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# Scientific Techniques And The Law Of Evidence: Judicial Treatment Of Emerging Forensic Methods

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**ABSTRACT:**

Scientific advancement has become more essential in solving modern, complex, and diversified crimes. Though traditionally the courts relied on witness testimony and documents, scientific evidence including DNA profiling, digital forensics, voice analysis, and emerging technologies have become vital. Though the Indian Evidence Act 1872 is old, it has grown to accommodatthe scientific methodology, and landmark judgments have already laid down their admissibility and reliability, including safeguards against misuse.

The statutory basis for expert opinion and electronic evidence can be found in key statutes such as Sections 45 and 65B of the Evidence Act. In addition, there are important procedural rules enabling consent and the protection of fundamental rights during forensic examination under the Code of Criminal Procedure. Current issues within the institutional forensic frameworks that exist include lack of standardization, inadequate accreditation, and resource constraints.

From State of Punjab v. Gurmit Singh to Mukesh v. State of Delhi, judicial decisions reveal a slowly evolving jurisprudence weighing forensic utility against constitutional protections such as privacy and protection against self-incrimination. But grave challenges persist due to uneven standards in laboratories, gulf in experts' qualifications, lapses in the chain of custody, and limited scientific literacy among judges.

International experiences like the US Daubert standard and UK forensic regulatory frameworks provide models for Indian reform in light of scientific validity, judicial gatekeeping, and institutional oversight. Recent legislation, such as the Bharatiya Sakshya Adhiniyam of 2023 and the Bharatiya Nagarik Suraksha Sanhita, attempt to reform forensic laws so as to enforce certification, make investigations into serious crimes compulsory, and introduce cutting-edge technologies.

Overall, the integration of forensic science into India's legal framework is progressing, but needs further legislative amendment, establishment of autonomous forensic regulatory bodies, certification of experts, judicial education, uniform protocols, protection of privacy, and technology innovation for it to fully play its role as a support to fair and effective justice.

## Introduction

Scientific advancements have become essential in solving crimes today. While courts once relied mainly on witness testimony and documents, modern investigations now depend on scientific methods to find the truth. With crimes becoming more complex—such as cybercrime, terrorism, financial fraud, and sexual offenses—reliable forensic evidence is more important than ever. The law of evidence plays a key role in the justice system by deciding what facts can be presented in court and how they should be proven. Scientific evidence helps improve accuracy but also raises questions about whether it should be accepted in court, how authentic it is, and how it affects the rights of the accused. Courts must carefully weigh the usefulness of scientific evidence against protecting legal rights. Though the Indian Evidence Act of 1872 is old, it has adapted to new technologies over time. Sections 45 and 65B have been interpreted by courts to include expert opinions and electronic records as valid evidence. For instance, the Supreme Court in *State of Punjab v. Gurmit Singh*[1] recognized DNA evidence as trustworthy scientific proof. In *Anvar P.V. v. P.K. Basheer*[2], the Court set clear rules for admitting electronic evidence under Section 65B. Other rulings, such as K.L. Verma v. Union of India3 the Supreme Court discussed the importance of scientific standards for forensic evidence. The Court stressed that scientific techniques and evidence must meet established standards of reliability and relevance before being admitted in court. It highlighted the need for proper protocols and qualified personnel in forensic laboratories to ensure the credibility of evidence. This judgment emphasized the judiciary's concern for the accuracy of forensic evidence and the necessity for regulatory frameworks in forensic science. and Lillu Rajan v. State of Haryana4, emphasize that scientific methods must meet reliability standards to be accepted. Despite progress, challenges remain because India lacks comprehensive forensic standards and many investigative bodies lack the necessary expertise. Courts often interpret existing laws broadly to keep up with new science, but legislative updates are needed to improve the quality and trustworthiness of forensic evidence. This paper will explore the current laws, analyze court decisions on scientific evidence, highlight problems with its acceptance and reliability, and suggest reforms to strengthen forensic law in India.

## Legal Framework in India

### Statutory Basis under the Indian Evidence Act, 1872

The statutory basis for scientific and expert evidence in India comes from the Indian Evidence Act of 1872. Key provisions appear in sections 45[5] through 51 of that Act. Section 45 treats expert opinions as relevant when courts need help forming views on foreign law or science or art or handwriting or finger impressions. Courts define an expert as someone with special knowledge or skill or experience in the field. Still the court decides in the end if the opinion seems credible or relevant enough.

Section 46[6] lets courts bring in facts that support or challenge what an expert says. This helps judges check and filter out opinions that lack backing or seem unreliable. Section 47 deals with experts giving views on

[1] **State of Punjab v. Gurmit Singh**, (1996) 2 SCC 384, https://lpr.adb.org/resource/state-punjab-vs-gurmit-singh-1996-2-scc-384-india (accessed 11 November 2025).

[2] **Anvar P.V. v. P.K. Basheer**, (2014) 10 SCC 473, https://www.scribd.com/document/846436878/Anvar-P-V-v-P-K-Basheer (accessed 11 November 2025).

[3] **K.L. Verma v. Union of India**, AIR 2005 SC 1150, https://www.casemine.com/search/in/k(DOT)l%20verma (accessed 11 November 2025).

[4] from https://lpr.adb.org/resource/lillu-rajesh-and-anr-vs-state-haryana-criminal-appeal-no-1226-2011-india

[5] **Expert Evidence Section**, https://www.scribd.com/document/684721733/Expert-Evidence-Section- (accessed 11 November 2025).

[6] **iPleaders**, *Expert Evidence: Types, Constitutionality, Evidentiary Value – Chronological Study*, https://blog.ipleaders.in/expert-evidence-types-constitutionality-evidentiary-value-chronological-study/ (accessed 11 November 2025).

handwriting identity. Then section 47A came in through the Information Technology Amendment Act of 2008 and it covers digital signatures. Section 51 points out that the reasons behind an expert opinion matter too for the court to consider.

The Information Technology Act of 2000 added more strength to how evidence works with section 65B. That section lays out rules for admitting electronic records. It requires certification to prove authenticity especially for data from computers.[7]

**Procedural Framework under the Code of Criminal Procedure, 1973**

Procedural rules under the Code of Criminal Procedure from 1973 cover this area too. Sections 53 and 53A and 54[8] allow medical exams for accused people and victims. These tests happen only with proper consent and they protect basic rights. Magistrates can order scientific checks in cases that fit to help with investigations and gathering evidence.

**Institutional Framework**

India runs its forensic science setup mostly through the Directorate of Forensic Science Services and the Central Forensic Science Laboratories. Problems continue though because accreditation standards vary across places and there is not enough trained staff. The Law Commission of India talked about this in its 185th report and also the 271st report. Those reports pushed for laws to recognize forensics better and set up independent bodies.[9] This would cut down on mistakes and tampering and make forensic work more reliable overall.

**EMERGING FORENSIC METHODS AND THEIR LEGAL STATUS**

**1. DNA Profiling**

DNA profiling has become the gold standard for identifying people in criminal cases. In Kamalanantha v. State of Tamil Nadu,[10] the Supreme Court made it clear that DNA analysis counts as solid corroborative evidence to back up witness testimony. The same thing happened in Santosh Kumar Singh v. State[11] (NCT of Delhi), where DNA profiling proved crucial in connecting the accused to the crime. The DNA Technology (Use and Application) Regulation Bill, 2019, tries to lay out clear rules for using DNA data—think databanks, privacy safeguards, and accountability. But since the Bill hasn't become law yet, Indian courts still lean on past decisions to make sure DNA evidence is both useful and protected from misuse.

2. **Brain Fingerprinting and Narco-Analysis**

Techniques like brain fingerprinting, narco-analysis, and polygraph tests try to dig up hidden information by looking at how people's bodies or brains react. The Supreme Court tackled the limits of these tests in Selvi v. State of Karnataka[12]. The Court decided that forcing someone to undergo these procedures breaks Articles 20(3) and 21 of the Constitution, since pulling out someone's private thoughts or subconscious info is basically forcing them to testify against themselves—it's a violation of both mental privacy and human

[7] **Drishti Judiciary**, *Opinion of Third Persons When Relevant*, https://www.drishtijudiciary.com/to-the-point/bharatiya-sakshya-adhiniyam-&-indian-evidence-act/opinion-of-third-persons-when-relevant (accessed 11 November 2025).

[8] Isha Anand, *Corpus Law Journal*, Juscorpus.com, https://www.juscorpus.com/wp-content/uploads/2022/12/52.-Isha-Anand.pdf (accessed 10 November 2025).

[9] **Expert Opinion**, *Relevancy and Admissibility of Expert Opinion*, Gov.In, https://cdnbbsr.s3waas.gov.in/s3ec015a01f0597ac4bdf35c24846734ee/uploads/2024/03/2024031272.pdf (accessed 10 November 2025).

[10] **Kamalanantha v. State of Tamil Nadu**, (2005) 5 SCC 194, https://indiankanoon.org/doc/192852 (accessed 11 November 2025).

[11] **Santosh Kumar Singh v. State**, (2010) 9 SCC 747, *The Legal Lock*, https://thelegallock.com/case-brief-santosh-kumar-singh-v-state-2010-9-scc-747/ (accessed 11 November 2025).

[12] **Selvi v. State of Karnataka**, (2010) 7 SCC 263, MANU_SC_0325_2010..

dignity. That said, the Court did allow these tests if the person agrees and the court signs off on it. This decision drew a clear line: science can't trample on personal freedom.

### 3. Voice Spectrography

In Ritesh Sinha v. State of Uttar Pradesh,[13] the Supreme Court looked at whether a magistrate can order an accused person to give a voice sample. The Court said yes, and explained that this doesn't violate Article 20(3), since a voice sample is just physical evidence—like fingerprints or handwriting—which fits with earlier rulings like State of Bombay v. Kathi Kalu Oghad[14]. By letting investigators use new tech, the Court tried to keep things fair—balancing law enforcement needs with people's rights.

### 4. Digital and Electronic Evidence

Digital evidence matters more than ever with cybercrime and online communication on the rise. Section 65B of the Indian Evidence Act, 1872, sets the rules for using electronic records in court. In Anvar P.V. v. P.K. Basheer[15], the Supreme Court said electronic evidence only counts if it comes with a Section 65B (4) certificate. Arjun Panditrao Khotkar v. Kailash Kushanrao *Gorantyal*[16] backed this up, stressing that you can't just skip these rules for convenience. These decisions help courts trust digital evidence and keep the process honest in today's tech-driven world.

### Ballistics, Fingerprints, and Handwriting Analysis

Long-standing forensic fields—like ballistics, fingerprint matching, and handwriting analysis—still play a key role in investigations. In State of Himachal Pradesh v. Mast Ram[17], fingerprint evidence was the clincher for proving identity. Experts help courts make sense of scientific details, but their opinions are just that—advisory, not final. As the Court said again in Magan Bihari Lal v. State of Punjab[18],judges need to weigh expert opinions along with other evidence before making up their minds.

## JUDICIAL TREATMENT OF SCIENTIFIC EVIDENCE

### State Bombay v. Kathi Kalu Oghad (AIR 1961 SC 1808)

This landmark case represents an important interpretation of Article 20(3) of the Constitution of India, that provides protection to an accused against being forced to be a witness against himself. The appellant-

[13] **Ritesh Sinha v. State of Uttar Pradesh**, (2019) 8 SCC 1, https://www.nayalegal.com/ritesh-sinha-v-state-of-up-2019 (accessed 11 November 2025).

[14] **The State of Bombay v. Kathi Kalu Oghad**, https://www.dhyeyalaw.in/the-state-of-bombay-v-kathi-kalu-oghad (accessed 11 November 2025).

[15] **Anvar P.V. v. P.K. Basheer Ors**, https://www.scribd.com/document/510735774/Anvar-p-v-vs-p-k-basheer-Ors-Final (accessed 11 November 2025).

[16] **Arjun Panditrao Khotkar v. Kailash Kushanrao Gorantyal**, https://www.lawgratis.com/blog-detail/arjun-panditrao-khotkar-v-kailash-kushanrao-gorantyal (accessed 11 November 2025).

[17] **State of H.P. v. Mast Ram**, https://www.legalauthority.in/judgement/state-of-h-p-vs-mast-ram-18760 (accessed 11 November 2025).

[18] from https://www.legalauthority.in/judgement/magan-bihari-lal-vs-state-of-punjab-32806

accused, Kathi Kalu Oghad, was charged with murder, and while in custody, the police got his specimen handwriting and thumb impressions. The Court had to decide whether the gathering of this evidence violated the constitutional protection against self-incrimination[19].

The Supreme Court explained that physical specimen writings, thumb impressions, fingerprints, and handwriting samples are outside the area of testimonial compulsion. The Court distinguished between the testimonial evidence—knowledge derived from one's own observation or assertions—and physical or mechanical evidence like fingerprints. It held that obtaining such samples is not compelling a person to be a witness against himself within the meaning of Article 20(3). The constitutional validity of Section 27 of the Indian Evidence Act was also upheld by the Court, whereby facts may be discovered by police if a statement made leads thereto, provided the statement was voluntarily made.

This judgment set the base for the admissibility of scientific physical evidence in criminal investigations and balanced the rights of the individual concerned with the need for effective law enforcement.

**Selvi v. State of Karnataka (2010) 7 SCC 263**

In the present case, the Supreme Court considered the constitutional validity of neuro-scientific investigative techniques—narco-analysis, polygraph tests, and brain mapping—to be administered in the course of criminal investigations. It held that the forcible administration of these tests violates the right against self-incrimination under Article 20(3) and the right to privacy under Article 21.

The Court viewed mental privacy as an integral element of the right to life and personal liberty and held that forcing anyone to such tests without their consent would amount to an unconstitutional invasion of mental integrity. The judgment emphasized that though scientific advancements are highly prized, their use should not override fundamental rights. This case laid down protective mechanisms against any abuse of emerging forensic technologies and marked a precedent in the realm of cerebral privacy[20].

**Ritesh Sinha v. State of Uttar Pradesh (2019) 8 SCC 1**

This landmark case involved the question of compulsory voice sample collection from an accused in the course of investigation. Ritesh Sinha challenged the order of a magistrate requiring him to provide a voice sample, contending that it was violative of his fundamental rights, more particularly under Article 20(3).

The Supreme Court, after a split verdict and consequent referral to a larger bench, held the voice samples to be physical evidence and not in the nature of testimonial evidence, liable to be compulsorily given with

[19] *Admissibility and Evidentiary Value of Scientific Evidence: Legislative and Judicial Approach in India*, https://doi.org/10.1732/IJLMH.26627 (accessed 11 November 2025).

[20] **Supreme Court judgment on polygraph, narco-analysis & brain-mapping: A boon or a bane**, *The Indian Journal of Medical Research*, 134 (2021), pp. 4–7.

adequate judicial authority. It stressed that such samples must go through a tight judicial process so that such sample collection is done only with the legality of the process, thus balancing the investigative use of voice samples with constitutional safeguards against self-incrimination and individual liberties.

**Anvar P.V. v. P.K. Basheer (2014) 10 SCC 473**

This case was a landmark judgment that changed the face of admissibility of electronic evidence in Indian courts. The Supreme Court ruled that electronic records need to be presented with a certificate of authenticity under Section 65B of the Indian Evidence Act. Without such certification, electronic evidence cannot be admitted, even if otherwise relevant.

The judgment thus laid down an imperative procedural safeguard that would guarantee the reliability, integrity, and due authentication of digital evidence. This judgment updated Indian evidence law to accommodate the rising reliance on electronic data in litigation and prosecution, and guards against the manipulation or forging of information in electronic format[21].

**Tomaso Bruno v. State of Uttar Pradesh (2015) 7 SCC 178**

In this context, the Supreme Court has underscored the fullest and most efficient utilization of modern scientific and technological methods in the criminal investigation. The Court called for law enforcement agencies and courts to avail themselves of all forensic tools available to assist the processes of fact-finding, such as DNA analysis, fingerprinting, biochemical tests, and electronic surveillance.[22]

The Court insisted on procedural discipline and correctness during evidence collection and analysis to avoid impairing the reliability of the evidence. This judgment underlined the need for continuous integration of science into criminal justice procedures in order to reduce reliance on circumstantial or testimonial evidence of questionable accurace.

**Mukesh v. State (NCT of Delhi) (2017) 6 SCC 1** – The Nirbhaya Case Following the heinous gang-rape incident in New Delhi in 2012, the Supreme Court made extensive use of scientific evidences, including DNA profiling, electronic communications, and CCTV recordings, to uphold the conviction of the accused. This represented judicial endorsement of forensic science playing a critical role in solving complicated and sensitive criminal cases. The Court's detailed examination of forensic evidence underlined the confidence of the judiciary to establish guilt beyond reasonable doubt with scientific tools, provided it is corroborated with adequate and meticulous procedural safeguards. The case was an example of the marriage between advanced scientific methods and constitutional principles of fair trial and due process. These cases collectively indicate a judicial trend that, while allowing the use of forensic science, applies strict constitutional checks. Indian courts respect scientific evidence's utility while preserving rights to privacy, self-incrimination protection, and fair procedure. This emerging jurisprudence reflects a balanced regime wherein modernity in crime investigation coexists with foundational human

[21] **Anvar P.V. v. P.K. Basheer & Ors**, (2014) 10 SCC 473, https://aphc.gov.in/docs/imp_judgements/Anvar%20PV%20case.pdf (accessed 11 November 2025).

[22] **Tomaso Bruno & Anr. v. State of U.P.**, (2015) 7 SCC 178, https://www.legitquest.com/case/tomaso-bruno-v-state-of-up/8e96a (accessed 11 November 2025).

rights. If necessary, this explanation can be further expanded through the use of relevant citations, cross-comparisons, and detailed doctrinal implications for constitutional and criminal law scholarship.[23]

## CHALLENGES IN ADMISSIBILITY AND RELIABILITY

The challenges facing the admissibility and reliability of forensic evidence in India are complex and deep-rooted from systemic, procedural, and technological shortcomings. An elaborate analysis follows that highlights critical concerns to be addressed in order to raise the credibility and effectiveness of forensic science in the judicial process.

### Absence of Standardization across Forensic Laboratories

One of the biggest challenges facing India's forensic landscape is related to a lack of uniformity in standards and protocols that different forensic laboratories follow. Many laboratories use outdated technology, non-uniform procedures, and operate without accreditation by an accrediting authority like the National Accreditation Board for Testing and Calibration Laboratories. The effect of such fragmentation is that the quality, accuracy, and reliability of forensic reports tend to vary considerably. For instance, two different laboratories analyse the same evidence could use different methodologies and thus arrive at different conclusions. The lack of either a uniform national forensic law or comprehensive guidelines further worsens this problem and makes it challenging to achieve uniformity in collecting, analyse, and presenting scientific evidence before judicial forums.

### Expert Qualification and Credibility Issues

Judicial reliance on expert testimony becomes complicated when experts differ in qualifications, experience, and opinions. An accreditation system for forensic experts is lacking altogether in India at present, leading to a difference in expertise that might result in contradictory analyses. Inconsistencies in opinions make the job of judges-who are usually scientifically untrained-even more difficult in assessing the weight and credibility of expert opinions. Expert evidence sometimes sows doubt rather than clarity of fact, thereby frustrating the truth-finding function of courts.

### Constitutional Conflicts and Ethical Concerns

The Supreme Court has viewed certain forensic techniques-narco-analysis, polygraph tests, and brain mapping-as violating constitutional rights to privacy and protection against self-incrimination. Such invasive techniques raise serious ethical questions pertaining to bodily autonomy and mental privacy. Balancing the state's interest in effective investigation with individual liberties remains a perennial challenge that invites judicial caution and strict safeguards on the use of such technologies. Ethical considerations of consent, dignity of the person, and fairness are important in debates surrounding admissibility.

[23] **Mukesh vs State of NCT Delhi**, *Testbook* (n.d.) https://testbook.com/landmark-judgements/mukesh-vs-state-of-nct-delhi (accessed 11 November 2025).

**Chain of Custody Issues**

Maintaining an unbroken and transparent chain of custody is critical to preserving the integrity of forensic samples. In India, lapses in documentation, storage, and handling of evidence often raise questions about authenticity and tampering. Courts may exclude forensic evidence where the chain of custody is compromised or inadequately proven, as seen in several judgments stressing procedural discipline. This presents a practical challenge, especially in resource-constrained forensic laboratories.

**Judicial Literacy**

Limited scientific literacy among judges and legal practitioners hampers the effective evaluation of complex forensic evidence. Judges often face difficulties understanding advanced technologies or the technical nuances of forensic reports, affecting their ability to critically appraise evidence. This gap can result in over-reliance on expert testimony or misinterpretation of scientific findings, influencing judicial outcomes.

**Ethical Considerations**

Certain methods, particularly narco-analysis and brain mapping, raise serious ethical and human rights concerns related to consent, bodily integrity, and mental privacy. The use of such techniques without strict safeguards violates ethical standards and constitutional principles, leading to landmark rulings that restrain their use. Ethical challenges also arise in the potential misuse of forensic data, privacy breaches in digital forensics, and human error or bias in expert analysis.

## INTERNATIONAl PERSPECTIVE

International experiences on admissibility and reliability of scientific evidence have some valuable lessons for the strengthening of forensic jurisprudence in India. Analysis of models from leading jurisdictions demonstrates a shared preoccupation with scientific validity, procedural safeguards, and institutional oversight in a way that can help inform the current series of reforms underway within India.

**United States: The Daubert Standard**

In Daubert v. Merrell Dow Pharmaceuticals Inc. (1993)[24], the U.S. Supreme Court changed the way expert scientific testimony is admitted into court by implementing a "reliability standard." Now, under that standard, all evidence to be presented by experts must be relevant and reliable in order to be admissible in court. The presiding judge acts as a "gatekeeper" who must determine the scientific validity of the testimony before it can come before the jury. Among the many criteria included in Daubert are whether the theory or technique:

Has been empirically tested,

Has undergone peer review and has been published.

Has a known or potential error rate,

Has set standards that govern its operations,

Is generally accepted within the relevant scientific community.

[24] **Jess Waltman**, *Expert Witnesses*, https://www.msbar.org/media/3553/jess-waltman-expert-witnesses.pdf (accessed 11 November 2025).

This rigorous framework seeks to exclude "junk science" and ensure that only scientifically grounded evidence influences judicial outcomes. The Daubert ruling has inspired procedural reforms in many other countries aimed at enhancing forensic evidence quality.

**United Kingdom**:

Statutory and Regulatory Frameworks Expert evidence in the UK is mainly regulated through the Criminal Justice Act, 2003;[25] this Act reformed many of the evidentiary procedures, including provisions on expert witnesses. The Act insists that expert testimony should assist the court in evidence evaluation and not usurp the role of the judge or jury in making any determination of fact. Furthermore, it requires experts to be objective and impartial, disclosing relevant interests. Complementing this statutory regime, the Forensic Science Regulator ensures that forensic providers comply with recognized quality standards and ethical norms. This office is responsible for the accreditation of laboratories, oversees proficiency testing, and develops codes of practice to protect scientific integrity. Transparency, standardization, and accountability stand as the cores of the UK forensic framework in response to concerns about the validity and potential misuse of scientific evidence in criminal trials.

**Recommendations and Reforms for Forensic Evidence in India**

The forensic jurisprudence and criminal justice system in India urgently need an overhaul to keep pace with exponential development in the field of forensic science and digital technology. Several key reforms can significantly enhance the reliability, credibility, and constitutional compliance of scientific evidence use:

**Amend the Indian Evidence Act**

Explicit amendments are needed to clearly address new scientific methods like DNA profiling, digital forensics, voice analysis, and other technology-based expertise. The proposed Bharatiya Sakshya Adhiniyam of 2023 is a milestone in itself as it brings up-to-date the law on scientific and electronic evidence by introducing certification about its authenticity, chain of custody, and conditions of admissibility compatible with the current state of forensic capabilities. It supplants the colonial-era provisions with a technology-based regime allowing greater transparency and reliability[26].

**Establish a National Forensic Science Commission**

An independent statutory body should be established in India, entrusted with the responsibility to oversee forensic science governance. Such a Commission would bear the responsibilities of accrediting forensic laboratories, licensing forensic experts, issuing operational guidelines uniformly, and enforcing quality

[25] **Forensic Science Regulator Act 2021 and the Forensic Science Regulator's Code of Practice**, Crown Prosecution Service, https://www.cps.gov.uk/prosecution-guidance/forensic-science-regulator-act-2021-and-forensic-science-regulators-code (accessed 11 November 2025).

[26] *Admissibility and Evidentiary Value of Scientific Evidence: Legislative and Judicial Approach in India*, https://ijrpr.com/uploads/V6ISSUE8/IJRPR52219.pdf (accessed 11 November 2025).

control and ethical standards across all forensic activities in the country. This would bring in uniformity in laboratory and expert practices, reducing disparities in forensic practice.[27]

### Compulsory Professional Certification and Licensure

Only scientifically qualified and professionally certified forensic experts should be allowed to express opinions in front of courts. A standardized certification system, along with the requirement for continuous professional development, would increase the credibility and consistency of expert testimony, limiting the conflicting, unqualified opinions that now undermine judicial evaluations.

### Judicial and Legal Education

There is an acute need for ongoing educational courses and training programs for judges and lawyers regarding the underlying scientific principles of forensic techniques and the limitations of various methods of proof. Increased judicial literacy will enable the courts to better fulfill their role as gatekeepers by rigorously analyzing the admissibility and weight of expert evidence while protecting the constitutional rights of litigants.

### Uniform Standard Operating Procedures SOPs

The adoption of uniform SOPs on the entire forensic process, right from evidence collection, packaging, transportation, and storage to analysis and presentation is done to maintain the integrity and continuity of chain of custody. These SOPs are required to be scientifically robust, as well as uniformly implemented in all regional and national forensic laboratories, for maintaining consistency and trustworthiness.[28]

**Privacy Protection in Forensic Data Handling Data** privacy has become integral with the integration of digital technologies in forensic investigations. Forensic data collection, storage, and dissemination should stringently follow data protection laws, such as the Digital Personal Data Protection Act, 2023. This requires strong safeguards against misuse, unauthorized access, and breach of sensitive forensic information

**Technological Integration for Evidence** Tracking The use of advanced technological solutions, including blockchain-based systems, is recommended for forensic evidence management. Blockchain technology can provide immutable, time-stamped logs of sample handling and chain-of-custody records, making the process of evidence transfer and analysis more transparent and less susceptible to tampering or fraud.

**Omnibus Forensic Science Reform Act** This would mean legislating an omnibus Forensic Science Regulation Act, incorporating the Law Commission recommendations to assimilate the fragmented rules and regulations in force and to empower the National Forensic Science Commission. Such an act would consolidate accreditation, training, ethical norms, evidence management, jury guidance, and institutional accountability, raising India's forensic science to sanguinary heights. Summary These reforms, when

[27] **Forensic Evidence in the Mosaic of Bharatiya Sakshya Adhiniyam, 2023**, *Intellectual Property Rights Services Online*, https://iiprd.wordpress.com/2025/07/29/forensic-evidence-in-the-mosaic-of-bhartiya-sakshya-adhiniyam-2023/ (accessed 11 November 2025).

[28] **All India Forensic Science Summit 2025: Role of Forensic Science in Effective Implementation of New Criminal Laws and Combating Terrorism**, March 22-23 2025, *National Forensic Sciences University / High Commission of India, Pretoria*, https://www.hcipretoria.gov.in/content/1740658099AIFSS%20Brochure-%20March%2022-23,%202025.pdf (accessed 11 November 2025).

adopted, would raise the forensic science system from being fragmented and irregular to a well-integrated, scientifically sound, and constitutionally compliant pillar within the Indian criminal justice administration. The Bharatiya Sakshya Adhiniyam, 2023 has laid a promising foundation in this direction, but sustained legislative, institutional, educational, and technological efforts will be required for the full realization of forensic advances in dispensing justice.

## Conclusion

The evolving landscape of forensic science and scientific evidence in India is representative of a dynamic interplay between technological advancement, legal frameworks, and constitutional safeguards. Scientific methods, such as DNA profiling, digital forensics, voice analysis, and emerging neuro-scientific techniques, have become indispensable in the solving of complex crimes and ensuring more accurate and reliable fact-finding. Despite foundational provisions in the Indian Evidence Act, 1872, and procedural rules under the Code of Criminal Procedure, 1973, India's forensic system faces significant challenges relating to a lack of standardization across laboratories, varying expert qualifications, chain of custody lapses, judicial scientific literacy gaps, and ethical concerns around invasive techniques. Judicial pronouncements have incrementally struck a balance between endorsing the utility of forensic science and constitutional protections, emphasizing the need for procedural rigor and rights safeguards. Internationally, models like the U.S. Daubert standard and the UK's statutory forensic regulation provide instructive examples for India regarding scientific validity benchmarks, judicial gatekeeping, and institutional accountability. Recent legislative reforms in India, especially the Bharatiya Sakshya Adhiniyam, 2023, and Bharatiya Nagarik Suraksha Sanhita, 2023, have announced a transformative trajectory with explicit recognition of forensic evidence, certification standards, obligatory scientific investigation in serious crimes, and integration of technological tools such as e-FIRs and digital evidence platforms. Realization of the full potential of forensic science in the justice system requires comprehensive reforms: amendment of evidence laws to explicitly include modern forensic techniques; establishment of independent regulatory bodies, such as a National Forensic Science Commission, to oversee accreditation and quality control; making expert certification mandatory; ensuring integrity and chain of custody with uniform standard operating procedures; conducting judicial training programs on forensic science; and ensuring strong data privacy protections consistent with recent data protection laws. Incorporation of technology, such as blockchain-based tracking of evidence, is advisable to enhance transparency and tamper-proofing. Thus, kind of reform will not only transform India's forensic jurisprudence into one unified and scientifically sound pillar but also constitutionally compliant for the criminal justice administration. This would substantially enhance investigation accuracy and judicial confidence in forensic proof, reduce wrongful convictions, and reinforce fundamental rights to usher in a new era of evidence-based justice.