Dna Fingerprinting and Its Legal Perspective in India

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***Abstract*—DNA fingerprinting has revolutionized forensic science, providing highly reliable identification methods for criminal investigations, paternity disputes, and disaster victim identification. In India, while the use of DNA technology has seen growing, its legal regulation has evolved gradually. This paper analyzes the scientific base of DNA profiling, its applicability in forensic investigations, and the legal perspective of DNA evidence in India. We will explore the historical development of DNA fingerprinting, its introduction into the Indian legal system, the regulatory framework surrounding its use and judicial development in India, recent trends, and ethical concerns, with a special focus on the implications of the new criminal laws—Bharatiya Nyaya Sanhita (BNS), 2023 and Bharatiya Nagarik Suraksha Sanhita (BNSS), 2023. Additionally, we will examine the ethical concerns and challenges associated with the use of DNA fingerprinting in the Indian legal context.**

***Index Terms*—DNA Fingerprinting, Forensic Science, Legal Perspective, India, DNA Evidence, DNA Profiling, Privacy, Ethics.**

I. INTRODUCTION

DNA fingerprinting is a method that helps identify people by analyzing their distinct genetic information[1]. It was first developed in 1984 by British geneticist Sir Alec Jeffreys and has since become a cornerstone of forensic science. The application of DNA profiling in criminal investigations, paternity disputes, and immigration cases has made it a vital tool in legal proceedings. However, as with any scientific advancement, the use of DNA evidence in the legal system raises important legal, ethical, and privacy concerns, especially in India, where legal frameworks and social norms sometimes lag behind technological advancements[2].

II. SCIENTIFIC BASIS OF DNA FINGERPRINTING

DNA fingerprinting involves analyzing specific regions of DNA that exhibit significant variability between individuals. The process is generally divided into several key stages:

- Collection of DNA Sample: DNA can be extracted from bodily fluids, hair, skin cells, or other biological material left at a crime scene.
- DNA Analysis: Short Tandem Repeats (STRs) or Variable Number Tandem Repeats (VNTRs) are commonly analyzed. These regions of DNA contain repeating sequences that vary significantly between individuals, making them ideal for identification.
- DNA Profiling: After extracting and analyzing DNA samples, a unique genetic profile is created, which is then compared with the profiles of suspects or databases.
- Matching DNA Profiles: A match or a mismatch of the DNA profiles can provide strong evidence to either confirm or eliminate the involvement of a suspect in a criminal case.

III. HISTORY AND DEVELOPMENT OF DNA FINGERPRINTING IN INDIA

The concept of DNA fingerprinting was introduced to India in the early 1990s. **Dr. Lalji Singh**, a renowned Indian geneticist, played a significant role in popularizing the technique in India. The first landmark case where DNA profiling was used in India was in 1995 in a paternity dispute case.

[1] https://www.sciencedirect.com/topics/immunology-and-microbiology/dna-fingerprinting (last visited May. 06, 2025).

[2] Jeffreys, A. J., et al. (1985). DNA Fingerprinting: The Basics and the Future. Nature.

Following this, DNA fingerprinting gained traction as a tool for criminal investigation.

The Indian government recognized the importance of DNA evidence in legal proceedings and began implementing it in criminal cases and paternity testing. However, the legal infrastructure surrounding DNA profiling in India was not formally established until later, leading to a growing need for legislation to regulate its use.

IV. SOURCES OF DNA FINGERPRINTING

DNA fingerprinting relies on biological samples containing DNA, such as blood, saliva, semen, hair, and skin cells, to create unique genetic profiles. These samples are collected from various sources, including crime scenes, individuals involved in legal matters, or for genetic testing[3].

1. Crime Scene Samples:

- Blood:

Blood stains, even small amounts, can provide a rich source of DNA for analysis[4].

- Saliva:

Saliva left on surfaces like doorknobs or drink containers can be analyzed.

- Semen:

Semen samples, even microscopic traces, can be analyzed for DNA identification[5].

- Hair:

Hair follicles, containing DNA, are a common source of evidence in criminal investigations.

- Tissues:

Any bodily tissue left at a crime scene can be a source of DNA[6].

2. Samples from Individuals:

- Blood: Blood samples are commonly taken for DNA fingerprinting[7].
- Skin: Even tiny flakes of skin can contain enough DNA for analysis.
- Hair: Hair roots are analyzed for DNA[8].
- Other body fluids: Urine, feces, and other body fluids can also be used for DNA fingerprinting.

3. Other Sources:

- Bone and Teeth:

In cases of mass disasters or unidentified remains, bone and teeth samples can be used for DNA fingerprinting.

- Cell Lines:

DNA fingerprinting can also be used to verify the identity and uniqueness of human cell lines.[9]

V. LEGAL FRAMEWORK AND DNA EVIDENCE IN INDIA

PRE-2023 PROVISIONS

- Section 53 & 53A of CrPC[10]: Allow medical examination of the accused, including DNA collection[11].
- Section 45 of Evidence Act[12]: Admissibility of expert opinions, including forensic and DNA evidence.

POST -2023 PROVISIONS

- The Criminal Procedure (Identification) Act, 2022[13]

[3] https://www.forensicsciencesimplified.org/dna/how.html#:~:text=Sources%20of%20DNA%20Evidence,%2C%20bone%2C%20tissue%20and%20cells (last visited May. 06, 2025).

[4] https://www.forensicsciencesimplified.org/dna/how.html . (last visited May. 06, 2025).

[5] https://www.forensicsciencesimplified.org/dna/how.html (last visited May. 06, 2025).

[6] https://www.forensicsciencesimplified.org/dna/DNA.pdf (last visited May. 06, 2025).

[7] https://www.webmd.com/a-to-z-guides/dna-fingerprinting-overview (last visited May. 06, 2025).

[8] https://www.webmd.com/a-to-z-guides/dna-fingerprinting-overview (last visited May. 06, 2025).

[9] https://www.atcc.org/resources/technical-documents/cell-line-authentication-test-recommendations (last visited May. 06, 2025).

[10] The Code of Criminal Procedure,1973.

[11] https://www.advocatekhoj.com/library/lawreports/custodialcrimes/85.php%3FTitle%3DCustodial%2520Crimes%26STitle%3DMedical%2520examination%2520of%2520the%2520accused

[12] Indian Evidence Act, 1872.

[13] https://www.mha.gov.in/sites/default/files/2022-11/CriminalPro_14112022%5B1%5D.pdf (last visited May. 06, 2025).

This law permits the collection of biometric and biological samples (including DNA) from convicts and accused for investigative purposes. However, concerns about data protection and privacy still prevails.

- Bharatiya Nyaya Sanhita (BNS), 2023[14]

Section 51: Allows police to collect DNA samples from people who are arrested for serious offences.

Section 52 & 53: Permit medical examination of the accused, including DNA profiling, to obtain evidence.

- Bharatiya Nagarik Suraksha Sanhita (BNSS), 2023[15]

Section 176(3): Mandates forensic and DNA evidence collection for offenses punishable with seven years or more; requires digital recording of the process.

Section 349: Empowers magistrates to order collection of DNA samples from individuals involved in proceedings.

Section 397: Obligates medical institutions to provide prompt treatment and preserve forensic evidence, including DNA, in rape and assault cases.

- The NDPS Act, 1985[16]

Though primarily focused on drug-related offenses, the NDPS Act includes provisions for DNA profiling to confirm the identities of drug offenders and prevent misidentification in narcotics-related crimes.

Section 67 (DNA in Narcotics Cases)[17]:

Section 67 of the NDPS Act allows for the collection of bodily fluids, including blood samples, from suspects involved in narcotics offenses for DNA profiling. This provision aids in identifying and linking suspects to drug-related crimes, particularly when direct physical evidence is absent.

These provisions modernize criminal investigations and aim to standardize the use of DNA in legal proceedings.

VI. JUDICIAL INTERPRETATION AND LANDMARK CASES

Several notable cases in India have highlighted the role of DNA fingerprinting in legal matters. These cases have had a significant impact on the acceptance of DNA evidence in Indian courts.

Kamti Devi v. Poshi Ram[18] (2001) :
Court emphasized DNA cannot override legal presumptions under Sec. 112 of the Evidence Act.

State of Uttar Pradesh vs. Rajesh Yadav[19] (2002):
In this case, DNA evidence played a crucial role in convicting the accused. The case involved a brutal murder, and the DNA of the accused was found to match the evidence at the crime scene. The case marked a significant moment in the use of DNA evidence to solve crimes in India.

Banarsi Dass v. Teeku Dutta[20] (2005) :
The court said, it is important to balance personal rights with the need to find the truth.

Selvi v. State of Karnataka[21] (2010) :
In this case the Supreme Court addressed the constitutionality of certain investigative techniques. The court ruled that compelling someone to undergo these tests without their consent violates Article 20(3) and constitutes a violation of the right to privacy and personal liberty. While taking DNA samples for physical evidence is not addressed in the same way, the case provides a framework for understanding the

[14] https://sudhirrao.com/section-51-bns-section-51-of-bharatiya-nyaya-sanhita-bns (last visited May. 06, 2025).
[15] https://www.indiacode.nic.in/handle/123456789/20099 (last visited May. 06, 2025).
[16] https://www.indiacode.nic.in/bitstream/123456789/18974/1/narcotic-drugs-and-psychotropic-substances-act-1985.pdf (last visited May. 06, 2025).
[17] https://www.drishtijudiciary.com/current-affairs/section-67-of-ndps-act (last visited May. 06, 2025).
[18] 5 SCC 311.
[19] 16S.C.R.967.
[20] 2005 SC 87.
[21] 7 SCC 263.

constitutional limitations on intrusive investigative techniques.

The Nirbhaya Rape Case[22] (2012):
In the infamous Nirbhaya case, DNA evidence was instrumental in identifying the perpetrators and securing convictions. The case highlighted the effectiveness of DNA fingerprinting in solving heinous crimes and the role of forensic science in the judicial process.

State of Gujarat v. Jayrajbhai Punjabhai Varu (2016) [23] :
Recognized DNA as vital forensic evidence.

K.S. Puttaswamy v. Union of India (2017) [24] :
Upheld right to privacy, affecting DNA data collection laws.

VII. RECENT CASE LAWS ON DNA FINGERPRINTING IN INDIA

- Matrimonial Disputes and Paternity:

- Aparna Ajinkya Firodia v. Ajinkya Arun Firodia (2023)[25]:

The Supreme Court emphasized that DNA tests in matrimonial disputes involving allegations of infidelity should not be ordered routinely. Such tests should only be directed when there is no other mode of proving the assertions, and the child's legitimacy should not be questioned frivolously.

- Nikhat Parveen v. Rafiqui (2023)[26]:

The Delhi High Court said that a DNA test can break the assumption that someone is the father of a child, as per Section 112 of the Indian Evidence Act.
The test showed the respondent wasn't the biological father, so he wasn't entitled to maintenance.

- Ivan Rathinam v. Milan Joseph (2025)[27]:

The Supreme Court reiterated that legitimacy determines paternity under Section 112 of the Indian Evidence Act until the presumption is successfully rebutted by proving 'non-access'. The Court emphasized that the Family Court cannot entertain proceedings for a declaration of legitimacy without a claim on the marital relationship.

- Criminal Cases and Forensic Evidence -

- Das @ Anu v. State of Kerala (2022)[28]:

The Kerala High Court said that the right against self-incrimination under Article 20(3) only applies to testimony.
Taking DNA samples in a criminal case, especially a sexual offence, does not violate this right.

- State of Karnataka v. X (2024)[29]:

The Karnataka High Court upheld the acquittal of the accused in a POCSO case, stating that it is "highly unsafe" to convict a person relying solely on a DNA test without corroborative evidence.

- Civil Matters and Inheritance-

- Rajkumar Gupta v. State (2023)[30] :

[22] Mukesh & Anr. v. State for NCT of Delhi & Ors., Criminal Appeal No. 609-610 of 2017, https://main.sci.gov.in/jonew/judis/44879.pdf (last visited May. 07, 2025).
[23] State of Gujarat v. Jayrajbhai Punjabhai Varu on 11 july 2016, https://indiankanoon.org/doc/14784813320 (last visited May. 07, 2025)
[24] K.S. Puttaswamy (Retd.) & Anr. vs. Union of India & Ors., 2017 INSC 801, https://indiankanoon.org/doc/91938676/(last visited May. 07, 2025).
[25] https://www.casemine.com/commentary/in/supreme-court-upholds-presumption-of-legitimacy-under-section-112:-comprehensive-commentary-on-aparna-ajinkya-firodia-v.-ajinkya-arun-firodia-(2023-insc-146)/view (last visited May. 07, 2025).
[26] https://indiankanoon.org/doc/21574469/ (last visited May. 07, 2025).
[27] https://indiankanoon.org/doc/77597954/ (last visited May. 08, 2025).
[28] https://indiankanoon.org/doc/34892452/ (last visited May. 08, 2025).
[29] https://clpr.org.in/litigation/ms-x-v-state-of-karnataka/ (last visited May. 08, 2025).
[30] https://indiankanoon.org/doc/135109223/?type=print (last visited May. 09, 2025).

Delhi HC accepted DNA as direct evidence in rape trial.

- Naveen v. State of MP (2023)[31] :

Emphasized strict sample handling protocols for admissibility.

- Manoj v. State of MP (2023)[32]:

SC laid guidelines for collection and analysis of DNA evidence.

- Mohammed Refeeq v. S. Mohammed Fairoz Ahamed (2024)[33]:

The Karnataka High Court allowed DNA profiling in a partition case. They said it's a scientific method to find out biological ties and inheritance rights.

- XYZ v. State of Chhattisgarh (2025)[34]:

The Chhattisgarh High Court directed a DNA profiling test of a doctor accused of rape, highlighting that in exceptional cases, such tests are necessary to ascertain the truth when other modes of proof are unavailable.

VIII. ETHICAL CONCERNS AND CHALLENGES:

While DNA fingerprinting offers undeniable advantages in solving crimes and disputes, it also raises ethical and privacy concerns, especially in India, where privacy protection laws are still evolving.

Privacy Issues:

The main concerns regarding DNA fingerprinting is the chances of misuse of genetic information. The creation of national DNA databases, as proposed in the 2019 Bill[35], has sparked debate about the risks of genetic profiling and surveillance.

There are fears that DNA databases could be used for purposes other than criminal justice, such as genetic discrimination or state surveillance[36].

Accuracy and Reliability:

Although DNA evidence is considered highly reliable, it is not infallible. False positives and errors in sample collection, analysis, or storage can lead to wrongful convictions. The legal framework in India must ensure that DNA evidence is subjected to rigorous standards of quality control and expert testimony to prevent such occurrences.

Informed Consent:

In criminal cases, there is often a lack of informed consent when DNA samples are collected from individuals. This can raise legal and ethical issues, particularly when DNA samples are taken from people who are unaware of the full implications of providing their genetic data[37]..

IX. CURRENT TRENDS

Shift Toward Mandatory Forensics: Under BNSS, DNA collection is increasingly becoming mandatory for serious offenses.

Withdrawal of the DNA Technology Bill: The 2019 Bill was withdrawn in 2023, as the government considered the 2022 Act sufficient.

Use in Civil Cases: Courts are increasingly permitting DNA tests to settle paternity and property disputes.

Integration of Digital Tools: Electronic evidence and digital tracking of DNA handling are being adopted as best practices.

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[31] https://supremetoday.ai/doc/judgement/IND_NGT_440_2023_DELHI (last visited May. 09, 2025).

[32] https://digiscr.sci.gov.in/admin/judgement_file/judgement_pdf/2023/volume%2011/Part%20I/2023_11_246-263_1702981364.pdf (last visited May. 09, 2025).

[33] https://indiankanoon.org/doc/156710296/ (last visited May. 09, 2025).

[34] https://indiankanoon.org/doc/94056592/#:~:text=As%20a%20result%20of%20said,humility%20and%20embarrassment%20before%20the (last visited May. 09, 2025).

[35] The "DNA Technology (Use and Application) Regulation Bill, 2019"

[36] https://privacyinternational.org/learn/dna-and-geneti.data#:~:text=Standalone%20DNA%20and%20genetic%20data%20can%20reveal,person's%20ethnic%20origins%20and%20other%20sensitive%20data. (last visited May. 09, 2025).

[37] https://petrieflom.law.harvard.edu/2019/01/14/ethical-concerns-of-dna-databases-used-for-crime-control/#:~:text=These%20issues%20include%20basic%20human,lab%20technicians%20and%20forensic%20experts. (last visited May. 09, 2025).

X. CONCLUSION

DNA fingerprinting is a powerful tool that enhances the justice delivery system. With the introduction of BNS and BNSS, India has taken a definitive step toward regularizing and standardizing DNA evidence collection and use.

However, these advancements must be supported by strict safeguards to protect individual rights, especially privacy and data security. The evolving judicial stance and emerging case law suggest a growing acceptance of DNA evidence, but always with judicial oversight to prevent misuse.

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[10] State of Gujarat v. Jayrajbhai Punjabhai Varu, (2016) 14 SCC 151.
[11] K.S. Puttaswamy v. Union of India, (2017) 10 SCC 1.
[12] Mohammed Refeeq v. S. Mohammed Fairoz Ahamed (2024 KHC 1341).
[13] XYZ v. State of Chhattisgarh (2024 SCC OnLine Chh 1177).
[14] Rajkumar Gupta v. State, 2023 SCC OnLine Del 1269.
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