

CRIMINAL INVESTIGATION VIS-À-VIS MEDICAL JURISPRUDENCE EMPHASIZING ON FORENSIC EVIDENCE: A LEGAL ANALYSIS ON EFFICACY OF LEGISLATIONS

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Abstract: Medical Jurisprudence is the discipline which deals with legal aspect of medical practice that covers forensic evidence in crime investigation. Forensic Science constitutes an integral part of crime investigation. It plays a vital role in answering the factual questions which create a plethora of doubt in criminal cases before reaching to a just and proper conclusion. Its objective is to provide reliable evidence which exonerate innocent individual and convict the real culprit. Medical Jurisprudence embraces all aspects of evidence collection which safeguard the rights of victim as well as that of offender. This article will emphasize the role of forensic science in criminal investigation, the challenges faced by the experts while conducting forensic examination and the legal framework which paves the way for effective administration of justice. To ensure the effectiveness the justice delivery system, forensic science provides powerful tools to identify the real accused, reconstruct crime scenes and present reliable evidence in the court of law. As far as evidentiary value is concerned, forensic evidence is more acceptable when compared to human testimony. As with the passage of time, humans may change their statements due to various factors whereas forensic evidence does not. Further, it aims to elaborate the evolution and development of forensic science in the Indian Legal System. Thereafter, the author would like to shed light on the various methods of forensic science examination emphasizing the medico-legal issues. This article will focus on the significance of forensic evidence in criminal investigation³ and intersection of medicine and law in India.

Keywords: Medical Jurisprudence, Crime Investigation, Forensic Science, Medico-legal Issues, Indian Legal System.

I. INTRODUCTION

Forensic Science holds indispensable role in criminal investigation providing scientific evidence aid in solving criminal cases¹. Its application starts right from the crime scene up to the conclusion of the criminal trial. Every step taken by forensic science examination is essential to get accurate result and one single step of negligence leads to wrongful conviction². In India, there is no special legislation which deals exclusively with forensic science but its mention can be found in several legislations³. The provision regarding conduct of examination and collection of medical evidence

has been embodied under the general criminal law legislations. At present, the Bharatiya Nyaya Sanhita, 2023; Bharatiya Nagrik Suraksha Sanhita, 2023 and Bharatiya Sakshya Adhiniyam, 2023 governs the conduct of forensic science examination and production of forensic evidence in criminal cases⁴.

Dr. Edmond Locard, a French criminologist and pioneer in forensic science formulated the basic principle of forensic science that is popularly known as Locard's Exchange Principle which states that no activity can take place without leaving a trace or it can be described as 'Every contact leaves a trace'⁵. His principle was

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³ Beulah Shekhar, Purvi Pokhariyal, *Forensic Justice: A Global Perspective* (1st edn, 2024)

⁴ Upinder Singh Jandu, Dr. Sarita Jand, *Forensic Science & Law* (1st edn, Allahabad Law Agency 2017).

⁵ National Institute of Justice, Advancing Justice Through Science 'The Impact of False or Misleading Forensic Evidence on Wrongful Convictions' (2023) <<https://nij.ojp.gov/topics/articles/impact-false-or-misleading-forensic-evidence-wrongful-convictions>> accessed 14 February 2025

⁶ Nisha Kumari, 'Forensic Evidence and Their Admissibility' (2020) 2(2) IJLSI < <https://www.ijlsi.com/wp-content/uploads/Forensic-Evidence-and-Their-Admissibility.pdf> > accessed 14 February 2025

⁷ Srishti, 'The Impact of Forensic Science on the Legal System in India' (2025) Journal of Forensic Science and Research < <https://www.forensicscijournal.com/apdf/jfsr-aid1072.pdf> > accessed 14 February 2025

⁸ Zakaria Erzincliglu, 'Every Contact Leaves a Trace: Scientific Detection in the Twentieth Century' (1st edn, 2001)

further modified by Paul L. Kirk who expressed that wherever he steps, whatever he touches, whatever he leaves, even unconsciously, will serve as a silent witness against him⁶. Thereby, it meant that even a minute trace including digital trace left by taking a small step while committing a crime constitutes a part of forensic evidence. It is strongly believed that every perpetrator brings something to crime scene and takes something away from it⁷. At every crime scene, touch of offender exists and where there is a touch there is a trace DNA (Deoxyribonucleic acid)⁸. The biological materials found commonly at crime scenes are blood which includes dry as well as wet blood, blood stain on cloth, blood stain on weapon, semen, seminal stains on cloth, hair, fibres, fingerprints, footprints, etc⁹.

Nowadays, the pace of development of society is such that offenders use novel technology to commit crime and in these types of crime traditional methods of investigation and examination fails to present the concrete evidence before the court¹⁰. In order to lessen the difficulties and ineffectiveness of traditional methods of investigation, forensic science examination comes into picture to play a crucial role in collecting the evidences and examining it to get the true result which further facilitates the judicial system in effective administration of justice¹¹.

II. EVOLUTION OF FORENSIC LAWS IN INDIA

A. During Ancient India

The emergence of forensic science in crime investigation in India can be traced in the Kautilya's Arthashastra where it was

mentioned that death can be caused mainly by four ways that includes strangling, hanging, asphyxiation, or drowning.¹² It describes two ways of physical injury either by beating or by throwing from a height¹³. Further, it provides a comprehensive list for establishing the cause of death. It has also described the necessity of establishing the cause of death by autopsy.

Additionally, Atharva veda gives insights for remedies for wounds, burns, poisoning, etc. which is now dealt under the forensic science methodology¹⁴. The Charaka Sanhita lays down the significance of medical ethics¹⁵ emphasizing upon training, duties and role of medical personnels which is now referred as medical professionals. Shusruta Sanhita composed by father of India Surgery, Shusruta gives knowledge relating to forensic medicine mainly focusing upon toxicology¹⁶. Therefore, these ancient texts highlighted the existence of forensic science since time immemorial which is now being developed as per the need of the society but the concept is not new.¹⁷

B. During British India

• Indian Penal Code, 1860

The Indian Penal Code, 1860 is a comprehensive code that covers all aspect of involvement of forensic science in commission of any offence¹⁸. It has categorized the offences on the basis of minute difference involved in forensic test right from a small injury¹⁹ to murder or death caused by any other way. It provides a framework for initiating forensic examination based on the nature of crime and its sensitivity in the society²⁰.

• Indian Evidence Act, 1872

The Indian Evidence Act, 1872 embodies the law of evidence which provides way to present

⁶ Alecto Forensics, 'The Three Principles of Crime Scene Investigation' < <https://www.alectoforensics.com/the-three-principles-of-crime-scene-investigation/> > accessed 14 February 2025

⁷ Ibid

⁸ Llyod Institute of Forensic Science, 'Evolution of DNA Analysis in Forensic Investigations' (4 June, 2024) < <https://lifs.co.in/blog/evolution-of-dna-analysis.html> > accessed 14 February 2025

⁹ Ibid

¹⁰ B Priyanka, 'Justice under the microscope: Forensic Science in the Indian Criminal Justice System' (2024) 6 (2) International Journal of Law, Policy and Social Review <<https://www.lawjournals.net/assets/archives/2024/vol6issue2/6046.pdf>> accessed 4 February 2025

¹¹ Ibid

¹² Surendra Kumar Sharma, Shweta Bajpai, 'Medicolegal death Investigation in India: An

Overview' (2015) 5(3) Sage Journal <<https://doi.org/10.23907/2015.048>> accessed 4 February 2025

¹³ Dr. Shilekh Mittal, Dr. Sonia Mittal, Dr. Moneeshindra Singh Mittal, 'Evolution of Forensic Medicine in India' (2007) 29(4) Sage Journal < <https://doi.org/10.1177/0971097320070411> > accessed 5 February 2025

¹⁴ Ibid

¹⁵ Shaun D. Pattinson, *Medical Law and Ethics* (3rd edn, Sweet and Maxwell 2013)

¹⁶ Jaising P Modi, *A Textbook of Medical Jurisprudence and Toxicology* (26th edn, LexisNexis 2018) 5

¹⁷ Ibid

¹⁸ Indian Penal Code 1860, s 40.

¹⁹ Indian Penal Code 1860, s 44.

²⁰ K D Gaur, *Textbook on Indian Penal Code* (8th edn, Lexis Nexis, 2023)

the evidence in different form by different persons depending upon their locus standi. Forensic evidence is generally presented by the experts. Section 45 to Section 51 of Chapter II of the Act provides for the relevancy of opinion of the third person, referred as experts²¹. These provisions have been incorporated for acknowledging the importance of having technical knowledge which is not easy to understand and draw opinion on the basis of forensic evidence only but the court need expert opinion to reach to the conclusion²².

C. Post Independence Developments

• **The Indian Constitution, 1950**

The Indian Constitution which is supreme law of the land that forms the base for enactment of any statute safeguards the right of person undergoing forensic examination while emphasizing the significance of forensic examination in crime investigation²³. It incorporates the principle of self-incrimination under Article 20(3) that protects the person from being compelled to undergo forensic examination against themselves. It also protects a person from arbitrary arrest under Article 22 which may involve forensic examination after arrest²⁴. It promotes fair trial under Article 14 which ensure equal protection under the law and safeguards right to privacy under Article 21 which may be impacted during conduct of forensic examination²⁵.

• **Indian Medical Council Act, 1956**

The Indian Medical Council Act, 1956 was enacted with the objective to ensure the medical ethics by the professionals. It establishes norms for professional conduct and sets etiquettes to be followed by the medical practitioners²⁶. It further aims to strengthen the intersection of medicine and law in solving criminal cases. It also mentions the qualification which entitles a medical practitioner to give evidence in the court of law as per Section 45 of the Evidence Act, 1872 and anyone acting in contravention of the provision embodied under the Act shall

be punishable with imprisonment for a term which may extend to one year or fine up to one thousand rupees.²⁷

• **Establishment of Institute of Criminology and Forensic Sciences, 1971**

This institute was established by the Ministry of Home Affairs, Government of India under its administrative control on 26th July, 1971 at New Delhi. It was established with an aim to evolve an efficient medico-legal service in India with threefold objectives that are, conducting research in the field of criminology and forensic science; to give training to in-service personnel of the Police, Judiciary and correctional services to equip them with the recent developments of forensic science; and providing an educational institution to persons seeking for higher studies at the postgraduate level either in the field of forensic science or criminology²⁸.

▪ **Identification Of Prisoners Act, 1920**

This Act was enacted with an objective to facilitate crime investigating involving forensic science by collecting finger impressions, footprints, photographs of the person accused or any other person suspected of commission of any offence²⁹. This Act has legalized the sample collection for the purpose of forensic examination³⁰ under Section 3 of the Act.³¹

▪ **Code of Criminal Procedure, 1973**

The code lays down an extensive legal procedure relating to forensic in criminal courts. It incorporates the provision for examination by medical practitioner³² under Section 53. The accused person may be examined at his own request under Section 54 of the Code.³³ Furthermore, it lays down procedure for inquest which includes police inquest under Section 174 and magistrate inquest under Section 176 which related to legal inquiry in cases of sudden, suspicious and unnatural deaths. It also provides list of government scientific experts³⁴ under Section 293 of the Code for the admissibility of expert opinion in the court.

²¹ Indian Evidence Act 1872, s 45.

²² Dr. Avtar Singh, *Principles of The Law of Evidence* (24th edn, Central Law Publication, 2020)

²³ Srishti Sinha, 'Constitutionality of Forensic Evidences/Scientific Evidences' (2024) 5(3) International Journal of Research Publication and Reviews <
<https://ijrpr.com/uploads/V5ISSUE3/IJRPR24018.pdf>> accessed 5 February 2025

²⁴ The Constitution of India 1950, art 22.

²⁵ The Constitution of India 1950, art 21.

²⁶ Indian Medical Council Act 1956, Objective

²⁷ Indian Medical Council Act 1956, s 15.

²⁸ Anshita, 'Forensic Science in India: A Review' (2024) 1(1) Royal Thrive <
<https://royaleducationalinstitute.com/uploads/review/1724992069-3.pdf>> accessed 5 February 2025

²⁹ Identification of Prisoners Act 1920, s 3.

³⁰ Handbook of DNA, *Forensic Applications and Interpretation* (1st edn, Springer Verlag, Singapore 2022)

³¹ Identification of Prisoners Act 1920, s 3.

³² Code of Criminal Procedure 1973, s 53.

³³ Code of Criminal Procedure 1973, s 54.

³⁴ Code of Criminal Procedure 1973, s 293.

• **Information Technology Act, 2000**

In the era of internet, this Act plays a vital role in dealing with the digital forensic³⁵. It aims to facilitate the investigation in criminal cases mainly emphasizing upon cybercrimes. Chapter XII A of the Act has been incorporated in consonance with Section 45 of the Indian Evidence Act, 1872 for the purpose of providing expert opinion before the court of law³⁶. Furthermore, a recent notification dated 3rd August, 2023 has empowered Digital Forensic Labs, Cyber Defence Center, National Forensic Sciences University, Gujarat with the power conferred under Section 79A of the Act as Examiner of Electronic Evidence³⁷.

• **The Criminal Law (Amendment) Act, 2005**

This Amendment has inserted a new section i.e. **Section 53A** which provides for examination of person accused of rape by a medical practitioner³⁸ and the report has to be forwarded to the investigating officer who shall further forward it to magistrate. It has strengthened the provision regarding forensic evidences in order to facilitate investigation and find true perpetrator.

• **The Criminal Procedure (Identification) Act, 2022**

The Act has been introduced in the Lok Sabha with an aim to bring exemplary change in the British Era law that enables the collection of samples not only from the convicts but from other persons also to facilitate the identification and investigation process³⁹. By the introduction

of this Bill, the Identification of Prisoners Act, 1920 was repealed.

▪ **Bharatiya Nyaya Sanhita, 2023**

It has amplified the provisions of forensic evidence by providing explanation to admissibility and relevance of forensic evidence in criminal proceedings⁴⁰. It further provides crystal clear guidelines for collection, preservation and analysis of forensic evidence.⁴¹ It also embodies the provision related to forensic psychiatry in Section 22 of the Sanhita which aims towards exemplary shift from criminalization to care in cases related to medico-legal issues⁴².

▪ **Bharatiya Nagrik Suraksha Sanhita, 2023**

It has led emphasis on forensic evidence collection mainly involving development of digital forensic⁴³. Some significant developments are as follows:

The Code of Criminal Procedure which is now replaced by Bharatiya Nagrik Suraksha Sanhita, 2023 has undergone significant amendments to incorporate audio-video technology in various stages of the investigative and judicial process⁴⁴. For instance, Section 54 of the Act allows for the recording of identification processes during Test Identification Parades using audio-video electronic means, particularly when the identifying person is mentally or physically disabled.⁴⁵

Furthermore, Section 105 of the Act emphasizes the role of digital forensic science in facilitating crime scene investigations⁴⁶. It mandates that police officers conducting search

³⁵ Deepali, Prpf. (Dr.) Radhika Dev Verma, Role of Digital Forensics and Criminal Investigation in India (2024) 5 (11) International Journal of Research Publication and Reviews <https://ijrpr.com/uploads/V5ISSUE11/IJRPR3461_1.pdf> accessed 6th February 2025

³⁶ Information Technology Act 2000, chapter XIIA.

³⁷ Information Technology Act 2000, s 79A.

³⁸ Dr. Priyanka Dhar, 'Collection of rape evidence in India: An Analysis' (2018) 6(6) Forensic Research and Criminology International Journal <<https://doi.org/10.15406/frcij.2018.06.00245>> accessed 7th February 2025

³⁹ The Criminal Procedure (Identification) Act 2022, s 3.

⁴⁰ Mamta Kumari, U Aravindan, 'Exploring amended Indian Laws in context of forensic medicine: A Comprehensive review' (2025) 10(1) IP International Journal of Forensic Medicine and Toxicological Sciences <<https://www.ijfmts.com/html-article/22207>> accessed 19 May 2025

⁴¹ Praveen Dixit, Mamta Kumari, U Aravindan 'Exploring amended Indian Laws in context of Forensic medicine: A comprehensive review' (2024) 9(4) IP International Journal of Forensic Medicine and Toxicological Sciences <<https://www.ijfmts.com/html-article/22207>> accessed 7th February 2025

⁴² Prakyath Ravindranath Hegde, Yogendra Malik, 'The Bharatiya Nyaya Sanhita Act 2023: Implications for Forensic Psychiatry in india' (2024) Sage Journal <<https://doi.org/10.1177/02537176241281465>> accessed 10 February 2025

⁴³ Ravi Sharma, Mahak Jain, 'Revolutionising digital forensics: India's new legal Frontiers' (27 July, 2024) <<https://www.barandbench.com/columns/revolutionizing-digital-forensics-indias-new-legal-frontiers>> accessed 15 February 2025

⁴⁴ Ibid

⁴⁵ Bharatiya Nagrik Suraksha Sanhita 2023, s 54.

⁴⁶ Bharatiya Nagrik Suraksha Sanhita 2023, s 105.

and seizure during an investigation record the process using audio-video technology, which must then be forwarded to the District Magistrate, Sub-divisional Magistrate, or Judicial Magistrate of the first class immediately after the completion of the investigation process.

Additionally, the Act provides for the smooth recording of statements of rape victims at their home or another preferred location using audio-video technology, including mobile phones⁴⁷. This is outlined in Section 176(1) of the Act. Section 176(3) further emphasizes the mandatory collection of forensic evidence by forensic experts from the crime scene in cases of offenses punishable with imprisonment for seven years or more⁴⁸. The process of collecting forensic evidence must also be recorded on mobile phones or other electronic devices⁴⁹.

Other notable provisions include Section 180(3), which allows for the recording of witness statements using audio-video electronic means at the discretion of the police officer⁵⁰. Section 254 of the Act permits deposition of evidence of public servants through audio-video electronic means in Sessions cases⁵¹. Sections 265 and 266 allow for the examination of witnesses during evidence for prosecution and defense, respectively, to be taken through audio-video electronic means in warrant cases at designated places notified by the State Government⁵².

Lastly, Section 308 of the Act⁵³ provides that all evidence taken during the course of trial in the presence of the accused can be done through audio-video electronic means at designated places notified by the State Government, allowing for the presence of the accused or their advocate to be dispensed with.⁵⁴

▪ **Bharatiya Sakshya Adhiniyam, 2023**

⁴⁷ Bharatiya Nagrik Suraksha Sanhita 2023, s 176.

⁴⁸ Bharatiya Nagrik Suraksha Sanhita 2023, s 176.

⁴⁹ Ibid

⁵⁰ Bharatiya Nagrik Suraksha Sanhita 2023, s 180.

⁵¹ Bharatiya Nagrik Suraksha Sanhita 2023, s 254.

⁵² Bharatiya Nagrik Suraksha Sanhita 2023, s 265 & 266.

⁵³ Bharatiya Nagrik Suraksha Sanhita 2023.

⁵⁴ Bharatiya Nagrik Suraksha Sanhita 2023, s 308.

⁵⁵ Chief Justice M Monir, *The Bharatiya Sakshya Adhiniyam, 2023* (13th edn, Lexis Nexis, 2024)

⁵⁶ Ibid

⁵⁷ Ibid

⁵⁸ Henry Cecil Kennedy Wyld, Eric Partridge, *Webster Universal Dictionary* (Unabridged international edn, Harver Educational Services, New York 1970)

It has laid emphasis on reliability on forensic science methods rather than on other methods of medical examination⁵⁵. The most important change in the Adhiniyam is introduction of evidentiary nature and admissibility of electronic evidence⁵⁶. It has retained most of provisions of Indian Evidence Act emphasizing upon expert testimony and judicial notice⁵⁷.

III. MAJOR TYPES OF FORENSIC TESTS INVOLVED IN CRIMINAL INVESTIGATION

A. DNA Test

According to Webster's Universal Dictionary, 'DNA is the main component of chromosomes that stores genetic information'.⁵⁸ DNA is abbreviated form of Deoxyribonucleic acid which, a molecule that contains genetic information in humans and all other organisms⁵⁹. DNA Test gives biological evidence in a crime investigation which is obtained from organic materials such as blood, saliva, semen, hair, and tissues⁶⁰. It plays a vital role in the investigation of murder, rape, maternity, paternity disputes and baby exchanging offences⁶¹. In 1986, the first forensic and legal application of DNA Test by Sir J. Jeffrey has been taken as evidence in the famous Collin's case in England⁶². Since then, DNA Test has been playing an important role in crime investigation.

B. Dactylography

Dactylography refers to the systematic examination of fingerprints for the purpose of collecting evidence from a crime scene⁶³. Fingerprints are unique pattern of ridges and valleys found on the fingertips, palms and soles of the feet. Fingerprint evidence is a valuable tool in forensic investigation and its analysis involves comparing the unique characteristics of

⁵⁹ Ramachandran, D.N.A. *Evidence in Criminal Trial* (1st edn, Lawmann's, 2024)

⁶⁰ B.S. Nabar, *Forensic Science in Crime Investigation* (3rd edn, Asia Law House, Hyderabad 2024)

⁶¹ Ibid

⁶² Visible Proofs: Forensic View of the Body, National Library of Medicine 8600 Rockville Pike Bethesda

<<https://www.nlm.nih.gov/exhibition/visibleproofs/galleries/cases/jeffreys.html>> accessed 5 February 2025

⁶³ G.S. Sodhi, Jasjeet Kaur, 'The forgotten Indian pioneers of fingerprint science' (2005) 88 (1) *Current Science Association* <<https://www.jstor.org/stable/24110116>> accessed 5 February 2025

a fingerprint found at crime scene⁶⁴. Generally, it is considered as strong evidence in crime investigation⁶⁵. However, its admissibility in the court of law depends upon various factors such as expertise of examiner, the process followed while collecting the samples, standardization measures, etc.⁶⁶

C. Ballistics

The term ballistic refers to the science of motion of projectiles such as bullets, bombs, or rockets⁶⁷. Forensic ballistic referred as the examination of crime scene to collect evidence from firearms that have been used while committing the crime⁶⁸. It basically involves matching of bullets and cartridge casings to specific firearms, determining the trajectory of a bullet, estimating the distance of shot, identifying the type of firearms used in commission of crime⁶⁹. It also helps in reconstruction of crime scene by recreating the events surrounding a shooting.

D. Toxicology

Toxicology refers to scientific examination of effects of chemicals and other substances on living organisms⁷⁰. Forensic toxicology is the study of pharmacodynamics and pharmacokinetics⁷¹. First one emphasizes the effect of any substance on the body whereas the latter focuses on what the body does to the substance. It determines the tolerance level that several individuals can build up as well as therapeutic index for various pharmaceuticals⁷². Toxicology helps in determining different metabolites that a specific drug could break down into inside the body.⁷³

E. Serology

Serology refers to scientific study of blood serum⁷⁴. Forensic serology is a branch of forensic science which deals with examination of biological fluids such as blood, saliva, semen and urine, by which it provides aid in criminal investigations⁷⁵. It deals with blood serum particularly emphasizing to its immunological reactions and properties.⁷⁶ It provides a higher degree of certainty in production of concrete evidence through examining the traces of biological materials from the crime scenes⁷⁷. It is highly effective in solving rape cases.

F. Brain Mapping

Brain Mapping is one of the Deception Detection Test (DDT) which is helpful in extracting the concealed information related to crime⁷⁸. It is a non-invasive test that measures brain activity by placing electrodes on the scalp of the person to record the electrical impulse from the brain⁷⁹. It helps in finding the truth when the person undergoes this test and delve into their subconscious mind.

G. NARCO-Analysis Test

Narco-analysis test is carried out by interfering with the nervous system the accused at molecular level to lower the subject inhibition⁸⁰. The test conducted after a detailed medical examination of the accused when it is found that accused is fit to undergo the said analysis⁸¹. It restricts the fact known to the accused to make him unable to lie as his answers would be based on the restricted facts only⁸².

H. Polygraph Test

Polygraph test is also known as lie detector test⁸³. There are various types of polygraph test which includes- Control Questions Test, Guilty Knowledge Test and Concealed Information

⁶⁴ Ibid

⁶⁵ Ibid

⁶⁶ Ibid

⁶⁷ Gurpreet Singh, 'Firearms and Ballistics' (2024) 12(9) International Journal for Research in Applied Science & Engineering Technology <<https://doi.org/10.22214/ijraset.2024.64418>> accessed 5 February 2025

⁶⁸ Ibid

⁶⁹ B.R. Sharma, *Firearms in Criminal Investigation & Trials* (5th edn, Universal Law Publisher, 2017)

⁷⁰ Upinder Singh Jandu and Dr. Sarita Jand, *Forensic Science & Law* (1st wdn, New Era Law Publication, Haryana, 2017)

⁷¹ Ibid

⁷² Ibid

⁷³ Ibid

⁷⁴ A. Thiruvani, 'Blood is an important tool for crime investigation' (2021) 9(3) International Journal of Creative Research Thoughts <<https://ijcrt.org/papers/IJCRT2103427.pdf>> accessed 5 February 2025

⁷⁵ Ibid

⁷⁶ Richard Saferstein, *Forensic Science: An Introduction* (2nd edn. Prentice Hall 2010)

⁷⁷ Ibid

⁷⁸ Yash Verma, 'Brain Mapping in Criminal Justice: A Medico-Legal Analysis' (2025) SSRN <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5205284> accessed 5 February 2025

⁷⁹ Ibid

⁸⁰ B. R. Sharma, *Forensic Science in Criminal Investigation and Trials* (3rd edn, Universal Law Publishing Co. Pvt. Ltd., New Delhi, 1990).

⁸¹ Ibid

⁸² Ibid

⁸³ Akshra Mathur, Jiya Nair, Anshuman, 'Getting the better understanding of truth: Diving into the polygraph test' (2022) 9 (4) Indian Journal of Forensic Medicine and Community Medicine <<https://www.ijfcm.org/article-details/18095>> accessed 10 February 2025

Test⁸⁴. It is basically conducted through a pseudoscientific device that uses numerical quantification system to measure the psychological response of the person undergoing the test while answering the questions asked by the investigator⁸⁵.

I. Digital Forensics

Digital forensic deals with the data collected in relation to a crime in electronic mode⁸⁶. In the era of internet, digital forensic plays a vital role in forensic investigation but one of the major difficulties which often arises is tampering of data collected. The significance of using digital forensic is that the data can be preserved for production before the court of law in original form. Its unique feature is that the pattern analysis of the collected data before the commission of any crime prevents such commission. It also helps to recover the data from electronic media⁸⁷.

J. Forensic Odontology

Forensic odontology is a branch of forensic anthropology which is very useful in establishing the identity of victims in cases of terrorist attack by using sophisticated explosives, mass disasters, accidental deaths, deaths resulting in consequence of riots⁸⁸. This branch of forensic science is also useful in age-determination of the victims in cases relating to sexual abuse of children⁸⁹. When other forensic methods got clueless then this branch of forensic science came to rescue of investigators due to peculiar oral structure and teeth pattern of human beings as two human beings cannot have the same dental patterns and buccal cavity structure⁹⁰.

K. Forensic Psychiatry

Forensic psychiatry is a branch of forensic science which studies the intersection of psychiatry and law which helps in solving crimes committed by a person of unsound mind⁹¹. This concept has been incorporated under Section 22 of the Bharatiya Nyaya

Sanhita, 2023⁹² that provides that “Nothing is an offence which is done by a person who, at the time of doing it, by reason of mental illness, is incapable of knowing the nature of the act, or that he is doing what is either wrong or contrary to law”. This provision renders a person free from the accusation of any crime if he/she has been suffering from mental illness or unsoundness of mind. The identification of such offenders again needs experts to deal with the medico-legal issues involved in the commission of crime.

L. Behavioral Forensics

Behavioral forensic refers to the psychological assessment of the accused based on behavioral principles to analyze the thoughts, emotions and behavior⁹³. It involves criminal profiling which emphasizes on all facets of human behavior involved in commission of a crime that may include modus operandi, behavioral typology, series of events before commission of crime, crime spot, motive of the offender, etc⁹⁴. The behavioral forensics needs neuroscientific expertise to carry out neuropsychological tests on the offender⁹⁵.

IV. UTILITY OF SCIENTIFIC TECHNIQUES IN CRIMINAL INVESTIGATION

Scientific techniques undoubtedly provide reasonable certainty in crime investigations to convert the suspicion into truth to find the guilt or innocence of the accused⁹⁶. The techniques used by forensic science aims to attain accuracy in the tests conducted during investigation. The identification and collection of traces from the crime scene facilitates the investigator to move forward in finding the correct methods under which research has to be done in order to get the desired result⁹⁷. It further simplifies the concepts used in getting the end results as there are various ways of conducting the forensic

⁸⁴ Ibid

⁸⁵ Ibid

⁸⁶ Dr. Nilakshi Jain, Dr. Dhananjay R KKalbande, *Digital Forensic : The Fascinating World of Digital Evidences* (1st edn, Wiley Precise Textbook Series, 2016)

⁸⁷ Ibid

⁸⁸ David, T.J. & Lewis, J.M., *Forensic Odontology: Principles and Practice* (1st edn, Academic Press, An Imprint of Elsevier, London, 2018)

⁸⁹ Ibid

⁹⁰ Ibid

⁹¹ R C Jiloha, Prerna Kukreti, Dinesh Kataria, *Forensic Psychiatry: An Indian Perspective* (1st edn, Jaypee Brothers Medical Publishers, 2018)

⁹² Bharatiya Nyaya Sanhita 2023, s 22.

⁹³ E. Billen, ‘Emotional, cognitive and behavioral self-regulation in forensic psychiatric patients: changes over time and associations with childhood trauma, identity and personality pathology’ (2023) 29(10) *Psychology, Crime & Law* <
<https://doi.org/10.1080/1068316X.2022.2044813>
> accessed 10 February 2025

⁹⁴ Ibid

⁹⁵ Ibid

⁹⁶ Upinder Singh Jandu, Dr. Sarita Jand, *Forensic Science & Law* (1st edn, Allahabad Law Agency 2017).

⁹⁷ Ibid

science tests and helps the judicial authority to understand the same by the scientific experts who are involved in the forensic examination⁹⁸. The evidence collected and examined by the scientific experts are presented before the court of law and supports the prosecution case and in case of any wrong allegation helps to exonerate the accused. It reduces the reliance on eye witness testimony which is somehow affected by several external factors that cannot be reliable⁹⁹. The database created by the forensic department allows the investigator to quickly compare the traces collected from the crime scene with known offenders and if does not match any history-sheeter then the automated system analyses large amounts of data quickly and accurately which potentially leads to a faster identification of the suspect¹⁰⁰. These techniques enable to improve accuracy by reducing the risk of human error and bias while performing any test. It also accelerates investigation process by promoting the role of scientific techniques to reduce the time required the complete the investigation by ordinary process. Therefore, it contributes in facilitating smooth investigation process based on scientific methods to ensure accuracy in results.

V. ISSUES AND CHALLENGES FACED WHILE CONDUCTING FORENSIC EXAMINATION

There are various challenges which are being faced during the process of conducting forensic examination. The first one is the collection of biological evidences, there is possibility for potential contamination with the traces found at crime scene, improper collection techniques, improper handling of the collected evidence, lack of standardized procedure to carry the

collected traces which results in potential degradation or loss of information¹⁰¹. Sometimes, bureaucratic hurdles undermine the effectiveness of process of forensic investigation¹⁰². Secondly, forwarding the evidences not within proper time frame where time sensitivity is required¹⁰³. Thirdly, inadequate training to investigators for proper evidence collection and its handling¹⁰⁴. Apart from that, there are other challenges which may be human error while making results of the forensic test, pressure to produce the results faster which impact the accuracy of result and interpretation made from those results to prepare evidence¹⁰⁵.

Standardization of procedures in forensic laboratories is one of the major concerns as lack of standardized procedures and protocols leads to inconsistent results which results in compromise with the reliability of evidence presented before the court of law¹⁰⁶. One of the challenges faced by toxicologists is that illicit drug manufacturers frequently change the chemical structures slightly which cannot be easy to determine by routine toxicology tests¹⁰⁷. To overcome this issue, laboratories tend to keep in-house databases for the substances they find locally¹⁰⁸. When the new compounds are discovered then these are entered into the database to use it as reference standards.

Furthermore, use of these techniques is subject to limitation. As some of the forensic examination techniques results in infliction of some 'pain and suffering' which is expedient in investigation in criminal cases¹⁰⁹. The stage where infliction of pain is beyond tolerance capacity then constitutional values step up¹¹⁰. Although, the constitution promotes the conduct of forensic examination to ensure

⁹⁸ Ibid

⁹⁹ Navdeep Kadian, 'Testimony of Eyewitness and its reliability in India: A Critical Analysis' (2023) 8(3) International Journal of Novel Research and Development < <https://www.ijnrd.org/papers/IJNRD2303235.pdf> > accessed 10 February 2025

¹⁰⁰ Gaëtan Michelet, Frank Breiting, Graeme Horsman, 'Automation for digital forensics: Towards a definition for the community' (2023) < <https://doi.org/10.1016/j.forsciint.2023.111769> > accessed 10 February 2025

¹⁰¹ Upinder Singh Jandu, Dr. Sarita Jand, Forensic Science & Law (1st edn, Allahabad Law Agency 2017).

¹⁰² Challenges in Police Investigations: Legal Procedural and System Hurdles to Justice, Legal Services India < <https://www.legalserviceindia.com/legal/article->

[19825-challenges-in-police-investigations-legal-procedural-and-systemic-hurdles-to-justice.html](https://www.legalserviceindia.com/legal/article-19825-challenges-in-police-investigations-legal-procedural-and-systemic-hurdles-to-justice.html) >

accessed 10 February 2025

¹⁰³ Ibid

¹⁰⁴ Ibid

¹⁰⁵ Ibid

¹⁰⁶ Ritika Bansal, Grishita Chopra, 'Forensic Investigation Process: A Critical Appraisal' (2022) 1(1) NFSU Journal of Forensic Science < [https://jfi.nfsu.ac.in/Uploads/EJournal/1/1/\(40-45\)%20FORENSIC%20INVESTIGATION%20PROCESS%20A%20CRITICAL%20APPRAISAL.pdf](https://jfi.nfsu.ac.in/Uploads/EJournal/1/1/(40-45)%20FORENSIC%20INVESTIGATION%20PROCESS%20A%20CRITICAL%20APPRAISAL.pdf) > accessed 10 February 2025

¹⁰⁷ Upinder Singh Jandu, Dr. Sarita Jand, Forensic Science & Law (1st edn, Allahabad Law Agency 2017).

¹⁰⁸ Ibid

¹⁰⁹ Ibid

¹¹⁰ Ibid

effective administration of justice but along with that it safeguards the rights of accused too by incorporating the provision of right against self-incrimination¹¹¹.

Hence, the conducting authority of forensic science examination has to justify the need for conducting such test and to what extent accused can be asked to undergo the test for facilitating the authorities in crime investigation.

VI. JUDICIAL RESPONSE TOWARDS FORENSIC EVIDENCE AND ITS RELEVANCY IN CRIMINAL INVESTIGATION

In India, the judiciary has over a period of time contributed a lot in the advancement of forensic science examination in solving criminal cases¹¹². Judicial precedents have played a crucial role in setting the standards to be maintained while conducting forensic tests. The Judiciary has fostered different dimension of forensic evidence in India¹¹³. In the case of *State v Sushil Sharma*,¹¹⁴ popularly known as 'Tandoor Murder Case' or 'Naina Sahni Murder Case'. Sushil Sharma, the accused and prominent politician has murdered his wife, then dismembered her and stuffed the pieces into a tandoor at a restaurant Bagia Bar-be-Que which was owned by him with the help of a restaurant employee, Keshav Kumar. Forensic ballistic test was conducted by ballistic expert, Roop Singh who prepared the report which shows that two lead bullets were extracted from skull and neck of the deceased which had been fired from .32 Arminius revolver and .32 cartridge cases and one lead bullet recovered from the flat of the accused which established the chain of circumstances that resulted in commission of the offence¹¹⁵. This case has shocked the country due to its brutality. But the decision of apex court was somewhere criticized as the reasoning given by the apex court was that the offence was committed in a brutal manner but brutality alone would not justify the death sentence in this case as accused has murdered his wife because of fit of rage due to suspicion on wife's loyalty and they were already having a

strained relationship¹¹⁶. Though forensic science has succeeded in finding the real accused but the opinion drawn by hon'ble apex court was not solely based on forensic evidence, also focusing on the facts and circumstances of the case¹¹⁷. In the case of *Selvi V State of Karnataka*,¹¹⁸ question before the Hon'ble Apex court was that whether the conduct of narcoanalysis, polygraph, and brain mapping tests on individuals suspected of criminal activity violate the right against self-incrimination provided under Article 20(3) of the constitution. The Hon'ble Supreme Court reaffirmed the importance of right to privacy and held that accused person cannot be compelled to undergo these forensic tests to provide evidence against themselves and declared brain mapping, lie detector test and narco-analysis to be unconstitutional and violative of Article 20(3) of the Indian Constitution¹¹⁹. In the very famous case *Nupur Talwar v. Central Bureau of Investigation and Anr.*¹²⁰ popularly known as Aarushi Talwar Murder Case in which it was alleged that Aarushi, daughter of dentist couple and her boyfriend Hemraj, who was working as servant in their house were murdered but in even after conducting narco-analysis test no concrete evidence was collected and were admissible in the court resulting in acquittal of the dentist couple & parents of Aarushi Talwar namely, Nupur Talwar and Rajesh Talwar. In the case of *Santa Singh v. State of Punjab*,¹²¹ the Hon'ble Supreme Court has acknowledged the significance of forensic evidence over eye-witnesses testimony. In this case, the forensic ballistic has concluded that the shot was fired from a very close distance about nine inches and a yard or a yard and a half whereas according to eye-witnesses testimony it was fired from a range of about twenty-five feet. Justice Chandrasekhara Aiyar who has delivered the majority opinion held that testimony of eye-witness could not be safely accepted, ignoring the medical evidence. The apex court has again given superseding effect to medical evidence over witness testimony in the case of *Majindra*

¹¹¹ Constitution of India 1950, art 20.

¹¹² Prodipta Barman and Dr. Vikas Kumar, 'Judicial interpretation of forensic evidence in criminal justice delivery system in India' (2024) 4(1) International Journal of Criminal, Common and Statutory Law <<https://www.criminallawjournal.org/article/71/4-1-18-882.pdf>> accessed 5 February 2025

¹¹³ Ibid

¹¹⁴ [1996] Cri LJ 3944

¹¹⁵ Ibid

¹¹⁶ Ibid

¹¹⁷ Ibid

¹¹⁸ AIR [2010] SC 1974

¹¹⁹ Constitution of India 1950, art 20.

¹²⁰ AIR [2012] SC 1921

¹²¹ AIR [1956] SC 526

*Bala Mehra v. Sunil Chandra Roy*¹²² by stating that it is wrong to say that medical evidence is only opinion evidence, it is often direct evidence of the facts found upon the victim's person.

The Indian justice delivery system is based on the principle that "a person is innocent until proved guilty and an innocent person cannot be convicted even if hundred criminals are acquitted".¹²³ Forensic science has two peculiar features, first one is the multi-professional and the second one is multidisciplinary approach.¹²⁴ It always has to focus on the investigating methods on one side and presenting the evidence before court of law on other side. Therefore, the judiciary always embraces various evidences collected while investigation and reach to the conclusion by drawing a logical opinion.

VII. CONCLUSION

From the above discussion, we may fairly conclude that in the recent years there has been tremendous change in the technical knowledge of an average man. The main reason behind such change is the drastic social change at a very rapid pace. Taking in view the contemporary issues and the need to embody the provisions which fosters forensic science examination, many provisions have been added in the newly enacted criminal laws namely, Bharatiya Nyaya Sanhita, 2023; Bharatiya Nagrik Suraksha Sanhita, 2023; Bharatiya Sakshya Adhiniyam, 2023. Forensic evidence can only achieve its optimum value in investigation when the investigator is fully conversant with the crime laboratory's techniques, capabilities, and limitations. The development in the new criminal law provides a robust mechanism to foster forensic science in crime investigation. While existing challenges and limitations, the continuous development and initiatives taken up by the institutional authorities contributes in refinement of these techniques which is essential for ensuring justice and improving the effectiveness of law enforcement agencies. The tests conducted under forensic science to collect the evidence are contested to be safer than the evidence collected by using 'third degree

methods' by the investigators. Furthermore, the experts and medical practitioner involve in the forensic examination are expected to act diligently every time in order to ensure the accuracy of the test results. The scene of occurrence of offence carries great significance to decide the success and failure of the whole investigation process as crime scene changes rapidly and it cannot be preserved forever. It is essential for the persons involved in any investigation be it of normal offence or of heinous offence to make careful note of minute details of the process undergoing the forensic examination and should not make hasty conclusion in hurry. There must be acquaintance with the orders of government relating to guidelines regulating forensic science department involved in crime investigation. It is pertinent to note that integration of medical fraternity and legal fraternity can only ensure upholding the interest of justice in any crime investigation. It often happens that when the court has to deal with the circumstantial evidence or where there is any conflict between conclusive proof based on presumption and a proof based on scientific evidence, the latter always prevail over the former.

In contemporary times, it is almost impossible to solve the criminal cases without the application of modern sophisticated scientific techniques in investigations. With the passage of time, the scope of forensic science is becoming ever-increasing phenomenon which thereby increases the need of standard training to the officials starting from the central level to local level. The need of the hour is to deploy more and more person as scientific expert which ultimately contributes in smooth investigation process and speedy disposal of the cases thereby reducing the burden of judiciary. Undoubtedly, the forensic science has strengthened the wings of investigation and has contributed in raising faith of common people in the administrative machinery as well as justice delivery system of the country. Therefore, it can be definitely ascertained that forensic evidence not only ensures the smooth running of a criminal trial, but also, protect the rights of both the parties by providing a definite result out the forensic examination.

¹²² AIR [1960] SC 706

¹²³ Tarun Jain, 'let Hundred Guilty Be Acquitted But One Innocent Should Not be Convicted: Tracing the Origin and the Implications of the Maxim, Researchgate <https://www.researchgate.net/publication/228226303_Let_Hundred_Guilty_Be_Acquitted_But_One_I

[nnocent Should Not Be Convicted' Tracing the Origin and the Implications of the Maxim](#)> accessed 10 February 2025

¹²⁴ B.R. Sharma, *Forensic Science in Criminal Investigation & Trials* (4th edn. Universal Law Publishing Co. 2010) 6