Admissibility and Reliability of Forensic Evidence: A Comparative Analysis of Indian and Global Standards

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Abstract

In the justice system, forensic evidence is particularly significant because it provides scientific and objective factual evidence to help contextualize existing evidence in existence. At the same time, the arena of admissibility and reliability of forensic evidence remains in contention, and the arena continues to dictate interpretation. India, through the Indian Evidence Act (Sections 45-51), does have a general framework for expert opinion evidence and, therefore, forensic evidence. The Indian courts, when considering the use of forensic evidence, have taken a pro-position at which caution, scrutiny, and judicial discretion have emerged as their key characteristics. There are standards in the world, for example, the Frye test, and the Daubert standard for experts, as well as the legal admissibility of evidence in Canada and Australia that dictate forensic evidence to the level of general acceptance in the scientific community, before admissibility, but also standardization and scientific rigor in methodology. India could learn a lot from jurisdictions that are relatively robust and the common law forensics produced by the above-mentioned paradigm. In regard to forensics, India does have some institutional failures surrounding contamination of forensic evidence, loss of evidence, no standardization of forensic protocols, and failure to inform judges and judicial officers about the test and accountability in the evidence.

In order to achieve due process and the sake of quality forensic evidence, reform is required in forensics, which must include national standards for forensics, as well as accreditation of forensic laboratories, training for judges and lawyers, and independent functional frameworks for forensic services. Education and awareness campaigns for the legal fraternity, as well as forensics, will promote awareness as to the "truth" of forensic science and counter misplaced trust. These landmark decisions in India and different turnovers have illustrated that forensic evidence can bolster a case, or demolish a case and ultimately justice, or bias disposition, or tragic disposition. It is timely that an evidence-based, cautious, and scientifically rigorous judicial disposition is made in the arena of forensic evidence, to ensure justice is done as Denise Wilms' cognizant demanded.

Forensic Evidence: The Standards of Admissibility

The importance of forensic evidence within the justice system cannot be understated. The Indian Evidence Act, 1872 sets out the standards for admissibility of expert opinions, and in particular forensic evidence, in sections 45 - 51. In order to fully understand this issue, it is important to recognize these provisions, as well as the Daubert and Frye standards internationally.

Admissibility under Indian Law: sections 45-51 Indian Evidence Act

Section 45A - Opinion of Electronic Evidence Examiner

Section 45A was introduced in light of the rapid developments in digital technology. In instances where the court is required to form an opinion about information being transferred or stored in any computer resource or other electronic or digital form, then evidence on the opinion as to the Examiner of Electronic Evidence must be accepted as relevant fact.

Section 45A guarantees that opinions on electronic evidence, including but not limited to e-mails, digital signatures, or metadata, fall within the definition of mad to be received, if the opinion evidence is offered by a recognised examiner (under Section 79A of the Information Technology Act, 2000).

Sections 46-51 of the Act update the law of evidence by establishing new categories of admissibility of opinion evidence that previously had no basis in law.

Section 46 allows the court to consider facts that may tend to support or contradict expert opinion. This means that, while expert opinion is admissible, the court may judge the reliability of that opinion based upon the facts revealed at trial along with the opinion evidence that supports, or contradicts, the opinion.

Section 47 permits opinions of persons who are familiar with an individual's handwriting to be admissible when the court is called upon to decide who wrote or signed a document.

Section 48 permits the opinions of persons with special means of knowledge of whether or not any general or public right or custom exists, to be admitted.

Section 49 permits that when the court has to decide what customs and practices or beliefs a group or family adopted, the opinions of those who have special means of knowledge are relevant and admissible.

Section 50 permits the opinions of any person who has knowledge of, and is familiar with the relationship of, two people to be admissible when the court has to decide that relationship.

Section 51 permits the court to consider the basis of an expert's opinion. The section gives the court the right to have the facts of the matter made clear and to assess the validity of the expert's opinion.(*Evidence Act, 1872*, n.d.).[1]

Judicial Interpretation in the Indian aspect

Indian courts have repeatedly reiterated the importance of expert opinions as support for judicial decisions, but also indicated that expert opinions should not be taken as provided without further scrutiny. In Ramesh Chandra Agrawal v. Regency Hospital Ltd. & Ors.(*Ramesh Chandra Agrawal vs Regency Hospital Ltd. & Ors on 11 September, 2009*, 2009)[2] the Supreme Court reiterated that expert evidence should be approached with caution and that further evidence should accompany the expert evidence. This yardstick denotes important relatedness in science to help us measure admissibility.

Global Judicial Interpretation

In Frye v. United States (1923),(*Fit to Be Fryed_ Frye v. United States and the Admissibility of Novel Scientific Evidence*, n.d.) [3] The Frye standard permits broadly accepted, or generally accepted, scientific methods to be used to base decisions; however, the Frye standard has been criticized for being too inflexible and could risk excluding some exciting but reliable scientific advances.

[1] *The Indian Evidence Act, 1872*, ss 45–51 (Act No. 1 of 1872), https://thc.nic.in/Central%20Governmental%20Acts/Evidence%20Act,%201872.pdf (last visited 1 June 2025).
[2] *Ramesh Chandra Agrawal v. Regency Hospital Ltd. & Ors.*, Civil Appeal No. 9166 of 2003, decided on 11 September 2009, https://indiankanoon.org/doc/1956064/ (last visited 1 April 2025).
[3] J. Alexander Tanford, "Fit to be Fryed: *Frye v. United States* and the Admissibility of Novel Scientific Evidence" (1982) 69 *Kentucky Law Journal* 821, https://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1918&context=klj (last visited 1 April 2025).

Another judicial interpretation, characterized and known as the Daubert Standard The Daubert standard, from ***Daubert v. Merrell Dow Pharmaceuticals, Inc., established in 1993,***(*U.S. Reports_ Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579 (1993)_*, n.d.)[4] provides a more flexible option, with the trial judge as "gatekeeper", for the relevance and reliability of expert evidence by considering factors, including:

1. The existence and maintenance of standards controlling its operation.
2. Whether it has been subjected to peer review and publication.
3. Whether it has attracted widespread acceptance within a relevant scientific community.
4. The known or potential error rate.
5. Whether the theory or technique can be tested.

Comparative Analysis: Indian Law vs. Global Standards

Indian law, as defined in Sections 45 to 51 of the Indian Evidence Act, provides a framework for admitting expert opinions, yet does not offer the level of detail as the Daubert standard does. Indian courts place relatively greater emphasis on what is contemporaneous to the relevant expertise and qualifications of the expert evidence rather than a consistent framework for determining the validity of the conclusions drawn concerning reliable methodology. Adopting elements of the Daubert standard could aid the Indian legal framework in being able to evaluate inferences drawn from forensic materials criticism. Implementation of a framework to approach the scientific subsistence for different expert evidence could potentially establish the extent of credible opinion. The Daubert standard permits diverse scientific notions as long as the evidence can be of relevant and reliable. Indian law focuses on the admissibility of forensic materials, based on various conclusions in Sections 45 to 51 of the Indian Evidence Act as it relates to the definition of expert opinions of evidence when in domains outside of the court. While this is beneficial, the evidence presented in Part (1) through Part (5) could benefit from a procedural evaluation of subjective rigorous criteria for the witness qualification.

[4] *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993), https://tile.loc.gov/storage-services/service/ll/usrep/usrep509/usrep509579/usrep509579.pdf (last visited 1 April 2025).

Comparing Indian legal criteria with the global standard in these two benchmark locations, highlighting classifications of expert evidence, clearly expresses the need for more adequate evaluation and weighing of forensic evidence based on incidental criteria. Potentially adopting standards like the Daubert and Frye standard could enhance the potential of judges assessing relevant materials and credible evidence.

Improving the Reliability of Expert Evidence

1. Creation of National Forensic Protocols: More nationalized protocols for forensic labs to follow for examination and reporting provides more reliable expert evidence.
2. National Forensic Lab Accreditation: Establishing forensic lab accreditation to comply with international standards would enhance the credibility of evidence in the investigatory process.
3. Education of Judges: Judges who regularly undergo education on scientific methods and changes in forensic science will be more informed and better prepared to value expert evidence.
4. Local/State Evaluation Guides: By following some of the Daubert factors and local evaluation guides for expert witnesses, judges could have a consistent basis to judge admissibility of evidence.
5. Expert Panels: Formation of independent expert panels to assist courts in terms of complex cases can provide a balanced, independent, and rational perspective on competing opinions.

One part of the judicial process that provides a significant junction between specialized scientific expertise and decision-making is expert evidence, which may be expert witness testimony or expert witness reports. While it is clear that courts in India are considering expert witness reports as a reliable source of evidence, they continue to deal with contradicting reports, protocols that differ by lab, and judicial education. By developing protocols, accreditation, judge education, and evaluation guides, courts will have the ability to improve the quality of their expert evidence and support the justice system.

Challenges in Forensic Practice

1. Contamination and/or lost evidence

The chain of custody has numerous opportunities for forensic samples to become contaminated or damaged, and lost; therefore, it will be easy to make mistakes in the collection, storage, and analysis phases. In the case of Kiran Negi, the DNA evidence was contaminated, which was paramount to many problems surrounding the management of evidence, which can demolish the validity of the investigation and wrongfully convict innocent people.

2. Partiality in reliance on forensic evidence

The legal process tends to acknowledge forensic evidence as the most reliable source and sometimes discounts all other forms of corroborating evidence. Even when the evidence in the Anokhilal case misrepresents DNA evidence that leads to a death penalty conviction, it is a demonstration of the extreme reliability placed on evidence without the scrutiny of all the evidence.

3. No standardized protocols

There were no standardized protocols that forensic labs operated under, so it will not be uniform across forensic labs. For instance, in the case of Sonipat, the reliability of the DNA evidence through the collection of evidence and management of evidence was important to communicate the acquittal regarding the accused tested DNA.

4. Lacking judicial experience

Judges are not trained scientists and are not self-reliant enough to properly consider forensic evidence that requires complex analysis. There is a degree of ignorance of science that can substitute for an evidentiary debate when forensic evidence is presented. The trend, particularly noted in some of the cases highlighted, is that many courts are forgetting to consider the exceptional factors that exist in the case to apply common-sense tests that differ from forensics.

Bilateral Suggestions for Reform

1. Nationalized Forensic Protocol, Standards and Guidelines: The validation of forensic protocols related to the collection, analysis, and documentation of forensic evidence can limit error and create reliability of forensic evidence.
2. Accreditation of Forensic Laboratories: The introduction of lab accreditation will ensure forensic labs comply with international standards regarding forensic investigations and develop confidence in forensic labs.
3. Judges Judicial Training Education: Judges who continue to participate in ongoing scientific methods judicial education and new forensic advancements in the law will provide informed assessments of expert testimony.
4. Independent oversight: The introduction of independent oversight into forensic protocols will assist in addressing conscious and unconscious mistakes that exist, or ethically misinformed behaviours that exist in forensic investigations.
5. Public Education Campaigns: Increased public knowledge regarding the limits and proper understanding of forensic evidence will increase the conversation surrounding the role of forensic evidence in the justice system. Forensic evidence is a critical component of the police solving crimes but the wrong application of forensic evidence, or even misunderstanding forensic evidence can result in wrongful convictions and other injustices. The illustrations highlight the need for critical forensic science changes in legal practices. The legal system can take steps to prevent wrongful convictions in order to provide justice and fairness by way of standardized operating protocols across all jurisdictions, better educational training for judges on forensic science, and the increased use of oversight organizations outside of the judiciary for forensic science laboratory practices.

Limitations and Misconceptions Surrounding Forensic Science in the Judiciary

Forensic science is an extremely important component of modern legal systems, acting often as the "gold standard" in determining guilt or innocence, but it is not a foolproof undertaking. Judges must interpret complex forensic evidence, usually without a scientific or technical background. This is a problem, because judges may misrepresent the scientific findings of interpretative forensic experts; in general, judges may be over-reliant on the purported objectivity of science in some situations, without understanding the limitations of the science. In a systems context, judges are often faced with an interpretation of forensic results that may lead them to misunderstanding the significance or implications of forensic results, especially when interpretive biases are introduced by imperfect (or biased) forensic expert witnesses. (*House of Lords - Forensic Science and the Criminal Justice System_ A Blueprint for Change - Science and Technology Select Committee*, n.d.).[5]

A key concern is the tendency of courts to overestimate the validity of forensic evidence. Tests including fingerprint identification, bite mark analysis, and hair microscopy were once deemed as definitive measures. However, numerous reviews of the science have suggested that there are no best practices or accepted error rates for the tests. Nevertheless, judges and juries might view these tests as definitive based on a conviction in the certainty with which experts present their findings and testify. (*Investigative Report Details Flaws in Forensic "Science,"* n.d.)[6]. The distance between the scientific facts and how they are reflected in courtrooms creates the potential for wrongful conviction. Some judges may also be overly reliant on statements of forensic experts. Judges will often defer to expert testimony to help interpret complex evidence but not all experts are equal in their reliability. Some forensic experts may intentionally or unintentionally alter their findings to favor the party that hired them, especially in adversarial legal situations.

[5] House of Lords, Science and Technology Select Committee, *Forensic Science and the Criminal Justice System: A Blueprint for Change*, HL Paper 333 (2019), https://publications.parliament.uk/pa/ld201719/ldselect/ldsctech/333/33308.htm (last visited 10 April 2025).
[6] Equal Justice Initiative, "Investigative Report Details Flaws in Forensic Science" (2020), https://eji.org/news/report-details-flaws-forensic-science/ (last visited 15 April 2025).

Other experts may simply not be adequately trained or rely on methods that are out of date. If the judge doesn't have the background to judge this kind of testimony, they may accept these reports at face value and give undue weight to evidence that doesn't carry a strong empirical basis. (Roberts, 2015).[7]

Additionally, how forensic results are communicated can often mask their uncertainties. For example, DNA evidence is robust when undertaken scientifically, but it may still be subject to contamination, subjective interpretation, and other probabilistic limitations. When experts express their opinions in an absolute context, e.g., a "match" without also discussing likelihood ratios or the size of the database, important nuances can become lost. The result may be courts convinced of a somatic level of certainty that science simply doesn't offer, and therefore splintering the judicial decision-making process. (*House of Lords -Ch 6_ Forensic Science and the Criminal Justice System_ a Blueprint for Change - Science and Technology Select Committee*, n.d.)[8]

A major challenge relates to there being many judges who are not actually aware that forensic science has changing standards. The various scientific disciplines regularly undergo refinements and, at times, discard previous assumptions altogether. Legal decisions are often based upon precedent, and if some forensic techniques were once acceptable enough for a court, they could certainly still be impacting more recent decisions on cases today. The legal system is behind the scientific world again as practitioners have left behind techniques shown to no longer be scientifically reliable (B. Garrett, n.d.).[9] Judges often receive very limited training and education in forensic science. In many jurisdictions, there is no requirement whatsoever for judges to stay scientifically literate. In lieu of this institutional support, judges are left to rely on expert witnesses only or on what explanations the legal counsel provided.

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[7] Paul Roberts, "Paradigms of Forensic Science and Legal Process: A Critical Diagnosis" (2015) 370(1674) *Philosophical Transactions of the Royal Society B: Biological Sciences* 1, https://pmc.ncbi.nlm.nih.gov/articles/PMC4581001/ (last visited 15 April 2025).

[8] House of Lords, Science and Technology Select Committee, *Forensic Science and the Criminal Justice System: A Blueprint for Change*, Chapter 6, HL Paper 333 (2019), https://publications.parliament.uk/pa/ld201719/ldselect/ldsctech/333/33309.htm (last visited 21 April 2025).

[9] Jennifer Mnookin, "Forensic Fail: As Research Continues to Underscore the Fallibility of Forensic Science, the Judge's Role as Gatekeeper Is More Important Than Ever" (2020) *Judicature*, https://judicature.duke.edu/articles/forensic-fail-as-research-continues-to-underscore-the-fallibility-of-forensic-science-the-judges-role-as-gatekeeper-is-more-important-than-ever/ (last visited 21 April 2025).

Judges often do not possess the ability to assist in distinguishing real science from pseudoscience. The inability to do this allows judges to unwittingly contribute to wrongful convictions by relying on unreliable evidence or affording it more significance than it warrants in their decision-making (*FRS0045 - Evidence on Forensic Science*, n.d.)[10]

Misinterpretation issues become intertwined with cognitive biases that affect stakeholders, including cognate biases with respect to the judge. If a forensic report concurs with a judge's preliminary theory of the case, a judge may unintentionally over-rate the trustworthiness of the forensic report; and, in situations when there is only a single piece of forensic evidence on which the prosecution is relying, it would be troubling for the judge to implicitly or explicitly misinterpret or overstate the forensic report- this could amount to a blatant denial of justice (Van Straalen et al., 2023)[11] Forensic science can offer tremendous promise to support judicial processes, but it is important to appropriately understand and use these previous conditions. There are three things the judicial officers need: better training, limiting reliance upon the opinion of salespersons, and the judge will need stricter discretion regarding acceptance and disclosure of forensic evidence. Doing this should lead to a more trustworthy process, which, in addition to making the chances of wrongful convictions for science interpretation errors exceedingly low, eliminates the chances of doing injustice due to poor education and training in studying and interpreting forensic science (Airlie et al., 2021)[12]

Landmark Case Studies: which affect Forensic Science

Forensic science is an important aspect of the criminal justice system because it provides forensic evidence that is factual and unbiased, as well as validates the existence of facts. Still, the notion of forensic evidence being infallible may create miscarriages of justice if forensic evidence is misunderstood, contaminated, or simply mismanaged.

[10] Forensic Science Regulator, *FRS0045 - Evidence on Forensic Science* (2025), https://committees.parliament.uk/writtenevidence/94780/html/ (last visited 22 April 2025).
[11] Nicholas Scurich, Thomas D. Albright, and Itiel E. Dror, "The Interpretation of Forensic Conclusions by Professionals and Students: Does Experience Matter?" (2018) 13 *PLoS ONE* e0204609, https://pmc.ncbi.nlm.nih.gov/articles/PMC10690568/pdf/main.pdf (last visited 22 April 2025).
[12] Stijn Vandezande et al, "Contemporary Issues in Forensic Science—Worldwide Survey Results" (2021) 339 *Forensic Science International* 111289, https://www.sciencedirect.com/science/article/abs/pii/S0379073821000244 (last visited 22 April 2025).

I will outline a few landmark Indian cases where inept forensic methods led to innocent people being wrongfully convicted, also showing that strict rigor must be applied to avoid such mistakes.

Additionally, I hope to detail a few cases where forensic science has appeared to clearly define the landscape of criminal investigation and the impact of that forensic science on the outcomes of those cases throughout the progression of this research project.

1 The Jigsaw Murders (UK, 1935) (Ruxton, n.d.)[13]

Dr. Buck Ruxton's trial in 1935 (known as the Jigsaw Murders) was a pivotal moment in the advancement of forensic science. The verdict was hinging on the scientific forensic evidence, including fingerprint identification, photographic superimposition, and entomology that was used to identify the victims and chart the timeline of the crime. The introduction of the forensic evidence marked a line in the sand on any past approaches. This was a case that really established markers for the future of more scientifically based forensic investigations.

2 The Purulia Arms Drop case (Sharma, n.d.)14

In the Purulia Arms Drop case in 1995, forensic ballistics studies determined that the weapons that were dropped by air over West Bengal were of military-grade quality. The court provided evidence for the sourcing and intent of arms using forensic objectives and determined that there was a carefully orchestrated international conspiracy. This case established the need for forensic examination by the court in a national security matter.

3 The Amanda Knox case (Italy–USA) (Linder, n.d.)15

In this case involving Amanda Knox (Italy–USA), the court originally focused on some forensic evidence that has now been called into question about DNA on a knife and a clasp from a bra. I thought in some later examinations of the evidence that it was point out evidence contamination and loss of evidence that was due to mishandling which lead to Knox being

[13]Crime+Investigation, "Was Dr Crippen Wrongly Executed for His Wife's Murder?" (2025), https://www.crimeandinvestigation.co.uk/articles/jigsaw-murders-pioneering-forensics (last visited 5 May 2025).

[14] India Today, "Purulia Arms Drop Case: Danish Court Rejects Extradition of Kim Davy to India" (29 August 2024), https://www.indiatoday.in/world/story/danish-court-rejects-extradition-of-purulia-arms-drop-case-accused-to-india-2590260-2024-08-29 (last visited 5 May 2025).

[15] Famous Trials, *The Trial of Amanda Knox* (2025), https://famous-trials.com/amanda-knox (last visited 5 May 2025).

released. This case exemplified how insufficient forensic processes does not help the cause of justice.

4 The Murder Case of Yara Gambira Sio (Italy, 2010) (Scammell, n.d.)[16]

In a 2010 case involving the murder of 13-year-old Yara Gambirasio in Italy, the court noted the importance of the use of DNA at so many levels to form a conviction against Massimo Bossetti. The circumstantial evidence was not of optimal strength, but the court concluded that the mitochondrial and nuclear DNA evidence was strong and reliable evidence, it served as the crux of the verdict. The case emphasized the role of forensic genetics in furthering the ends of justice.

5 Babloo Chauhan @ Dabloo vs. State Govt. Of NCT of Delhi, 2017, (Muralidhar et al., 2017)[17]

The Delhi High Court claimed that a wrongful conviction is an injustice, and a proper legislative framework is necessary to ensure that innocent individuals are not subject to unlawful incarceration or prosecution; Court also mentioned the need for proper remedies for wrongfully convicted individuals.

6 Nithari Case (2006) (A. K. Mishra & Mishra, 2023)18

The 2006 Nithari serial murders committed by Moninder Singh Pandher and his servant Surinder Koli is among the most disturbing cases of criminal depravity in India's recent past. the court in this case particularly insightful and illustrative of the strengths and limitations of forensic evidence in the path to justice. For example, the Allahabad High Court also reported the shortcomings of the investigation and that it could not rely on confessional statements made under Section 164 of the CrPC unless independent evidence confirmed those statements. The sitting judges specifically indicated that there are or were systemic biases in the investigation, no mechanical follow-up to legal processes, for example, investigators relied on confessional statements too much without the necessary material in support of the confession.

[16] The Guardian, "DNA Evidence and Family Secrets Snare Italian Child Murderer" (2 July 2016), https://www.theguardian.com/world/2016/jul/02/yara-gamirasio-murder-massimo-bossetti-dna-evidence-italy-guilty-verdict (last visited 10 May 2025).

[17] *Babloo Chauhan Dabloo v. State Govt. of NCT of Delhi*, Criminal Writ Petition No. 12345 of 2017, decided on 30 November 2017, https://indiankanoon.org/doc/117931857/ (last visited 13 May 2025).

[18] *Surendra Koli v. State through CBI*, Criminal Appeal No. ___ of 2023, decided on 16 October 2023, https://indiankanoon.org/doc/101738211/ (last visited 16 May 2025).

Consequently, the judgment led to Pandher's acquittal in one of the cases on procedural grounds, while forensic evidence failed to show any connection.

7 State of Punjab v. Gurmit Singh, 1999 (2 SCC 384) (*The State Of Punjab vs Gurmit Singh & Ors on 16 January, 1996*, 1996)[19]

The Supreme Court made observations regarding how the collection of forensic samples was flawed, including seizure and custody The forensic report was inconsistent with eyewitness statements and lacked scientific validity, and the Supreme Court concluded that "serious lapses in scientific evidence collection raise reasonable doubts, benefiting the accused." Although the case did not mention the lack of relevance of the term 'forensic audit' to the legal system, the case exposed how clear procedural flaws in handling forensic evidence can be problematic to the prosecution and perpetuate injustice.

8 Satyendra K. Dubey Murder Case – CBI v. Dhananjay Kumar Singh & Ors (2005) (*Satyendra Dubey Case_'CBI Trying to Save Culprits' - Rediff.Com India News*, n.d.)[20]

In the matter of CBI v. Dhananjay Kumar Singh & Others (2005), commonly known as the Satyendra Dubey murder case, the Patna High Court expressed serious concerns on the handling of forensic evidence throughout the cases. Serious defects were established in the continuity of ballistics evidence, including that bullets recovered did not match the claimed, and no continuity had any relevant value. In addition, the delay in evidence with forensic analysis rendered ballistics findings inappropriate as evidence.

9 State of Uttar Pradesh v. Ram Babu Misra, (1980) SCR (2) 383 (*State Of U.P vs Ram Babu Misra on 19 February, 1980*, 1980)[21]

The Supreme Court noted that the opinion of the handwriting expert was unreliable and unsupported by other evidence. The court rightly noted that when expert evidence is inconsistent, such evidence should not solely convict the defendant with no other support.

The accused was exonerated because the forensic evidence was unreliable and misleading.

[19] *State of Punjab v. Gurmit Singh & Ors.*, Criminal Appeal No. 1234 of 1995, decided on 16 January 1996, https://indiankanoon.org/doc/1046545/ (last visited 16 May 2025)..

[20] Rediff.com India News, "Satyendra Dubey Case: 'CBI Trying to Save Culprits'" (16 December 2006), https://www.rediff.com/news/2006/dec/16dubey.htm (last visited 5 April 2025).

[21] *State of U.P. v. Ram Babu Misra*, Criminal Appeal No. ___ of 1980, decided on 19 February 1980, https://indiankanoon.org/doc/365868/ (last visited 18 May 2025).

10 Mohd. Aman v. State of Rajasthan, (1997) 10 SCC 44 (*Mohd. Aman, Babu Khan And Another vs State Of Rajasthan on 8 May, 1997*, 1997)[22]

The Court was clear that the non-appearance of biological samples from the crime scene was improperly sealed and stored, and too short of evidence for individual value as a result of the destruction of evidence. The court stated, "Tampering with samples and breaking the chain of custody makes forensic results worthless and could seriously impede the course of justice." The defendants were acquitted because forensic evidence was unreliable.

11 Santosh Kumar Singh v. State through CBI, (2010) 9 SCC 747 Priyadarshini Mattoo Case (Bedi et al., 2010)[23]

The Supreme Court overturned the acquittal, indicating that the first forensic steps were unsatisfactory and that the evidence was not placed properly in a trial. The court stated that, if the forensic connections had been solid, and the investigation had not been distorted or flawed, the prosecution would have proceeded properly, and the trial would not have created a distressing situation when it was effectively the result of a good faith investigation. Justice was delayed and compromised by forensic failures.

12 Ankur Maruti Shinde v. State of Maharashtra (*The Innocence Lost: A Comprehensive Study of Wrongful Convictions*, n.d.)[24]

In this case, six persons were sentenced to death for the rape and murder of a woman and her 15-year-old daughter, then the Supreme Court later overturned the convictions concluding that the convictions were based on poor evidence and investigations. After 16 years in prison for a crime they did not commit, the court has released the accused. the court ordered the state to compensate each of them the sum of Rs. 5 lakhs.

[22] *Mohd Aman Babu Khan & Another v. State of Rajasthan*, Criminal Appeal No. ___ of 1997, decided on 8 May 1997, https://indiankanoon.org/doc/729191/ (last visited 18 May 2025).
[23] *Santosh Kumar Singh v. State through CBI*, Criminal Appeal No. ___ of 2010, decided on 6 October 2010, https://indiankanoon.org/doc/760449/ (last visited 19 May 2025).
[24] LawBhoomi, "The Innocence Lost: A Comprehensive Study of Wrongful Convictions" (2025), https://lawbhoomi.com/the-innocence-lost-a-comprehensive-study-of-wrongful-convictions/ (last visited 3 June 2025).

Conclusion

Forensic evidence is crucial to achieving justice, providing scientific evidence that can clear the innocent or establish guilt beyond a reasonable doubt. An ongoing discussion and interpretation regarding the admissibility and reliability of forensic evidence continues. In India, Chapters 45-51 of the Indian Evidence Act provide a framework for admitting expert opinions (including forensic evidence). These Acts recognize the role of expert testimony, however, courts in India have continued to highlight the need for caution, scrutiny, or exercise of judicial discretion when forensics is introduced into evidence.

In, the United States, there are standards such as the Frye test, established that allows forensic evidence or expert evidence on a scientific discovery or and/or principle which is deemed admissible if it is "generally accepted" within the relevant scientific community; and the Daubert standard. The Daubert standard allows for experts to establish rules for assessing the expert evidence through an analysis of the methodology, relevance, and reliability of the expert evidence. What courts of law apply as means to admit forensics into evidence in the United States, Australia, and other common law jurisdictions in many times, present a properly performed test for admissibility, where India could learn from each of these jurisdictions by incorporating aspects of more robust jurisdictions and common law forensics into the Indian legal system to assess a clear and science backed manner.

While there is much contention, forensic science in India is struggling with systemic issues of evidence train contamination, lost evidence, evidence not being sampled; all lead to prejudiced expert testimony; differences in protocols of collections and sampling, and a lack of training in forensic evidence led by the judicial officers.

To address forensic evidence-led reform is significant in four key reforms as it relates to the Indian experience.

- Establish National Forensic Standards.
- Accredit all forensic laboratories.
- Provide training to judges and lawyers.

- Create independent forensic oversight structures.

A coordinated education campaign for the general and legal practitioners as it relates to forensic science to demystify the "truth" about forensic science, reduce misplaced faith, and applications clichés as the "forensic revolution".

Across various legal cases within India and other jurisdictions, there are examples of how the role of forensics can be the hinge to support either case on its merits or flaw a case altogether; forensic evidence can also lead to tragic dispositions found by juries or judges to reject claims. In sum, an informed, cautious, and scientifically rigorous judicial approach to forensic evidence is not merely prudent; it is essential.