EVIDENTIARY VALUE OF DNA AND ITS UTILIZATION BY THE JUDICIARY

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ABSTRACT

Deoxyribonucleic Acid (DNA) evidence has revolutionized criminal and civil justice by providing highly accurate means of individual identification and relationship determination. As a unique genetic marker for every person (except identical twins), DNA profiling has become a critical tool in investigating crimes, resolving paternity disputes, identifying missing persons, and even in mass disaster victim identification. In India, courts have increasingly relied on DNA evidence, recognizing its ability to strengthen fact-finding and reduce wrongful convictions. However, its use also raises important legal, ethical, and procedural challenges. The admissibility of DNA evidence under the Bharatiya Sakshya Adhiniyam,2023 depends on relevance, reliability, and proper collection, preservation, and analysis of samples. Judicial decisions have elaborated principles governing compulsory DNA testing, admissibility of expert testimony under Sections 39 and 45 of the Bharatiya Sakshya Adhiniyam, and the exercise of judicial discretion in ordering DNA analysis. Constitutional concerns, particularly the right to privacy, bodily integrity, and the protection against self-incrimination under Article 20(3), have been carefully balanced with the probative value of such evidence. This paper critically examines the evidentiary value of DNA profiling in India, explores key judicial pronouncements, and draws comparative lessons from jurisdictions with established forensic legislation. It also discusses pressing challenges, including the absence of a comprehensive DNA law, risk of misuse, chain-of-custody issues, and privacy concerns. The study concludes that DNA evidence is indispensable to modern justice but must be supported by statutory safeguards, rigorous procedures, and judicious evaluation to uphold fairness and constitutional values.

Keywords: DNA Evidence, Bharatiya Sakshya Adhiniyam, Paternity Disputes, Right to Privacy, Chain of Custody, Forensic Legislation

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INTRODUCTION

The evidentiary landscape of modern law has undergone a paradigm shift with the advent of science and technology, and among the most significant of these innovations is Deoxyribonucleic Acid (DNA) profiling. DNA, the genetic blueprint unique to every individual, has emerged as an invaluable tool in the pursuit of truth within the justice system. It provides a level of precision and reliability previously unattainable, transforming the way courts approach questions of identity, paternity, and criminal culpability. Internationally, the significance of DNA evidence was first recognized in the 1980s, most notably in the landmark case of *R v. Pitchfork (1988, UK)*, where DNA analysis led to the first conviction in a double murder case and simultaneously exonerated an innocent suspect.[2] This groundbreaking use of DNA established it as the "*gold standard*" of forensic science, setting the stage for its global acceptance as a trustworthy means of linking suspects to crimes and excluding the innocent.

In India, the judiciary has cautiously but progressively embraced DNA evidence, mindful of the delicate balance between scientific truth-seeking and constitutional guarantees of due process, privacy, and bodily autonomy. The **Bharatiya Sakshya Adhiniyam,2023**, particularly Sections 39 and 45, provides the legal foundation for the admissibility of expert opinion, under which DNA evidence is brought into consideration.[3] Judicial pronouncements have since elaborated on the circumstances under which DNA testing may be ordered, its probative value, and the safeguards necessary to prevent misuse. This article explores the legal framework, judicial interpretation, and evidentiary significance of DNA in Indian law. It critically examines landmark judgments, comparative perspectives, and the emerging challenges of privacy, data protection, and the absence of comprehensive legislation, while underlining DNA's indispensable role in strengthening justice delivery.

CONCEPT AND SCIENCE OF DNA EVIDENCE

Deoxyribonucleic Acid (DNA) is the fundamental building block of life, carrying the genetic instructions that determine the biological characteristics of every individual. Found within the nucleus of nearly every cell in the human body, DNA is a double-helical molecule

[2] R v. Pitchfork, [1988] EWCA Crim 1 (UK) (recognizing for the first time the use of DNA profiling in criminal investigation leading to conviction and exoneration)
[3] Bharatiya Sakshya Adhiniyam, No. 45 of 2023, §§ 39, 45 (India) (providing statutory basis for admissibility of expert opinion including DNA evidence).

composed of nucleotides, which are arranged in sequences unique to each person, except in the rare case of identical twins.[4] This uniqueness forms the very basis for its use as a tool of identification in legal and forensic contexts.

DNA evidence is extracted from a wide range of biological materials, including blood, semen, saliva, hair follicles, bone, and other tissues. Even trace amounts of these samples can yield sufficient genetic material for analysis, thanks to modern forensic techniques. The most common methods employed in India for DNA profiling are "Polymerase Chain Reaction (PCR)" and "Short Tandem Repeat (STR) analysis".[5] PCR enables scientists to amplify minute quantities of DNA to generate sufficient material for testing, while STR analysis focuses on examining specific repeating sequences in the DNA strand that vary greatly among individuals. These variations form a genetic "fingerprint" that can be matched with a high degree of accuracy.

The probative value of DNA evidence stems from its "extraordinary statistical reliability". When properly collected, preserved, and analyzed, DNA matching offers probabilities as high as "one in a billion" that the profile could belong to someone else. This level of certainty far surpasses traditional forms of identification such as eyewitness testimony, which is prone to human error. Consequently, DNA has been hailed as one of the most significant scientific advancements in forensic investigation. However, the reliability of DNA evidence is contingent upon strict adherence to procedural safeguards, including proper chain of custody, contamination prevention, and validation of testing protocols. Any lapse at the collection or analysis stage can compromise its integrity, rendering it vulnerable to challenge in court. Thus, while DNA represents the pinnacle of forensic science, its evidentiary weight is only as strong as the scientific rigor and procedural fairness that govern its use.

LEGAL FRAMEWORK IN INDIA

The legal regime governing the admissibility of DNA evidence in India is primarily rooted in the Bharatiya Sakshya Adhiniyam,2023. Although the Act does not expressly mention DNA profiling, the judiciary has interpreted its provisions to bring such scientific evidence within

[4] ALBERTS ET AL., MOLECULAR BIOLOGY OF THE CELL 101–104 (6th ed. 2014) (explaining DNA's structure and uniqueness except in identical twins)
[5] NATIONAL RESEARCH COUNCIL, THE EVALUATION OF FORENSIC DNA EVIDENCE 55–60 (Nat'l Acad. Press 1996) (detailing PCR and STR analysis as standard DNA profiling techniques).

the fold of admissible material.

The principal provision invoked for this purpose is Sections 39 and 45, which deals with the opinion of experts.[6] Under this section, when the Court must form an opinion on a point of science, the opinion of a person especially skilled in such science is deemed relevant. DNA analysis, being a highly technical scientific process, therefore falls squarely within the ambit of expert opinion evidence.

Apart from Sections 39, Sections 45 is also relevant, as it allows facts that support or are inconsistent with expert opinion to be proved, thereby enabling the Court to evaluate the credibility and reliability of DNA evidence. Nevertheless, admissibility alone is not sufficient; the Court must also be convinced of the evidentiary weight and the reliability of the methods used, as improper collection, contamination, or tampering may compromise the integrity of DNA evidence.

A unique dimension of DNA evidence in India arises from its interaction with *Sections 116 of the Bharatiya Sakshya Adhiniyam*, which provides that a child born during the subsistence of a valid marriage, or within 280 days of its dissolution, is conclusively presumed to be the legitimate child of the husband, unless it can be shown that the parties had no access to each other at the relevant time.[7] This presumption, designed to protect the sanctity of marriage and the social status of children, has occasionally clashed with the scientific accuracy of DNA evidence.

The Supreme Court's landmark decision in *Nandlal Wasudeo Badwaik v. Lata Badwaik (2014) 2 SCC 576* marked a significant development in this area. The Court held that where there is a conflict between the conclusive presumption of legitimacy under Sections 116 and scientifically accurate DNA test results, the latter should prevail.[8] The judgment emphasized that the purpose of judicial adjudication is to discover the truth, and when science provides a near-certain answer, the law must not be an impediment to justice. This progressive interpretation reflects the judiciary's willingness to harmonize statutory presumptions with

[6] Bharatiya Sakshya Adhiniyam, No. 45 of 2023, §§ 39, 45 (India) (providing legal basis for expert opinion evidence including scientific and technical matters)
[7] Bharatiya Sakshya Adhiniyam, No. 45 of 2023, § 116 (India) (Birth during marriage, conclusive proof of legtimacy).
[8] Nandlal Wasudeo Badwaik v. Lata Badwaik, (2014) 2 SCC 576, 15–18 (holding that DNA evidence prevails over statutory presumption when conflict arises)

modern scientific developments. In addition, courts have exercised discretion in ordering DNA tests, particularly in cases concerning paternity disputes, criminal trials involving sexual offences, and identification of deceased persons. The Supreme Court in *Banarsi Dass v. Teeku Dutta (2005) 4 SCC 449* cautioned that DNA tests should not be ordered routinely, as they have the potential to invade personal privacy and disturb familial relationships.[9] Thus, judicial orders for DNA testing must strike a balance between the quest for truth and the right to privacy under Article 21 of the Constitution.

Collectively, these judicial pronouncements form the backbone of the legal framework on DNA evidence in India. They demonstrate the evolving nature of the law, where courts strive to ensure that legal presumptions do not override scientific truth, thereby aligning the justice system with technological progress.

JUDICIAL INTERPRETATION AND KEY CASE LAW ON DNA EVIDENCE IN CRIMINAL TRIALS

The judiciary in India has played a pivotal role in shaping the contours of DNA evidence within the criminal justice system. Courts have recognized that while DNA profiling is a powerful tool in identifying perpetrators and exonerating the innocent, its use must be carefully scrutinized to ensure that it does not infringe constitutional rights or result in miscarriages of justice. Through a series of landmark decisions, the judiciary has elaborated on the admissibility, probative value, and limitations of DNA evidence.

One of the most significant cases where DNA evidence played a decisive role is *Mukesh & Anr. v. State (NCT of Delhi) (2017) 6 SCC 1*, popularly known as the *Nirbhaya gang-rape and murder case*.[10] The Supreme Court, while upholding the conviction and death penalty of the accused, relied heavily on DNA evidence to corroborate the chain of circumstances. Biological samples collected from the victim, crime scene, and accused were subjected to DNA profiling, which conclusively established the presence of the accused at the scene of the crime.[11] The Court observed that the DNA evidence, along with other forensic reports,

[9] Banarsi Dass v. Teeku Dutta, (2005) 4 SCC 449, 13–15 (India) (cautioning against routine ordering of DNA tests to protect privacy and family integrity).
[10] Mukesh & Anr. v. State (NCT of Delhi), (2017) 6 SCC 1 (India) (popularly known as the Nirbhaya case; affirming convictions and upholding death penalty with reliance on DNA evidence). Available at: (https://indiankanoon.org/doc/200185515/).
[11] Central Forensic Science Laboratory, Directorate of Forensic Science Services, Govt. of India, "DNA Profiling Report – Nirbhaya Case" (2013) (submitted before trial court to corroborate chain of circumstances).

provided scientific certainty that went beyond reasonable doubt and played a crucial role in securing justice.

In *Krishan Kumar Malik v. State of Haryana (2011) 7 SCC 130*, the Supreme Court held that in prosecutions for sexual offences, the evidence of the prosecutrix, if found credible, may be sufficient for conviction.[12] However, the Court also highlighted that scientific techniques such as DNA profiling add corroborative value and help rule out false accusations. The judgment encouraged investigating agencies to make DNA testing a regular feature in sexual assault investigations to strengthen the evidentiary base.

Another noteworthy decision is *Kanchan Bedi v. Gurpreet Singh Bedi (2012) 12 SCC 476*, where the Court reiterated that DNA testing is the most legitimate and scientifically accurate means of establishing biological relationships and can be relied upon even in sensitive cases where social and moral issues are involved.[13]

The judiciary has also addressed concerns about over-reliance on DNA evidence. In *Selvi v. State of Karnataka (2010) 7 SCC 263*, though primarily dealing with narco-analysis and polygraph tests, the Supreme Court cautioned against coercive collection of bodily samples, emphasizing that the right to privacy and bodily integrity under *Article 21* must be respected.[14] This principle applies equally to DNA sampling, making judicial oversight a crucial safeguard.

Furthermore, in *Santosh Kumar Singh v. State (2010) 9 SCC 747 (Priyadarshini Mattoo case)*, the Court highlighted how the failure to properly collect and preserve DNA evidence during investigation led to initial acquittals and delayed justice.[15] This case underscores the importance of maintaining a proper chain of custody and following forensic protocols to preserve the evidentiary value of DNA samples.

Collectively, these decisions reveal that Indian courts have embraced DNA profiling as a

[12] Krishan Kumar Malik v. State of Haryana*, (2011) 7 SCC 130, 37–39 (India) (encouraging use of DNA profiling to rule out false accusations and corroborate victim testimony). Available at: (https://indiankanoon.org/doc/1658029/).
[13] Kanchan Bedi v. Gurpreet Singh Bedi*, (2012) 12 SCC 476 (India) (approving DNA testing as legitimate and accurate means of establishing paternity).
[14] Selvi v. State of Karnataka*, (2010) 7 SCC 263, 206–212 (India) (holding that coercive techniques infringe Article 21 and must be subject to judicial scrutiny). Available at: (https://indiankanoon.org/doc/338008/).
[15] Santosh Kumar Singh v. State*, (2010) 9 SCC 747 (India) (Priyadarshini Mattoo case; stressing importance of proper chain of custody and forensic protocol to ensure justice). Available at: (https://indiankanoon.org/doc/323528/).

reliable and objective form of evidence, especially in cases involving sexual offences, homicide, and other grave crimes. However, the judiciary continues to insist on strict compliance with procedural safeguards, including proper collection, storage, and documentation of samples, to eliminate the possibility of contamination or tampering. The overarching judicial approach reflects a balance between leveraging scientific advancements to strengthen prosecution cases and safeguarding the rights of the accused to ensure a fair trial.

PRIVACY CONCERNS, ETHICAL ISSUES, AND THE NEED FOR A DNA PROFILING LAW IN INDIA

While DNA profiling has become an indispensable tool in the pursuit of justice, it simultaneously raises complex questions concerning privacy, ethics, and the potential for misuse. The extraction, storage, and analysis of an individual's genetic material involves intimate information that goes far beyond mere identification. DNA can reveal sensitive details about a person's health, ancestry, and biological relationships.[16] Thus, its use in legal proceedings must be weighed against the fundamental right to privacy and the constitutional guarantees of dignity and bodily autonomy under Article 21 of the Constitution of India.

The *right to privacy* was explicitly recognized as a fundamental right in *Justice K.S. Puttaswamy (Retd.) v. Union of India (2017) 10 SCC 1*, where a nine-judge bench of the Supreme Court unanimously held that privacy is intrinsic to the right to life and personal liberty under Article 21.[17] The judgment underscored that any State action infringing privacy must satisfy the tests of legality, necessity, and proportionality. Applied to DNA profiling, this means that the collection of biological samples must have a clear legal basis, must be necessary for a legitimate state interest (such as crime investigation), and must be proportionate to that purpose. Indiscriminate or mass collection of DNA data without sufficient safeguards would violate constitutional principles.

Concerns have been raised that misuse of DNA information could lead to violations of individual rights. For instance, unauthorized access to DNA databases could enable surveillance, discrimination based on genetic traits, or stigmatization of individuals and

[16] NATIONAL HUMAN RIGHTS COMMISSION, Human Rights Issues in Forensic Science: DNA Profiling (2018) (discussing ethical concerns about DNA revealing sensitive genetic information).
[17] Justice K.S. Puttaswamy (Retd.) v. Union of India*, (2017) 10 SCC 1, 297–310 (India) (recognizing right to privacy as intrinsic to right to life and liberty). Available at: (https://indiankanoon.org/doc/91938676/).

communities.[18] The possibility of planting, tampering, or contamination of biological samples further complicates matters, as it could lead to wrongful convictions. Hence, robust safeguards are essential to ensure that DNA evidence does not become an instrument of injustice.

Recognizing these concerns, the Government of India introduced the *DNA Technology (Use and Application) Regulation Bill, 2019*.[19] The Bill seeks to regulate the use of DNA technology for establishing identity in criminal matters, paternity disputes, missing persons investigations, and disaster victim identification. It proposes the creation of a *DNA Regulatory Board* to oversee laboratories, set quality standards, and ensure accuracy and reliability of tests. The Bill also envisages the establishment of national and regional DNA databanks, with strict rules for retention, access, and destruction of DNA profiles to prevent misuse.

However, the Bill has also attracted criticism for potential privacy risks. Critics argue that the creation of large DNA databases could lead to state surveillance and profiling, especially if not backed by strong data protection legislation. The Bill's provisions on consent have also been debated, as they allow for collection of DNA samples in certain circumstances without the individual's consent, which may conflict with the principles laid down in Puttaswamy.

From an ethical standpoint, DNA profiling must be conducted with respect for human dignity. The principle of informed consent is critical, particularly in civil disputes such as paternity cases, where compelling a person to undergo DNA testing may intrude upon personal autonomy. Courts have therefore exercised caution in ordering such tests, balancing the interest of justice with the individual's right to privacy and family integrity.

The need for a comprehensive statutory framework is urgent. A well-drafted DNA law should provide:

I. Clear legal authority: for collection and use of DNA evidence.

II. Procedural safeguards: to prevent unlawful collection, contamination, or tampering

[18] . Vidhi Centre for Legal Policy, *Comments on the DNA Technology Regulation Bill, 2019* (2019) (warning against risk of misuse, surveillance, and discrimination). Available at: https://vidhilegalpolicy.in/research/the-dna-technology-bill-2019/.

[19] The DNA Technology (Use and Application) Regulation Bill, 2019, Bill No. 128 of 2019 (India). Full text available at: (https://prsindia.org/billtrack/the-dna-technology-use-and-application-regulation-bill-2019).

of samples.

III. Independent regulatory oversight: to maintain quality and reliability of laboratories.

IV. Strict privacy protections: including data minimization, purpose limitation, and time-bound destruction of profiles.

V. Penalties for misuse: of genetic information by authorities or private parties.

In conclusion, while DNA profiling strengthens the truth-seeking function of courts, its unregulated or indiscriminate use could threaten fundamental rights. Balancing technological advancement with constitutional values is therefore essential. A robust legislative framework, coupled with judicial vigilance, can ensure that DNA evidence serves the cause of justice without compromising privacy and dignity.

COMPARATIVE PERSPECTIVES – USE OF DNA EVIDENCE IN FOREIGN JURISDICTIONS

The evolution of DNA evidence in the legal systems of other countries offers valuable insights for India as it continues to refine its own jurisprudence on this subject. Jurisdictions such as the **United Kingdom, the United States, and the European Union** have pioneered the use of DNA profiling, developed robust legislative frameworks, and addressed key ethical and privacy concerns through statutory and judicial safeguards. A comparative analysis of these systems highlights best practices that can guide Indian lawmakers and courts in striking a balance between scientific progress and fundamental rights.

1) UNITED KINGDOM: THE CRADLE OF DNA PROFILING

The United Kingdom holds the distinction of being the birthplace of DNA profiling. The first successful application of DNA evidence was in *R v. Pitchfork (1988)*, where the accused Colin Pitchfork was convicted for the rape and murder of two teenage girls.[20] This case demonstrated DNA's unique ability to link an offender to a crime with scientific certainty, revolutionizing forensic investigation.

The UK established the *National DNA Database* (NDNAD) in 1995, one of the largest and

[20] R v. Pitchfork, (1988) Crim LR 674 (UK) (first case where DNA evidence led to conviction in a double murder-rape case).

most comprehensive databases in the world.[21] Under the *Criminal Justice and Public Order Act, 1994*, police were empowered to collect and retain DNA samples from individuals arrested for recordable offences. However, in *S. & Marper v. United Kingdom (2008) ECHR 1581*, the *European Court of Human Rights* (ECHR) held that indefinite retention of DNA profiles of persons not convicted of any offence violated Article 8 of the European Convention on Human Rights (right to privacy).[22] Following this judgment, the UK enacted the *Protection of Freedoms Act, 2012*, which mandated the destruction of DNA samples of individuals not charged or convicted, except in limited circumstances.[23] This reform underscores the UK's approach of combining scientific utility with robust privacy safeguards.

2) UNITED STATES: EMPHASIS ON DUE PROCESS AND RELIABILITY

The United States has also been a leader in the adoption of DNA technology. The *Federal Bureau of Investigation* (FBI) established the *Combined DNA Index System* (CODIS), a tiered national database that allows state, local, and federal agencies to exchange and compare DNA profiles.[24] The *DNA Identification Act, 1994* provides the legal framework for CODIS and sets quality assurance standards for laboratories.

American jurisprudence has consistently emphasized due process and reliability in admitting DNA evidence. In *Daubert v. Merrell Dow Pharmaceuticals, Inc. (1993) 509 U.S. 579*, the U.S. Supreme Court laid down the "*Daubert Standard*" for admissibility of expert scientific evidence, requiring that the methodology used must be testable, peer-reviewed, have a known error rate, and enjoy general acceptance in the scientific community.[25] This standard has been applied to DNA evidence, ensuring its scientific validity before it is presented in court.

The United States has also used DNA evidence to exonerate wrongfully convicted individuals through initiatives like the "*Innocence Project"*, which has overturned hundreds of

[21] NATIONAL DNA DATABASE, UK HOME OFFICE, Annual Report (2021). Available at:(https://www.gov.uk/government/collections/national-dna-database-statistics).
[22] S. & Marper v. United Kingdom, (2008) ECHR 1581, 119–125 (holding indefinite retention of DNA samples of unconvicted persons violates Article 8 ECHR).
[23] Protection of Freedoms Act, 2012 (UK), c. 9, Part 1 (requiring destruction of biometric data for those not charged or acquitted).
[24] FBI, CODIS and NDIS Fact Sheet (2023). Available at: https://www.fbi.gov/how-we-can-help-you/dna-fingerprint.
[25] Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579 (1993), 593–595 (establishing scientific reliability standard for expert testimony).

convictions based on post-conviction DNA testing.[26] This highlights the dual role of DNA evidence: it not only strengthens prosecution cases but also protects against miscarriages of justice.

3) EUROPEAN UNION: HARMONIZATION AND DATA PROTECTION

The European Union has taken a harmonized approach to the cross-border use of DNA data. The *Prüm Convention* (2005) facilitates the exchange of DNA profiles among member states for the purposes of combating terrorism and serious crime, thereby enhancing international cooperation.[27] However, the EU's strong data protection framework, particularly under the *General Data Protection Regulation* (GDPR), ensures that genetic data is treated as "*special category data*" subject to stringent safeguards.[28] Consent, necessity, and proportionality are central to its processing, reflecting the EU's commitment to privacy.

LESSONS FOR INDIA

The comparative experience of these jurisdictions offers critical lessons for India. First, it highlights the importance of "*comprehensive legislation*" to regulate the collection, storage, and retention of DNA profiles. Second, it underscores the need for "*judicial oversight"* and privacy safeguards to prevent misuse and protect citizens' fundamental rights. Third, international practice shows that DNA evidence must meet rigorous scientific standards to be admissible, thereby reinforcing the integrity of the justice system.

India's proposed *DNA Technology (Use and Application) Regulation Bill, 2019* attempts to create a legal framework similar to those seen abroad, but it must be supplemented with robust data protection laws and independent regulatory mechanisms to gain public trust. By adopting global best practices, India can ensure that DNA technology serves as a powerful instrument of justice without compromising individual liberty and dignity.

EVIDENTIARY VALUE OF DNA EVIDENCE

The evidentiary value of DNA evidence in India has been consistently recognized as

[26] The Innocence Project, DNA Exonerations in the United States (2023). Available at: (https://innocenceproject.org/dna-exonerations-in-the-united-states/).
[27] COUNCIL OF THE EUROPEAN UNION, Prüm Convention (2005), Official Journal of the European Union C 115/1. Available at: (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:42005A0514%2801%29).
[28] General Data Protection Regulation (GDPR), Regulation (EU) 2016/679, Art. 9 (classifying genetic data as special category data with heightened protections).

exceptionally high, owing to its scientific precision and objectivity. Under *Section 39 of the Bharatiya Sakshya Adhiniyam,2023*, DNA evidence is admissible as the opinion of an expert in the field of science.[29] The courts have repeatedly affirmed that expert testimony, including DNA analysis, assists the court in forming a conclusion but does not bind the judge. This principle was articulated in *State of H.P. v. Jai Lal (1999) 7 SCC 280*, where the Supreme Court held that expert opinion is advisory in nature, and the court must evaluate it alongside other evidence before reaching a final verdict.[30]

DNA profiling, by virtue of its scientific reliability, is often regarded as one of the most trustworthy forms of forensic evidence. It provides near-certain identification, linking an accused to a crime scene or excluding innocent suspects with remarkable accuracy. The probative force of DNA evidence was particularly highlighted in *Krishna Kumar Malik v. State of Haryana (2011) 7 SCC 130*, where the Supreme Court upheld the conviction of the accused for rape, placing substantial reliance on DNA test results that corroborated the testimony of the prosecutrix.[31] The Court observed that DNA profiling had attained global acceptance as a reliable forensic tool and should be utilized by investigating agencies wherever possible to strengthen prosecution cases.

However, Indian courts have simultaneously exercised caution in placing absolute reliance on DNA evidence. This is because the reliability of DNA findings depends on a rigorous chain of custody, proper sample collection, and contamination-free storage. Any procedural lapse, tampering, or mishandling of biological evidence can render the results questionable.[32] Hence, courts have generally preferred to treat DNA evidence as corroborative rather than conclusive, except in cases where it is free from doubt and supported by other circumstantial or direct evidence.

Judicial practice reflects a balanced approach: while acknowledging DNA as a powerful truth-determining mechanism, the courts remain mindful of its limitations and potential for misuse. The guiding principle remains that expert evidence, including DNA, must be weighed

[29] Bharatiya Sakshya Adhiniyam, 2023, § 39 (provides for admissibility of expert opinion including scientific evidence).
[30] State of H.P. v. Jai Lal, (1999) 7 SCC 280, 17 (holding that expert evidence is only advisory in nature).
[31] Krishna Kumar Malik v. State of Haryana, (2011) 7 SCC 130, 31–33 (relying on DNA profiling to confirm guilt).
[32] Sharma, R. & Choudhary, S., "Chain of Custody in Forensic Science: Safeguarding Integrity of Evidence," Indian Journal of Forensic Medicine & Toxicology, Vol. 15(3), 2021, pp. 45–52. Available at: (https://www.forensicmedjournal.in).

holistically with the entire body of evidence—oral testimony, circumstantial facts, and documentary proof—to ensure that justice is served.

Thus, DNA evidence holds significant evidentiary value in the Indian legal system, but it is not infallible. Its strength lies not only in its scientific foundation but also in the procedural integrity with which it is collected, preserved, and presented in court. When handled with due diligence, DNA can be the linchpin of prosecution or defense; when mishandled, it risks undermining justice rather than securing it.

CONSTITUTIONAL CONCERNS

The admissibility and use of DNA evidence in India must be assessed in light of constitutional protections, particularly Article 20(3) and Article 21 of the Constitution of India. Article 20(3) guarantees that no person accused of an offence shall be compelled to be a witness against himself — a cornerstone of the right against self-incrimination.[33]

In *State of Bombay v. Kathi Kalu Oghad (1962) SCR Supl. (3) 10*, an eleven-judge Bench of the Supreme Court provided clarity on the scope of Article 20(3). The Court held that "*testimonial compulsion*" implies forcing an accused to provide personal knowledge of relevant facts, thereby acting as a witness against oneself. However, giving fingerprints, specimen handwriting, voice samples, or other physical evidence was held not to amount to testimonial compulsion because such acts do not involve conveying personal knowledge but only furnishing physical evidence.[34]

This principle has direct relevance for DNA profiling. Collecting a blood, saliva, or hair sample for DNA analysis is seen as providing physical evidence rather than testimonial testimony, and hence is not barred by Article 20(3). Consequently, courts have consistently upheld the permissibility of DNA testing when ordered by competent authorities.[35]

Nevertheless, the constitutional inquiry does not end there. Article 21, which guarantees the right to life and personal liberty, has been interpreted expansively to include the right to privacy and bodily integrity. Following *Justice K.S. Puttaswamy v. Union of India (2017) 10 SCC 1*, any intrusion into bodily autonomy must satisfy the tests of legality, necessity, and

[33] INDIAN CONSTITUTION art. 20, cl. 3 (guaranteeing protection against self-incrimination).
[34] State of Bombay v. Kathi Kalu Oghad*, (1962) SCR Supl. (3) 10, 10–15.
[35] Gautam, A., Law Relating to DNA Evidence in India, Eastern Book Company (Lucknow, 2022), pp. 55–60

proportionality.[36] Compulsory DNA testing, therefore, must be backed by law, serve a legitimate state interest such as criminal investigation or paternity determination, and be proportionate to the purpose sought to be achieved.

Thus, while DNA collection per se does not violate Article 20(3), it must be conducted in a constitutionally compliant manner — ensuring voluntary consent wherever possible, judicial oversight when necessary, and adequate safeguards to prevent misuse or arbitrary action.[37]

CHALLENGES AND LIMITATIONS

Despite its revolutionary potential, the use of DNA evidence in India faces several structural, legal, and ethical challenges that restrict its optimal utility in the justice delivery system.

A. Absence of a Comprehensive Legal Framework

India currently lacks a dedicated and comprehensive statute regulating DNA profiling. While DNA evidence is admissible under *Sections 39 of the Bharatiya Sakshya Adhiniyam,2023*, there is no codified law governing its collection, preservation, and use. The *DNA Technology (Use and Application) Regulation Bill, 2019*, which seeks to establish a national DNA data bank, regulate laboratories, and lay down safeguards against misuse, remains pending in Parliament.[38] The absence of such legislation creates ambiguity regarding procedural safeguards, data retention, and consent protocols — leaving room for arbitrariness and misuse.

B. Privacy and Constitutional Concerns

The landmark judgment of *Justice K.S. Puttaswamy v. Union of India (2017) 10 SCC 1* elevated the right to privacy to the status of a fundamental right under Article 21 of the Constitution. This development has significant implications for DNA collection and storage. DNA profiles contain sensitive personal information that may reveal not only identity but also genetic disorders and familial relationships. Without a robust legal framework to regulate access and retention, there is a risk of state overreach, surveillance, and potential breaches of

[36] Justice K.S. Puttaswamy (Retd.) v. Union of India*, (2017) 10 SCC 1, 297–310 (laying down proportionality test for privacy infringements).
[37] Singh, A., "DNA Profiling and Privacy in India: Need for a Balanced Approach," NUJS Law Review, Vol. 12(2), 2020, pp. 212–230. Available at: https://nujslawreview.org.
[38] DNA Technology (Use and Application) Regulation Bill, 2019, Bill No. XXVII of 2019 (India).

informational privacy.[39]

C. Risk of Misuse and Wrongful Convictions

DNA evidence, though highly reliable, is not infallible. Risks of contamination, tampering, and human error in collection or interpretation can lead to false incrimination. Mishandling of biological samples — whether during collection at the crime scene or during storage — can produce misleading results. The absence of mandatory guidelines for maintaining the "*chain of custody*" increases the risk of wrongful convictions.

D. Infrastructural and Institutional Gaps

A significant bottleneck in India's criminal justice system is the shortage of forensic infrastructure. According to the *National Crime Records Bureau (NCRB) 2020 report*, forensic laboratories across the country face massive backlogs, delaying examination and thereby slowing down the trial process.[40] There is also a shortage of trained forensic experts, leading to compromised quality and credibility of reports.

E. Financial and Logistical Barriers

Setting up state of the art DNA laboratories and maintaining them to global standards involves heavy financial investment. Many states lack adequate budgetary allocation, resulting in uneven access to DNA testing facilities across the country. This creates disparity in justice delivery, particularly in rural and underdeveloped regions.

In summary, while DNA evidence has unparalleled probative value, its potential is undermined by systemic and procedural shortcomings. The way forward lies in "passing a robust DNA profiling law", strengthening forensic infrastructure, training personnel, and creating privacy-compliant protocols. Only then can DNA evidence truly fulfill its promise as a pillar of accurate, speedy, and fair justice in India.

FUTURE DIRECTIONS AND RECOMMENDATIONS

To overcome the challenges identified above and ensure that DNA evidence serves as a tool

[39] "Privacy and DNA Profiling," Vidhi Centre for Legal Policy (2021), available at: (https://vidhilegalpolicy.in).
[40] National Crime Records Bureau (NCRB), Crime in India 2020: Statistics, Ministry of Home Affairs, Govt. of India.

for justice rather than injustice, the following reforms are recommended:

a) **Enactment of a Comprehensive DNA Law:** Expedite the passage of the *DNA Technology (Use and Application) Regulation Bill, 2019*, ensuring it incorporates strong privacy safeguards, consent requirements, and clear data-retention policies.

b) **Strengthening Forensic Infrastructure:** Establish well-equipped DNA laboratories in every state and ensure they are accredited and monitored by a central regulatory authority to maintain uniform quality standards.

c) **Training and Capacity-Building:** Regularly train police, forensic personnel, and judicial officers on proper collection, handling, and interpretation of DNA evidence to minimize errors and contamination.

d) **Standardizing Chain-of-Custody Protocols:** Create mandatory, uniform procedures for sample collection, storage, and transfer to ensure integrity and admissibility of DNA evidence in court.

e) **Data Protection and Privacy Compliance:** Integrate safeguards consistent with *Puttaswamy (2017)* and global best practices to prevent misuse of DNA profiles and protect individuals' informational privacy.

f) **Public Awareness and Transparency:** Promote awareness campaigns about the role of DNA evidence in justice delivery and the rights of individuals during collection and testing, enhancing public trust.

g) **Adequate Funding and Resource Allocation:** Increase budgetary support for forensic science infrastructure and research to make DNA testing affordable and accessible across urban and rural areas alike.

The future of DNA evidence in India is promising but contingent upon addressing these systemic challenges. With robust legislation, improved forensic infrastructure, and strict procedural safeguards, DNA profiling can significantly enhance the criminal justice system's ability to deliver fair and timely justice. At the same time, ethical and privacy concerns must remain at the forefront, ensuring that technological advancement does not come at the cost of constitutional liberties. The ultimate goal should be a forensic system that is scientifically

sound, legally robust, and socially responsible—one that harnesses the power of DNA to protect both the innocent and the integrity of justice.

CONCLUSION

DNA evidence has revolutionized the administration of justice, offering unmatched accuracy in identifying individuals, establishing biological relationships, and reconstructing crime scenes. Indian courts, through cases like *Nandlal Wasudeo Badwaik v. Lata Badwaik and Krishan Kumar Malik v. State of Haryana*, have recognized its probative strength while cautioning against misuse. Its admissibility under Sections 39 and 45 of the *Bharatiya Sakshya Adhiniyam, 2023* underscores its growing acceptance as expert evidence. However, challenges such as the absence of a comprehensive DNA law, privacy concerns post-Puttaswamy, and infrastructural gaps must be addressed. The *DNA Technology (Use and Application) Regulation Bill, 2019* promises clarity but must include robust safeguards and independent oversight. The future of DNA evidence lies in legislative reform, forensic capacity building, and judicial prudence. When applied responsibly, DNA can simultaneously secure convictions and protect the innocent—strengthening both justice delivery and constitutional liberties.