. This marked the culmination of a three year long project by FSI in partnership with An Garda Síochána, Idemia and Accenture to upgrade the outdated legacy system. AFIS has been used to aid fingerprint examiners in Ireland since 2000, with the outgoing system, Idemia’s MorphoTrakBIS, in place since 2007.

This paper describes the validation of the new system MBIS to ensure all functions operated appropriately and in tandem with the fingerprint examiner and the FSI procedures under ISO 17025. As part of this validation both the 2007 system and 2024 system functions were functionally mapped and a ground truth fingerprint database created. The validation comprised of a comparison between the old and new systems and demonstrated that the new increased the chance of matching and returned true matching candidates higher in the respondent list than with Bistrak in all but one case in the validation.

The validation was performed on a non-live Operational Readiness Testing platform, custom built for the purpose of the validation and containing all migrated data of the legacy system. Following the validation a successful

external assessment was awarded by the Irish National Accreditation Board (INAB) extending the laboratory's scope to MBIS in May 2024.

As part of the validation, a post deployment longitudinal study was planned to ensure the thresholds set for both quality control and tenprint to tenprint matching were adequate. The data from this study is also described.

07: Forensic Management and Quality Systems: Other
10:30 - 11:45 EcoCem Room

Forensic Management and Quality Systems: Other

The Westminster Commission on Forensic Science: Findings and Recommendations. 10:30 - 11:00

C. McCartney[1], A. Gallop[2], S. Black[3]

[1]Leicester University, Law, Leicester, United Kingdom, [2]Stellar Forensic, Oxford, United Kingdom, [3]Oxford University, Oxford, United Kingdom

Abstract Body: In 2022, the All Party Parliamentary Group on Miscarriages of Justice (APPGMoJ) launched a review of forensic science in England and Wales in response to growing concerns about the frequency with which forensic science was being raised in discussions relating to miscarriages of justice. With the Conservative Government reneging on their commitment to a Royal Commission on Criminal Justice, the APPG asked two eminent forensic scientists, Prof Angela Gallop and Dame Prof Sue Black, to lead a group of lawyers, academic experts, forensic scientists and police, to interrogate the current status of forensic science in England and Wales, known as the Westminster Commission on Forensic Science. This paper will report on their 2025 report, detailing the extensive evidence gathering, and consequent findings and recommendations in relation to the delivery of forensic services, the reception of forensic evidence in court, and the status of research and national strategy. The paper will also consider the most recent government proposals for establishing a 'national centre' for forensic science in England and Wales.

Shaping Forensic Science: The Impact of the Sydney Declaration 11:00 - 11:15

C. Roux[1], R. Bucht[2], M.D. Miranda[3], L. Bugeja[4], O. Ribaux[5]

[1]University of Technology Sydney, Centre for Forensic Science, Broadway, Australia, [2]National Bureau of Investigation, Forensic Laboratory, Vantaa, Finland, [3]Farmingdale State College, SUNY, Center for Criminal Justice Studies, Farmingdale, United States, [4]Monash University, Department of Forensic Medicine, School of Public Health and Preventive Medicine, Southbank, Australia, [5]Université de Lausanne, Ecole des Sciences Criminelles, Lausanne, Switzerland

Abstract Body: The Sydney Declaration (SD) is a pivotal document stemming from years of international discussions aimed at defining forensic science and identifying its foundational principles through seven key tenets

(https://doi.org/10.1016/j.forsciint.2022.111182). Since its publication in 2022, the SD has been actively disseminated, discussed, and promoted globally. It is also the centerpiece of a special issue in Forensic Science International.

Rather than serving solely as an academic milestone, the SD was envisioned as a transformative framework for forensic science. To understand its initial impact, we investigated its reception and application within the forensic community. Our approach included a literature review, analysis of impact indicators (e.g., translation requests, adoption by groups within and outside traditional forensic fields), and a formal survey targeting forensic professionals. The survey aimed to (1) gather feedback on the SD's definition of forensic science and its principles, (2) evaluate its dissemination, and (3) identify its integration into education, training, and practice.

This presentation examines the results, highlighting the SD's growing influence, particularly its adoption by individuals outside the original discussions. These findings underscore the need for broader 'community ownership' to ensure the SD's long-term impact. By embedding its principles into everyday forensic science practices, education, and research, the SD can continue shaping the field in meaningful and lasting ways.

Forensic Intelligence and Its Uses, Perceptions, and Representations by Forensic Practitioners 11:15 - 11:30

N. Ballèvre[1], *O. Ribaux*[1], *B. Renard*[2]

[1]Université de Lausanne, Ecole des sciences criminelles, Lausanne, Switzerland, [2]Institut de criminalistique et de criminologie, Bruxelles, Belgium

Abstract Body: *Traces have been in use in investigations for decades, with mostly a reactive approach. Its end-use is mainly for supporting the decisions of tribunals. However, a community of scientists have been putting forward that the contribution of forensic science is broader. One of the components of this integrative approach is forensic intelligence (ForInt). To implement a functional ForInt system, forensic information needs to be analyzed to become actionable when disseminated to guide decision-making, requiring accuracy, timeliness and usefulness. Consequently, this brings the question of how, what, when and by whom this data is analyzed and to whom intelligence products are communicated. To make it possible, it is therefore necessary to understand how the various stakeholders, in particular forensic experts from the laboratory, view this issue in order to implement an operational process that cross the different components of the criminal justice system.*

This is the reason and focus of this study integrated into a broader project, Be-ForIntel of the National Institute of criminology and criminalistics (NICC). It aims to examine under what conditions and how forensic intelligence can be implemented in Belgium. This presentation will focus on the different outtakes from the interview of a dozen forensic experts addressing their representations and perceptions through their trust and understanding of the concept of forensic intelligence. Finally, the current practices of these

experts will be explored to understand the challenges they are facing and what solutions they see for them.

Operational Relevance of the Sydney Declaration: The Example of the Australian Federal Police (AFP) Forensics Command 11:30 - 11:45

E. Bruenisholz[1], K. Jones[1], S. Walsh[1], J. Bunford[1], F. Knott[1], A. Lam[1], M. Tahtouh[1], M. Taylor[1]

[1]Australian Federal Police, Forensics Command, Canberra, Australia

Abstract Body: In 2022, a group of eminent forensic scientists published The Sydney Declaration - Revisiting the essence of forensic science through its fundamental principles in Forensic Science International. The Sydney Declaration was delivered to revisit “the essence of forensic science, its purpose, and fundamental principles”. At its heart, revisiting these foundational principles is hoped to “benefit forensic science as a whole to be more relevant, effective and reliable”.
But can these principles be translated operationally by a forensic services provider to achieve the benefits prescribed? How do we make the leap from a theoretical concept and begin to put it into practice to bring about the real and meaningful change that the declaration hopes to achieve?
This presentation will discuss how the Australian Federal Police (AFP) Forensics Command has reflected on the Sydney Declaration by relating reforms developed and implemented to our operating model with some selected principles. We hope to show that while the Sydney Declaration could be perceived as academic and disconnected from operations, it has the potential to impact and positively influence reforms and changes for forensic science providers. The AFP Forensics Command experience shows the operational relevance of The Sydney Declaration.

09: Interpretation: Likelihood Ratios
10:30 - 12:00 Wicklow Meeting Room 3

Interpretation: Likelihood Ratios

Constructing Coherent Score-Based Likelihood Ratios that Account for Rarity 10:30 - 10:45

D. Ommen[1], N. Garton[2]

[1]Iowa State University, Department of Statistics, Ames, IA, United States, [2] General Atomics - Commonwealth Computer Research, Inc., Charlottesville, VA, United States

Abstract Body: Score-based likelihood ratios (SLRs) are the most practical alternative to feature-based likelihood ratios for the evaluation of the strength of forensic evidence. The construction of effective general score functions, however, has received little attention. Many scores are measures of dissimilarity between two pieces of evidence. However, it is not always obvious which two pieces of evidence should be compared. This leads to applications of score-based likelihood ratios that suffer from incoherence, e.g. when you change the order in which the hypotheses are considered and the resulting SLR value is different from what's expected. We will argue

that this legitimate problem with SLRs should not be characterized as a lack of coherence, but rather a subtlety relating to the choice of an appropriate score function. Specifically, we will show that the standard argument as to why SLRs are incoherent can be understood as the comparison of two SLRs based on different score functions. This line of thought then leads to natural questions about how to construct scores even in the presence of an agreed upon dissimilarity metric. For example, another common criticism of SLR approaches is that they do not account for the rarity of the features in a relevant background population. Towards this end, we consider building scores as an aggregation of many dissimilarity metrics and discuss potential relationships between these approaches and rarity. Furthermore, we demonstrate that the resulting SLRs are both coherent and superior to standard scores via simulations.

LLR-Overestimation: A Direct Way of Assessing LR-System Validity 10:45 - 11:00

L. van der Ham[1], *I. Alberink*[1]

[1]NFI, Evidence Evaluation & Statistics, The Hague, Netherlands

Abstract Body: With the growing amount of LR-systems being developed, focus is now also shifting towards standardisation of their development steps. An essential step is checking whether the calculated LRs actually make sense. Existing approaches include the use of metrics such as $cllr_{cal}$ and devPAV and of the interval specific calibration discrepancy. The first and second approach share the use of isotonic regression, while the second and third both indirectly use the property that 'the LR of the LR is the LR'. An important disadvantage of all these approaches is that they are not straightforward to explain to and by many forensic experts. Additionally, calculated values for $cllr_{cal}$ and devPAV are hard to interpret. This work describes a more direct way of using 'the LR of the LR is the LR' to assess LR-system validity. For all the LR-values within the relevant range, the ratio between the probability density estimates of the two LR-distributions should be equal to those LR-values. The base-10 logarithm of the LR-value divided by this ratio is chosen as quantity of interest. Ideally, it should be zero. Since a positive value indicates an LR-system that is producing LRs that are too high, the quantity is called the LLR-overestimation. It can be visualised as function of the LR, and integrated to yield a single metric. This work will show how the LLR-overestimation behaves for both 'perfect', disturbed, and empirical LR-systems.

Development and Evaluation of a Contrastive Learning Framework for Forensic Source Identification 11:00 - 11:15

S. Fox[1], *D. Ommen*[1], *C. Saunders*[2], *J. Buscaglia*[3]

[1]Iowa State University, Department of Statistics, Ames, IA, United States, [2] South Dakota State University, Brookings, SD, United States, [3]Federal Bureau of Investigation, Quantico, VA, United States

Abstract Body: To interpret the value of forensic evidence resulting from paired item data, the common source identification framework asks: do the items share a common unknown source or do they come from two different unknown sources? This question can be addressed using a variety of

forensic statistics techniques, including the usual Two-Stage, Likelihood Ratio, and Bayes Factor approaches. Contrastive learning methods address the question using two major components: a method for quantifying the similarity (or dissimilarity) of pairs of evidence items, and a method for determining the best separation of within-source or between-source comparisons. Contrastive learning methods are particularly useful when the data derived from the evidence is high-dimensional or complex. In this case, the contrastive learning algorithms take advantage of high-performing artificial intelligence and machine learning tools to avoid specifying complicated probability models for the usual forensic statistics approaches. In this presentation, a contrastive learning algorithm framework is developed for complex evidence and applied to data from aluminum powder particles recovered from two pre-blast improvised explosive devices. The methods can be generalized to other types of evidence, as well. The output of the contrastive learning algorithm can be used in a score-based likelihood ratio to interpret the value of evidence. Additional work is necessary to apply the method to the specific source question (whether an item came from a specific known source).

Likelihood Ratio System for Nitrogen Isotope Ratios of Ammonium Nitrate 11:15 - 11:30

C.D. van Dijk[1], L.V van der Ham[1], A. Hulsbergen[2], K. Bezemer[2]

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Abstract Body: Ammonium nitrate (AN) based fertilizer is a material that can relatively easily be used as explosive, hence it is commonly found in forensic casework. When multiple samples of this type of fertilizer are found in different locations, the question may arise whether these samples came from the same batch or not.

In essence we want to compare the same source hypothesis with the different source hypothesis. As evidence we use the difference between the nitrogen isotope-ratios of the two samples. We developed and validated a score-based likelihood ratio (LR) system following the steps described in [1]. A set of 56 samples with four repeated measurements of nitrogen isotope-ratios of AN based fertilizer, extracted from the data presented in [2], was used to train and validate the system. Special attention was given to the handling of the repeated measurements, i.e. if and how to average over them. Cross-validation was applied due to the small amount of data. After applying cut-off values (ELUB), most validation LRs were at the upper limit of 30 (for same source pairs) or lower limit of 1/26 (for different source pairs). Moreover, the system had a Cllr of 0.23. This indicates that the LR system performs quite well.

[1] Leegwater, A.J. et al. (2024) ‘From data to a validated score-based LR system: A practitioner’s guide’, Forensic Science International, 357, doi:10.1016/j.forsciint.2024.111994.

[2] Brust, H. et al. (2015) ‘Isotopic and elemental profiling of ammonium nitrate in forensic explosives investigations’, Forensic Science International,

248, doi:10.1016/j.forsciint.2014.11.024.

Using Elicitation to Construct Bayesian Networks to Assign Likelihood Ratios to Footwear Comparisons 11:30 - 11:45

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Abstract Body: Forensic footwear examinations provide useful information for criminal investigators seeking to link a suspect to a crime scene. However, reporting the results of these examinations in an understandable and accurate way can be challenging, especially for only weakly informative findings. Evaluative reporting using likelihood ratios (LRs) is a promising approach to communicating footwear comparison results as it enables logical and scientifically sound expression of differing degrees of support the findings provide for propositions of interest.

Unfortunately, assigning LRs is not straightforward for footwear comparisons. While footwear print databases allow estimating the prevalence of certain types of prints, the most important source of information in footwear examinations is the comparison of small details (e.g. dents, holes and other signs of wear and tear) between samples. Such features are extremely variable which renders collection of representative databases required by a purely data-driven LR system exceedingly difficult. The forensic footwear examiner thus remains the main source of information for the weight of evidence.

At the National Bureau of Investigation Forensic Laboratory in Finland, a project is currently underway aiming to use probability elicitation to leverage this expert information in footwear examination reporting. In this project, a Bayesian network for assigning LRs in footwear comparisons is constructed based on probabilities elicited from examiners. This model will enable a transparent, reliable and consistent way for providing LR conclusions. The presentation outlines the elicitation process and the challenges involved and introduces the current version of the elicited statistical model alongside usage examples.

From Data to Simple, Well-Calibrated LR Systems: Combining AI With Statistics 11:45 - 12:00

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Abstract Body: Apart from DNA, feature-based likelihood ratio systems have as main drawback that the statistical models used to describe the data are at best reasonable approximations to the true data generating process. As a result, calibration of such LR systems is poor and performance is lost. On the other hand, AI based LR systems have as drawback that the models are hard to interpret or explain in court. Using a statistical model as output layer in a neural network potentially results in well-calibrated LR systems based on simple statistical models,

that are relatively easy to interpret and to explain in court, alleviating all known drawbacks of both approaches! Also, since statistical model parameters and random variables have a clear interpretation, not only the output LLRs can be targeted (for example by a loss function), but also the random variables themselves. In this contribution, we show the potential of this approach, demonstrating a proof of principle LR system for a glass dataset, using AI and statistics.

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12:00 - 12:45 Auditorium

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