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# **FROM SCENE TO SENTENCE: EVALUATING THE ROLE OF FORENSIC SCIENCE IN STRENGTHENING INDIA'S CRIMINAL JUSTICE SYSTEM**

AUTHORED BY - DEVYANI<sup>1</sup>

*"There is nothing more deceptive than an obvious fact." —Sherlock Holmes*

## **Introduction**

The conceptual foundation of the criminal justice system is to safeguard the innocent and to ascertain the truth in any case presented before the court, thus ensuring the delivery of justice.<sup>2</sup> The objectives of the criminal justice system have not been clearly defined; however, these can be gathered from different statutes and judicial pronouncements. The primary objective of the criminal justice system is to reduce the rate of crimes in society, ensure maximum detection of reported crimes, convict the offenders and award pertinent punishment to the convicts, provide rehabilitation programs, and compensate the victims. The justice system of any country depends on the strength of the evidence brought during investigations and trials, on the basis of which a person can be convicted. The criminal justice system has many stakeholders—police, prosecution, judges, witnesses, defendants, and custodial and correctional services. Apart from these, the forensic science community and the general public are two more very important stakeholders of the system. This is the stage at which forensic science aids in the effective dispensation of justice. The rhetorical claims made by science in every field is so powerful that their use in the criminal justice system is inevitable. Science provides verifiable and logical solutions to almost every problem. Forensic science is a discipline of 'science' that deals with matters related to law. It provides comprehensiveness to questions of 'who,' 'what,' 'when,' and 'how'?<sup>3</sup>

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<sup>2</sup> H.J. Walls, FORENSIC SCIENCE: AN INTRODUCTION TO SCIENTIFIC CRIME DETECTION, 2<sup>nd</sup> ed., 2008, pp. 17-19.

<sup>3</sup> Morgan, Ruth M(ed.), "Forensic Science, Revealing the Unseen and the Unknown," *Picturing the Invisible: Exploring Interdisciplinary Synergies from the Arts and the Sciences*, UCL Press, 2022, pp. 11–24. JSTOR, <http://www.jstor.org/stable/j.ctv1v090jc>.

## The Scientific Evolution and Legal Recognition of Forensic Evidence

The National Institute of Justice (NIJ, 1908) defines forensic science as the application of scientific knowledge within the legal system. Since the twentieth century, the term "forensics," derived from the Latin word *forensis*, came to be used synonymously with the use of science in the context of law or courtroom to assist in solving crimes, with dedicated teams employed by police to search for and recover evidence, coupled with the establishment of dedicated laboratories to process forensic material and to make comparisons between the material recovered from a crime scene and that from a suspect across a range of disciplines.<sup>4</sup> The development of forensic science in the twentieth century led to the furthering of the establishment of forensic science infrastructure as well. Forensic laboratories increased tremendously since the early 1970s due to growing pressure on the police and courts to rely on objective evidence, including major breakthroughs in fields such as DNA testing.

In India, the "Best Evidence Rule" forms the cornerstone of the law of evidence and mandates that the best available evidence be presented before the court. The best evidence is the one that is procured from the direct source, but practically, many times it is not possible to collect direct evidence. In such situations, circumstantial evidence is to be relied upon. The court allows the opinion of the expert so that the fact finding and judgement can be based upon a reasoned conclusion. There are many matters before the court which require special knowledge and skill and the court is incapacitated to form a judgement without consulting an expert. A witness who is skilled and qualified to speak on such matters is an expert. Section 45 of the Indian Evidence Act 1872 has recognized the relevancy of expert evidence. The importance of Expert Testimony has been reiterated by the Courts through various judgements. In *Titli v. Jones*<sup>5</sup>, the Court observed that, "*the real function of the expert is to put before the court all the materials, together with reasons which induce him to come to the conclusion, so that the court, although not an expert, may form its own judgment by its own observation of those materials. 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 these criteria to the facts proved by the evidence of the case.*" In *Ramesh Chandra Agarwal v. Regency Hospital Ltd.*<sup>6</sup>, the Court laid down that, "*the scientific question*

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<sup>4</sup> D. Umamaheswari, "Medico-Legal Aspects in the Admissibility of Scientific Evidence", International Journal of Innovative Science, Engineering & Technology, Vol. 1 Issue 8, October 2014, ISSN 2348 – 7968.

<sup>5</sup> AIR 1934 All 237.

<sup>6</sup> B.R. Sharma, FORENSIC SCIENCE IN CRIMINAL INVESTIGATION AND TRIALS, 6th ed., 2020, Ch (Introduction).

*involved is assumed to be not within the court's knowledge. Thus cases where the science involved, is highly specialized and perhaps even esoteric, the central role of expert cannot be disputed.”*

At the heart of the legal regime governing expert testimony lies a fundamental tension: the need to harness specialized knowledge while ensuring that justice remains anchored in fairness, transparency, and the right to a fair hearing. In India, this tension is mediated through Section 45 of the Indian Evidence Act, 1872, which provides that the opinions of “persons specially skilled” in areas such as science, handwriting, or foreign law are relevant facts. However, the Supreme Court has consistently underscored that such opinions are only advisory and must not supplant the independent judgment of the court.

In *State of Himachal Pradesh v Jai Lal*,<sup>7</sup> the Court reaffirmed that an expert is not a witness of fact but provides criteria by which the judge may test the evidence. The Court warned against uncritical reliance on expert opinion, noting, “An expert is expected to put before the court all materials which induced him to come to the conclusion and also to explain the reasons for his opinion so that the court may test the accuracy of the opinion.” This position echoes earlier rulings, such as *Magan Bihari Lal v. State of Punjab*,<sup>8</sup> which described expert testimony as inherently “weak” and to be “received with caution”. Similar skepticism appears in *Ram Chander v. State of Haryana*,<sup>9</sup> where the Court emphasized that expert testimony is corroborative at best and cannot override direct evidence. In *Mohd. Aman v. State of Rajasthan*,<sup>10</sup> the Court rejected handwriting expert evidence in the absence of corroborative facts, reflecting its wariness of subjective or speculative expertise. The U.S. jurisprudence underwent a radical transformation with *Daubert v. Merrell Dow Pharmaceuticals Inc.*,<sup>11</sup> which replaced the *Frye* “general acceptance” test with a flexible standard evaluating both relevance and reliability. As Targ and Feldman explain, *Daubert* recognizes the epistemological gap between science and law: “Science is something of an octagonal peg trying to fit into a round hole most of it fits, but it leaves some gaps around the edges”.<sup>12</sup> In *Kumho Tire Co v. Carmichael*<sup>13</sup>, the U.S. Supreme Court extended the *Daubert* standard to all expert testimony, whether scientific or technical. Indian courts, while not formally adopting *Daubert*,

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<sup>7</sup> AIR 1999 SC 3318.

<sup>8</sup> AIR 1977 SC 1091.

<sup>9</sup> AIR 1981 SC 1036.

<sup>10</sup> (1997) 10 SCC 44.

<sup>11</sup> 509 US 579 (1993).

<sup>12</sup> 526 US 137 (1999).

<sup>13</sup> (2013) 12 SCC 406.

have increasingly shown awareness of similar concerns. In *Ramesh Chandra Agrawal v Regency Hospital Ltd.*<sup>14</sup> the court reiterated that expert testimony must be weighed carefully and cannot displace the judicial mind.

### **Linguistic Barriers and Communicative Challenges**

The evidentiary impact of forensic testimony is further diluted by poor communication and linguistic opacity. Technical reports are frequently composed in scientific jargon inaccessible to judges, lawyers, and jurors alike.<sup>15</sup> This is compounded in multilingual jurisdictions like India, where translations may introduce further distortions.<sup>16</sup> As Edmond and Roach have noted, unclear language undermines the transparency of expert reports and ultimately weakens their persuasive value in court.<sup>17</sup> Recognizing this, the UK's Forensic Science Regulator has issued guidance urging clarity and standardized reporting protocols.<sup>18</sup> In India, however, there remains a lack of uniformity, which often forces courts to rely on the stature of the expert rather than the content of their analysis.<sup>19</sup>

The judiciary's limited capacity to scrutinize scientific testimony is a result of both structural and educational gaps. Few judges or lawyers receive training in scientific reasoning, inferential statistics, or experimental methodology.<sup>20</sup> As a result, courts sometimes exhibit undue deference to experts, accepting opinions without adequately examining the processes by which they were derived.<sup>21</sup>

This overreliance is what some term the "fallacy of expertise," where credentials substitute for critical engagement.<sup>22</sup> Scholars argue that unless Indian legal education integrates scientific literacy and courts adopt a more structured approach to assessing evidence, this gap will

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<sup>14</sup> (2009) 9 SCC 709

<sup>15</sup> Gary Edmond, 'Legal versus Scientific Epistemologies' (2000) 33 UBC Law Rev 51.

<sup>16</sup> Emma Cunliffe, *Murder, Medicine and Motherhood* (Hart Publishing 2011).

<sup>17</sup> Rasmus H Pedersen, 'Courtroom Interpretation and the Role of the Interpreter' (2005) 10 Int'l J Speech Lang & the Law 201.

<sup>18</sup> Gary Edmond and Kent Roach, 'A Contextual Approach to the Admissibility of the State's Forensic Science and Medical Evidence', (2011) 61 UTLJ 343.

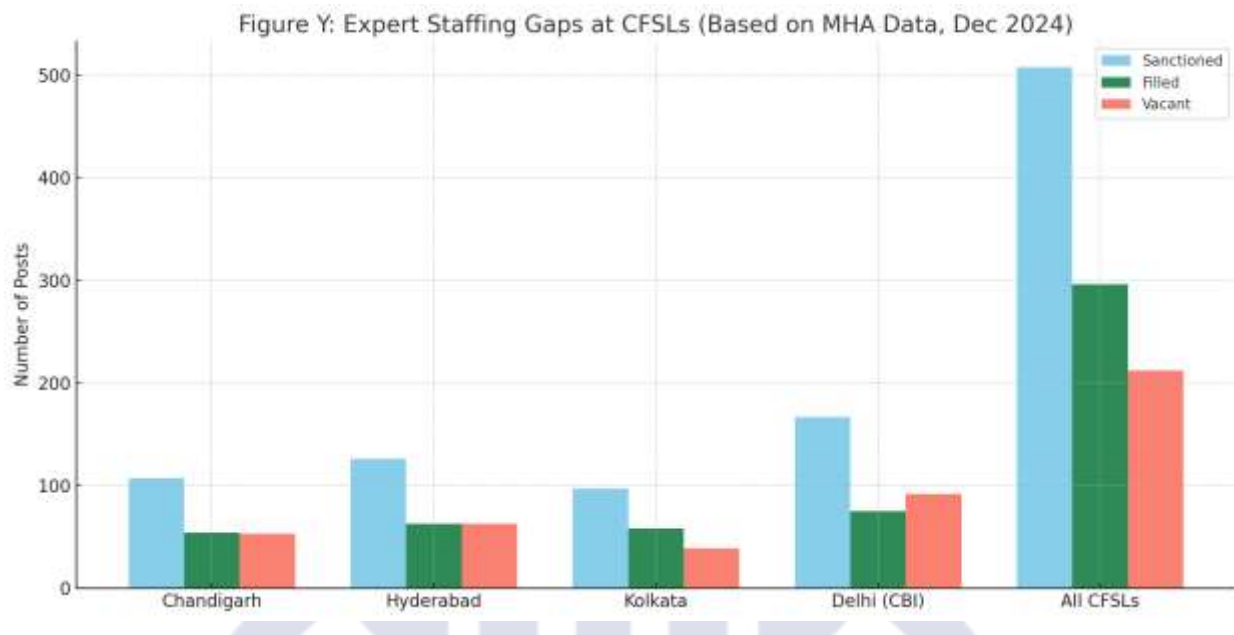
<sup>19</sup> Forensic Science Regulator, *Codes of Practice and Conduct* (UK Home Office 2021).

<sup>20</sup> Sonia Chopra and Pamela Raghunath, 'Understanding Forensic Testimony in Indian Courts' (2017) 3 NLUD J Legal Stud 103).

<sup>21</sup> D Michael Risinger, 'Navigating Expert Reliability' (2000) 34 Seton Hall L Rev 1.

<sup>22</sup> Edmond G, 'Judging the Scientific Credibility of Forensic Science in Criminal Trials' (2013) 37 Australian Journal of Legal Philosophy 1.

continue to impair the probative value of forensic inputs.<sup>23</sup>



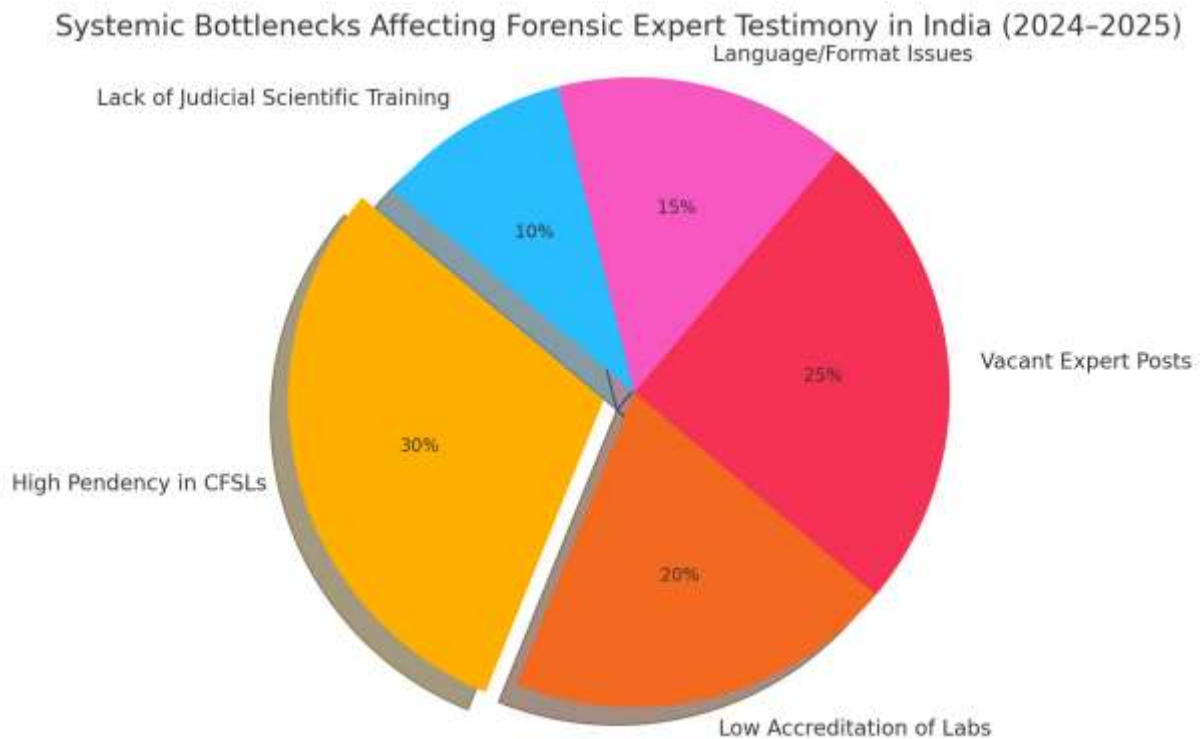
### Institutional Setup and Practical Challenges

The first forensic laboratory was established by Edmond Locard in 1910. In India, increasing awareness within the police and judiciary about the importance of scientific methods in analyzing material evidence has led to the establishment of forensic science laboratories at both the state and central levels. For an effective application in criminal investigations, a multi-professional approach is needed where the roles of the functionaries of the criminal justice system are seen. The investigating officer has to know it, the counsels have to understand it, and the judges have to appraise or utilize it in the determination of the guilt or innocence of the accused.<sup>24</sup> The criminal at the crime scene leaves clue materials at the crime scene, on the victim, or on the various articles at the crime scene; or, he picks clue materials from them. The evidence against the offender may be compelling if the clue materials are appropriately gathered, stored, sent, and assessed, and if their identity, integrity, and authenticity is undeniable. For instance, a fingerprint is discovered at the scene of a crime. Legal access to the scene is denied to the suspect. Identifying this fingerprint as belonging to the suspect makes it obvious that they were involved in the crime.

<sup>23</sup> Gary Edmond, “What Lawyers Should Know About the Forensic Sciences,” *Adelaide Law Review* 36, no. 1 (2015): 33–61; see also Roach, Kent. *Forensic Science and Miscarriages of Justice*. Cambridge University Press, 2010, p. 74.

<sup>24</sup> Roux, Claude, et al. “The End of the (Forensic Science) World as We Know It? The Example of Trace Evidence.” *Philosophical Transactions: Biological Sciences*, vol. 370, no. 1674, 2015, pp. 1–8.

One of the most important developments in the recent past has been in DNA profiling for the identification of human beings. At each stage of the application of forensic science in the criminal justice system, it is inevitable. The social changes in the society, the anonymity of the criminals, increasing technical know-how in committing crimes, and verifiable and better evidence are some of the reasons that there is an increasing need to use forensic science in the criminal justice system.<sup>25</sup> A critical intersection between forensic sciences within the context of criminal justice lies in the literature and reports indicating the questions of how evidence is collected from the scene of occurrence, how it is examined at the forensic laboratory, the manner in which evidence is introduced at the trial, and the role it plays in convictions or acquittals.



### Strengthening Forensic Science: Bridging Practice and Policy

Forensic science, fundamentally a multidisciplinary field, embodies not only the union of science and law but also a commitment to justice. As Harris and Lee observe, the value of forensic evidence depends as much on its proper collection, preservation, and presentation as

<sup>25</sup> Supra note 5.

on its scientific validity.<sup>26</sup> In India, however, inconsistent standards, lack of accreditation, and insufficient training compromise its credibility and risk miscarriages of justice.<sup>27</sup>

One necessary reform is the establishment of nationally uniform standards and accreditation mechanisms. White underscores that laboratories must conform to demonstrable quality benchmarks, such as ISO/IEC 17025, to inspire judicial confidence.<sup>28</sup> Presently, India's laboratories operate under varying state-level protocols, inviting inconsistency and skepticism. The proposed National Forensic Board and the expanded role of the National Forensic Science University offer opportunities to standardize procedures and enforce quality control.<sup>29</sup> Houck and Siegel highlight the importance of routine audits and proficiency testing to uphold scientific integrity.<sup>30</sup> Such measures would enhance the reliability of forensic findings and minimize wrongful convictions arising from flawed analyses.<sup>31</sup>

Equally important is robust training and continuing education for all justice stakeholders. Harris and Lee argue persuasively that the chain of custody, frequently compromised, depends on the competence of police officers and prosecutors as much as on forensic scientists.<sup>32</sup> In India, inadequate training leads to frequent evidence contamination and diminished probative value. Bell warns that improperly handled evidence can become irretrievably compromised, undermining trials.<sup>33</sup> Interdisciplinary training involving police, forensic professionals, prosecutors, and judges is essential, with modules addressing cognitive biases, ethical responsibilities, and effective communication of scientific uncertainty.<sup>34</sup>

Emerging technologies, including artificial intelligence, biometric databases, and predictive analytics, promise to transform forensic investigations but raise concerns regarding transparency and fairness. Stoney and Schmitt caution that AI-driven tools often function as opaque "black boxes," challenging explainability in court.<sup>35</sup> Legal safeguards and transparent

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<sup>26</sup> Howard A. Harris & Henry C. Lee, *Introduction to Forensic Science and Criminalistics* (CRC Press, 2010) 22.

<sup>27</sup> *Ibid.*, 31-33.

<sup>28</sup> Peter C. White (ed.), *Crime Scene to Court: The Essentials of Forensic Science* (4th edn, RSC Publishing, 2015) 65.

<sup>29</sup> *Ibid.*, 72.

<sup>30</sup> Max M. Houck & Jay A. Siegel, *Fundamentals of Forensic Science* (3rd edn, Elsevier, 2015) 201–203.

<sup>31</sup> *Ibid.*, 215.

<sup>32</sup> Harris & Lee ( *Supra* note 20) 41.

<sup>33</sup> Suzanne Bell, *Forensic Science: An Introduction to Scientific and Investigative Techniques* (2nd edn, CRC Press, 2008) 91.

<sup>34</sup> Houck & Siegel (*Supra* note 24) 228–230.

<sup>35</sup> David A. Stoney & Thomas J. Schmitt, *The Future of Forensic Science: Governance, Ethics, and Policy* (Elsevier, 2018) 144.

methodologies must accompany their adoption. The UK Forensic Science Regulator explicitly warns against overstating the value of AI-generated evidence without rigorous validation.<sup>36</sup> India should draw on such guidance when formulating policies on technology integration.

Ethical dimensions also warrant close attention. The widespread collection and storage of biometric data, including DNA, raises concerns over privacy, consent, and misuse. Bell emphasizes that forensic evidence must balance public security with civil liberties.<sup>37</sup> The proposed DNA Technology Bill is a positive step but requires further safeguards, including independent oversight and robust data protection.<sup>38</sup> Without these, public trust in forensic institutions may erode.

Finally, international cooperation and harmonization of forensic practices are imperative in addressing cross-border crimes such as cyber fraud and terrorism. The UNODC's guidelines on the effective use of forensic science provide a valuable framework for aligning Indian practices with global standards.<sup>39</sup> Strengthening India's forensic capabilities in this regard would reinforce its credibility as a jurisdiction committed to justice and scientific integrity.

Through a coordinated approach that integrates technology, law, ethics, and global best practices, forensic science in India can evolve into a cornerstone of justice delivery, meeting the demands of a modern legal system while safeguarding fundamental rights.

## Conclusion

While recent policy reforms and financial allocations mark a positive shift in India's approach to forensic science, the ground reality continues to be marked by severe bottlenecks. Chronic delays, infrastructural imbalance, and acute personnel shortages, especially in key states such as Delhi, Haryana, Kerala, and Himachal Pradesh, undermine the potential impact of these initiatives. Mere structural expansion is insufficient if not matched with procedural uniformity, timely case management, and technical standardization.

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<sup>36</sup> The Forensic Science Regulator, *Codes of Practice and Conduct* (2021, UK) §3.6.

<sup>37</sup> Bell (Supra note 27) 121.

<sup>38</sup> Ibid., 122–123.

<sup>39</sup> UNODC, *Guidelines for the Effective Use of Forensic Science in Criminal Justice Systems* (2016) 8–11.

To truly transform forensic science into a credible and consistent tool for justice delivery, reforms must include enforceable statutory timelines for forensic reporting, transparent digital evidence management systems, and institutional capacity-building measures. Public-private partnerships can serve as catalysts for innovation, while independent judicial oversight is vital to maintaining accountability and ensuring fair trial rights.

Furthermore, India must invest in training a new generation of forensic professionals equipped to handle evolving scientific and legal challenges. Only through a coordinated strategy that merges technology, law, and ethics can forensic science evolve into a pillar of evidentiary integrity and public trust within the criminal justice system.

