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Beyond Reasonable Doubt: How Forensic Science Shapes the Criminal Investigation?

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ABSTRACT

Forensic science is closely linked to the field of law numerous branches of forensic science, including DNA, fingerprint, and brain mapping analysis aids in the criminal investigation. This method provides an unbiased assessment of the suspect's guilt or innocence as it relies on the factual evidence rather than human influence. In this Article The author's goal is to assess the evidential significance of forensic science within the legal justice system. whether applying different methods of forensic science on suspects without their consent violates Article 20(3) of constitution or not. As well as how forensic science correlates to criminal investigations and role of forensic experts in identifying victims, cause of death By using different forensic techniques such as anthropology, autopsy etc and lastly conclude it with the landmark judgements in which forensic techniques were used in criminal investigation.

KEYWORDS

*Forensic science, Criminal Investigation, DNA Report,
Forensic experts*

INTRODUCTION

Forensic is based on the Latin phrase “*forensis*” which means of or before the forum. Forensic science play crucial role in investigation procedure. Investigating officer collects samples of DNA, fingerprint, blood stains from the crime scene and send it to the laboratory for unbiased reports which used as a evidence in criminal and civil case.

According to (Richard Saferstein) forensic science is applied science to those criminal and civil laws that are enforced by police agencies in criminal justice system¹

In India forensic science is became part of investigation in narrow sense the forensic scientist used different effective techniques to analyse the crime scene to collect evidence and help investigation team.² Forensic scientists testify as a expert witnesses and there opinion are relevant in court under Section 39 of BSA. The forensic science used in two ways firstly its report directly used as a evidence in the trial and secondly it connect the link by giving clue to determine the suspect.³

Role of forensic science in Criminal investigation

Forensic science is a technology that is directly linked to the law. The role of forensic science is to provide unbiased reports through which courts identify various things such as age, sex and the relationship of the accused. Forensic science not only helps to determine the guilt of the accused but also provides justice by determining the innocence of the person through scientific techniques.

Forensic science is a multidisciplinary field that involves the application of scientific principles And techniques to analyse and interpret physical evidence from crime scenes. Forensic science and the criminal justice system are two distinct but closely related components of the process of investigating, prosecuting, and adjudicating crimes. While they have different roles and functions, they work in tandem to ensure the fair and effective administration of justice. Here's a comparison of forensic science and the criminal justice system. Therefore, forensic science is a specialized field within the criminal justice system that provides essential scientific support and evidence analysis. While forensic

¹ Criminalistics: An introduction to forensic science by Richard safer-stein

² Donald C. Lehman American Society for Clinical Laboratory Science April 2012,

³ <https://shodhganga.inflibnet.ac.in/bitstream/10603/380314/7/chapter-2.pdf>

scientists focus on the objective analysis of physical evidence, the criminal justice system, as a whole, manages all aspects of criminal cases from investigation to adjudication. These two components work collaboratively to ensure the fair and effective resolution of criminal matters and to uphold the principles of justice.⁴

Research Methodology

The research gathered it's primary data from various provisions of constitution, BNSS and BSA and through the various landmark judgements and to examine the objective and answers the research questions the secondary data is gathered from various websites, books and legal commentaries.

Research question and Objectives of the Research

- How different forensic techniques help to determine whether a person is guilty or innocent.
- What is the admissibility of forensic reports in criminal justice system.

FORMS OF FORENSIC TECHNIQUES USED IN CRIMINAL INVESTIGATION

There are many forms of forensic science techniques which is used in criminal investigation to uncover the truth are discussed below-

Narco-analysis Test

The Narco Analysis Test is also known as the Truth Serum Test. Narco-analysis is a sort of psychotherapy that can aid in scientific interrogation. A narco-analysis test involves administering a drug, such as sodium amytal, to a suspect to determine the truth about the crime.⁵

In Aarushi Talwar-Hemraj Double Murder case⁶ , Dr. Rajesh Talwar and Dr. Nupur Talwar were subjected to Narco-analysis test to confirm their involvement in The crime. In this case, the results of Narco-analysis were admissible in the court.Narco-analysis has been criticized on the ground that it is not completely reliable.

4. International Journal of Research in all Subjects in Multi Languages [Author: Mrs. Neetaben K. Patel] [Sub.: Law] I.F.6.133

5. www.wjpmr.com | Vol 10, Issue 9, 2024

6. 2013 (82) ACC 303

7. Gautam Kundu vs state of west Bengal 1993 SCR (3) 917

DNA Profiling

DNA is the genetic substance found in the nucleus of all living cells. It provides essential knowledge for personal development. The investigating officer collects samples of saliva, blood, hair, and nails from the crime scene and sends them for DNA testing. Its reports are used as evidence in the court of law to determine the guilt or innocence of a person.

Section 116 of Bhartiya Sakshya adhiniyam talks about birth during marriage is a conclusive proof of legitimacy controversy arises when considering the use of DNA evidence it was ruled that no individual can be forced or compelled to give blood samples for any purpose⁷ but afterwards this position is changed and it was held by several courts that neglecting DNA test is unjust and unfair⁸.

Ballistics test

Ballistics is the branch of forensic science that focuses on firearms and the projectiles they release. This field specifically examines the unique markings left on a bullet by a gun, the trajectory angle of a bullet post-firing, and the effects a bullet has upon impact with a target. Ballistic evidence helps determine the type of firearm utilized in a crime and provides additional information about the incident, such as the shooter's position relative to the target. It can also indicate if a weapon used in one offense has been implicated in another incident where similar ballistic evidence was found.⁹

In the case of *State vs Sushil Sharma* court confirmed through the ballistic report that bullet recovered from the sahni's body fired from sharma's licenced gun. So ballistic technique is a form of forensic science which give accurate results in order to punish the person by connecting link through its reports.

Fingerprint Test

The analysis of fingerprints has been utilized for over a century to identify suspects and resolve crimes, continuing to serve as a vital resource for law enforcement. A key application of fingerprints is their ability to connect different crime scenes associated with the same individual. Additionally, fingerprint identification assists investigators in tracing a criminal's history, including prior

8. Nandlal basudeo badwaik vs Lata Nandlal Badwaik, AIR 2014 SC 932

9. <https://mdcriminalattorney.net/ballistic-evidence/>

arrests and convictions, which can be beneficial during sentencing.¹⁰

The provisions of criminal procedure identification act (2022) and the identification of prisoners act 1920 permits the gathering of fingerprints, biological specimens, and additional identifying information from individuals convicted of crimes and those apprehended for offenses. Fingerprint specimen of the accused if taken is admissible in the court of law and does not violate any fundamental right under article 20(3) of the Indian constitution¹¹

In the case of *State of M.P vs Sitaram Gajraj* singh court stated that although there are various metrics and indicators associated with the analysis of fingerprint impressions, there isn't a strict guideline for it. Even if certain fingerprint patterns do not resemble the sample fingerprint, they can still serve to establish true identity¹².

SPECIAL AREAS OF FORENSIC SCIENCE INCLUDES

Forensic toxicology

Forensic toxicology involves examining biological samples to detect toxins, including various drugs. The toxicology report can reveal crucial details about which substances are found in a person and whether their concentrations align with therapeutic levels or surpass dangerous amounts. These findings can aid in drawing conclusions regarding a substance's possible impact on an individual's death, health issues, or mental and physical functioning.¹³

Forensic toxicology is significant in criminal investigations because it aids in the identification of drugs and other Harmful compounds in biological samples and provides critical information to law enforcement agencies and the Judicial system.¹⁴

Forensic anthropology

Forensic anthropology is a subdivision of physical anthropology that integrates with the legal system to assist in criminal investigations. These specialists are crucial in resolving cases that

10. <https://www.forensicsciencesimplified.org/prints/>

11. [1961] 2 SCR 125.

12. 1978 MPLJ 197.

13. <https://nij.ojp.gov/topics/forensics/forensic-toxicology>

14. Research & Reviews: Journal of Pharmacology and Toxicological Studies
e-ISSN: 2322-0139 p-ISSN: 2322-0120.

involve uncertainties regarding an individual's identity. They aid in unraveling criminal mysteries by analyzing skeletal remains in situations involving buried corpses. By utilizing various analytical and examination methods, these experts determine the identity of the deceased, the cause of death, the time elapsed since death, and other relevant details.¹⁵

Forensic Pathology

Forensic pathologists are essential in investigations surrounding death. Their work involves identifying the cause and manner of death through autopsies, reviewing medical histories, and evaluating evidence. The cause of death indicates the medical issue or trauma that resulted in the individual's passing, whereas the manner of death refers to the context in which the death occurred, which can include categories such as homicide, suicide, accidental, or natural.

Autopsies serve as the key method for forensic pathologists to ascertain the cause and manner of death. In an autopsy, the pathologist inspects the body for any indications of injury, disease, or trauma. They may also collect samples for toxicological analyses and other lab tests. The results from the autopsy are then utilized to establish the cause of death and to provide critical evidence for criminal cases or civil disputes.¹⁶

Forensic Engineering

Forensic engineering involves examining the causes of property damage and injuries resulting from failures in materials, components, designs, or construction.¹⁷ Forensic Engineering applies various engineering disciplines, such as mechanical engineering, civil engineering, and materials science, to forensic science. For example, mechanical engineers may analyze the mechanics of a crime scene, such as the trajectory of a bullet or the damage caused by a collision. Civil engineers may examine the structural integrity of a building or the cause of a collapse.¹⁸

Digital forensic

Digital forensics encompasses the retrieval, examination, and analysis of electronic information to reveal evidence for legal

15. <https://lifs.co.in/blog/forensic-anthropology.html>

16. <https://www.longdom.org/open-access/forensic-pathology-its-role-in-legal-systems-and-death-investigations-102148.html>

17. <https://fox-ae.com/the-role-of-forensic-engineering-in-investigation/>

18. <https://www.numberanalytics.com/blog/role-engineering-forensic-science>

disputes, criminal investigations, internal inquiries, and incidents of data breaches. Digital forensic is essential in investigating cybercrime, fraud detection, counter terrorism, crypto crime etc. The computer system and storage devices can be valuable evidence in the investigation.

EVIDENTIARY VALUE OF FORENSIC SCIENCE IN CRIMINAL JUSTICE SYSTEM

Prior to an item being accepted as evidence, a proper legal groundwork must be established for its inclusion. Both procedural regulations and the substantive law of evidence mandate a prerequisite condition for admitting an item into evidence.¹⁹ According to section 39 of bhartiya sakshya adhiniyam 2023 When the Court has to form an opinion upon a point of foreign law or of science or art, or any other field, or as to identity of handwriting or finger impressions, the opinions upon that point of persons specially skilled in such foreign law, science or art, or any other field, or in questions as to identity of handwriting or finger impressions are relevant facts²⁰ Section 53 of BNSS provides that The examination of accused person by the medical practitioner at the request of the police officer if there are reasonable grounds that such examination provides evidence²¹. The reports of scientific experts Submitted for examination in legal proceedings to be used as evidence.²²

Who is experts and what is relevancy of their opinions?

Individuals who possess specialized knowledge regarding a specific fact are considered experts in that area; thus, a forensic scientist can be someone with particular skills and experience in the scientific and forensic disciplines. The opinions of experts cannot become the sole basis of conviction unless corroborated if it is improperly collected. Admissibility is determined by a multitude of elements, including the Status of the expert witness, the quality of the methodology, and the underpinning science.²³

In the case of State of Himachal pradesh vs Jai lal 1999 it was ruled that An expert is not a witness of fact. His evidence is really of an advisory character. The duty of an expert witness is to furnish the Judge with the necessary scientific criteria for testing the accuracy of the conclusions so as to enable the judge to form his independent judgment by the application of this criteria to the

19. Younger and M goldsmith principle of evidence (National Institute 1984) 3

20. Section 39 of Bhartiya Sakshya adhiniyam 2023

21. Section 53 of b

22. BNSS Section 329 of bnss

23. www.ijrti.org

facts proved by the evidence of the case.²⁴

In the case of *Madan Gopal v. Naval Dubey* 1992 It was determined that a medical opinion is merely an opinion and does not have a binding effect on the court. The court regards opinions on technical matters and factual information provided by medical professionals solely as guidance, and it must arrive at its own conclusion.²⁵

In the Nirbhaya murder and rape case, the critical factor was the forensic evidence. The evidence included the fingerprints of the four suspects and their bite marks. In this case, the bench, which also included Justices R. Banumathi and Ashok Bhushan, stated, “DNA technology not only assisted in the investigation but also provided the court with essential information regarding the ‘identifying characteristics’ of criminals, and such evidence is increasingly utilized by the courts.²⁶

So, the relevancy of forensic experts opinion cannot conclusive in nature unless consistent with the circumstantial and direct evidence but in some instances if court deems fit that DNA reports, fingerprint tests, or narco analysis directly shows the accused guilt or innocence become the sole basis for conviction or acquittal.

CONSTITUTIONAL VALIDITY OF FORENSIC SCIENCE IN CRIMINAL JUSTICE SYSTEM

The Constitution of India consists of several principles Which protects rights of accused it is general principle that the person is innocent until proven guilty forensic science held to be constitutional if it does not contravenes provisions of constitution

There are several fundamental rights which must follow to ensure the constitutional validity of forensic science are as follows –

Article. 20(3) - According to the Indian Constitution, no one who is charged with a crime may be forced to testify against himself. The purpose of this piece was to protect the accused from the psychological harassment they endure while the police are investigating them. It was found that cops would severely beat the accused and force them to act as witnesses against themselves in order to wrap up the case. According to this principle, no one is compelled to answer any questions or provide any reports that

24. Indian Kanoon - <http://indiankanoon.org/doc/1652872/>

25. www.manupatra.com

26. lex fortii legal journal vol -1 issue- 111

27. Article 20 Indian constitution

could be used against them in court²⁷

Can DNA tests violates Article 20(3) of constitution ?

The various landmark judgements clear that DNA test, fingerprints and thumb impression if use as evidence in the court cannot violates accused rights of privacy and self incrimination under article 21 and 20(3) of indian constitution.

In the case of Das Anu vs state of kerala 2022 it was held by the court that DNA profiling of accused and victim is permissible according to section 53A and section 164 A of the CRPC.

In the case of Kanchan Bedi vs Gurpreet singh Bedi²⁸ high court held that when there is a question related to the father of child to undergo DNA test does not violate any right of the person.

Narco analysis test is permissible in what circumstances

Narco analysis Involves injecting a medication called sodium pentothal with distilled water into the body of the accused or any suspect, neutralizing their imagination and expecting them to reveal true information about the crime. Thus, the Narco-analysis test is also known as the truth serum.²⁹

The court provided different views in different cases related to permissibility of narco analysis test

In the case of selvi vs state of Karnataka the court held that The compulsory administration of neuroscientific tests amounted to testimonial compulsion and violated the rule against self-incrimination guaranteed under Article 20(3)The Court noted that the purpose of the right against self incrimination was to ensure that testimony considered during trial was reliable, since involuntary statements were more likely to be inaccurate, while also violating the dignity and integrity of the person³⁰

It was ruled by SC in Amlesh Kumar vs State of Bihar³¹that compelling an accused to undergo such a test without free consent violates their fundamental rights under Articles 20(3) and 21 of the Constitution. The Court held that even when narco-analysis tests are administered voluntarily, their results cannot form the sole basis of conviction.³²

28. Kiran Bedi vs Gurmeet Singh Bedi AIR 2003 Delhi 446

29. <https://juriscentre.com/2022/10/05/narco-analysis-test-and-its-constitutional-validity/>

30. <https://privacylibrary.ccgnlud.org/case/selvi-vs-state-of-karnataka>

31. <http://www.scconline.com/DocumentLink/t7n0Ic08>

32. Vinobhai v. State of Kerala, 2025 SCC Online SC 178 and Manoj Kumar

So from the various judgments, we can say that if a narcoanalysis test is done without the accused's consent or involuntarily, it is not permissible.

CASE REFERENCES

Sheena Bohra Murder case 2015

In this case Sheena bohra was murdered by her mother and court come to the conclusion through the various forensic evidence such as tooth, hair , DNA which was collected from crime scene. Digital forensic used to identity the call data records forensic science in this case fill the gap between the missing physical evidence.³³

State of Gujarat vs Kishan Bai 2014

The defendant, Kishan, is accused of abducting a six-year-old girl named Gomi, raping her, and mutilating her body. In this case investigating officer collect sample of pubic hair , DNA of the accused through which it is clear that the rape ad murder was committed by the accused and held guilty by the court.

***Rohit Shetty vs Narayan Dutt Tiwari* ³⁴**

wherein, the issue of paternity was concerned and the Delhi High Court ordered the respondent to undergo a DNA test, as the petitioner was able to produce DNA evidence which excluded the possibility that his legal father was his biological father and the judgment of the High Court was upheld in the Apex Court.

Nitish Katara vs State of UP 2016

This case was based on honour killing in which identity and cause of death was determined by using different forensic science techniques such as forensic Pathology and based on this 30 year imprisonment was awarded to Vikas and Vishal Yadav.

Zahira Habidullah Sheikh vs State of Gujarat 2004

In this case family of Zahra was attacked in which 14 individuals were killed through ballistic report and post-mortem Court awarded sentence to the accused.

Soni v. State of M.P., 2023 SCC OnLine SC 984,

33. <https://www.thehindu.com/news/national/maharashtra/sheena-bora-case-prosecution-confident-that-dna-report-will-34.2012/SCC-554>

LIMITATION OF FORENSIC SCIENCE IN INVESTIGATION

Although forensic science significantly aids in crime resolution and the attainment of justice, it encounters numerous hurdles. The possibility of human mistake in the evaluation and interpretation of the evidence is among the most important problems. The accuracy of forensic analyses can be affected by bias, insufficient training and many other factors.³⁵ If there is a link gap in the forensic investigation, it gives incorrect results.

According to the study of Dr. John Morgan³⁶, The person was convicted for the offenses that were not committed by him. Faulty forensic science is partly to blame for some of these convictions. The problems with forensic evidence range from simple mistakes to invalid techniques, although in some cases it's impossible to distinguish one type of forensic error from another. To advance this, Dr. Morgan designed a study to examine the specific types of errors associated with forensic evidence, such as lab error, poor communication, wrong sample collections, etc.

CONCLUSION

So, from this paper we understand that Forensic science comes up as an imperative tool in the pursuit of justice. Forensic proof is often used for both who have been convicted and acquitted. The testimony of forensic experts can be admissible in the court if supported by other circumstantial evidences. Recent advances in modern biological research have redefined forensic Science it's likely that advanced forensic techniques help to solved the cold cases which is previously not possible. Forensics can be utilised to both identify the body and narrow down the list of Prospective murder suspects in the case of human remains. Analysing the Dental work on the bones, as well as studying the skeletal structure of the deceased can help to identify the body. To guarantee that no innocent person can be penalized due to mistakes in datainterpretation andEvidence gathering, it is crucial to provide training to scientists when implementing new forensic science technologies

³⁵ <https://www.longdom.org/open-access/challenges-and-key-branches-of-forensic-science-in-criminal-investigations-104610.html>

³⁶ <https://nij.ojp.gov/topics/articles/impact-false-or-misleading-forensic-evidence-wrongful-convictions>