EXAMINING THE CHALLENGES UNDERMINING THE EVIDENTIARY VALUE OF DNA EVIDENCE IN INDIAN CRIMINAL TRIALS

Ms. Mahima Makkar[1] and Dr. Mona Goel[2]

ABSTRACT

In Indian criminal jurisprudence, DNA profiling occupies a paradoxical position. It is viewed by the court and the public as the closest approximation of scientific certainty that is accessible to any fact-finder; it is merely one type of opinion evidence under Section 45 of the Indian Evidence Act, 1872 (now Section 39 of the Bharatiya Sakshya Adhiniyam, 2023), whose weight depends on the integrity of the process that produced it. This article looks at that tension. The popularly held belief regarding the probative strength of DNA evidence in India, the paper contends, is often disengaged from the institutional conditions required to sustain it. The failure of trained first responders, non-standardised collection protocols, and the chronic backlog and uneven accreditation of forensic laboratories impaired such probative strength. Similarly, the judicial unfamiliarity with the statistical logic of random match probability does too. With the help of the statutory scheme of medical examination and expert opinion, constitutional constraints under Article 20(3), and the doctrinal development going from Kathi Kalu Oghad through *Selvi v. State of Karnataka* to the Supreme Court's 2025 intervention in *Kattavellai @ Devakar v. State of Tamil Nadu*, the area traces a judicial shift from near-blanket deference to a more sceptical, corroboration-requiring positioning. It maps three interlocking systemic hurdles: chain-of-custody failures, institutional capacity deficits, and poorly trained human intermediaries and situates India's regulatory vacuum against comparative frameworks such as the UK's Forensic Science Regulator Act 2021.

Keywords: DNA evidence, forensic science, Indian Evidence Act, Bharatiya Sakshya Adhiniyam, chain of custody, random match probability, criminal procedure

[1] Research Scholar, Guru Nanak Dev University, Amritsar, mahima.makkar8@gmail.com, 7837798774
[2] Assistant Professor, Guru Nanak Dev University, Regional Campus, Jalandhar, monagoel23@gmail.com 79868 93050.

1. Introduction

The Indian criminal justice system has slowly and unevenly accepted forensic science. Most Indian court verdicts during the twentieth century were based on ocular testimony, confessions, and chains of circumstantial inference, typically linked to the last seen together doctrine and to recovery evidence admissible under Section 27 of the Evidence Act.[3] Fingerprints and serological evidence were used in courtrooms earlier, but genetic profiling was first accepted in India in a paternity case in 1995; it is a relatively recent addition of DNA Fingerprinting and its Legal Perspective in India.[4] The arrival of the Government of India, the sharp growth of the prevalence of different types of *sexual violence* (SV) and *sexual offence* (SO) prosecutions, particularly the 2012 Delhi gang-rape case, led to statutory amendments requiring biological sampling in sexual offence investigations.[5]

The statutory framework arising from this legal provision appears in sections 53, 53A, and 164A of the Code of Criminal Procedure, 1973 ("CrPC"). This legal framework is now, to a large extent, reproduced in the Bharatiya Nagarik Suraksha Sanhita, 2023 ("BNSS"). This is a consequential legislative judgment that biological evidence is essential to the prosecution of sexual offences in particular. At times, judicial rhetoric has treated a DNA match as proof of guilt. The main argument of the article is that this kind of rhetoric outstrips the institutional reality. DNA profiling, as a technique, has high probative value. However, its evidentiary value may not always be reliable if certain institutional conditions, like trained personnel at the collection centre, an untainted chain of custody, compliant laboratories with appropriate staffing, and a judiciary equipped with the ability to interrogate and not just accept, are not present. No forensic technique possesses infallibility. At best, infallibility is an aspiration in Indian criminal procedure, which presently lacks the scaffolding to support it.

2. The Legal Framework of DNA Admissibility in India

Sections 53 and 53A CrPC (now Sections 51 and 52 BNSS) empower a police officer to order the medical examination of an arrested or accused person. Under the Explanation below

[3] Jennifer Ward, *Origins And Development Of Forensic Medicine And Forensic Science In England, 1823-1946* (PhD thesis) (The Open University, 1993).
[4] Preet Inder Singh et al., "Evidentiary Rigour of a DNA Match," 47 *Journal of Indian Academy of Forensic Medicine* 71–6 (2025).
[5] Sakshi Gupta, "The 2012 Delhi Gang Rape Case: Sociopolitical and Legal Ramifications," in *Chains of Silence: From Mathura to Nirbhaya, India's Battle against Rape* 111–118 (Bharti Publications, 2025).

Section 53, "the use of modern and scientific techniques including DNA profiling". Section 53A deals with the examination of the person accused of rape, and the registered medical practitioner who is examining the accused is required to record "*the description of material taken from the body of the accused for DNA profiling*".[6] As per Section 164A CrPC, rape case victims go through medical examinations as per the procedures and requirements specified by the section. In *Krishan Kumar Malik v. State of Haryana*[7], the Supreme Court concluded that once 'reasonable grounds' exist, the provision of Section 53A is functionally mandatory. The position is clear that when the prosecutor seeks to bring home a charge of rape, the prosecutor is obliged to cause DNA profiling to be conducted of the accused, the victim and other appropriate persons. In *Rajendra Prahladrao Wasnik v. State of Maharashtra*[8], the court held that where the prosecution fails to adduce DNA evidence in an appropriate case, the court will draw an adverse inference against the prosecution. The obligation placed on the prosecution cannot be invoked to fill evidentiary gaps post-investigation or after framing of a charge. Moreover, it does not, by itself, guarantee conviction or acquittal where other cogent evidence exists.

2.1 Statutory basis for admissibility

DNA test reports are admitted as expert opinion in evidence under Section 45 of the Indian Evidence Act, 1872 ("IEA"), and now under Section 39 of the Bharatiya Sakshya Adhiniyam, 2023 ("BSA"). This distinction has doctrinal importance, since expert opinion is advisory, not conclusive by definition. The Supreme Court made this clear in *Pattu Rajan v. State of Tamil Nadu*[9] that, "*DNA evidence is also in the nature of opinion evidence as envisaged in Section 45 of the Indian Evidence Act*," so a court is not bound to accept it, and its evidential worth "*varies from case to case, depending on the facts and circumstances of the case, the quality of the evidence adduced, and both corroborative and contradictory materials on the record*". As a result, a match with DNA cannot be treated as conclusive proof in law. The match forms part of the normal structure of circumstantial and corroborative evidence of guilt.

2.2 Constitutional boundaries under Article 20(3)

According to Article 20(3) of the Constitution, the accused in a case cannot be compelled to be

[6] Md. Pappu @ Md. Saba Uddin v. State of Bihar, Criminal Appeal (DB) No. 14 of 2019.
[7] Krishan Kumar Malik v. State of Haryana (2011) 7 SCC 130.
[8] Rajendra Prahladrao Wasnik v. State of Maharashtra, (2019) 12 SCC 460.
[9] Pattu Rajan v. State of Tamil Nadu (2019) 4 SCC 771.

a witness against himself. The compelled taking of biological samples, therefore, raises a clear tension. The case of *State of Bombay v. Kathi Kalu Oghad*[10] dealt with the meaning of "testimonial compulsion". The Supreme Court distinguished between the terms "furnishing evidence" and "being a witness." The first term, the Court held, covers things like fingerprints and handwriting exemplars and, by extension, bodily substances. The second term, however, covers only communicative, testimonial acts. Physical samples that were coerced do not come under the protection of Article 20(3) as they do not convey any knowledge of the accused in a communicative sense.

The particular judgment in *Selvi v. State of Karnataka*[11] was delivered by the Supreme Court of India on 5th October 2010. The court ruled that both narcoanalysis and polygraph examination cannot be used against the will of the victim, as it violates Articles 16 and 21 of the Indian Constitution. It was held that compulsory administration of the techniques would violate the accused's right against self-incrimination. In general, the above-mentioned judgment richly contributed to major advancements in the constitutional status of narcoanalysis, polygraph, and related techniques. The subsequent decisions, *Sharda v. Dharmpal*[12] in the civil sphere, and *Das @ Anu v. State of Kerala*[13], have confirmed that court-ordered DNA testing does not offend Article 20(3) or Article 21, and more so on their own. However, Sharda warns that such orders should not be "in a routine manner", but must be based on the facts of the case. Table 1 summarises this statutory and constitutional architecture, cross-referencing the pre-2024 and post-2024 codes.

Table 1: Statutory Architecture Governing DNA Evidence Collection and Admission in India

Function	Pre-2024 Provision	Post-2024 Provision	Core Judicial Authority
Medical examination of accused (general)	Section 53, CrPC 1973	Section 51, BNSS 2023	—
Examination of accused in rape cases (DNA sampling)	Section 53A, CrPC 1973	Section 52, BNSS 2023	*Krishan Kumar Malik (2011)*

[10] State of Bombay v. Kathi Kalu Oghad, AIR 1961 SC 1808.
[11] Selvi v. State of Karnataka (2010) 7 SCC 263.
[12] Sharda v. Dharmpal (2003) 4 SCC 493.
[13] Das @ Anu v. State of Kerala, 2022 LiveLaw (Ker) 560.

Medical examination of rape victim	Section 164A, CrPC 1973	Corresponding BNSS provision	*Rajendra Prahladrao Wasnik* (2019)
Admissibility as expert/opinion evidence	Section 45, Evidence Act 1872	Section 39, BSA 2023	*Pattu Rajan* (2019)
Constitutional limit (physical vs. testimonial compulsion)	Article 20(3), Constitution of India	Unchanged	*Kathi Kalu Oghad* (1961); *Selvi* (2010)

Note. Compiled from statutory text and case law identified in this review.

3. Judicial Interpretation and the "Infallibility" Myth

The court's treatment of DNA evidence in India was more or less imbued with awe or respect. That posture has been progressively adapted. Three doctrinal moves mark this shift.

First, courts made it clear that DNA evidence is only a matter of opinion, not substantive evidence. Further, such evidence should be assessed alongside other evidence on record, not instead of it. Pattu Rajan is illustrative on this point. The superimposition test and not the DNA test were relied on by the prosecution for the identification of the body of the murder victim. The Supreme Court accepted the superimposition test, noting that it "cannot be regarded as infallible" because it was corroborated by independent circumstantial evidence. The ruling in this case suggests that no single forensic technique can speak for itself, including DNA; value is a transactional value, contingent on the evidentiary matrix.

Second, the courts have become significantly more sensitive to procedural integrity as a prerequisite for evidentiary weight. In the case of *Rahul v. State (NCT of Delhi)*[14], the Supreme Court did not accept the DNA evidence as reliable because the biological sample was under the police's custody for a period of two months in the absence of adequate safeguards. It held that the resulting possibility of tampering vitiated the probative value of the DNA evidence. This indicates that the court accepted the idea that a scientifically valid technique would produce an unreliable output if its chain of custody is not intact. It implies a kind of "garbage

[14] Rahul v. State (NCT of Delhi), 2022 SCC OnLine SC 1532.

in, garbage out" principle applied to forensic law.

The third and crucial aspect is the ruling by the Supreme Court in 2025 in *Kattavellai @ Devakar v. Tamil Nadu*[15], which transformed these accumulated anxieties of the Court into binding, nationwide procedural directions. The court had sentenced the accused to death for rape and murder on the basis of DNA and circumstantial evidence. The Court found "*a large amount of unexplained delay*" in transmitting vaginal swab samples to the Forensic Science Laboratory, an unestablished chain of custody, and an accompanying "possibility of contamination [which] cannot be ruled out". It said that, though individual states have issued fragmentary guidelines, "*there is no uniformity nor is there a common procedure which is required to be followed by all investigating authorities*". The appellant was acquitted by the Court that, in exercise of its constitutional powers, directed every State Director General of Police to adopt a standard Chain of Custody Register, notwithstanding "Police" and "Public Order" falling within the State List, to be maintained "*from the point of collection to the logical end, i.e., conviction or acquittal*", in which FIR particulars, the details of the investigating officer and the signatures of the examining medical officer and independent witnesses will be recorded, transmitted to the forensic laboratory in 48 hours, and added to the record of the trial court. The court also pointed out that DNA evidence is only opinion evidence under Section 39 BSA / Section 45 IEA, the 'values of which differ from case to case' and is subject to scientific and legal independent verification.

4. Systemic Hurdles Undermining Evidentiary Value

Within the evolving scientific evidentiary process in trials and courts, the following challenges remain relevant and underscore unmet issues.

4.1 Contamination and chain of custody

The Kattavellai @ Devakar directions reflect a pattern of recorded and repeated failures, namely, the delayed transmission of samples from rural or under-resourced crime scenes, the lack of SOPs by first-attending police personnel, improper sealing and labelling, and unexplained gaps in custodial handover. In transit across great distances to a limited number of forensic facilities, heat, humidity, and microbial action, poorly controlled, can degrade DNA samples, as these are biological materials. Before Kattavellai @ Devakar, there was no

[15] Kattavellai @ Devakar v. Tamil Nadu, 2025 INSC 845.

uniform, codified chain-of-custody protocol in the country. The adequacy of documentation varied from state to state, from district to district and often, from officer to officer. The Court itself mentioned that the absence of such a guideline created a lack of "uniformity" which could affect "the cases investigated" throughout the country.[16]

4.2 Institutional constraints

The forensic lab system of India is structurally stressed. As per the data given by the Ministry of Home Affairs in Parliament, between 2020–21 and October 2024–25, the seven Central Forensic Science Laboratories (CFSLs) received 69,826 cases. As of October 2024, 3,953 cases are pending. Notably, the network has 123 sanctioned vacancies that remain unfilled.[17] The State Forensic Science Laboratories, which accept over 90% of the casework, do not supply pendency data to any agency. Therefore, a nationwide picture is not possible.[18] When remedial investments were made, the results were instructive. For instance, the FSL in Delhi saw a 72 per cent decrease in case pendency from 27,585 pending cases in June 2025 to 7,178 by July 2026.[19] This was due to the recruitment of 247 contractual scientific staff, extension of working hours and workflow optimisation. This was a great demonstration of the scale of the underlying deficit and its responsiveness to resourcing. The National Accreditation Board for Testing and Calibration Laboratories (NABL) certification under ISO/IEC 17025 is not uniform across state laboratories; for instance, the Rs 22,545-crore National Forensic Infrastructure Enhancement Scheme (approved June 2024)[20] of the Union government exists precisely because pre-existing capacity was deemed inadequate to meet the caseload envisaged under the new criminal codes, which will mandate forensic investigation for offences punishable by seven years' rigorous imprisonment or more[21].

[16] Darshan Mohar v. State of NCT of Delhi and Anr., 2025:DHC:11150.
[17] Ministry of Home Affairs, Government of India, "Forensic Labs and Forensic Infrastructure", *Press Information Bureau*, 24 July 2024, https://www.pib.gov.in/PressReleasePage.aspx?PRID=2036389&reg=48&lang=2
[18] Wayne J. Pitts et al., "Understanding research methods, limitations, and applications of drug data collected by the National Forensic Laboratory Information System (NFLIS-Drug)," 68 *Journal of Forensic Sciences* 1335–42 (2023).
[19] Press Trust of India, "Delhi FSL cuts case pendency by 72 pc, says Minister Ashish Sood", *PTI*, 8 August 2026.
[20] Press Information Bureau, Government of India, "Cabinet approves Central Sector Scheme National Forensic Infrastructure Enhancement Scheme (N.F.I.E.S.)", 19 June 2024. https://www.pib.gov.in/PressReleasePage.aspx?PRID=2026704&reg=48&lang=2
[21] Pradipta Nath, "Significance Of New Criminal Laws in Today's India–An Analysis", 3(1) *Journal of Legal Research and Polity* 19-31 (2026).

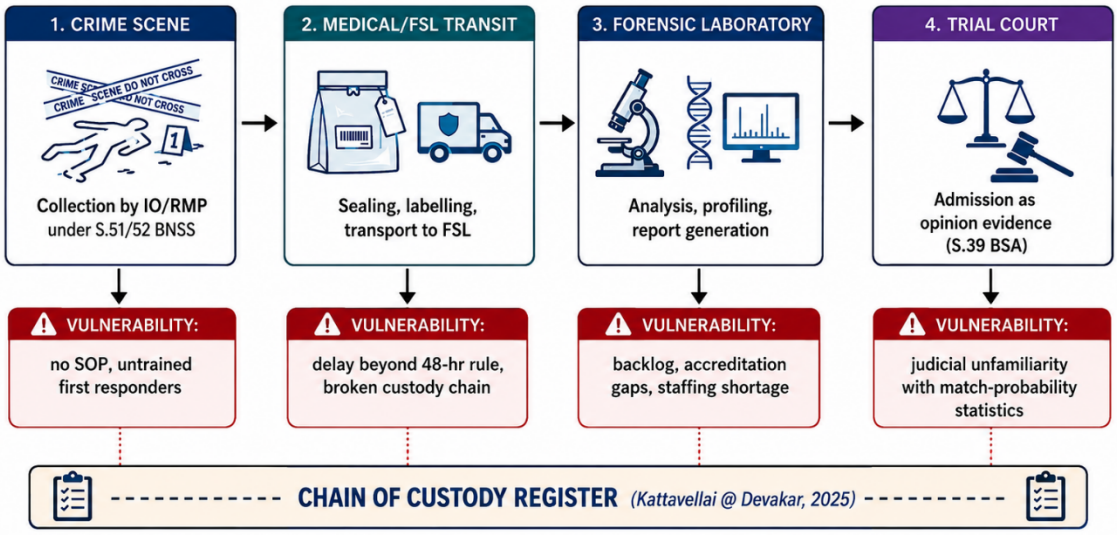
4.3 The human element

One of the biggest challenges, though not immediately apparent, is the incompetence of the human experts involved. A 2021 report from the Parliamentary Standing Committee, which was referenced to support the ultimate withdrawal of the DNA Technology (Use and Application) Regulation Bill in 2019, revealed that testing DNA in India was being done only by thirty to forty qualified DNA experts across fifteen to eighteen laboratories, who together were dealing with fewer than 3,000 cases a year, amounting to an estimated two to three per cent of actual national requirement.[22] While there is a lack of capacity, there is an equal lack of capability. First-responding police officers usually lack the training necessary to collect evidence without contamination. In addition, investigating officers are not uniformly instructed in what a 'match' can and cannot tell us.[23] Moreover, judicial officers who should ultimately weigh expert testimony are not systematically trained in the statistical logic behind random match probability, which is the calculation that expresses the likelihood of a coincidental match between functionally unrelated individuals. Without a probability statement to accompany it, a mere assertion that two profiles match carries little weight.[24] Likewise, an Indian trial court untrained in understanding such a statement is ill-equipped to determine whether an expert has a scientific basis for their confidence or whether that confidence is inflated. Pattu Rajan's judgment argues that DNA can act as one input among many, to be weighed and not deferred to. This presupposes a judicial capacity to critically weigh this evidence, which the current training infrastructure does not reliably support.[25]

This scheme, as shown in Figure 1, tracks the statutory custodial pathways as set out in the BNSS and BSA, with the specific point of failure identified at each stage in the case law and official data reviewed above. The Chain of Custody Register, as directed by the Supreme Court in Kattavellai @ Devakar, is intended to maintain a running log across all four stages, not only on any one weakness.

[22] E. T. V. Bharat, "Govt withdrew DNA Bill as it didn't want elaborate safeguards recommended by standing committee: Cong" *ETV Bharat News*, 2023, *available at*: https://www.etvbharat.com/english/state/delhi/govt-withdrew-dna-bill-as-it-didnt-want-elaborate-safeguards-recommended-by-standing-committee-cong/na20230725112806825825096 (last visited on August 13, 2026).
[23] Heather Wolffram, "Teaching Forensic Science to the American Police and Public: The Scientific Crime Detection Laboratory, 1929-1938," 11 *Academic Forensic Pathology* 52–67 (2021).
[24] Mark W. Perlin et al., "The reliability and reporting of DNA match strength for uncertain genotype evidence," 12 *Heliyon* e44753 (2026).
[25] Paul Roberts, *Expert evidence and scientific proof in criminal trials* (Routledge, 2017).

Figure 1
Forensic Evidence Flow and Vulnerability Points Across the Criminal Justice Process



Source: Adapted from Kattavellai, K., & Devakar, R. (2025). *Chain* of custody *in forensic investigation: Legal requirements and best practices. Indian Journal of Forensic Medicine & Toxicology, 19*(1), 1–10; *Directorate of Forensic Science Services* (DFSS). (2020). *Guidelines for collection, packing and forwarding of physical evidence.* Ministry of Home Affairs, Government of India.

5. Comparative Analysis and a Reformative Path Forward

Compared to other jurisdictions, India's legal framework on DNA technology is much less codified. The Forensic Science Regulator Act 2021 (UK) imposes a statutory duty on forensic science providers working within the criminal justice system to comply with a Code of Practice, enforceable by an independent Regulator.[26] This Act addresses the accreditation and quality-control deficiencies documented in Part 4. The post-2009 forensic reform discourse in the United States, spurred by the National Academy of Sciences' Strengthening Forensic Science in the United States report and reinforced by the President's Council of Advisors on Science and Technology 2016 review of feature-comparison methods, has similarly pushed towards standardised validation protocols and statistical transparency in expert testimony.[27] An earlier effort towards comprehensive statutory regulation in India, the DNA Technology (Use and Application) Regulation Bill, which was first introduced in 2018 and reintroduced in 2019, lapsed and was ultimately withdrawn from Lok Sabha in 2023 following parliamentary apprehensions regarding potential misuse of DNA data on the basis of religion, caste or political affiliation, and because the Government indicated that its substantive content is "broadly covered" by the Criminal Procedure (Identification) Act, 2022 an Act the dominate

[26] Emmanuel Nsiah Amoako and Carole McCartney. "Swapping carrots for sticks: Forensic science provider views of the forensic regulator act 2021", 62(5) *Science & Justice* 506-514 (2022).
[27] Stephen Cordner et al., "The Foundations of the Comparison Forensic Sciences: Report of the President's Council of Advisors on Science and Technology", 24(2) *Journal of law and medicine* 297-302 (2016).

objective of which is the collection of measurements and biometric data rather than laboratory accreditation, quality assurance or database governance.[28] This resulted in a regulatory vacuum. India has comprehensive rules for collecting samples. But there is no law or independent statutory authority that can accredit forensic labs, audit quality control, or regulate retention and use of DNA profiles and databases.

First, Parliament must take a fresh look at specialised DNA legislation, this time excluding the provisions on identity databases which caused the controversy over the 2019 Bill. The legislation should be narrowed in scope to require mandatory NABL (or equivalent) accreditation, so that laboratory reports are admissible under Section 39 of the BSA, in line with the UK model.

Second, the Kattavellai @ Devakar Chain of Custody Register ought to be given a statutory footing through the BNSS and not left to judicial direction, along with fixed consequences - with a rebuttable presumption against admissibility - for non-compliance.

Third, mandatory training for judges and police on the statistical interpretation of random match probability must be institutionalised through the National Judicial Academy and State Judicial Academies as part of refresher curricula on criminal law to remove the human-element deficit, which is neither the same as nor resolved by laboratory-side infrastructure spending.

Conclusion and Suggestions

The doctrinal and empirical material examined in the article points to a single cumulative conclusion. It suggests that DNA evidence in Indian criminal trials is indeed probative. It suggests, however, not, and cannot presently be treated as, infallible. The fact that it is classified as opinion evidence under Section 39 of the BSA, is not because it is a technicality but because that is what is its true nature in terms of evidence, the nature of which is composed as much by the institutional conditions of collection, transport, and analysis as by the underlying molecular science. A judicial journey from Kathi Kalu Oghad to Pattu Rajan, and onwards to Kattavellai @ Devakar, illustrates this process of maturation. This maturation has culminated in binding procedural safeguards that treat the integrity of the chain of custody as a precondition, not an

[28] Rudra Chandran, "Collection of dna and the Creation of dna Databases in India: A Proportionality Analysis on Whether There is a Violation of Genetic Privacy", 25(3) *Asia-Pacific Journal on Human Rights and the Law* 282-308 (2024).

afterthought, for evidentiary weight. The judicial system is aware of these deficiencies. They date back to the Supreme Court's 2015 decision in the Narco Analysis case. Moreover, the government itself has expressed them in Parliament in 2018 and 2020. The application of forensic science in the investigation of a criminal case is not a replacement for a thorough investigation by a trained police officer, but is a discipline imposed upon it; a technique whose evidentiary value is not only limited but realised only to the extent that the surrounding institutional architecture is built to sustain it. As a result, reform aimed at the architecture of statutory accreditation, codified chain-of-custody obligations, and systematic judicial and investigative training is not peripheral to the future reliability of DNA evidence in India but is constitutive of it.