FORENSIC SCIENCE AND THE INDIAN LEGAL SYSTEM: BRIDGING THE GAP BETWEEN LAW AND MEDICINE

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1. INTRODUCTION

In the administration of justice, the nexus of science, medicine, and law has always been vital. The use of scientific techniques and medical knowledge in the investigation of crimes and legal issues is known as forensic science, and it has revolutionised how courts view evidence.[1] In a time when circumstantial evidence may not be sufficient and eyewitness testimony may be faulty, forensic science offers impartiality and scientific legitimacy in criminal cases. Forensic science shows up as a potent instrument that enhances both investigation and adjudication in India, where the judicial system still struggles with late justice, low conviction rates, and structural defects in investigation.[2] Its significance extends beyond its ability to resolve intricate criminal cases; it also helps to prevent erroneous convictions, protecting the rights to life and personal liberty protected by Article 21. A naturally of the law in this process is medicine. Medico-legal tools such as toxicological reports, DNA profiling, post-mortem examinations, and injury assessments help courts reach just decisions. However, a persistent "gap" between law and medicine persists due to a lack of cooperation between medical professionals and legal practitioners, poor infrastructure, and judges' and lawyers' ignorance of scientific methods.[3]

To guarantee that justice is not only served, but also served in a fair and scientific manner, this divide must be closed. The purpose of this project is to examine the function of forensic science in the Indian legal system, emphasise the medical aspect of forensic inquiry, evaluate judicial and legislative methods, pinpoint issues, and recommend changes to close the gaps that now exist. The study will try to offer a comprehensive knowledge of how science can support the rule of law by analysing case legislation and comparing practices from other countries.[4]

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1 S. H. James, J. J. Nordby, and S. Bell, *Forensic Science: An Introduction to Scientific and Investigative Techniques* (4th edn, CRC Press 2014) 2

2 Law Commission of India, *239th Report on Expeditious Investigation and Trial of Criminal Cases Against Influential Public Personalities* (2012) https://lawcommissionofindia.nic.in accessed 29 August 2025.

3 V. Raghavan, 'Forensic Science in India: A Legal Perspective' (2019) 7(2) *Indian Journal of Criminology* 23.

4 UN Office on Drugs and Crime, *Forensic Services and Infrastructure: International Best Practices* (UNODC 2019) https://www.unodc.org accessed 29 August 2025.

2. EVOLUTION OF FORENSIC SCIENCE IN INDIA

In order to support criminal prosecutions, the British government introduced scientific methods of investigation during the colonial era, which is when forensic science first emerged in India. A significant step towards establishing scientific credibility in criminal justice was the late nineteenth-century early application of fingerprint analysis and handwriting comparison. In actuality, India was among the first nations to set up a fingerprint bureau in Calcutta in 1897, which went on to become a global standard for fingerprint identification.[5]

With the creation of Central Forensic Science Laboratories (CFSLs) under the Bureau of Police Research and Development (BPRD) following independence, forensic science rose to prominence. These labs, which were first located in Hyderabad, Kolkata, and Chandigarh before being extended to other cities, served as the foundation for forensic analysis in India. State Forensic Science Laboratories (FSLs) were also set up to assist local law enforcement with criminal investigations.[6] At the same time, the field of forensic medicine emerged, which applies medical knowledge to legal matters. In order to perform autopsies, evaluate sexual assault victims, and report injuries, government hospitals started establishing medico-legal sections. However, because legal experts were not aware of it, the use of forensic science in courtrooms remained minimal. The field of forensic science in India has expanded throughout the years due to technological improvements. The system can currently handle DNA profiling, cyber-forensics, narco-analysis, voice spectrography, brain electrical oscillation signatures (BEOS), toxicological research, and classic fingerprinting and handwriting analysis. [7] The importance of DNA and medical evidence in obtaining convictions was brought to light by landmark cases such as the 2012 Nirbhaya gang rape case, which brought forensic science into the mainstream of the legal community. There are still difficulties in spite of these developments. Many judges and solicitors still mostly rely on witness testimony rather than scientific evidence, laboratories are overworked, and there aren't enough forensic specialists. Thus, while forensic science has evolved significantly, the gap between its

5 A. K. Kapoor, 'History of Forensic Science in India' (2015) 37(1) *Indian Journal of Forensic Medicine and Toxicology* 22; N. K. Jain, *The Finger Print Bureau: A Century of Excellence (1897–1997)* (Government of India Press 1997).

6 National Crime Records Bureau (NCRB), *Crime in India 2020: Statistics* (Government of India 2021) xlviii.

7 S. Modi, *Medical Jurisprudence and Toxicology* (LexisNexis 2019) 102.

potential and actual use in the legal system remains wide. Bridging this gap requires systematic reforms, institutional coordination, and greater synergy between medicine and law.[8]

3. ROLE OF FORENSIC SCIENCE IN THE CRIMINAL JUSTICE SYSTEM

Forensic science is a cornerstone of contemporary justice, not just an investigative tool. By integrating unbiased, scientific approaches into legal thinking, it enhances the courts' ability to discover the truth.

3.1 Reconstructing Crime Scenes ,Reconstructing the chronology of events is one of forensic science's most important accomplishments. Digital fingerprints on a hard drive, ballistic trajectories, or patterns of blood splatter frequently tell a story that is impossible for human witnesses to. Forensic reconstruction, for example, can determine if an explosion was intentional or unintentional, or whether injuries were sustained prior to or following death. These reconstructions give the story presented in court more consistency.[9]

3.2 Lessening Reliance on Verbal Evidence Trials in India frequently end in failure because witnesses become hostile or change their minds under duress. Convictions are strengthened even when there are no cooperating witnesses because forensic science lessens the system's excessive reliance on oral evidence. For instance, DNA evidence has a greater voice than a reluctant witness.[10]

Improving the Delivery of Justice's Credibility When decisions are grounded in scientific reasoning rather than conjecture, public confidence in the legal system increases. Forensic scientific integration aids in addressing claims of prejudice, erroneous convictions, or political meddling during legal proceedings. This is especially crucial in well-known instances where the public is always examining the justice system's fairness.[11]

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8 R. K. Gorea, 'Bridging the Gap between Law and Medicine in Medico-Legal Investigations' (2013) 35 *Journal of Indian Academy of Forensic Medicine* 108.

9 J. Horswell, *The Practice of Crime Scene Investigation* (2nd edn, CRC Press 2016) 211.

10 *Santosh Kumar Singh v. State* (2010) 9 SCC 747 (Priyadarshini Mattoo case), where DNA evidence secured conviction despite weak witness testimony.

11 *Mukesh v. State (NCT of Delhi)* (2017) 6 SCC 1 (Nirbhaya case), where forensic proof ensured fairness and public trust in the trial.

4. MEDICAL DIMENSIONS OF FORENSIC SCIENCE

In the field of forensic medicine, where medical expertise helps courts unearth the truth, medicine and law most clearly intersect. Forensic medicine concentrates on the scientific application of medicine to crime investigation and the administration of justice, whereas medical jurisprudence addresses the legal implications of medical practice. Therefore, doctors have two roles in society: they are healers and they are expert witnesses whose testimony might affect the outcome of a prosecution.[12]

Perhaps the most well-known contribution of medical to law is the function of post-mortem exams. In order to distinguish between homicide, suicide, and accident, forensic pathologists perform autopsies to ascertain the cause, time, and manner of death. For example, toxicological results, internal organ states, and injury patterns frequently provide a narrative that is not possible for human witnesses to hear. Similar to this, medical evidence such as DNA swabs, injury reports, and forensic examinations of the victim's body becomes crucial in sexual assault cases to support claims and connect offenders to the crime.[13]

Another crucial field is toxicology, which determines whether alcohol, drugs, or toxins are present in the human body. Chemical analysis of viscera samples is commonly used to detect deadly chemicals in dowry death, suicide, and accidental poisoning cases. Determining entry and exit wounds, range of fire, and cause of death for gunshot wounds and ballistic injuries also calls for the specific knowledge of forensic medicine professionals. [14] Furthermore, the importance of forensic psychology and psychiatry has increased recently, especially when mental health issues influence criminal liability. Following the Indian Penal Code, Indian courts frequently require medical evaluations to determine whether an accused person was mentally ill at the time of the offence, utilising clauses such Section 84 IPC (the insanity defence). Forensic psychiatric

11 *Mukesh v. State (NCT of Delhi)* (2017) 6 SCC 1 (Nirbhaya case), where forensic proof ensured fairness and public trust in the trial.

12 R. K. Sharma, *Concise Textbook of Forensic Medicine & Toxicology* (Elsevier 2018) 12.

13 *State of Punjab v. Gurmit Singh* (1996) 2 SCC 384, where medical evidence in sexual assault supported the victim's testimony.

14 *State of Uttar Pradesh v. Krishna Gopal* (1988) 4 SCC 302 (ballistics evidence in murder trial); V. V. Pillay, *Modern Medical Toxicology* (4th edn, Jaypee Brothers 2013) 87.

evaluations are also necessary for determining criminal guilt, determining a person's fitness to stand trial, and determining whether someone is lying about having a mental disease.[15]
Despite their significance, India's medico-legal services are severely limited.

Due to their lack of sophisticated forensic training and frequent workload, doctors provide subpar reports that are not up to legal scrutiny. Furthermore, police and judges often lack the medical expertise required to decipher intricate forensic results. As a result, there is a "communication gap" between the legal and medical fields, which leads to injustices. More investment in medico-legal infrastructure, improved forensic medicine training for physicians, and increased cooperation between courts, forensic labs, and hospitals are all necessary to close this gap.[16]

5. LEGAL FRAMEWORK GOVERNING FORENSIC SCIENCE IN INDIA

The Indian legal system recognizes forensic science primarily as an aid to judicial reasoning. However, its statutory framework has both strengths and gaps.

5.1 Forensic Evidence as a Corroborative Tool

Sections 45–51 of the Evidence Act reveal a fundamental principle: forensic evidence is meant to support, not substitute, judicial reasoning. This balances the role of science with the role of human judgment, ensuring that courts do not abdicate their responsibility to experts.

5.2 Mandatory Medical Examination in Certain Offences

The CrPC makes medical examination compulsory in certain contexts for example, sexual assault cases (Section 164A) and situations where bodily evidence may link the accused to the crime (Section 53). These provisions highlight the legislature’s acknowledgment that forensic medicine is integral to justice.

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15 Basant K., *Forensic Psychiatry in India: Principles and Practice* (National Book Trust 2019) 56.
16 National Human Rights Commission (India), *Report on Medico-Legal Care for Victims of Sexual Violence* (2018) https://nhrc.nic.in accessed 29 August 2025.

5.3 The Digital Turn in Evidence Law

With the rise of cybercrime, Indian law has increasingly recognized electronic and digital evidence. Amendments to the Evidence Act (Sections 65A and 65B) have introduced the concept of electronic records, giving statutory legitimacy to cyber-forensic analysis. This indicates that the scope of forensic science in India is dynamic, expanding with technological progress.[17]

6. CHALLENGES IN INTEGRATING FORENSIC SCIENCE WITH LAW

Despite its acknowledged importance, forensic science in India faces numerous challenges that hinder its full potential in strengthening the justice system. Perhaps the most significant problem is the inadequacy of forensic infrastructure. State forensic laboratories are overburdened, understaffed, and ill-equipped to handle the increasing number of cases. Delays in analysis mean that critical evidence often loses its relevance by the time results are produced in court.[18]

Moreover, medico-legal experts themselves face systemic issues. Doctors are often compelled to perform post-mortems under poor working conditions without access to advanced equipment. Their reports are scrutinized in court, but their professional autonomy is seldom respected. This discourages many medical practitioners from taking forensic medicine as a specialization, leading to a shortage of skilled experts.

Thus, while forensic science is capable of transforming justice delivery, these challenges reveal why its actual contribution remains inconsistent. Addressing these concerns is crucial to truly bridge the gap between science and law in India.

- Forensic reports can take years to complete, which negates the goal of scientific inquiry. Due to laboratories' inability to provide timely reports, cases in certain states are postponed indefinitely. The fundamental guarantee of prompt justice is

17 A. Chawla, *Cyber Laws and Forensic Evidence in India* (Bloomsbury 2020) 142.

18 Parliamentary Standing Committee on Home Affairs, *Report on the Functioning of Forensic Science Laboratories in India* (Rajya Sabha Secretariat, 2021) 18.

undermined by this delay in proceedings.

- Modern forensic facilities may be available in urban regions, yet rural areas are still neglected. Due to the inability of victims in remote locations to rely on prompt forensic assistance, this disparity results in unequal access to justice.
- Lawyers and judges frequently lack the necessary training to assess forensic reports objectively. It is possible for complex toxicological or DNA results to be oversimplified or misinterpreted. The judge runs the danger of either overvaluing or undervaluing forensic evidence if it lacks adequate scientificliteracy.
- The quality of the investigation used to gather forensic evidence determines its strength. Strong evidence can frequently become useless due to poor police officer training, poor sample storage, and failures to preserve the chain of custody.
- Investing heavily in technology, labs, and training is necessary for forensic infrastructure. Forensic science frequently receives insufficient attention in budget allocations in a nation where the criminal justice system is chronically underfunded.

7. BRIDGING THE GAP: REFORMS AND RECOMMENDATIONS

The Indian legal system and forensic science differ in execution rather than aim. Finding the truth and upholding justice are the ultimate goals of both law and medicine, but structural flaws keep this collaboration from realising its full potential. A multifaceted strategy that enhances cooperation, modifies processes, and fortifies institutions is needed to close this gap.[19]

The first step is to improve the forensic infrastructure. There are very few state and regional forensic labs in India, and many of them are understaffed and lack contemporary equipment. Establishing specialised forensic institutes in each state, complete with ballistic sections, toxicology divisions, digital forensics units, and DNA labs, would guarantee prompt scientific assistance for investigations.One step in this way is Gujarat's National Forensic Sciences University (NFSU), but it needs to be extended throughout the nation.

Second, it is crucial to enhance stakeholders' capacity. Judges, prosecutors, and police personnel all need specific forensic awareness training. Police academies and judicial training institutions

19 UN Office on Drugs and Crime, *Forensic Services and Infrastructure: International Best Practices* (UNODC 2019) 9.

must to incorporate courses on medico-legal science, evidence handling, and expert testimony. In a similar vein, improved incentives, recognition, and possibilities for professional growth are needed to motivate physicians to specialise in forensic medicine.

Third, in order to guarantee uniformity and clarity in the application of forensic evidence, legal reforms are required. The Indian Evidence Act is still based on a framework from the 19th century, and although its provisions on expert testimony are useful, they fall short in addressing contemporary technologies such as digital forensics, DNA sequencing, and cyber investigations. Admissibility, chain of custody, and laboratory certification requirements might be codified in a distinct Forensic Evidence Act.[20]

Fourth, medical and legal cooperation needs to be formalised. Hospitals ought to establish medico-legal departments staffed by forensic specialists who collaborate closely with detectives. Frequent workshops involving judges, solicitors and doctors can promote mutual awareness of their fields and close the communication gap that frequently results in a lacklustre comprehension of the evidence.[21]

Fifth, moral protections are crucial. The constitutional rights to privacy and dignity should be weighed against the use of biometric information, DNA profiling, and narcoanalysis. Forensic technologies must not be abused for coercion or illegal monitoring, according to independent oversight organisations.

Last but not least, public awareness is crucial. The importance of forensic science in enforcing the law must be acknowledged by the public, which puts pressure on institutions to advance this discipline. Using forensic science to bridge the gap between law and medicine is becoming essential as India modernises its criminal justice system.

8. CASE STUDIES: LEARNING FROM EXPERIENCE

Although the assignment focuses more on conceptual integration than case law, some real

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20 A. Chawla, *Cyber Laws and Forensic Evidence in India* (Bloomsbury 2020) 144.

21 R. K. Gorea, 'Bridging the Gap between Law and Medicine in Medico-Legal Investigations' (2013) 35 *Journal of Indian Academy of Forensic Medicine* 111.

incidents show how forensic science has shaped the outcomes of justice in India.

In high-profile murder cases, forensic medicine often plays a central role. For example, in several dowry death trials, viscera analysis confirmed the presence of poison, making it possible to secure convictions despite attempts to disguise the deaths as suicides. Similarly, DNA testing has revolutionized the prosecution of sexual assault cases, where biological samples have directly linked perpetrators to crimes.

Another domain where forensic science has been decisive is terror investigations, where explosives analysis, fingerprint recovery, and digital forensics have been used to identify networks and establish links between accused persons. Even in civil cases such as disputed paternity, courts have relied on DNA evidence to settle long-standing disputes that could not be resolved by traditional evidence.[22]

These examples reveal that while forensic science is already contributing to justice delivery, its impact is uneven. In cases where investigation agencies, medical examiners, and courts work in tandem, science proves invaluable. However, in cases where evidence is lost due to mishandling or laboratories take years to return results, justice is delayed and sometimes denied. Case studies therefore highlight both the potential and the pitfalls of forensic integration in India.

9. CASE STUDIES

9.1 The Priyadarshini Mattoo Case (1996)

In this case, forensic DNA profiling played a decisive role. Initially, the trial court acquitted the accused due to lack of direct evidence. However, forensic evidence later linked the accused to the crime, and the Delhi High Court convicted him. This case highlighted the importance of forensic DNA testing in strengthening criminal trials.

9.2 The Nirbhaya Gang Rape Case (2012)

Here, forensic evidence such as DNA, medical reports, and mobile phone records were crucial in

22 *Banarsi Dass v. Teeku Dutta* (2005) 4 SCC 449 (Supreme Court held DNA testing is admissible in paternity disputes).

corroborating the victim's testimony. The use of forensic science ensured that the case was prosecuted with strong evidence, leading to speedy conviction.

9.3 Aarushi Talwar and Hemraj Double Murder Case (2008)

The case exposed the **weaknesses** in India's forensic infrastructure. Poor handling of the crime scene, conflicting forensic reports, and delayed collection of evidence created serious doubts in the trial. This case became a classic example of how forensic lapses can derail justice.

9.4 Uphaar Cinema Fire Case (1997)

Forensic fire investigation and structural analysis helped establish negligence and lapses in safety measures. The forensic findings were crucial in assigning liability for the deaths caused by the fire.

10. THE FUTURE OF FORENSIC SCIENCE IN INDIA

India must acknowledge forensic science as a fundamental component of the administration of justice, not as an elective help, if it is to genuinely close the gap between law and medical. A modern, autonomous, and morally sound forensic infrastructure is necessary due to the growing complexity of crime, which includes anything from cyberattacks to transnational terrorism. maintaining strong institutions, maintaining scientific databases, embracing technology, and establishing rigorous human rights safeguards are all essential to the future of forensic science in India.

The 2020 founding of Gujarat's National Forensic Science University (NFSU) is among the most important turning points in this direction. Being the first in the world, NFSU has the potential to establish itself as a central hub for forensic science instruction, research, and standards-setting. NFSU may turn forensic science from a disjointed system into a unified national framework by guaranteeing consistent procedures across states and establishing a connection between academia and field application.[23]

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23 R. K. Sharma, *Forensic Science in Criminal Investigation and Trials* (6th edn, Universal Law Publishing 2017) 34 (noting the importance of institutional frameworks in forensic science).

The establishment of centralised forensic databases is equally crucial. Similar to the Combined DNA Index System (CODIS) in the United States, India needs integrated archives for digital evidence, ballistics, DNA, and fingerprints. Such databases would accelerate the identification of suspects, link repeat offenders across jurisdictions, and significantly reduce delays in criminal trials. But this also brings up privacy and data protection issues, necessitating a robust legal structure to control access and storage.

The incorporation of digital tools and artificial intelligence into forensic procedures is another exciting area. Investigations can be completely transformed by AI-powered facial recognition, crime-pattern analysis, and predictive policing. Digital forensics will also be essential in combating financial offences, online fraud, and cybercrime. However, in order to guarantee that efficiency does not come at the expense of individual liberties, these developments must be supported by thorough data protection regulations.

It is impossible to overestimate the influence of education and training on the future. All medical schools should make forensic medicine a required course to guarantee that physicians are sufficiently prepared for their medico-legal duties. Law schools should also include forensic interpretation courses so that aspiring judges and solicitors can evaluate expert testimony. A more integrated judicial system will be promoted by this dual focus on education, which will close the knowledge gap between law and medical.Another area in dire need of improvement is institutional independence. The majority of forensic science laboratories (FSLs) are currently governed by state police, which raises questions regarding their impartiality and possible prejudice.

India must also look outward on a global scale. International partnerships with universities of advanced forensics and agencies such as Interpol can facilitate the exchange of training methods, technologies, and best practices. This is especially important in the fight against transnational crimes including drug trafficking, terrorism, and cross-border cybercrimes. Cross-border forensic collaboration can give India the resources it needs to function in a globalised criminal justice system.

Finally, while the future of forensic science in India appears promising, it must remain firmly grounded in **human rights protections**. As forensic technologies become increasingly invasive whether through DNA profiling, biometric surveillance, or predictive algorithms there is a real

risk of infringing upon constitutional freedoms. India must therefore evolve strong ethical frameworks and legislative safeguards to balance scientific efficiency with civil liberties. The ultimate goal should be to create a system where science strengthens justice without compromising individual rights.

11. CONCLUSION

At the nexus of medicine and law, forensic science offers the scientific impartiality that isn't always possible with human recollection or circumstantial inference. Even though expert testimony is legally recognised in India, forensic science is still not widely applied. The full potential of forensic medicine in the judicial system is hindered by inadequate coordination, a shortage of qualified specialists, weak infrastructure, and unclear legal provisions.But there are a tonne of options. Digital forensics can disclose crimes in cyberspace; toxicology can identify concealed poisons; autopsy results can show the truth behind strange deaths; and properly gathered and examined DNA evidence can achieve convictions in sexual assault cases. These all show that forensic science is an essential companion to law, not just a help.

Whether India can change its forensic environment will determine how justice is delivered in the future. To make sure that science and law function together, it is imperative that laboratories be invested in, legal processes be reformed, and doctors and judges collaborate more. Only then will the Indian legal system be able to fully realise the constitutional guarantees of justice, truth, and a fair trial.In this way, closing the gap between forensic science and the judicial system is not just a technical change but also a moral requirement, as it guarantees that justice is founded on scientific certainty rather than conjecture.

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Online Resources

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