IASR
INTERNATIONAL ASSOCIATION OF SCIENTISTS & RESEARCHERS

eConference Proceedings

12th INTERNATIONAL eCONFERENCE-2021

11th-12th December 2021

Forensic Physics

Supported by

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Sherlock Institute of Forensic Science India

GREETINGS FROM THE ORGANIZING DESK

The new era post the global pandemic has affected academics, establishments, and individuals' preparedness worldwide. Forensic Science has an interdisciplinary approach and its true essence can be proved meaningful with collaborative efforts of people present around the globe functioning together as a team. With a vision to bring all the academicians, students, and professionals and share their valuable contemplations, the International eConferences are structured to lead the way through endeavors focused to take Forensic to greater heights. We welcome every science enthusiast to become a part of this revolutionizing effort and explore the technological advancements, scientific researches, and opportunities for everyone to flourish.

Dr. Ranjeet Kr. Singh
President
International Association
Of Scientists and Researchers

Phaneendar B N
Forensic Expert, CEO
Clue4 Evidence Foundation

THE ORGANIZER

INTERNATIONAL ASSOCIATION OF SCIENTISTS AND RESEARCHERS (IASR)

IASR is a non-profit organization focused to deliver the updated literature and research work to not only the global scientific and research society, but also to everyone. Providing open access to critically reviewed high-quality research papers and literature, it works with a mission of providing a user- friendly global platforms for researchers, scientists for sharing information, and dissemination of recent ground breaking researches and advancements in various fields working together for the betterment of the world.

About the eConference

Forensic Science has proffered techniques that have leveled up the competence of humankind and are staying up with the trend. At the outset, the International Association of Scientists and Researchers (IASR) in association with the Sherlock Institute of Forensic Science (SIFS) India organizing the 12th International eConference on "Forensic Physics", 2021. With utmost enthusiasm, the organizing committee invites the young minds and professionals of various disciplines of forensic science and become a part of the first-ever convention organized with the motto of bringing the unrecognized talents, present globally. The program would follow talks by eminent national and international experts accompanied by e-paper presentations, ePoster presentations, discussions, and scientific excellence awards.

Mission Statement

"Committing towards the fact of being a lead-follower of technology with a bold spirit of risk-taking, helping us make our presence noticeable worldwide".

SPEAKER'S PROFILE

MOHAMMAD A. ALSHAMSI

Dubai Police HQ, UAE

Capt. Eng. Mohammad AlShamsi is the Head of Firearms and Toolmarks section at Dubai Police. He graduated from the first INTERPOL Young Global Police Leaders Program in 2019 and the UAE Government Leaders Programme in 2021. He is a member of numerous international associations such as the Association of Firearms and Toolmarks Examiners AFTE where he is the point of contact for the Middle-East and West-Asia region and the first Firearms and Toolmarks Examiner to achieve all AFTE certifications outside of North America in the World FA/TM/GSR-AFTE. He represents the Middle-East Region at the International Association for Property and Evidence IAPE and is the first Certified Property and Evidence Specialist CPES in the Middle-East and Asia. He is an Adjunct Faculty member at the International Institute for Forensic & Security Studies for the Bachelor's and Master's students in Forensic Science Ballistics and Advanced Ballistics course. He has lectured and trained more than 3410 attendees in events and training courses since the beginning of 2017 to date.

DR. N. P. WAGHMARE

Forensic Science Laboratory, Goa, INDIA

Dr. Narayan Pandurang Waghmare is currently working as a Director of Forensic Science Laboratory, Panaji, Goa. He is one of the renowned personality in the field of Forensic Science who has experience in almost all the aspects of the Forensic. He served as a Scientific Officer in the Ballistics Division at Forensic Science Laboratory, Delhi. In addition to this, he has also provided training to a large number of students in the field of Cyber Forensics. He has a vast hands-on experience in the Forensic Science and provided his assistance in a large number of cases. He has delivered lectures and shared his experience with other in numerous conferences and seminars at University, National and International level. He has published numerous research papers in various International and National journals.

SPEAKER'S PROFILE

DR. NIHA ANSARI

National Forensic Science University, Gandhinagar, INDIA

Dr. Niha Ansari is currently working as an Assistant Professor in Institute of Forensic Science at National Forensic Science University, Gandhinagar, India. In 2017, she worked as Assistant Professor in Department of Forensic Science at Jain University, Bangalore, India. She also served as Visiting Faculty in the Department of Forensic Science at Gujarat University, Ahmedabad, India. She has an approximate experience of 6 years in teaching. In addition, she is working as a Private Forensic Expert specialized in the field of Forensic Handwriting and Fingerprint. She completed her PhD (2016), M.Sc. (2011) and B.Sc. (2009) in Forensic Science from Gujarat University, Ahmedabad. She has presented her research work at National, International and University level and attended numerous workshops to enrich her knowledge. She has contributed in organizing seminars and Short Term Course in the University. She has numerous publications under her name in National and International journals.

DR. RACHEL BOLTON KING

Staffordshire University, Engaland, UK

Dr. Rachel Bolton-King is an Associate Professor of Forensic Science at Staffordshire University, specialising in firearms and ballistics. She is a Technical Advisor for the Association of Firearm and Tool Mark Examiners, Professional Member of the Chartered Society of Forensic Sciences and incoming Editor-in-Chief of the Science & Justice journal. She works on multi-disciplinary, international projects, particularly focusing on the manufacturing, non-destructive detection, examination and analysis of firearms and ammunition. Over the last 10 years she has published numerous research articles and book chapters, speaking at international conferences and industry events. In 2019, she was awarded a Winston Churchill Fellowship researching the people, processes and technologies used to advance firearm investigations across South Africa, USA, UK and France. She is keen to support the development of academia-industry partnerships, for example through the Staffordshire Forensic Partnership and the development of Research4Justice (www.research4justice.ac.uk), a centralised platform sharing open access research relevant to international justice systems.

SPEAKER'S PROFILE

DR. MUKESH SHARMA

Regional Forensic Science Laboratory, Jaipur, INDIA

Dr. Mukesh Sharma (M.Sc. Ph.D., DCA, BAFS), is holding the post of Assistant Director in Physics Division at Regional Forensic Science Laboratory, Jaipur (Raj.). He has completed his Ph.D. in 2005, in the field of Material Science, joined as SSO, in Forensic Science through RPSC with rank first. He has published more than 128 research articles in International/National Journals/ Conferences/Magazines and Journals in Forensic Sciences, and 07 textbooks in Engineering. Recently, he has been elected as Associate Member of the British Academy of Forensic Science, England (First Indian Forensic Scientist). Dr. Sharma is a fellow member and life member of National/International renowned societies. He has received training in various forensic techniques of examination from the National Institute of Justice (Online) (USA), NICFS (Delhi), BARC (Bombay), and DO-IT, MHA (Delhi). He is a reviewer of numerous International Journal, as the International Journal of Forensic Engg. (IJFE), SPIE, Journal of Forensic Research, etc. He is familiar with the Computational Materials Science code for Band structure calculations like CRYSTAL06 (Torino, Italy) and WIEN2K (Vienna, Austria) gets training from the developers. He has delivered various Invited talks at National and International Conferences in India and also having experience teaching a PG course in Forensics as a Guest speaker at NICFS, New Delhi.

DR. G. RAJESH BABU

National Forensic Sciences University, Gujarat, INDIA

Dr. Rajesh Babu holds his Ph.D. in Anthropology from Central University, Pondicherry (2008) and he has completed his M.Sc. Forensic Sciences from Madras University (1994). He held the position of Lecturer of Forensic Medicine and Toxicology, Sri Siddhartha Medical College, Tumkur, Karnataka from 1996-2009. He joined GFSU as Assistant Professor from 2009-2019 and currently, he is working as Associate Professor in the School of Forensic Science and Head of International Centre for Humanitarian Forensics at NFSU. He has been in the profession of teaching since September 1996 (almost 25 years) in various capacities in the field of forensic medicine and forensic sciences with ardent professionalism. As a forensic scientist, he has been involved in professional academics by developing novel academic curriculum such as Forensic Nursing, Forensic Odontology, Forensic Accounting and Forensic Anthropology in his parent institution. He has developed the curriculum of Humanitarian Forensics in association with the ICRC experts. He has been involved in professional training in the field of contemporary forensic sciences with the advanced techniques in criminal identification to the police officers of India and other nations such as Nepal, Myanmar, Bangladesh, Iraq, Sri Lanka, Ghana, Uganda, Ethiopia, Belarus and many other nations in South East Asia and Africa He has been involved in cutting edge research in the Forensic anthropology, crime scene analysis, Terminal ballistics, Molecular and Microscopic fingerprints, Forensic mineralogy/ material sciences etc. He has published more than fifty research articles in various journals of national and international repute.

SPEAKER'S PROFILE

DR. RAJESH VERMA

Forensic Science Laboratory, Mandi, INDIA

Dr. Rajesh Verma has about 30 years of experience in research and analytical work out of which more than 20 years in a Forensic Science Laboratory. He is currently working as the Deputy Director, Head of the Regional Forensic Science Laboratory, Central Range, Mandi, Himachal Pradesh supervising the work of different divisions in the laboratory. He has also served as the Assistant Director (2000-2011) in the State Forensic Science Laboratory, Head of the Physics and Ballistics Division. With this, he has also served as Project Associate in the State Council for Science, Technology, and Environment, H.P. Shimla under the Solar House Action Plan for Himachal Pradesh. He has a number of publications in renowned journals in his name. He has also been awarded the best paper presentation in numerous conferences. He has also given training to various professionals and students related to the arenas of forensic science and has been continuously contributing and sharing his pool of knowledge with others.

12th INTERNATIONAL eCONFERENCE-2021

Forensic Physics

Keynote Speakers

AN OVERVIEW OF TOOLMARKS ON BONES AND CARTILAGES

Mohammad A. AlShamsi

CHALLENGES IN FORENSIC VOICE COMPARISON

Dr. Rajesh Verma

EMERGING TRENDS IN FORENSIC BALLISTICS

Dr. N.P. Waghmare

ROLE OF FORENSIC PHYSICS IN CURRENT CRIME SCENE INVESTIGATION

Dr. Niha Ansari

SHOOTING FOR THE STARS: REFLECTING ON FORENSIC BALLISTICS & FIREARMS

Dr. Rachel Bolton-King

FORENSIC PHOTO FACIAL ANALYSIS INCLUDING CAMERA FOOTAGE

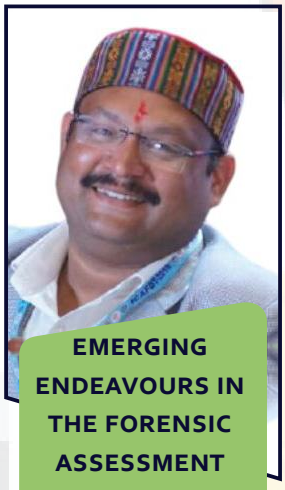
Raj Shrivastava

NEW APPROACH IN CRIME SCENE INVESTIGATION

Rajinder Singh Dangi

INTERPRETATION OF EVIDENCES USING FUNDAMENTAL PHYSICS

Dr. Mukesh Sharma



EMERGING ENDEAVOURS IN THE FORENSIC ASSESSMENT OF GLASS: A 21ST CENTURY SCENARIO

Dr. Ankit Srivastava

CHALLENGES IN FORENSIC BALLISTICS & FIREARM EXAMINATION

Dr. Sumit Kumar Choudhary

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Forensic Physics

Day 1: 11th December 2021

Time	Topic	Keynote Speaker
10:00 to 10:30 AM IST	An Overview Of Toolmarks On Bones And Cartilages	**Mohammad A. AlShamsi**
10:30 to 11:00 AM IST	Challenges In Forensic Voice Comparison	**Dr. Rajesh Verma**
11:00 to 11:30 AM IST	Emerging Trend In Forensic Ballistics	**Dr. N P Waghmare**
11:30 to 12:00 PM IST	Role Of Forensic Physics In Current Crime Scene Investigation	**Dr. Niha Ansari**
12:00 to 12:30 PM IST	Shooting For The Stars: Reflecting On Forensic Ballistics & Firearms	**Dr. Rachel Bolton-King**

Day 2: 12th December 2021

10:00 to 10:30 AM IST	Forensic Photo Facial Analysis Including Camera Footage	**Raj Shrivastava**
10:30 to 11:00 AM IST	New Approach In Crime Scene Investigation	**Dr. Rajinder Singh Dangi**
11:00 to 11:30 AM IST	Interpretation Of Evidences Using Fundamental Physics	**Dr. Mukesh Sharma**
11:30 to 12:00 PM IST	Emerging Endeavours in the Forensic Assessment of Glass: A 21st Century Scenario	**Dr. Ankit Srivastava**
12:00 to 12:30 PM IST	Challenges In Forensic Ballistics & Firearm Examination	**Dr. Sumit Kumar Choudhary**

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Forensic Physics

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11th Dec. 2021

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Dr. S. R. Singh
Forensic Science Consultant Voice Identification, Former Senior Faculty NICFS, New Delhi

Chairperson

Sh. Nilendu Bikash Bardhan
(Former Director) Central Forensic Science Laboratory, CBI, New Delhi

Chairperson

Arun Sharma
State Forensic Science Laboratory Lucknow

Chairing Panel
12th Dec. 2021

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Chairperson

Dr. Arun Sharma
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Forensic Physics

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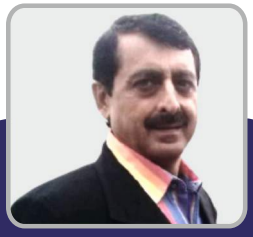

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PA 11	Varshini. H	Time Of Flight-Secondary Ion Mass Spectrometry: Overview And Forensic Applications

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Paper Presentations

STATE OF THE ART STRATEGIES IN GSR DETECTION FOR FORENSIC INVESTIGATIVE PURPOSES

Abhimanyu Harshey[1], Alok Kumar[1], Tanurup Das[1], Dr. Ankit Srivastava[1]

[1]Dr. A.P.J. Abdul Kalam Institute of Forensic Science & Criminology, Bundelkhand University, Jhansi – 284128 (U.P.)

Abstract

Forensic investigation of shooting incidents and related firearm is tedious task. In connection with the shooting scene and firearms, examination of Gunshot Residue (herein after GSR) offers several investigative leads, e.g., identification of shooter, arm-ammunition linkage, differentiation of exit and entry wounds etc. Primer and propellant residues contribute in GSR and have been identified as inorganic and organic markers for the GSR detection. GSR examination has been explored for many decades and earlier, presence of three elements viz. lead, barium and antimony were sought to be signature of the presence of GSR. Various analytical techniques have been used and recommended for the forensic analysis of GSR. In the context of advances in ammunition manufacturing and strides towards field deployable devices, several methodologies are being introduced for effective analysis with enhanced sensitivity. Here, challenges with conventional methodologies for GSR analysis and recent advances are discussed.

Keywords: Forensic Science, GSR, Firearm, Analytical Techniques, Field Deployable Device.

ENGINEERING FORENSICS IN EARTHQUAKE INVESTIGATIONS: LESSONS FROM CASE HISTORIES

Fulmita Deb[1]

[1]Sherlock Institute of Forensic Science

Abstract

Unlike conventional engineering which is a process of synthesis, forensic approaches to its domains is analytical procedure. Procedures in analysis start from evidence collection, forming failure hypotheses, testing hypothesis against evidence and thus governing the most probable ground of structure fails. Successful forensic investigation requires investigating engineers to put aside the traditional design process and apply a forensic process on various damage patterns of the structural failures. A damage pattern of building strongly depends on the type of building structures which are masonry, wood frame, and reinforced concrete with moment-resisting concrete frame. By comparing damage to individual structures with the illustrated chart we propose it would be possible to conduct a short-time and low-misidentify survey. This paper presents a review on the role of forensic engineering in earthquake investigations based on various case analyses from Italy, China, Japan and Nepal. This paper also describes the monitoring of structures in japan for extreme scenes of seismic vibrations. Vibration-based monitoring is an important work in the advancement of research on earthquake- and wind-resistant structures.

Keywords: Damage Patterns, Structural Failures, Earth-Quake, Forensic Engineering, Design, Vibration-Based Monitoring and Forensic Investigation.

ANTHROPOMETRIC MEASUREMENT OF 2D FOOT IMPRESSIONS FOR LIVING BODY WEIGHT DETERMINATION AMONG PHILIPPINE TAGALOG POPULATION FOR CRIME SCENE APPLICATION

T. Nataraja Moorthy[1], Nur Ayesha BT Ahmad Affandi[2], Ivan Nikkimor LD[3]

[1]Professor of Forensic Sciences, Faculty of Health and Life Sciences, Management and Science University, Shah Alam, Selangor, Malaysia

Abstract

Personal identification is the foremost task in any forensic investigation. The individual identification is based on the evidence found at the crime scenes. Foot impressions are left by the perpetrators without their knowledge, form valuable evidence in the crime scenes. A foot impression is a universal and easy way to fix an offender that provide more information than fingerprint. Researchers have indicated that foot impression can be used to determine stature, body weight and gender for positive identification of the suspects, considering the ethnicity. The present study was aimed to develop regression equations to determine living body weight from 2D foot impressions among Tagalog population in Philippines. The study recruited 100 male and 100 female volunteers of Tagalog ethnic group, living in Philippines, with age ranged from 18 to 60 years. Following the standard procedure, the 2D foot impressions were collected along with living body weight from the study population and recorded for analysis. From each volunteer, ten-foot impression length measurements were made, five from left and five from right side. The mean foot impression length of male is found to be longer than females in all toes and the mean body weight of male is comparatively higher than female. The data were analyzed statistically using SPSS software, version 20 and ten linear regression equations were developed from 2D foot impression lengths to determine living body weight, and the result findings were presented in the form of tables and graphs. The advantage of the study is that even the presence of partial foot impression in the crime scenes, the result findings can be very well used to determine the body weight by Philippine Police Scene of Crime Officers (SOCO).It is a collaborative work with Philippine Police, the first ever forensic research in Philippines and I have personally visited Philippines for sample collection.

Keywords: Forensic Science, 2D Foot impression, Body weight, Tagalogs, Philippines.

FATAL TRANSECTION OF FEMORAL VESSEL: A CASE REPORT

Dr. Balraj Sharma[1], Dr Anil Garg[1],Dr Sunil Kumar[1], Dr Gaurav Sharma[1], Dr Virkant Kumar[1]

[1]Department of Forensic Medicine and Toxicology, BPS GMCW Khanpur Kalan, Sonipat, Haryana.

Abstract

Deaths from sharp force injuries are a significant cause of violent death. While homicides and suicides caused by sharp force wounds are common, accidental injuries are less often described in forensic literature, so their actual incidence or prevalence is not known. This paper presents an accidental death due to massive blood loss which resulted from lesions to the left femoral vessel by glass fragments. The body was found in a pool of blood surrounded by glass fragments. Autopsy revealed a total transection of the femoral vein. In case of accidental sharp force injuries, a thorough medico-legal process, including death scene investigation, autopsy examination and toxicological analyses, is always necessary to determine the manner of death.

Keyword: Alcohol, Glass bottle, Accidental, Impaling injuries, Femoral vessel

FORENSIC ANALYSIS OF TOOL MARKS AND ITS IMPRESSION

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Abstract

Tool marks identification is a fascinating field of forensic science.If any object or instrument reaches the surface with enough force to allow its signature design to be indented is defined as Tool marks.Forensic analysis of tools marks plays a significant role in identification process by comparing the class and individual characteristics and even acts as collaborative evidence in crime scene. Forensic tool mark identification includes firearms identication,an area of tool mark investigation that specializes in identifying different firearms and parts of a firearm being used in crime scene. Toolmark identification is the microscopic comparison and potential identification of striated or impressed toolmarks as having been made by the same tool. The foundation for this technique is based on the following principles: A tool will bear unique microscopic characteristics due to the manufacturing processes it undergoes, as well as through use and abuse. Tools will generally mark surfaces with which they come in contact with class and individual characteristics. These class and individual characteristics are typically reproducible and identifiable with a particular tool. Test marks from an evidence tool compared to toolmarks on evidence items recovered from a crime scene to determine if the evidence tool marked the evidence item.Evidence toolmarks recovered from multiple crime scenes to determine if the scenes are related to a single tool**.** Tools marks caused three types of actions/impression-compression action,sliding/frictional action or cutting action(1).Determination of tool marks referes to the recognition,adjustment and comparison of the indentations left on the surface after the contact with the tool. Tools marks identification includes the physical matching of suspected tool with test tool,photographing, lifting of tool marks and casting . With the aid advanced digital technology,tools marks are compared through automated system also.Tool marks evaluation and interpretation are complex operations requiring consideration of several intrinsic and extrinsic variables.

Keywords: Forensic analysis,tool marks, impression,class characterictics and individual characteritics

DIFFERENT METHODS OF FOOTPRINT CASTING: A CASE STUDY

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[1]Vivekananda Global University, Jaipur

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Abstract

At scene of crime and spot the footprint is important evidence in the criminal investigation. As it does not only helps identify the suspect but also establishes solid proof against the criminal. There are numerous ways for the detection, identification and collection of footprints pattern from a scene of crime. 3D prints from the crime scene are collection by its casting, which have been reported in this article. Apart from the 3D prints of footprints, there also availability of 2D footprints from the crime scene, as 2D prints are obtained using the silicone and mikrosil methods. Further the footprints obtained from the crime scene are examined against any controlled sample taken in the laboratory under an expert. In this paper, the footprints were majorly studied through case study on different surface. Blood pattern on the shoe on scene of occurrence, were compared in the lab with old analysis pattern and computer based super imposition methods.

Keywords: Footprint, Casting,Criminal investigation, Blood pattern, Mikrosil method.

FORENSIC ANALYSIS OF GLASS

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Abstract

Glass is an amorphous solid. In pure form it is made up of silicon and oxygen molecule. The high melting point is over 20000 c. It is hard and brittle like a solid. This paper provides information on the analysis of glass evidence. Toughened glass(tempered glass), soda lime glass, borosilicate glass, alumino silicate glass, leaded glass, fused silica glass are some of the types of glass. Glass is forensically important and it is found at most crime scenes. Glass generally class evidence, except when a fracture match is found, which is considered to be an individual characteristic. Random stress patterns and breaks are unique. There are variety of techniques and methods which could be utilized to analyze and make comparison between glass types. This paper explains how glass fragments can be placed in specific classes through the use of optical and non-optical analysis method. It also describes, how to individualize a glass fragment by making a fracture match. Density is defined in a qualitative manner as the measure of the relative heaviness of object with a constant volume. Density measurement of liquid and the density is determined as a result of the liquid's displacement. Broken glass analysis is forensically important to the reconstruction of events in a criminal act. Analysis can include sequence of the fracture, the direction of the force which caused the fracture like did the break occur from inside or outside. Radial, concentric and conchoidal are the three types of glass surface fracture patterns. The first and most common analysis of glass would be optical analysis. It is understood that glass breaks in different ways when relative force and different types of smashing techniques are applied to them. Glass acts as an elastic surface and bends away when an initial force is applied.

Keywords: Introduction, Types of Glass, Analysing Broken Glass, Types of Glass Surface Fracture Patterns, Measurement of Density.

FORENSIC IMPORTANCE OF SOIL EVIDENCE

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Abstract

In many criminal cases can occur in conditions when soil moves to a criminal or victim, soil can contribute vital information to criminal investigations as transfer evidence. Because soils vary so much from place to place, dirt can be used to show a relationship between a suspect and a crime scene. Soil is a complicated combination with a wide range of mineralogical, chemical, biological, and physical characteristics. In light of this intricacy, a number of forensic science procedures have been created. Because minerals are an important component of soils, forensic soil identification requires a mineralogical investigation. There are a variety of different strategies that may be employed to improve discriminating power, but not all of them must be used. What matters is that examiners assess the context of the soil samples when selecting an acceptable combination of procedures. This paper compiles a number of publications on the examination of soil constituents and closely related materials such as plant fragments, pollen and spores, and diatoms, with a focus on the relevance of screening tests based on a number of basic approaches. Parent materials, temperature, water condition, vegetation, time, and chemical reactions such as solution, oxidation, and reduction, as well as human activities, all play a role in the soil formation process. Soil colour reflects the history of a soil's evolution as the outcome of such a complicated soil formation process. For screening, systematic monitoring of several soil hues is extremely beneficial. Soil is a heterogeneous collection of inorganic minerals, organic elements, and biological stuff with varying consistency over the earth's surface. This inconsistency derives from the fact that the elements that drive soil formation - temperature, rainfall, humidity, air pressure, and parent rock composition - vary from place to place. It's important to note that soils differ not only in chemical elements such as ions, polymers, and carbonaceous deposits, but also in physical qualities like as colour, texture, and density. Soil is a significant evidence to link a suspect to the crime scene because of its unique properties, which serve as identifying markers for distinct units of landscape.

Keywords: Parent Material, Climate, Organisms, Topography, Soil Evid

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EXAMINATION OF GUNSHOT RESIDUE (GSR)

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Abstract

The review of the paper is based on the examination of gunshot residue discharged from a firearm. Gunshot residue is the result of a mass of debris which comes out of the muzzle along with the projectile(s) during a shot. The composition of GSR mainly includes the primer residues, residues from the projectile(s), partially burned or unburned gun powdered particles. The examination of patterns of GSR on items of evidence can be used to determine the muzzle to target distance. In addition, the GSR can also be found on individual who have had come in contact with the firearm or fired ammunition components or with objects that has GSR on it. The examination of these GSR can give a huge range of information that can link the person with an action that could have transferred these GSR on them. The amount and pattern of GSR deposited may vary with the gun used to fire the bullet. The GSR may be deposited by two mechanism which include impact deposition from particles propelled by the force of the blast and fallout deposition of drifting particles that settle on a surface. GSR may be expelled ahead of the bullet, along the bullet or even after the bullet. Though the amount of residue deposited tends to decrease with the increasing range of fire, the actual deposits can be highly variable for the ranges up to 20 cm. The presence of GSR vary from the entrance to exit wounds. The deposition of GSR will be more in the entrance wound while it will be less or no deposition of GSR will be found in the exit wound. The major methods used for the detection of the primer residues are analytical and qualitative analysis. Analytical methods include neutron activation analysis (NAA), atomic absorption spectrophotometry (AAS) and inductively coupled plasma mass spectroscopy (ICP-MS). The qualitative methods used for the identification of primer residue include Scanning electron microscope with energy dispersive analysis by x-ray detector (SEM-EDX).

Keywords: Gunshot residue (GSR), composition of GSR, detection of primer residue, analytical methods and qualitative methods.

RESTORATION OF ENGRAVED CHASSIS NUMBER ON HIGH STRENGTH ALUMINUM ALLOY SURFACE BY ETCHING TECHNIQUE

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Abstract

Every object has its own unique identity. Chassis numbers are used as unique identification marks for variety of vehicles. But when the object involved in criminal activities, the offenders tries to erase or obliterate the identification marks or made it unreadable. Nowadays many methods are available to restore the erased chassis number. Chemical etching is one of the most common and reliable technique used for restoration of these marks on metal surfaces. The alloy surfaces were mechanically engraved with the number using ‘‘Gravograph’’.The marks are obliterated by removing the metal below the depth that they have been engraved. In chemical itching method different reagents are used and for this case study a mixture of 25g ferric chloride, 25ml hydrochloric acid and 100ml of water was prepared. Reagent taken on cotton swab was rubbed until the number appeared. Sensitivity was good and marks were reproducible.

Keywords: Chemical Etching, Obliteration, Surface, Identification, Reagents

TIME OF FLIGHT-SECONDARY ION MASS SPECTROMETRY: OVERVIEW AND FORENSIC APPLICATIONS

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Abstract

Time of Flight-Secondary ion Mass Spectrometry is a surface sensitive analytical method that has been proved to be successful in the analysis of wide range of forensic evidences such as Toxicological samples, Gunshot residues, Fingerprints, Hairs, Glass, Dyes & Inks, Questioned documents and cosmetics. The technique can provide qualitative information in spatially resolved visualization of structures and trace chemical residues in very complex samples. The Advantages and limitations of this technique with respect to the various samples are examined and presented. The technique has been observed to possess significant potential with a unique combination of features compared to other advanced instrumental techniques. ToF-SIMS has proved to be successful in identifying even minor components, both organic and inorganic compounds, provides particle fine structure in three dimensions with its elemental mapping and etching capability. This paper reviews various studies on the use of ToF-SIMS and combines the applications in forensic analysis emphasizing the importance of this technology and also discussing the feasibility of this instrument in casework scenarios.

Keywords: Time of flight-Secondary ion Mass Spectrometry (ToF-SIMS), Forensic applications, Mass spectrometry, GSR, Ink examination

GUN SHOT INJURY WITH AMBIGUOUS MANNER - A CASE REPORT

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Abstract

Firearms wounds are usually recognized without difficulty due to their specific findings such as singeing, tattooing and blackening etc. The primary difficulty is to certain the exact manner of firearm injury especially when there is only single wound rather than multiplicity and it became quite difficult in absence of proper history and reluctant police investigation. However, crime scene visits and photographs play a pivotal role in formulating the manner of death in these types of cases or where there would be discrepancies arise in the police investigation report and actual findings found during the postmortem examination. In our case, crime scene photographs and meticulous autopsy played decisive role in ascertaining the manner of death.

Keywords: Crime scene, Suicide, Gun shot, Muzzle, Tattooing.

FORENSIC ANALYSIS OF CONTAMINATED SOIL SAMPLES USING ATR-FTIR

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Abstract

Soil is one of the most common physical evidence encountered in cases like theft, burglary, murder, etc. In a forensic investigation, soil may be of great evidential value as it can help in linking a person or object to a crime scene or in reconstruction of the crime. In violent crimes, soils are often found contaminated with biological fluid, most commonly with blood, and this contamination can alter the physical and spectral features of soil in one or another way. Present study is performed on the surface and depth soil samples collected from 3 different sites of Jhansi, U.P. to observe the changes in physical and spectral features of soil contaminated with blood and also to observe the thermal degradation of contaminated samples. A total of 126 samples were analyzed for this study. Spectral analysis was done by ATR-FTIR spectroscopy. Results of ATR - FTIR analysis shows that after contaminating the soil with blood, there are some changes in the original spectra of soil. The absorbance of IR radiation in characteristic regions shows that blood in the soil can be easily identified after getting completely mixed within it. In some samples, these peaks aren't sharp and show weak absorbance. The reason behind this weak absorbance may be the dominance of soil over blood and/or the degradation of blood by microbes present in the soil. Findings of this study pronounce ATR-FTIR as significant analytical tool for the analysis of soil sampled contaminated with blood.

Keywords: Soil, Blood, ATR-FTIR, Contamination, Forensic Investigation

SOIL SAMPLE COMPARISON

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Abstract

Soil can play an important role in forensic cases in Linking suspects or objects to a crime Scene by comparing samples from the crime scene with samples derived from items.The study uses an adapted ED - XRF analysis(Sieving instead of grinding to prevent destruction of microfossils)to produce elemental composition data of 20 elements.Different data processing techniques & statistical difference were evaluated using the data from 50 samples and the log - LR cost the best performing combination.Canberra Distance, relative data & square root value is used to construct a discriminative model.Examples of the spatical resolution of the method is crime scenes are shown for three locations , sampling strategy is discussed. The study shows how the combination of an analysis technique, a database & a discriminative model can be used to compare multiple soil samples quickly.

Keywords: Forensic Science, elemental composition, Canberra distance,trace evidence, energy - dispersive X - ray fluorescence, Soil comparison.

GAIT PATTERN

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Abstract

An individual, while walking or running makes a series of impressions or footprints, this is called as a gait pattern. Gait pattern is created due to the movement of limbs during locomotion. Gait pattern is found to be highly individualistic. Hence it acts as an evidence in solving certain crimes. Examining and analyzing the gait pattern of an individual is very important because it helps to determine age, sex, height of an individual. Gait normally means the manner or way in which a person walks. Since walking is an unconscious behavior it can be used for the identification of an individual. Gait is a biological characteristic of an individual. There are several factors that affect gait pattern like personality, footwear of an individual, sex, emotional behavior, speed of walking, any disorders, age, pregnancy, light conditions. Gait pattern can be seen in most of the cases like robbery, murder, theft, housebreaking, dacoity, kidnapping, etc. Gait pattern is the most commonly encountered pattern evidence found in most of the crime scenes and it helps to create link between crime and criminal. It's also helps to determine the number of suspects involved in the commission of crime.

Keyword: Gait Pattern, Evidence, Crime, Biological characteristic.

OPTICAL EMISSION SPECTROSCOPY IN FORENSIC BALLISTICS

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Abstract

A new analytical method is proposed for the Pb, Ba and Sb quantifications on gunshot residues (GSR) from firearms using inductively coupled plasma optical emission spectrometry (ICP OES). Lead (Pb), barium (Ba) and antimony (Sb) concentrations in GSR from .38 revolver and .380 and .40 caliber pistols were determined as function of number of shots (from 1 to 5 for the .38 revolver and from 1 to 10 for the pistols) and multiple linear regression model was constructed to determine the number of shots. Also, the sensitivity of ICP OES was compared to conventional colorimetric test in function of distance of shooting (from 0 to 200 cm). Analyzing the effect of distance of shooting over the GSR concentration, the colorimetric test evidenced the presence of a red-pink color only at short distances (from 0 to 10 cm), thus indicating the presence of Pb. Therefore, it was possible to predict the number of shots with good accuracy from Pb, Ba and Sb concentrations using .38 revolver and .40 and .380 caliber pistols. Furthermore, the GSR concentration from different firearms, increased in the following order: .40 pistol > .380 pistol > 38 revolver.

Keywords: Forensic ballistics, Firearms, Lead, Barium, Antimony, ICP OES.

FORENSIC IMPORTANCE OF PAINT

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Abstract

A relationship between individuals, places, and items could be established by examining paint found at a crime scene. Paint analysis usually entails comparing paint from the crime scene with a sample of paint acquired from a recognised source. It aids with the safe and sanitary storage of the objects. Paints improve the appearance of the surface, make it waterproof, and make it more durable. Examining paint samples from a crime scene establishes a link between location, person, and objects. As a trace evidence, paint is discovered. Depending on the mechanism of contact and the type of the surface, paint can be collected from the crime scene in a variety of methods. The paint might come in the shape of a chip or a smudge. Paint is used as a trace evidence in situations of car accidents, hit-and-runs, and theft, among other things. The paint can be found on tools, buildings, cars, or victims' clothing at the crime scene. Paint is a substance that is applied to a surface with the goal of covering it. The purpose of painting a substance is to protect it from external variables such moisture, heat, oxygen in the air, snow, rain, and UV radiation. Paints are also used to cover over old paint, dents, and any other damage that may be present, such as scratches or abrasion. The paint may be used on a variety of materials, including wood, metals, and plastics. The paints are often used for decorative purposes. Oil paints, Varnish, Enamel, Latex Paint, Water-Reducible Paints, Alkyds, Automotive paints, Epoxy Paints, Polyester-Epoxy paints, Acrylic-Epoxy paints, Shellac, Aluminium paint, Acrylic-Urethane coatings, and other types of paints are frequently used.

Keywords: Introduction, Paint, Importance, Trace Evidence, Substance, Plastic.

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ACCIDENTAL RECONSTRUCTION

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Abstract

Vehicle Accident Reconstruction or Traffic Collision Reconstruction is defined as the process to investigate, analyse and draw conclusions about the causes and events happened during the vehicle collision. The process of reconstruction is performed to determine how and why the accident happened. It is done to identify the cause of the collision, contributing factors due to which the accident is caused such as role of the driver, role of the vehicle, roadway and environmental conditions, and also for improving safety aspects of motor vehicle designs and used for making roads and highways safer after detecting the major cause of accidents. Contributing factors due to which the accident may occur (Causes) includes:- Human Factors (consists of conditions such as Driver's health, alcohol or drug impact on driver, distractions at the time of driving, reaction time, etc.), Physical Factors or Condition of the vehicle (consists of type of vehicle, Brakes, Headlights, Vehicular defects, etc.) and Environmental Factors or Visual Obstructions (consists of weather conditions, lighting conditions, dirt on windshield, background noise, etc.). Accident can be caused due to reasons such as Over speeding, without wearing helmet and seatbelt, driving while speaking on the phone and also if the driver of the vehicle is not following the traffic rules. And to determine the probable cause due to which the accident occurred the process of Accident Reconstruction is performed as well as to avoid such fatal accidents some preventive measures are also created after reconstructing the several accidental scenes of particular area and making corrective measures to avoid it further especially in that particular area. These accidents can be prevented by various methods such as more signs and boards should be put at various prone locations to warn drivers, by improving road conditions and imposing strict punishments or huge fine for over speeding. In this e-poster, I will briefly conclude the major causes due to which the accident is caused, and why and how the process of reconstruction performed is.

Keywords: Accident, Reconstruction, Collision, Motor vehicles, Headlights.

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TOOL MARKS: TYPES OF TOOL MARKS AND EXAMINATION OF TOOL MARKS

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Abstract

A toolmark is the impression left by the contact of a tool (or a similar object) onto a surface. When the tool or object contacts the surface with sufficient force to create an indentation, the pattern of the tool is permanently reproduced onto that surface. Toolmarks examination is an important discipline of criminalistics. Its goal is to establish a link between a toolmark and the tool that created it. Such links are crucial in forensic sciences, as tools are often used in criminal activities, particularly in burglaries, and can help to identify a criminal. Toolmarks bear two kinds of characteristics: class and individual. The class characteristics of a toolmark include the type of impression, its general shape, and its general dimensions. Class characteristics typically allow the examiner to determine what type of tool created the impression and how the mark was created. Conversely, they do not permit the identification of the exact tool that created the impression. This means that if only class characteristics are available on a toolmark, it will not be possible to distinguish which tool, among a series of similar tools, made the impression. Individual characteristics, also called accidental characteristics, are the striations and small particularities exhibited by the tool that is individual to one unique tool. They consist of small, commonly microscopic; indentations, ridges, and irregularities present on the tool itself. There are two main types of tool marks that can be distinguished: slipped and molded impressions. The slipped impression occurs as the tool drags or slides across the surface. The resulting toolmark is a series of striations running parallel to each other following the direction of the drag. The molded impressions are the result of the contact of a tool onto a surface with no lateral motion (no drag nor slip). The resulting toolmarks are a three-dimensional mold of the part of the tool that contacted the surface.

Keywords: Tool Marks, Impressions, Ridges, Indentations, Tool Marks Analysis.

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CRIME SCENE RECONSTRUCTION: A TOOL TO SOLVE MYSTERY

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Abstract

Crime scene reconstruction is the process of determining or eliminating the events and actions that occurred at the crime scene through analysis of the crime scene pattern, the location and position of the physical evidence, and the laboratory examination of the physical evidence. A competent crime scene Reconstructionist must understand the value of various piece of evidence and need to fit within the overall context of the scene. The dead body is the most valuable piece of potential evidence at any death scene. Both forensic crime scene and autopsy officers should undertake a systematic and keen examination of the deceased. Reconstruction not only involves scientific scene analysis, interpretation of the scene pattern evidence and laboratory examination of physical evidence, but also involves systematic study of related information and the logical formulation of a theory. It is often useful to determine the actual course of a crime by limiting the possibilities that resulted in the crime scene or the physical evidence as encountered. The possible need to reconstruct the crime is one major reason for maintaining the integrity of a crime scene. It should be understood that reconstruction is different from re-creation, Re-creation is to replace the necessary items or actions back at a crime scene through original scene documentation. It involves consideration and incorporation of all investigative information with physical evidence analysis and interpretation moulded into a reasonable explanation of the crime and its related events. Logic, careful observation, and considerable experience, both in crime scene investigation and forensic examination of physical evidence, are necessary for proper interpretation, analysis and, ultimately, crime scene reconstruction. The foundation of crime scene reconstruction is established by the Locard theory of transfer. It is the fundamental basis of any forensic analysis. There are many types of reconstruction depending on the nature of the crime.

Keywords: Crime scene, Crime scene reconstruction, Scene analysis, Locard theory, Examination, Interpretation.

DETERMINATION OF RANGE AND DIRECTION OF FIRING

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Abstract

Firearms are categorized in two categories rifled firearm and smooth firearm. In rifled firearm as well as in smooth firearm entry wound consist of contact range, close range, near range and distant range. Different collars leads to different cases, whether it is abrasion collar or contusion collar. Contact shot consist of large, irregular hole resulting from the explosive blast effect. For example in most of the suicide cases we found contact shot because firearm is placed in contact with the skull contact gunshot wound on forehead can indicate stellate, lacerated wound with blackening visible within the wound and the margins of wound . Case of distant shot is different from every shot as the distant shot is out from the range of flame and powder. Mostly in distant range entrance wounds, wounds are oval to circular in shape. Exit wound of rifled firearm in generally is greatly in size, shape, larger than the entry wound but in some cases it is difficult to interpret because they vary in shape, size and not consistently larger than their preceding entrance wounds. No presence of blackening, tattooing, scorching and lead ring is found in exit wound. Entry wound are always inverted while exit wounds are always everted. This e poster will tell how can we examine Blackening, tattooing, scorching and lead ring that helps in determining the range of firing, how we estimate whether it is contact shot, close shot or any other shot, whether abrasion collar form on entry shot or not, how direction of firing can be estimated by entry of bullet whether the shape of wound become circular or oval, how appearance of entrance wound helps us in knowing the range of fire, how shape of entry wounds and exit wounds determine direction, at what distance we measure whether it is contact shot, close shot, near shot or distant shot.

Keywords: Range, Direction, Abrasions, Blackening, Gunpowder.

FORENSIC FIREARM EXAMINATION

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Abstract

Forensic firearm examination is the forensic process of examining the characteristics of firearms or bullets left behind at a crime scene. Forensic firearm examination is a sub-discipline that uses the firearm as the tool and the ammunition components as the work piece. The components of the firearm are made of hardened steel. Ammunition components are significantly softer than the firearm counterparts they come in contact with; therefore, the marks from the firearm are transferred onto the ammunition components. The transfer of unique marks onto the softer material provides individual and class characteristics that are used during the examination. There are numerous parts of the firearm that create a variety of characteristics. A firearm can be identified on their class and individual characteristics. It bears markings by manufacturer for the purpose of identification of calibre, design, type, model, firing mechanism, no. of land and grooves, firing pin marks, breech face marks, ejector and extractor marks, chamber marks, other marks etc. Any firearm collected during the course of an investigation could yield viable evidence if examined. For forensic firearm examination specific evidence that can be recovered includes weapon serial numbers and potentially fingerprints left on the weapon's surface.

Keywords: Firearms, ballistics, firearm examination, bullets, cartridge cases.

OBLITERATION OF VEHICLE IDENTIFICATION NUMBER

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Abstract

Obliteration is the action or fact of removing all sign of something either by restoring it or covering it so that it cannot be seen. Vehicle identification number (VIN) is the identifying code for specific automobile through which each automobile is unique and identified individually. Obliteration of vehicle identification number is filling or grinding. The original number is filled away or ground down with a power grinder which is followed by polishing and then over-stamping with a new number. Obliterated techniques such as, Filling or Grinding, Peening (hammering over the surface), Over-stamping, Center punching, Drilling and Welding. When vehicles are stolen it has been analyzed that vehicle identification numbers are created to escape direction through which people use the stolen vehicle with new VIN number. The new numbers are punched into the metal in the same location as original numbers because on every vehicle the vehicle identification number is engraved on different parts and places of the vehicle. The analysis of obliteration of vehicle identification number requires the restoration of erased VIN numbers through different techniques one of them which is most commonly used is Chemical Etching. Chemical etching is the most sensitive method to recover obliterated VIN number on metal surfaces successfully. It is the high pressure high temperature chemical spray to remove material to create a permanent etched image in a metal. Etching reagents are composed of nitric acid as the oxidizer, hydrofluoric acid as the coordination agent and mixed with glacial acetic acid or acetone as the solvents. Copper and Iron containing compounds are the compounds which mainly give results successfully.

Keywords: Obliteration, Vehicle identification number (VIN), Filling or Grinding, Peening, Over-stamping, Center punching, drilling and Welding, Chemical Etching.

IDENTIFICATION OF 3D TOOL MARKS

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Abstract

In the world of forensic science, toolmarks has becomes a special function for the examination of crime scene by forensic experts. Forensically, toolmarks present on crime scene are to be compared with suspected tools or firearms. However, there can be various type of toolmarks such as impression, scratch or abrasion which are made when a harder surface (tool) comes in the immediate contact with a softer surface (object). Toolmarks identification is essential in forensics because toolmarks too are the unique character and they leave the signature of the tools hitting the surface. Some of which are 3 Dimensional toolmarks that have resulted in expanding the scope for investigators to resolve the crime. Forensic Physics have shown rapid advancement in the production of various techniques that helps in identification of 3D toolmarks and relating them to suspected tool. Techniques such as 3D printer like tevo-tarantula, naked eye photography of toolmarks using LEICA M205C stereomicroscope, comparison microscope, silicone casting are used for identification of 3D toolmarks. A huge number of homicides are committed with sharp forks with might be created with various weapons like tools, axes, broken bottle pieces, blunt or sharp blades, pocket knives etc. The entire poster is coming to deal with such toolmark identification techniques with more valuable information whether how the crime is committed.

Keywords: 3D toolmarks, sharp objects, LEICA M205C stereomicroscopy, silicone casting