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DNA Fingerprinting and Its Implications on Indian Criminal Jurisprudence: A Legal and Constitutional Analysis

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This research paper presents a detailed legal and constitutional examination of DNA fingerprinting and its growing role in Indian criminal jurisprudence. With its unparalleled accuracy in identifying individuals, DNA evidence has emerged as a crucial element in contemporary criminal proceedings. The paper examines the scientific underpinnings of DNA profiling, assesses the trustworthiness of its evidence, and examines how recent statutory reforms have incorporated it into Indian law. This paper focuses on the transformative changes introduced by the Bharatiya Nagarik Suraksha Sanhita, 2023 (BNSS) and the Bharatiya Sakshya Adhiniyam, 2023 (BSA). These statutes update and clarify the admissibility and procedural handling of forensic evidence, including DNA, effectively replacing the outdated provisions of the Indian Evidence Act and the CrPC. Additionally, the study severely evaluates the constitutional limits set by Article 20(3) (protection against self-incrimination) and Article 21 (right to privacy and fair trial). Landmark Supreme Court judgments such as Kathi Kalu Oghad, Selvi v State of Karnataka, and Justice K.S. Puttaswamy v Union of India are analysed for their enduring influence on the legal treatment of DNA evidence. A comparative analysis is also undertaken, referencing the UK and US frameworks, including the Police and Criminal Evidence Act 1984, the European Convention on Human Rights (Article 8), and Maryland v King, which collectively highlight how privacy safeguards are integrated into DNA evidence regimes abroad. Through a study of key Indian cases such as Kunhiraman v Manoj, Mukesh v State (NCT of Delhi), and Manoj v State of Madhya Pradesh, the paper traces the judiciary's evolving

perspective. It concludes by emphasising the need for a dedicated DNA regulation law that ensures scientific progress is balanced with individual rights and constitutional propriety.

Keywords: *dna fingerprinting, forensic evidence, bsa, Right to Privacy, article 21.*

INTRODUCTION

DNA: DNA (the deoxyribonucleic acid), often well known as the congenital blueprint or the building blocks and essential components of life, was originally outlined by scientists Francis H. C. Crick and James D. Watson in 1953. Crick and Watson disclosed that DNA is an essential component that makes up the genetic alphabet of living things. They also showed that DNA has a double-helix structure that appears as a twisted ladder. The pattern of the molecules that comprise a certain individual DNA dictates how the form of life develops. Every cell in the human body, including blood, sperm, and skin cells, shares the same genetic code. Except for identical twins, each individual has their own DNA blueprint.[1]

Adenine, thymine, cytosine, guanine, and phosphoric acid are the four nitrogenous bases that comprise DNA, also known as deoxyribonucleic acid, and they are arranged predictably. It is made up of nucleotides, which are the building blocks that make up a DNA strand. A phosphate group and a sugar base component make up the backbone of a DNA strand. Two DNA strands wound in a double spiral (helix) make up the DNA molecule. Describing one more proportional rare characteristic of a person's genome or genetic composition is referred to as genotyping, fingerprinting, profiling, verification, DNA identification analysis, or typing. Due to their definite genetic makeup, every human, lower animals, and sexually reproducing plant have well-defined phenotypes or physical characteristics.[2]

[1] Dr Nirpat Patel et al., 'The Role of DNA in Criminal Investigation – Admissibility in Indian Legal System and Future Perspectives' (2013) 2(7) International Journal of Humanities and Social Science Invention <https://www.ijhssi.org/papers/v2(7)/Version-3/C0273015021.pdf> accessed 10 June 2025

[2] Jaising Prabhudas Modi, *Modi's Medical Jurisprudence and Toxicology* (23rd edn, LexisNexis Butterworths India 2008)

FINGERPRINTS AND DNA FINGERPRINTING

Fingerprints: Another name for the study of fingerprints is “Dactyloscopy,” based on Modi's Toxicology and Medical Jurisprudence. Also referred to as the fingerprint system, “dactylography” involves using printer ink to create impressions of the pulp of the fingers and thumbs on a piece of unglazed white paper, which are then examined under a magnifying glass.

The two tenets of dactyloscopy are:

- That no two fingerprints are alike, and,
- Fingerprints are immutable due to their two distinct qualities, individuality and persistence.[3]

Fingerprints are important as evidence because of the following features. Their characteristics include being distinct, permanent, universal, inimitable, classifiable, and often accessible as evidence in criminal cases.[4]

The Indus Valley Civilisation is when fingerprints first appeared, and they were frequently used on clay seals and tablets. The fact that seals employ fingerprints shows how important they are for identification. For countless centuries, fingerprints and palm prints, known as Panja, were utilised in West Bengal. In this regard, it is clear that Shahjahan’s Royal Hand Seal was applied to several significant documents. The pioneers who made fingerprints an unfailing method of human identification deserve recognition for their significant contributions to the history and advancement of fingerprint science as an identifying method. They are Rai Bahadur Hemchandra Bose, Khan Bahadur Aziz-Ul-Haq, Sir Edward Richard Henry, Sir Francis Galton, Sir William Herschel, and Dr. Henry Faulds.

DNA Fingerprinting: DNA, the outline for life and the genetic material that is passed down from one generation to another, is the most important chemical component of all living organisms. It contains all of the crucial data needed to regulate every biological process, including protein synthesis, cell division, and growth. A nucleic acid made up of nucleotides is called DNA. Phosphate (phosphoric acid), pentose sugar, and nitrogenous base combine

[3] Marvin D'Souza and RP Kataria, *Forensic Science in Criminal Trial & Investigation* (1st edn, Orient Publishing Company 2016)
[4] BR Sharma, *Forensic Science in Criminal Investigation & Trial* (4th edn, Universal Law Publishing 2015)

chemically to form nucleotides, which are full units of nucleic acid. A gene is a functioning DNA nucleotide fragment that serves as the unit of heredity and can synthesise a particular protein. Genes are genetic units that make up the self-replicating nucleoprotein filaments known as chromosomes.[5]

Relevance of DNA Fingerprinting in Criminal Trials: In a DNA examination for a forensic investigation, a suspect's DNA molecule is first broken down, and then particular pieces are separated and measured using highly sophisticated scientific apparatus. Next, a specimen of physical evidence and the suspect's DNA profiles are examined to see if they match. If there happens to be a clear non-match, the suspect may be eliminated from consideration. If a match is discovered, data analysis determines the probability that the material evidence sample came from the same person as the suspect. The judges utilise this statistical outcome to conclude whether a suspect is guilty or innocent.

DNA Profiling and the Indian Legal System: For the court to be persuaded that the evidence is reliable, DNA evidence must always be gathered, stored, and recorded precisely and correctly. It can only be allowed into evidence after that. In India, there isn't a specific statute that can provide the court and investigating agencies with detailed guidelines about what to do when DNA evidence is used. Furthermore, there are no particular provisions under the Indian Evidence Act of 1872 or the Code of Criminal Procedure of 1973 for dealing with problems associated with forensic science or technology, which makes it quite challenging for an investigator to obtain evidence that establishes the accused's guilt using modern techniques in the absence of such a provision.

Sections 51 and 53 of the Bharatiya Nagarik Suraksha Sanhita, 2023,[6] and Sections 53 and 54 of the former Code of Criminal Procedure, 1973[7] allow a police officer to seek the assistance of a medical expert in good faith and conscience for the investigation. It does not, however, permit a complainant to get blood, semen, or other proof to bring criminal charges against the accused.

The Cr.P.C. (Amendment) Act 2005 included two recently developed sections that permit the investigating officer, with the help of a medical expert, to get a DNA sample from the body of the

[5] Arup Kumar Mitra et al., *A Text Book of Biology* (4th edn, Book Syndicate 2007)
[6] Bharatiya Nagarik Suraksha Sanhita 2023, ss 51-53
[7] Code of Criminal Procedure 1973, ss 53–54

accused and the victim. According to these sections, a medical professional may examine the rape victim and the person who is suspected of rape, respectively. However, the applicability of this evidence has continued to be in issue due to the contradictory conclusions of the Supreme Court and many High Courts in various rulings.[8]

SCIENTIFIC AND LEGAL NATURE OF DNA FINGERPRINTING AS EVIDENCE

How DNA Fingerprinting Works and Its Reliability?

Procedure: A forensic technique for recognising people based on their well-defined genetic composition is DNA fingerprinting, sometimes mentioned as DNA profiling. It usually concentrates on short tandem repeats (STRs), which are extremely polymorphic DNA regions. To create a distinct profile that is still up for debate, the procedure demands extracting DNA from biological samples (blood, saliva, semen, etc.), amplifying the STR sections using polymerase chain reaction (PCR), and then sorting the pieces by electrophoresis.[9]

Reliability: The technique's reproducibility and specificity make it regarded as scientifically sound. Every person has a different STR profile, except identical twins, and the likelihood of two people matching at random is incredibly low, often stated as 1 in several trillion.[10]

DNA profiling's foundation in molecular biology, particularly its reliance on STR loci amplified by PCR techniques, allows forensic scientists to examine regions of the genome that vary highly among individuals. Since each person has a different number of repeats, the STRs—short sequences of DNA repeated in tandem- are perfect targets for forensic identification. These sections are quickly replicated using PCR (Polymerase Chain Reaction), which produces enough DNA for examination even from small or deteriorated samples, making the method both powerful and sensitive for forensic use. As noted by Budowle et al., STRs form the core of the CODIS database due to their high polymorphism and the efficiency with which they can be amplified via PCR, allowing for highly reproducible and statistically powerful results. When performed under accredited laboratory settings, which enforce stringent protocols for sample

[8] Patel (n 1)
[9] National Research Council, *The Evaluation of Forensic DNA Evidence* (1st edn, National Academy Press 1996)
[10] Bruce Budowle et al., 'Population Data on the Thirteen CODIS Core Short Tandem Repeat Loci in African Americans, US Caucasians, Hispanics, Bahamians, Jamaicans, and Trinidadians' (1999) 44(6) Journal of Forensic Sciences <https://pubmed.ncbi.nlm.nih.gov/10582369/> accessed 10 June 2025

collection, contamination prevention, and chain of custody, DNA analysis achieves high levels of reliability and integrity.[11]

Strengths, Challenges and Practical Concerns of DNA Fingerprinting in Criminal Law –

Strengths: The primary strength of DNA evidence lies in its accuracy and objectivity. It is capable of excluding innocent suspects and establishing strong links between perpetrators and crime scenes.[12] The scientific basis of DNA evidence has been upheld by Indian courts as highly persuasive and often determinative when uncontested.[13]

Challenges: However, there are certain difficulties with using DNA evidence. First, sample contamination is a major risk due to the sensitivity of PCR. Even trace amounts of foreign DNA can affect results.[14] Second, the interpretation of mixed or degraded samples requires advanced expertise and may still be inconclusive. Third, the infrastructure in India for forensic testing is uneven, with a shortage of accredited labs and trained personnel.[15]

Additionally, there are ethical and legal issues. The Constitution's Articles 20(3) (right against self-incrimination) and Article 21 (right to privacy) may be violated by the mandatory collection of DNA samples.[16] The proposed DNA Technology (Use and Application) Regulation Bill, 2019, which aimed to create databanks and control the use of DNA data, has drawn criticism for its lack of protections and potential for abuse.[17]

Practical Concerns: In actuality, appropriate sample collection, transportation, and analysis are necessary for DNA evidence to be effective. Delays in submission to forensic labs, poor

[11] Henry C Lee and Carll Ladd, 'Preserving and Collection of Biological Evidence' (2001) 42(2*)* Croatian Medical Journal <https://www.abacusdiagnostics.com/Collection_of_Evidence.pdf> accessed 10 June 2025
[12] David H Kaye, *The Double Helix and the Law of Evidence* (1st edn, Harvard University Press 2010)
[13] *State of UP v Sunil* AIR 2017 SC 2150
[14] Natalie Ram, 'Genetic Privacy After Carpenter' (2019) 105(7) Virginia Law Review 1357 <https://virginialawreview.org/articles/genetic-privacy-after-carpenter/> accessed 10 June 2025
[15] Grette Sara Titus, 'The Role and Importance of DNA Evidence in the Indian Criminal Justice System' (2023) 17(4) Indian Journal of Forensic Medicine & Toxicology <https://doi.org/10.37506/ijfmt.v17i4.19937> accessed 10 June 2025
[16] Gautam Bhatia, 'State Surveillance and the Right to Privacy in India: A Constitutional Biography' (2014) 26(2) National Law School of India Review 127 <https://ssrn.com/abstract=2605317> accessed 10 June 2025
[17] The DNA Technology (Use and Application) Regulation Bill 2019

preservation, and broken chain-of-custody records can render DNA evidence inadmissible or unreliable.[18]

DNA FINGERPRINTING AS FORENSIC EVIDENCE IN INDIA: STATUTORY AND CONSTITUTIONAL ANALYSIS

DNA fingerprinting, a scientific technique that identifies individuals by their unique genetic code, has become a cornerstone of forensic investigation worldwide. In India, its importance in criminal justice has grown markedly since the mid-2000s. For instance, the recent *Bharatiya Nagarik Suraksha Sanhita* (BNSS) 2023 (which replaced the CrPC 1973) expressly retains and strengthens provisions for DNA profiling in serious crimes. Under BNSS §176(3), police must cause a forensic specialist to visit the scene of any offence punishable by seven years or more to collect forensic evidence (including DNA). Thus, DNA evidence is now statutorily recognised as crucial for linking suspects to crimes.[19]

Provisions on Sampling and Forensic Evidence in the Bharatiya Nagarik Suraksha Sanhita 2023 (BNSS) and Code of Criminal Procedure 1973 (CrPC): The BNSS 2023 (Indian Criminal Procedure Code) contains several provisions concerning the collection of bodily samples and forensic evidence, many of which mirror the provisions of the erstwhile CrPC 1973. BNSS Section 52 (replacing CrPC Section 53A) authorises medical examination of persons arrested for rape. Its broad definition of "examination" covers the use of contemporary, scientific methods, such as DNA profiling, to gather blood, semen, swabs, hair clippings, fingernails, etc. Among other things, the examining physician is required to provide a report that includes "the description of material taken from the person of the accused for DNA profiling." Therefore, a court may order a hospital physician to perform an examination and take DNA samples where there are good reasons to think the body of a rape suspect may contain evidence (subject to medical ethics and agreement of the examinee).[20]

Similarly, BNSS Section 184 (replacing CrPC Section 164A) governs the examination of female rape victims. It requires prompt medical examination (with the victim's consent) and reporting

[18] *Santosh Kumar Singh v State through CBI* (2010) 9 SCC 747
[19] Pankaj Kumar Srivastava, 'New Criminal Laws Are Betting on DNA Fingerprinting. India Must Prepare to Offset Risks' *The Print* (22 July 2024) <https://theprint.in/opinion/new-criminal-laws-are-betting-on-dna-fingerprinting-india-must-prepare-to-offset-risks/2182137/> accessed 10 June 2025
[20] Code of Criminal Procedure 1973, s 53A; Bharatiya Nagarik Suraksha Sanhita 2023, s 52

of injuries. Importantly, the doctor's report must include "the description of material taken from the person of the woman for DNA profiling."[21]

BNSS §184(7) explicitly safeguards the victim's autonomy by providing that no exam may be conducted without her consent.[22] Thus, both the victim and the accused can be asked to provide biological samples for DNA analysis, but only under judicial direction and (for victims) with their consent. BNSS Section 176(3) further emphasises forensic collection at crime scenes: police must engage forensic experts to document and collect all possible evidence (physical, blood, DNA, etc.) whenever the offence is serious (≥7 years).[23] This codifies earlier mandates such as CrPC §157(2) and underscores the special status of DNA evidence in investigations. Practically, these provisions link the collection of DNA evidence to the procedural codes (CrPC/BNSS) rather than the Evidence Act. In addition, the Criminal Evidence Act (Identification of Prisoners Act) 2022 authorises the collection of DNA from convicts, arrestees of serious offences and those charged with sexual assault.[24]

The Indian Evidence Act, 1872 (IEA) and Bharatiya Sakshya Adhiniyam, 2023 (BSA) on Expert Evidence and DNA: Under the *Bharatiya Sakshya Adhiniyam*, 2023 – the new Evidence Act – expert testimony on DNA or any scientific question is expressly admissible as relevant. BSA Section 39 provides that when "the Court has to form an opinion upon a point of … science or art … or as to identity of … finger impressions," the opinions of persons "specially skilled" in that field (i.e. experts) are relevant facts.[25] This directly codifies the judicial practice of relying on forensic experts in evaluating DNA evidence, continuing the earlier position under Section 45 of the Indian Evidence Act, 1872 (now repealed).[26]

These provisions formally incorporate earlier mandates such as Section 157(2) of the Code of Criminal Procedure (CrPC), and they emphasise the growing evidentiary significance of DNA in criminal investigations. While the Indian Evidence Act 1872 and its successor, the Bharatiya Sakshya Adhiniyam (BSA) 2023, provide the framework for the admissibility and evaluation of expert and scientific evidence, including DNA, the actual collection, preservation, and

[21] Code of Criminal Procedure 1973, s 164A; Bharatiya Nagarik Suraksha Sanhita 2023, s 184
[22] Bharatiya Nagarik Suraksha Sanhita 2023, s 184(7)
[23] Bharatiya Nagarik Suraksha Sanhita 2023, s 176(3)
[24] The Criminal Procedure (Identification) Act 2022
[25] Bharatiya Sakshya Adhiniyam 2023, s 39
[26] Indian Evidence Act 1872, s 45

procedural compliance related to DNA samples are governed by procedural codes, namely the CrPC and the Bharatiya Nagarik Suraksha Sanhita (BNSS) 2023.[27] This results in a separation of duties: the BNSS specifies how DNA evidence must be gathered for legal use in a trial, while the BSA decides whether it is acceptable in court. Additionally, fingerprints, footprints, and biological samples like blood and hair from convicted individuals, arrestees for serious crimes, and accused individuals in cases involving sexual violence were previously permitted by the Identification of Prisoners Act 1920, which was repealed and eventually incorporated into the CrPC through amendments and the BNSS.[28] The transition from this standalone statute to consolidated provisions under the BNSS reflects a legislative effort to streamline and modernise forensic and biometric evidence collection within India's criminal justice framework.

STATUTORY AND EVIDENTIARY SUMMARY

Investigation Stage (CrPC/BNSS): Criminal procedure codes empower courts to order medical examination and sample collection if warranted. Under CrPC Section 53A / BNSS Section 52, a rape suspect's person may be examined by a doctor (who must then detail any DNA material collected).[29] CrPC Section 164A / BNSS Section 184 similarly allows examination of a rape victim (with her consent) and collection of evidence, including DNA.[30] By these provisions, the legislature has explicitly integrated DNA sampling into the police inquiry process. BNSS Section 176(3) additionally obliges on-site forensic collection for grave crimes.[31] Failure to secure DNA evidence at this stage (for example, by not medically examining a rape survivor promptly) can result in loss of crucial proof and is discouraged by law.

Admissibility (Evidence Act/BSA): There is no unique exclusionary rule for DNA evidence. It is treated like other expert or scientific evidence. BSA Sections 39–40 render expert opinions (including DNA profilers) admissible and relevant.[32] Thus, a forensic expert's testimony and laboratory DNA reports can be admitted, provided foundational reliability and chain of custody are established. The Indian courts apply general tests of admissibility (relevancy, competence of witness, etc.) to DNA. For example, a DNA report must ideally be certified by an accredited lab,

[27] Code of Criminal Procedure 1973, s 157(2); Bharatiya Sakshya Adhiniyam 2023, ss 39, 48 and 57; Bharatiya Nagarik Suraksha Sanhita 2023, ss 51–52 and 350
[28] Identification of Prisoners Act 1920, ss 3–5; Bharatiya Nagarik Suraksha Sanhita 2023, s 51
[29] Code of Criminal Procedure 1973, s 164A; Bharatiya Nagarik Suraksha Sanhita 2023, s 52
[30] Code of Criminal Procedure 1973, s 53A; Bharatiya Nagarik Suraksha Sanhita 2023, s 184
[31] Srivastava (n 19)
[32] Bharatiya Sakshya Adhiniyam 2023, ss 39-40

and the expert should be cross-examined if challenged. Where sample collection procedures were unlawful or violated rights (e.g. torture to obtain blood), courts would exclude the evidence. But mere lack of consent by the suspect (if judicially ordered) does not per se render it inadmissible under Article 20(3), following *Oghad*'s material/testimonial distinction.[33]

Evidentiary Weight: DNA evidence is accorded high probative value when properly handled. It can establish identity or non-identity with statistical certainty. While Indian law does not assign automatic "presumptions" to DNA profiles, judges recognise DNA as a powerful corroborative tool. Some civil and criminal judgments have drawn adverse inferences (Evidence Act Section 114) when a party refuses DNA testing without explanation (akin to refusing any test)[34]. However, such inferences are discretionary and must be drawn considering all circumstances. DNA evidence remains subject to the usual safeguards: possible contamination, laboratory errors, or alternative explanations must be considered by the fact-finder.

CONSTITUTIONAL PRINCIPLES AND LIMITS ON DNA TESTING: ARTICLES 20(3) AND 21

Despite its technological advancements, the use of DNA evidence must adhere to the constitutional framework that preserves individual dignity and defends the accused's rights. The normative limits for the collection, use, and admissibility of DNA in criminal proceedings are established by two important constitutional provisions: Article 20(3) and Article 21.

Article 20(3): Right Against Self-Incrimination: Article 20(3) of the Constitution of India provides that "no person accused of any offence shall be compelled to be a witness against himself."[35] The primary safeguard here is against testimonial compulsion, which the Supreme Court has interpreted narrowly.

The Court ruled in the seminal case of State of Bombay v Kathi Kalu Oghad that providing physical evidence, such as blood samples, fingerprints, or handwriting, does not constitute

[33] 'State of Bombay v Kathi Kalu Oghad: Interpreting self-incrimination under Article 20(3) of the Indian Constitution' (*CaseMine,* 04 July 2024) <https://www.casemine.com/commentary/in/state-of-bombay-v.-kathi-kalu-oghad:-interpreting-self-incrimination-under-article-20(3)-of-the-indian-constitution/view> accessed 10 June 2025

[34] *Ashok Kumar v Raj Gupta* (2022) 1 SCC 20

[35] Constitution of India 1950, art 20(3)

testifying under duress because it is not predicated on the accused's use of mental faculties.[36] Accordingly, DNA samples, being physical/material evidence, do not fall within the protection of Article 20(3).

This interpretation was affirmed in Selvi v State of Karnataka, where "testimonial" and "non-testimonial" evidence were distinguished by the Supreme Court.[37] Although the Court ruled that involuntary methods such as brain mapping and narco-analysis were unconstitutional because they were testimonial and coercive, it made clear that biological sample collection is constitutionally permissible as long as it is carried out legally.

Article 21: Right to Privacy, Dignity and Fair Procedure: Article 21 of the Constitution guarantees that "no person shall be deprived of his life or personal liberty except according to procedure established by law."[38] The right to privacy, physical autonomy, and a fair trial are only a few of the substantive and procedural guarantees that are based on this article.

In Justice K.S. Puttaswamy v Union of India, the right to privacy was firmly acknowledged by the Supreme Court as a fundamental right that is implied in Article 21.[39] Given that DNA carries sensitive personal information capable of revealing familial relationships, medical history, and identity, its collection and retention must meet the tests of necessity, proportionality, and legality. Arbitrary or excessive use of DNA testing could violate these constitutional guarantees.

The Court in Ashok Kumar v Raj Gupta set aside a High Court order directing DNA testing in a civil property dispute, holding that such testing—without compelling justification—violated the individual's bodily integrity and decisional autonomy.[40]

Similarly, in Bhabani Prasad Jena v Orissa State Commission for Women, the Supreme Court emphasised that DNA testing should be used as a last resort rather than the first option and denounced the routine or automated ordering of DNA tests in custody or marriage disputes.[41] These rulings highlight the fact that, even though DNA testing might advance justice, it cannot be applied arbitrarily or under duress. Courts have to carefully weigh each party's right to due

[36] *State of Bombay v Kathi Kalu Oghad* AIR 1961 SC 1808
[37] *Selvi v State of Karnataka* (2010) 7 SCC 263
[38] Constitution of India 1950, art 21
[39] *Justice KS Puttaswamy v Union of India* (2017) 10 SCC 1
[40] *Ashok Kumar v Raj Gupta* (2021) SCC OnLine SC 1207
[41] *Bhabani Prasad Jena v Orissa State Commission for Women* (2010) 8 SCC 633

process, privacy, and dignity against the state's interest in conducting an efficient criminal investigation.

JUDICIAL APPROACH: EVOLUTION OF JUDICIAL PERSPECTIVES ON DNA EVIDENCE

The preliminary case where DNA evidence was admissible in Indian Courts: Kunhiraman v Manoj.[42] The earliest paternity case involving DNA analysis, which was handled at The Centre for Cellular and Molecular Biology (CCMB), Andhra Pradesh (A.P.), was brought before the Chief Judicial Magistrate, Thalassery, Kerala. This case had a profound impact on the entire Indian judicial system and the media.

Facts of the Case: According to the case description, Vilasini, a country girl, sued Kunhiraman, his boyfriend, to support her son, Manoj. She has said that because of their illicit relationship, she gave birth to her child (Manoj). Her spouse disputed her son's paternity and disowned her. The C.J.M. ordered them and their child to go through a DNA test at CCMB in Hyderabad, Andhra Pradesh, India. Dr. Lalji Singh, who was a forensic scientist, and his colleagues performed the DNA test, and the procedural findings proved that Kunhiraman was the child's father. In M.C. No. 17 of 1988 (the Vilasini case), the Forensic Science Laboratory (FSL) accepted DNA evidence following analysis using the BKm 2(8) probe—a hypervariable minisatellite DNA sequence developed by Sir Alec Jeffreys that enabled multi-locus DNA fingerprinting. This technique marked one of the prior uses of scientifically validated DNA profiling in India, allowing for highly individualised identification based on genetic variation across multiple loci.[43]

Held: According to Section 45 of the Indian Evidence Act, which permits the admission of expert opinions, the C.J.M. declared that DNA evidence is a scientific investigation and that the belief of a microscopic and biological expert is admissible, just like the opinion of an analytical chemist or fingerprint expert. The Kerala High Court agreed, holding that a DNA test could independently establish paternity.[44]

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[42] *Kunhiraman v Manoj* II (1991) DMC 499
[43] Alec J Jeffreys, Victoria Wilson and Swee Lay Thein, 'Hypervariable "minisatellite" Regions in Human DNA' (1985) 314 Nature <https://doi.org/10.1038/314067a0> accessed 10 June 2025
[44] MW Pandit and Lalji Singh, 'DNA Testing, Evidence Act and Expert Witness' (2000) 47(4) Indian Police Journal <https://www.ojp.gov/ncjrs/virtual-library/abstracts/dna-testing-evidence-act-and-expert-witness> accessed 10 June 2025

Pattu Rajan v State of Tamil Nadu (2019): Limits of DNA as Sole Evidence[45] -

Facts of the case: The inquiry into the 2001 kidnapping and murder of a man named Santhakumar was at the heart of the Pattu Rajan v State of Tamil Nadu case. After the body was found, a second FIR was filed under Section 302 IPC for murder, while the original FIR was filed under Section 364 of the Indian Penal Code (IPC) for kidnapping. The Madras High Court maintained the conviction of Rajan, the appellant, who was prosecuted on testimonial and circumstantial evidence.[46]

Issues:

1. What is the validity of registering multiple FIRs for connected incidents?
2. What is the reliability of forensic and scientific results, especially those based on expert opinion, like DNA analysis?

Although DNA testing was not central in this case, the Court offered significant observations on its legal status.[47]

Held: According to Section 45 of the Indian Evidence Act, 1872, the Supreme Court ruled that DNA evidence is considered expert opinion and is therefore advisory rather than legally binding, much like any other expert testimony. The bench, led by Justice Shantanagoudar, stated that courts are not required to accept scientific opinion as conclusive proof. Instead, its weight depends on the facts, circumstances, and corroborative evidence produced in each case.

"Merely because the expert opinion is admissible under Section 45 of the Evidence Act, it does not mean that it is binding on the Court... DNA evidence must be examined in the context of other circumstances and evidence."[48]

The Court further noticed that improper collection, poor chain of custody, or lack of corroboration may render DNA evidence inconclusive or even inadmissible. While scientific

[45] *Pattu Rajan v State of Tamil Nadu* (2019) 4 SCC 771
[46] Rishabh Jain, 'Pattu Rajan v State of Tamil Nadu' (*The Amikus Qriae*, 29 March 2019) <https://theamikusqriae.com/case-pattu-rajan-vs-state-of-tamil-nadu-2/> accessed 10 June 2025
[47] *Ibid*
[48] *Pattu Rajan v State of Tamil Nadu* (2019) 4 SCC 771 [21]

tools like DNA analysis enhance investigative capabilities, the Court issued a warning against using such evidence as a stand-in for comprehensive judicial analysis or as infallible.[49]

Strong circumstantial evidence and reliable witness testimony ultimately led the Supreme Court to uphold the conviction, reaffirming that scientific evidence is but one component of the evidentiary matrix. This case continues to serve as a standard for courts weighing the fundamental ideas of evidence law against the probative usefulness of DNA.

Mukesh & Anr v State (NCT of Delhi) (2017): DNA Evidence in Heinous Offences[50]

A young woman was gang-raped and later killed on December 16, 2012, which led to the historic ruling in Mukesh & Anr v State (NCT of Delhi) on the use of DNA evidence in criminal proceedings, and the physical assault of her male companion, both of whom were attacked aboard a private bus in New Delhi.

Facts and DNA Evidence: Following the crime, the police collected blood-stained clothes, swabs, and other biological samples from the bus and accused under CrPC s 53A, which was introduced post-2005 for DNA collection in rape cases. Three independent accredited forensic laboratories analysed these samples and produced DNA profiles matching the accused with the blood found on the bus and the victim's clothing. The prosecution depended greatly on these DNA reports to put forth that the accused were physically involved in the offence, linking them scientifically to the scene.

Held: The Supreme Court placed substantial emphasis on the scientific rigour of DNA profiling:

- **Statutory Recognition:** The Court ruled that since Section 53A CrPC was added in 2005, DNA profiling has become a part of the statutory framework, allowing scientific analysis to be used in investigations of sexual offences.
- **Probative Weight:** In paras 213 and 224, it was noted that DNA reports carry high probative value unless the accused proves procedural or collection defects. The Court observed that the DNA profiles were "foolproof" in linking the accused to the crime scene.[51]

[49] *Pattu Rajan v State of Tamil Nadu* (2019) 4 SCC 771
[50] *Mukesh & Anr v State (NCT of Delhi) & Ors* (2017) 6 SCC 1
[51] *Ibid* para 224

- **Legal Threshold:** At paragraph 450, the Court reaffirmed that, where DNA evidence is appropriately gathered and examined, it can serve as incontrovertible proof of guilt, subject to broader evidentiary and legal scrutiny[52].
- The Court confirmed that scientific evidence can serve as the foundation for a criminal conviction in heinous crimes by upholding the accused's death sentences based on DNA evidence backed by eyewitness accounts and circumstantial evidence.

Manoj v State of Madhya Pradesh (2022): Scientific Gaps in DNA Evidence Evaluation[53] -

The Supreme Court re-examined the evidentiary standard for DNA profiling in the case of Manoj v State of Madhya Pradesh, which involved the rape and killing of a young girl. The ruling emphasises how crucial methodological integrity is to forensic science, particularly when it comes to DNA evidence.

Facts and Use of DNA Evidence: Manoj, the appellant, was found guilty and culpable of raping and killing a 15-year-old girl. A forensic DNA result that asserted a match between the accused and biological specimens taken from the crime site served as the main basis for the conviction. However, statistical evaluations like the Random Match Probability (RMP) or likelihood ratio, two common measures of the significance of a DNA match, were absent from the State's DNA report.

Held: The Court set aside the conviction, underscoring several scientific and procedural lapses:

Absence of Statistical Basis: The Court noted that the DNA report merely claimed a match without disclosing any numerical probability or match likelihood, which is essential to convey the evidentiary strength of such results.[54]

Lack of Scientific Rigour: The Court observed the lack of population frequency statistics, allele frequencies, or probability calculations; the forensic conclusions failed to meet the minimum scientific thresholds required under Section 45 of the Indian Evidence Act.

[52] I*bid* para 450
[53] *Manoj v State of Madhya Pradesh* (2022) SCC OnLine SC 677
[54] *Ibid*

Impact on Fair Trial: The Bench held that the report, as presented, offered no real probative value and could not alone form the basis for conviction. It noted the risk of miscarriage of justice when courts rely on uncorroborated or technically deficient scientific evidence.

Failure of Prosecution: The Court also highlighted broader investigative shortcomings, including the prosecution's failure to summon expert witnesses to explain or defend the DNA analysis, leaving significant gaps in the evidentiary chain.[55]

The appellant was thus acquitted after the court overturned the conviction. This ruling establishes a standard for Indian courts to examine DNA evidence more closely. It reinforces that DNA results must not only establish a match but must also quantify their reliability, ensuring that judicial decisions rest on scientifically verifiable grounds rather than conclusory assertions.

COMPARATIVE JURISPRUDENCE ON DNA EVIDENCE: INDIA, UNITED KINGDOM, AND UNITED STATES

The United Kingdom and the European Court of Human Rights (ECHR): In the United Kingdom, the applicability of DNA evidence is well established under the framework of the Police and Criminal Evidence Act 1984 (PACE)[56] and supplemented by guidelines under the National DNA Database (NDNAD). DNA evidence is classified as expert evidence and routinely accepted in criminal trials, provided it complies with procedural safeguards.

However, the European Court of Human Rights has played a pivotal role in setting constitutional limits on data retention. In S. and Marper v United Kingdom,[57] the Court determined that it was against Article 8 of the European Convention on Human Rights to retain the fingerprints and DNA profiles of those who had been found not guilty,[58] which guarantees the right to privacy. Following this judgment, UK law was reformed to differentiate between convicted and non-convicted individuals, limiting the scope of retention.

[55] *Ibid*
[56] Police and Criminal Evidence Act 1984
[57] *S and Marper v United Kingdom* [2008] ECHR 1581
[58] European Convention on Human Rights 1953, art 8

While UK law permits buccal swabbing and other non-invasive methods for DNA collection from arrestees, such procedures are subject to judicial authorisation and oversight. This approach balances the investigatory utility of DNA with individual rights under the ECHR.

United States of America: The American legal system adopts a more permissive stance toward the collection, grouping and use of DNA evidence. In Maryland v King,[59] the constitutionality of using cheek swabs to get DNA from people detained for serious crimes was maintained by the U.S. Supreme Court, holding that such collection is analogous to fingerprinting and falls within the ambit of a lawful search under the Fourth Amendment.

Post-King,[60] U.S. states now authorise DNA sampling at the time of booking for individuals facing felony charges. DNA evidence is admitted in court under the Frye or Daubert standards for scientific testimony, with courts generally treating it as reliable and probative.

Nonetheless, privacy concerns persist. States vary in rules governing the retention and expungement of DNA profiles for arrestees who are not convicted. While the general trend in U.S. jurisprudence has favoured broad DNA databasing, there is growing public debate around the implications of mass genetic surveillance.

India: Position and Emerging Framework: On the other hand, India's constitutional and legislative views on DNA evidence are still developing. In 2023, the Bharatiya Sakshya Adhiniyam (BSA) and the Bharatiya Nagarik Suraksha Sanhita (BNSS) established a systematic framework for DNA evidence collecting and admission. DNA evidence is accepted as expert testimony under BSA section 39,[61] whereas BNSS sections 51–52 permit the accused to be medically examined to acquire DNA.[62] However, the Indian courts, while accepting DNA evidence as admissible, have issued cautionary rulings to ensure compliance with constitutional safeguards.

For instance, in Selvi v State of Karnataka, the Supreme Court clarified that DNA samples, being physical evidence, do not attract Article 20(3) protections.[63]

[59] *Maryland v King* [2013] 569 US 435
[60] *Ibid*
[61] Bharatiya Sakshya Adhiniyam 2023, s 39
[62] Bharatiya Nagarik Suraksha Sanhita 2023, ss 51-52
[63] *Selvi v State of Karnataka* (2010) 7 SCC 263

Meanwhile, in Justice K.S. Puttaswamy v Union of India, the Court underscored the right to privacy under Article 21, requiring that DNA collection be guided by necessity and proportionality.[64]

Importantly, India does not yet have a standalone data protection statute regulating the storage and use of DNA profiles. The DNA Technology (Use and Application) Regulation Bill, 2019, remains pending, leaving a gap in legislative clarity regarding retention limits, consent, and oversight mechanisms. This distinguishes India from the UK and the US, where such policies are codified and subject to judicial review.

CONCLUSION

The incorporation of DNA fingerprinting into Indian criminal law represents a significant advancement at the nexus of law and science. The ability of DNA evidence to reliably identify people and prove or disprove involvement in a crime has made it a potent instrument in the administration of justice. The Bharatiya Sakshya Adhiniyam, 2023, and the Bharatiya Nagarik Suraksha Sanhita, 2023, have replaced the Indian Evidence Act, 1872, and the Code of Criminal Procedure, 1973, respectively, providing much-needed statutory clarity and modernisation to the way scientific and expert evidence is treated. By codifying the admission of DNA evidence and offering a framework for its legal collection and use, this legislation demonstrates an institutional commitment to the growth of forensic science. However, the evidentiary strength of D//NA must not eclipse the constitutional safeguards that regulate its application. While the judiciary has recognised that DNA samples do not amount to testimonial compulsion under Article 20(3), the right to privacy under Article 21 requires that the collection, analysis, and retention of genetic material be subjected to principles of necessity, proportionality, and informed consent.

Landmark decisions such as *Kathi Kalu Oghad*, *Selvi v State of Karnataka*, and *Justice K.S. Puttaswamy v Union of India* reflect a consistent judicial emphasis on balancing investigative needs with individual rights. Moreover, judgments like *Manoj v State of Madhya Pradesh* reveal the dangers of relying on DNA reports that lack statistical rigour or scientific transparency.

[64] *Justice K S Puttaswamy v Union of India* (2017) 10 SCC 1

Thus, DNA evidence must not be seen as a conclusive substitute for thorough investigation, corroboration, and procedural fairness. Courts must continue to assess their admissibility with caution and an understanding of their limitations. A forensic report devoid of probabilistic explanation or lacking scientific validation should not be treated as dispositive. DNA fingerprinting, though valuable, is not infallible.

SUGGESTIONS

To ensure that the application of DNA evidence complies with both scientific integrity and constitutional safeguards, there is an urgent need for a comprehensive statutory regime, such as the long-pending DNA Technology (Use and Application) Regulation Bill, 2019, that regulates the collection, storage, use, and destruction of DNA profiles. Such legislation must include clear consent protocols, retention limits, safeguards against misuse, and oversight mechanisms. Until such a law is enacted, courts must fill the vacuum through strict judicial scrutiny of forensic evidence and case-specific directions to protect privacy rights.

Further, trial courts and law enforcement agencies must be sensitised to the scientific dimensions of DNA analysis, including population frequency statistics and the importance of the chain of custody. Judicial education on forensic science should be institutionalised to prevent uncritical reliance on DNA reports, especially when unsupported by contextual or corroborative evidence. In sum, the admissibility and application of DNA evidence must be grounded not only in technological reliability but also in the principles of fairness, transparency, and constitutionality. Only then can DNA fingerprinting serve its rightful role in advancing justice without compromising individual liberties.