



Forensic Techniques for Dealing with Criminal Cases

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ABSTRACT: The field of forensic science, also known as criminalistics, is relatively new in the larger landscape of taught sciences. Forensic scientists are typically tasked with evaluating evidence from crime scenes to discover objective findings that can be used in a court of law. There are notably a variety of specialties within forensic science, with each potentially being used in a different way to help build a sound case against a suspect. The relationship between forensic science and criminal investigations is an important one. It could mean the prosecution of a criminal or absolve an innocent person from a wrongful conviction.

KEYWORDS-forensic, science, criminal, cases, suspect, investigations, discover, prosecution

I. INTRODUCTION

Forensic science applies natural and physical scientific methods during an investigation process for solving crimes. Equipment is used to analyze an array of evidence to tie a criminal to a crime and victim. A forensic scientist will examine physical evidence gathered at the crime scene, such as DNA, blood, clothing fibers, tire tracks, firearm residue, drugs, and other chemicals. Then, tests are administered in a laboratory setting to analyze and interpret data so it can be presented in a court of law. There are several different areas of study in forensic science, each focusing on specific analysis of evidence. For example, forensic pathologists perform autopsies to determine manner of death. But forensic engineers examine materials to identify defects or sources of materials tied to the crime. By using high-tech equipment, forensic scientists can help law enforcement track down even the most sharp-witted perpetrator. Forensic science provides the criminal justice system with evidence that could be used to convict a suspect even when an eyewitness is not present. Forensic scientists can be used in the initial investigation at the crime scene, gathering the evidence for further analysis in a laboratory. Then, specialized tests are performed on the evidence according to current testing standards to ensure the evidence can meet the requirements of the trial. [1,2,3]

An assortment of forensic scientists and forensic tools may be used to establish facts admissible in a court of law.

The important relationship between forensics and the law ensures both convictions or exonerations occur without bias or injustice. Also, forensic science is governed by legal procedures and scientific protocols with support from professional communities such as the American Academy of Forensic Sciences. Law enforcement officers may not have the background or complete understanding of the importance of a criminal investigation. That's why the need for forensic scientists continues to increase and illustrates the need for interdisciplinary forensic studies programs across the country.

The International Committee of the Red Cross (ICRC) uses forensic science for humanitarian purposes to clarify the fate of missing persons after armed conflict, disasters or migration, and is one of the services related to Restoring Family Links and Missing Persons. Knowing what has happened to a missing relative can often make it easier to proceed with the grieving process and move on with life for families of missing persons.

Forensic science is used by various other organizations to clarify the fate and whereabouts of persons who have gone missing. Examples include the NGO Argentine Forensic Anthropology Team, working to clarify the fate of people who disappeared during the period of the 1976–1983 military dictatorship. The International Commission on Missing Persons (ICMP) uses forensic science to find missing persons, for example after the conflicts in the Balkans.

Recognising the role of forensic science for humanitarian purposes, as well as the importance of forensic investigations in fulfilling the state's responsibilities to investigate human rights violations, a group of experts in the late-1980s devised



a UN Manual on the Prevention and Investigation of Extra-Legal, Arbitrary and Summary Executions, which became known as the Minnesota Protocol. This document was revised and re-published by the Office of the High Commissioner for Human Rights in 2016

II.DISCUSSION

Forensic science is the use of science in the examination of criminal and civil laws, as guided by legal criteria of acceptable evidence and criminal process. Forensic evidence analysis is utilized in the investigation and prosecution of civil and criminal cases. Sections 45 and 46 of the Indian Evidence Act offer a summary of the admissibility of forensic evidence in courtrooms.[5,7,8]

Legitimacy has historically been seen as a cornerstone of the judicial system in a modern and democratic society. With the passage of time, there has been a significant advancement in the operation of the court system. As a result, there has been a tremendous penetration of technology and procedures in the process of a criminal investigation. In this case, forensic science comes in handy. Forensic science is the use of science in the examination of criminal and civil laws, as guided by legal criteria of acceptable evidence and criminal process. The definition of forensics refers to the use of scientific procedures and techniques in the investigation of crime. Forensics is a branch of science that works to solve legal issues. It comprises of nearly all categories of data and is a critical and cost-effective facilitator in the administration of justice in criminal, civil, regulatory, and social contexts. It is the application of science to respond to questions of legal concern. Many fields, including physics, computer science, chemistry, biology, and engineering, are used in evidence analysis. For example, physics is employed to decode a blood splatter pattern, biology is used to track down the origin of an unidentified suspect, and chemistry is utilized to determine drug composition. The significance of forensic science in criminal justice and the legal system is frequently underestimated.

Forensic analysis is often performed by professionals working alone or in groups. Forensic evidence analysis is utilized in the investigation and prosecution of civil and criminal cases. It may frequently aid in determining the guilt or innocence of potential suspects. Forensic evidence is also utilized to connect crimes that are suspected to be linked. For example, DNA evidence might link a single criminal to many crimes or crime locations (or exonerate the accused). Linking crimes assists law enforcement agencies in narrowing the pool of prospective suspects and establishing patterns of crime, which is important in identifying and prosecuting criminals.

Forensic Science is one of the essential components of criminal justice. It essentially deals with the scientific assessment of physical clues gathered from the crime scene. The identity (what) of the crime committed is gathered through rhetorical investigation of physical clues. The conditions speak volumes about the time (when) of the occurrence. The rhetorical proof establishes the location of the crime (where/crime scene). The rhetorical investigation determines the offender's technique (how). Finally, it explains the motive for the crime. The culprit and hence the victim are determined by the rhetorical investigators. The work of a forensic scientist in a criminal investigation is crucial since it involves a comprehensive examination of evidence while assuring that it is not tampered with. A diverse array of forensic professionals and forensic techniques are used in the investigation of a criminal activity. Autopsies to identify the cause of death, for example, are performed by forensic pathologists. An autopsy can assist in identifying the cause and manner of death by examining bodily fluids and tissues. Forensic scientists analyze physical evidence (fingerprints, DNA, hair, etc.) acquired from the crime scene to identify suspects. [9,10,11] Furthermore, forensic professionals use image modification technology to seek down perpetrators who have eluded authorities for a long time. Forensic Science in Criminal Proceedings Evidence is collected at the scene of the crime during an investigation, tested in a laboratory, and the results are presented in court. Forensic science is important in the criminal justice system because it provides accurate information through the study of physical evidence, as well as the identification of the perpetrator through personal indicators such as fingerprints, footprints, blood droplets, or hair. It connects the perpetrator to the crime by artefacts left at the site and with the victim, or transported from the scene and with the victim. On the other hand, if the discovered clues do not connect the accused to the victim or the location of the crime, the accused's innocence is proven. The judicial system recognizes the value of forensic evidence in criminal proceedings. This is due to the fact that when scientific ideas and methodologies are used, there is minimal opportunity for bias or unfairness. As a result, DNA profiling and some other forensic evidences are widely accepted in courts worldwide. Forensic scientists can filter down



prospective suspects by evaluating a criminal's behaviors and features. Based on psychological evaluations of the objects seized from a criminal there is a contribution to the building of a thorough social and psychological profile of the perpetrator. Forensic Science in Civil Proceedings Forensic evidence is not only used in criminal investigations and trials. Forensic investigations and analysis have been shown to be useful in mediation, arbitration, and civil litigation. Physical evidence is subject to the same forensic concepts, protocols, and scientific methodologies whether the case is criminal or not. Handwriting and Questioned Document Examination can be critical in dispute resolution instances involving fraudulent documentation because it addresses issues such as whether a controversial document has been manipulated, backdated, substituted, or whether the signatures on a document were faked. In civil lawsuits involving traffic accidents or industrial mishaps, where the claimant is suing the defendant for negligence in order to recover compensation, the expertise of a forensic scientist who is well-versed and skilled in niche areas such as road accident reconstruction, occupational injuries reconstruction, and examination of damaged materials will be useful in assisting the courts in determining the culpability of the parties involved in the occurrence. Forensic investigations, analysis, and modelling tests can be very helpful in understanding the contributing components and underlying causes of an occurrence such as a fire, explosion, or vandalism. Forensic discoveries aid in unravelling the events that most likely occurred, as well as the behaviors of individuals. Forensic Analysis in the Indian Scenario Sections 45 and 46 of the Indian Evidence Act offer a quick summary of the admissibility of forensic evidence in courtrooms. The following may be found in sections 45 and 46: When required, the court will depend on experienced experts with technical and field knowledge of the facts described in the case. The court will depend on the report presented by the official or expert who arrived at his conclusions in good faith utilizing a range of techniques. Any evidence that appears irrelevant to the court but is important in the expert's opinion will be given relevance as a result of the expert's opinion. Sec. 73 of the Indian Evidence Act, directs that any person can be asked to give a fingerprint or DNA examination even if they are the accused. The Code for Criminal Procedure has several provisions enabling the analysis by an expert in order to examine certain cases. Section 53 (I) CrPC states that an accused may be investigated by a medical practitioner at the request of a police officer who is using reasonable force. Section 53 (ii) CrPC requires that any examination of a female accused person be conducted only by or under the supervision of a female certified medical practitioner. Under Section 54 CrPC, a medical practitioner may examine an arrested person at his request in an attempt to identify evidence in his favor.[12,13,15] There have constantly been concerns that forensic evidence given in a court of law violates the fundamental provisions of the law. According to Article 20(3) of the Indian Constitution, any person accused of criminal conduct cannot be forced to testify against himself. Many people believed that using fingerprints and DNA analyses for verification violated Article 20. (3). They contended that requiring the accused to provide fingerprints is equivalent to the accused providing evidence against themselves. However, in the case of State of Bombay v. Kathi Kalu Oghad and Anr.[1961 AIR 1808], the Supreme Court ruled that ordering anybody to provide forensic evidence such as fingerprints, blood, or hair sperm did not violate the clause of Article 20(3). The Hon'ble Supreme Court upheld the constitutionality of the use of narco-analysis and lie detectors in the case of Ramchandra Reddy and Ors. v. The State of Maharashtra[1 (2205) CCR 355 (DB)], but recently in 2006, in the case of Selvi and Ors. v. State of Karnataka and Anr. [(2010) 7 SCC 263] held that if the person providing statements in brain mapping or narco-analysis test is in a semi-conscious state they cannot be considered conclusive and thus it cannot be made a part of the compulsory investigation process. Despite the fact that the use of forensic evidence has increased in the court system, there is still a limiting usage in the Indian judiciary. To date, the court has relied heavily on non-forensic, non-scientific evidence to render a decision. According to a recent survey undertaken by the Supreme Court of India and the High Court of Delhi, barely 60-65 cases are resolved using forensic evidence. DNA evidence has only been utilized in roughly 5% of murder cases and 3% of rape cases. These numbers demonstrate the absence of scientific evidence in an Indian criminal inquiry. Courts have often remarked on the grounds for their unwillingness to employ forensic evidence in criminal investigations, including faulty collection, lack of preservation, non-collection of physical proof, unmaintained chain of custody, and delayed dispatch of tangible evidence for scientific examination.[17,18,19]

III.RESULTS

In recent years, forensic science has grown dramatically, particularly in the fields of DNA collection and analysis and crime scene reconstruction. Nonetheless, there are far too few specialists who are competent in utilizing forensic science in legal situations. Well-trained forensic scientists and medical examiners may make or break evidence's capacity to appropriately depict the facts of a case. Forensic science may be employed in practically every case; however, homicide, rape, and arson investigations gain the most from it. Forensic science, as a scientific approach, is a boon to the justice system. To move forward, we must address the current faults. On the same hand, there is a need to ensure that law enforcement and investigative agencies fully comprehend and utilize forensic science as a comprehensive problem-



solving resource. There has been a focus in India on the inclusion of technology in the field of inquiry. Several commission studies argued that using the scientific approach in delivering decisions might bring about fairness, which is a cornerstone of democracy. However, courts have been hesitant to incorporate forensic science into their systems, owing to past experiences with contaminated evidence and fabricated outcomes. The government must take initiatives to raise public knowledge about the value of forensic science in the justice system. Police, investigating officers, detectives, and researchers must be educated on the advancement of science and technology, as well as the significance of such evidence.

Subdivisions-of-forensics

- Art forensics concerns the art authentication cases to help research the work's authenticity. Art authentication methods are used to detect and identify forgery, faking and copying of art works, e.g. paintings.
- Bloodstain pattern analysis is the scientific examination of blood spatter patterns found at a crime scene to reconstruct the events of the crime.
- Comparative forensics is the application of visual comparison techniques to verify similarity of physical evidence. This includes fingerprint analysis, toolmark analysis, and ballistic analysis.
- Computational forensics concerns the development of algorithms and software to assist forensic examination.
- Criminalistics is the application of various sciences to answer questions relating to examination and comparison of biological evidence, trace evidence, impression evidence (such as fingerprints, footwear impressions, and tire tracks), controlled substances, ballistics, firearm and toolmark examination, and other evidence in criminal investigations. In typical circumstances, evidence is processed in a crime lab.
- Digital forensics is the application of proven scientific methods and techniques in order to recover data from electronic / digital media. Digital Forensic specialists work in the field as well as in the lab.
- Ear print analysis is used as a means of forensic identification intended as an identification tool similar to fingerprinting. An earprint is a two-dimensional reproduction of the parts of the outer ear that have touched a specific surface (most commonly the helix, antihelix, tragus and antitragus).
- Election forensics is the use of statistics to determine if election results are normal or abnormal. It is also used to look into and detect the cases concerning gerrymandering.
- Forensic accounting is the study and interpretation of accounting evidence, financial statement namely: Balance sheet, Income statement, Cash flow statement.
- Forensic aerial photography is the study and interpretation of aerial photographic evidence.
- Forensic anthropology is the application of physical anthropology in a legal setting, usually for the recovery and identification of skeletonized human remains.
- Forensic archaeology is the application of a combination of archaeological techniques and forensic science, typically in law enforcement.
- Forensic astronomy uses methods from astronomy to determine past celestial constellations for forensic purposes.
- Forensic botany is the study of plant life in order to gain information regarding possible crimes.
- Forensic chemistry is the study of detection and identification of illicit drugs, accelerants used in arson cases, explosive and gunshot residue.[18,19]
- Forensic dactyloscopy is the study of fingerprints.
- Forensic document examination or questioned document examination answers questions about a disputed document using a variety of scientific processes and methods. Many examinations involve a comparison of the questioned document, or components of the document, with a set of known standards. The most common type of examination involves handwriting, whereby the examiner tries to address concerns about potential authorship.
- Forensic DNA analysis takes advantage of the uniqueness of an individual's DNA to answer forensic questions such as paternity/maternity testing and placing a suspect at a crime scene, e.g. in a rape investigation.
- Forensic engineering is the scientific examination and analysis of structures and products relating to their failure or cause of damage.
- Forensic entomology deals with the examination of insects in, on and around human remains to assist in determination of time or location of death. It is also possible to determine if the body was moved after death using entomology.



- Forensic geology deals with trace evidence in the form of soils, minerals and petroleum.
- Forensic geomorphology is the study of the ground surface to look for potential location(s) of buried object(s).^[73]
- Forensic geophysics is the application of geophysical techniques such as radar for detecting objects hidden underground^[74] or underwater.^[75]
- Forensic intelligence process starts with the collection of data and ends with the integration of results within into the analysis of crimes under investigation.^[76]
- Forensic interviews are conducted using the science of professionally using expertise to conduct a variety of investigative interviews with victims, witnesses, suspects or other sources to determine the facts regarding suspicions, allegations or specific incidents in either public or private sector settings.
- Forensic histopathology is the application of histological techniques and examination to forensic pathology practice.
- Forensic limnology is the analysis of evidence collected from crime scenes in or around fresh-water sources. Examination of biological organisms, in particular diatoms, can be useful in connecting suspects with victims.
- Forensic linguistics deals with issues in the legal system that requires linguistic expertise.
- Forensic meteorology is a site-specific analysis of past weather conditions for a point of loss.
- Forensic microbiology is the study of the necrobiome.
- Forensic nursing is the application of Nursing sciences to abusive crimes, like child abuse, or sexual abuse. Categorization of wounds and traumas, collection of bodily fluids and emotional support are some of the duties of forensic nurses.
- Forensic odontology is the study of the uniqueness of dentition, better known as the study of teeth.
- Forensic optometry is the study of glasses and other eyewear relating to crime scenes and criminal investigations.
- Forensic pathology is a field in which the principles of medicine and pathology are applied to determine a cause of death or injury in the context of a legal inquiry.
- Forensic podiatry is an application of the study of feet footprint or footwear and their traces to analyze scene of crime and to establish personal identity in forensic examinations.
- Forensic psychiatry is a specialized branch of psychiatry as applied to and based on scientific criminology.
- Forensic psychology is the study of the mind of an individual, using forensic methods. Usually it determines the circumstances behind a criminal's behavior.
- Forensic seismology is the study of techniques to distinguish the seismic signals generated by underground nuclear explosions from those generated by earthquakes.
- Forensic serology is the study of the body fluids.^[77]
- Forensic social work is the specialist study of social work theories and their applications to a clinical, criminal justice or psychiatric setting. Practitioners of forensic social work connected with the criminal justice system are often termed Social Supervisors, whilst the remaining use the interchangeable titles forensic social worker, approved mental health professional or forensic practitioner and they conduct specialist assessments of risk, care planning and act as an officer of the court.
- Forensic toxicology is the study of the effect of drugs and poisons on/in the human body.
- Forensic video analysis is the scientific examination, comparison and evaluation of video in legal matters.
- Mobile device forensics is the scientific examination and evaluation of evidence found in mobile phones, e.g. Call History and Deleted SMS, and includes SIM Card Forensics.
- Trace evidence analysis is the analysis and comparison of trace evidence including glass, paint, fibres and hair (e.g., using micro-spectrophotometry).
- Wildlife forensic science applies a range of scientific disciplines to legal cases involving non-human biological evidence, to solve crimes such as poaching, animal abuse, and trade in endangered species.[15,17]

IV.CONCLUSIONS

Forensic analytical techniques play a major role in solving many criminal cases. DNA analysis, Finger printing, voice recognition, hand writing analysis, ballistics, autopsy etc are forensic methods to detect a reason for crime or death.



Most important areas of physical, life and materials science are used in forensic analytical techniques. Techniques such as chromatography will be used as forensic analytical technique, where some hidden metals and chemicals are traced. There are forensic analytical techniques, where the age of an unknown human body will be estimated. In some forensic analytical techniques, data will be analysed using digital forensics.[20]

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