

DNA AS CORE EVIDENCE IN LEGAL CASES.

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1. Abstract:

The introduction to Deoxyribonucleic acid. What is DNA? The scope of DNA profiling of a person in court of law and admissibility. The extent up to which the validity of the DNA as evidence. Why has DNA of a person become core evidence? The Guidelines which must be followed in DNA profiling. Legislative framework in India. Legislative framework in United States and United Kingdom. The Constitutionality of DNA profiling; right to Privacy and protection against self-incrimination under Article 21 and 20(3) respectively. Limitation of Dna profiling. Research gap which is present as of now. Future Scope.

2. Keywords:

DNA- deoxyribonucleic Acid , DNA present in the nucleus of a human being. DNA profiling, Reliability, Infallible evidence.

3. Introduction:

Deoxyribonucleic acid, or otherwise DNA to be short, is an inherent component in every living cell. The significance of the DNA on the life has been unveiled since its discovery in 1869 by Swiss chemist Friedrich Miescher. The discovery of DNA made huge impact on identity of a person, very similar to that of fingerprint of a person. Every individual has a “UNIQUE” sequence of DNA strand (of course except the case of maternal twins) is what, gave a scope to the FORENSIC domain to use it as a pivotal tool, to collect evidence admissible on court. What is fascinating is that despite the developed procedures and techniques to identify the DNA sequence, there are constraints, which are inevitable, which will be addressed herein after¹.

Since the inception of DNA fingerprinting in the late 1980s, the legal system has increasingly relied on the molecular signatures of biological materials to ascertain guilt, exonerate the innocent, and map the complex parameters of criminal liability.

DNA is a hereditary material in all human beings containing genetic instructions for all functions including development, reproduction and other body functions. It serves as blueprint for all living organisms. The nucleotides which is the backbone of each strand alternate between phosphate groups and deoxyribose sugar. Each sugar is bound to either thymine (T) or, adenine (A) or, cytosine (C) or, guanine (G). Chemical bonds between the bases bind the two strands together; cytosine and adenine binds with guanine and thymine respectively. The bases form complementary pairs (A with T and G with C) and create chemical bonds that function as rungs on a ladder. Which makes the DNA highly stable molecule, almost indestructible, which enables it to survive this constant onslaught through highly efficient repair mechanisms, though it cannot survive absolute destruction.

¹ Hunter, G. K. (2000). *Vital forces: The discovery of the molecular basis of life*. Academic Press.

DNA herein mentioned is the nucleic- DNA, which means it is present in every single cell of the body. Which provides scope for the Forensic domain to extract the DNA information from any kind of body part, extends to the mere blood, to a hair strand, to nails, to even a sperm present in semen. So far it has been used in criminal and civil trials to uniquely identify individuals, with primary applications including sexual assault, homicide, and homicide investigations, as well as paternity testing and immigration cases².

4. Why DNA is a core evidence, in Court of Law

In scientific view, when any two objects come into contact, transfer of biological material is inevitable. Traces from a scene may be carried away on the person or tools, of the subject person, wherever the person touches or whatever is left in a place serves as evidence against him. In the criminal domain for example, *Mukesh v. State (Nirbhaya Case, 2017)*³, DNA profiling was recognized as "virtually infallible evidence" that played a central role in upholding convictions by linking the accused to the crime scene with high precision.

Performing DNA profiling is strictly subject to the guidelines as prescribed in *Devakar v. State of Tamil Nadu (2025)*⁴, wherein the Supreme Court established strict guidelines for DNA profiling to prevent sample contamination and uphold forensic credibility.

- i. **Standardization of Documentation:** Every DNA sample ought to be sealed as soon as collection is done accompanied by a detailed label containing the FIR number, case sections, date, and names of the Investigating Officer (IO), medical officer, and independent witnesses.
- ii. **Chain of Custody Register:** An proper, uninterrupted chain of custody must be maintained from collection through trial, documented in a register which will be admissible in court of law.
- iii. **Mandatory 48-Hour Transport Rule:** Investigating Officers must deliver DNA samples to the Forensic Science Laboratory (FSL) within 48 hours of receiving the collection.
- iv. **Delayed Delivery Protocol:** if at all any delay beyond 48 hours, must be justified in writing by the officer, with refrigeration and preservation enforced.
- v. **Storage and Sealing Restrictions (preservation):** Once the collected sample is sealed thereafter, the package shall not be opened, altered, or resealed without explicit prior order the trial court.
- vi. **Expert Testimony and Opinion:** DNA evidence is not considered conclusive evidence under Section 39 of the Bharatiya Sakshya Adhiniyam, 2023, requiring rigorous scientific and legal validation to determine its probative value.

5. Legislative framework:

In India there is no specified legislation for the overviewing of the DNA profiling and procedure, The DNA Technology (Use and Application) Regulation Bill, 2019, was withdrawn by the Indian government in July 2023, not passed, due to intense scrutiny over data privacy, risks of misuse for caste/community profiling, and insufficient infrastructure safeguards. Though the Act addressed the consent of the accused (other than specified offences), it was criticized for infringing Right to Privacy, as the consent was only superficial and minimal.

² Rahman, Atta Ur. "Nucleic acid structure." *Fundamentals of cellular and molecular biology*. Bentham Science Publishers, 2024. 15-35.

³ AIR 2017 Supreme Court 2161

⁴ 2025 INSC 845 or 2025 LiveLaw (SC) 703

5.1 Criminal Procedure (Identification) Act 2022:

But later, in 2022, **Criminal Procedure (Identification) Act**⁵, empowers law enforcement to collect a wider range of biometric and biological data for criminal investigations. It officially came into force on **August 4, 2022**, and repealed the century-old Identification of **Prisoners Act, 1920**⁶. The Act significantly broadens the types of data that can be collected. Beyond traditional fingerprints and footprints, it now includes: palm-print and footprint impressions., Photographs, iris, and retina scans, Biological samples (such as hair, blood, or DNA) and their analysis, behavioral attributes, including signatures and handwriting. While general "measurements" can be taken from any arrested person, biological samples (like DNA) can only be forcibly collected if the person is arrested for, offences against women or children, offences punishable with a minimum of seven years of imprisonment.

5.2 Bharatiya Nagarik Suraksha Sanhita, 2023:

Sections 349 to 351 (formerly Sections 53, 53A, 54 of CrPC) empower law enforcement to collect DNA samples from suspects and victims with medical assistance. Section 349 empowers magistrates to issue an order for collection of biological material from accused person and other persons to aid investigation. Section 350, specifically concerns the medical examination of a victim in sexual assault, involving collection of samples, ensures only collected after consent and strict adherence to dignity. And the DNA profiling should be done under the surveillance of medical practitioners within 24 hours of receiving information. Section 351, power to examine the accused, allowing the court to question the accused to explain circumstances in the evidence against them⁷.

5.3. Bharatiya Sakshya Adhinyam, 2023 (BSA)

, **section 39**, Corresponds to the Indian Evidence Act, Section 45 admits expert opinions, including DNA evidence, in court, ie. Qualified medical practitioner.

Recent cases demonstrate that Indian courts are gradually recognizing the importance of DNA and digital evidence but need clearer legislative support. In case law, *Ranjitsing Brahmajeetsing Sharma vs State of Maharashtra* (2005)⁸, the Supreme Court emphasized that scientific evidence like DNA profiling and other forensic tests must be evaluated within the context of total evidence, rather than as infallible and standalone proof. It should be only treated as contextual evidence, not absolute proof. Though the DNA evidence is strong and infeasible, must be supported by chain of other evidence.

5.4 Legal framework in other countries:

In the United States, the admissibility of forensic evidence is governed by a complex patchwork of state and federal standards, predominantly split between the *Frye* and *Daubert* doctrines.

The *Frye* standard, originating from the 1923 case *Frye v. United States*⁹ involving an early systolic blood pressure deception test (polygraph), dictates that novel scientific evidence or expert testimony is admissible only if the methodology has gained "general acceptance" in the relevant scientific community. While it was historically dominant and instrumental, in early DNA admissibility cases such as the 1989 landmark *People v.*

⁵Shekhar, Siddharth. "An Analysis of the Criminal Procedure (Identification) Act, 2022." *Indian J. Integrated Rsch. L.* 3 (2023): 1.

⁶Kakkad, Dhaval R. "The Criminal Procedure (Identification) Act, 2022 and Its Relation with the Identification of Prisoners Act, 1920." *Issue 2 Indian JL & Legal Rsch.* 5 (2023): 1.

⁷ <https://indiankanoon.org/doc/142872252/>

⁸ (2005) 5 SCC 294.

⁹ Giannelli, Paul C. "The admissibility of novel scientific evidence: *Frye v. United States*, a half-century later." *Colum. L. Rev.* 80 (1980): 1197.

Castro ruling, *Frye* is heavily criticized by legal scholars for being excessively conservative. The rigid requirement for consensus inherently delays the admission of highly reliable but novel technologies (such as early NGS or specific epigenomic markers) simply because they lack widespread laboratory implementation, essentially equating general acceptance with validity.

In 1993, the Supreme Court's decision in *Daubert v. Merrell Dow Pharmaceuticals*¹⁰ revolutionized admissibility by positioning the trial judge as an active "gatekeeper" i.e, their proactive duty is to ensure reliable, relevant and legally admissible evidence is presented to jury. Interpreting Federal Rule of Evidence 702 (FRE 702), the *Daubert* court established a flexible, multi-pronged test focusing on the scientific method itself rather than mere consensus. The judge must evaluate whether the theory or technique has been tested, whether it has been subjected to peer review and publication, its known or potential error rate, the existence and maintenance of standards controlling its operation, and its degree of general acceptance.

In the UK, DNA evidence is not governed by a single "DNA Act" but by a combination of policing statutes and extensive common law. Police and Criminal Evidence Act 1984 (PACE) is the fundamental statute. **Section 63** allows police to take "non-intimate" samples without consent if a person is arrested for a "recordable offence". **Section 78** is a critical "gatekeeper" provision that gives judges the discretion to exclude DNA evidence if its admission would have such an adverse effect on the fairness of the proceedings that the court ought not to admit it. **Criminal Justice Act 2003** further, expanded police powers, allowing for the routine collection and permanent retention of DNA from anyone arrested, even if they are never charged. **Protection of Freedoms Act 2012**, following a human rights challenge in *S and Marper v UK (2008)*¹¹, this Act introduced rules to delete DNA profiles of innocent individuals from the National DNA Database, balancing state interests with privacy. *R v Tsekiri, 2017*¹² is the landmark case established that there is no legal principle preventing a case from going to a jury based solely on DNA evidence found at a crime scene, provided the DNA is on a non-movable object (like a door handle) and there is a high probability of matching.

R v Doheny and Adams (1997), Established the "Prosecutor's Fallacy" guidelines, instructing experts and judges on how to explain match probabilities to a jury without misleading them into thinking a match equals a absolute certainty of guilt. DNA evidence is seen mere as an one piece of puzzle. According to the guidelines, a Jurist must: 1. Consider the **DNA match probability** alongside other evidence (such as alibis or eyewitness descriptions). 2. Use their natural justice, to determine if the combined evidence proves guilt beyond a reasonable doubt.

6. Constitutionality of DNA profiling.

DNA in forensic evidence is often taken from the suspect, without their consent, in the name of justice, on other hand taken from a deceased rape victim where there is no room for consent. Does the State has the power to take or in other words seize the very identity for the purpose of evidence? Or to put in another way, to what extend can the State as the power to intrude into a Personal identity.

But in the precedent case, *M. Vijaya v. The Chairman, Singareni Collieries*, 15¹³ the Court, upon a detailed discussion of the competing rights of a private party and public right with reference to right to privacy of a person suspected of suffering from AIDS, held: "There is an apparent conflict between the right to privacy of a person suspected of HIV not to submit himself forcibly for medical examination and the power and duty of

¹⁰ Farrell, Margaret G. "Daubert v. merrell dow pharmaceuticals, inc.: Epistemology and legal process." *Cardozo L. Rev.* 15 (1993): 2183.

¹¹ Higgins, Edwina, and Laura Tatham. "Recent Legal Developments: Human rights The national DNA database and a step too far S. and Marper v. United Kingdom, ECHR, 4 December 2008." (2009): 209-217.

¹² Richmond, Karen. "Court of Appeal: DNA Profiling: Transfer and Persistence R v Tsekiri [2017] EWCA Crim 40." *The Journal of Criminal Law* 81.4 (2017): 275-277.

¹³ A.I.R. 2001 A.P. 502: 2002 AIHC 475.

the State to identify HIV infected persons for the purpose of stopping further transmission of the virus. In the interests of the general public, it is necessary for the State to identify HIV positive cases and any action taken in that regard cannot be termed as unconstitutional as under Article 47 of the Constitution, the State was under an obligation to take all steps for the improvement of the public health. A law designed to achieve this object, if fair and reasonable, in our opinion will not be in breach of Article 21 of the Constitution of India. It is well-settled that right to life guaranteed under Article 21 is not mere animal existence. It is a right to enjoy all faculties of life. As a necessary corollary, right to life includes right to healthy life." Does this precedent validate the DNA profiling is constitutional. Two wings of constitutionality could be addressed herein;

1. Right to Privacy, under Article 21, is being protected and
2. No violation of Article 20(3) and would lead to self- incrimination.

In the landmark case, *K.S. Puttusamy v. The Union of India*¹⁴, the challenge originated whether the government Aadhar's scheme, which collected mandatory biometric data and concern about surveillance and privacy protection is upheld. The Supreme court held that personal liberty under Article 21 can only be restricted by State if it is protected by law serves a legitimate purpose and is proportionate. In the light of this precedent, the DNA profiling though not supported by any Specific legislation they are backed up by Section. 51, 52, 53 of BNSS (Bharatiya Nagarik Suraksha Sanhita). Further in *Sharda v. Dharmpal (2003)*¹⁵ The Supreme Court established that matrimonial courts possess the authority to order medical examinations, including DNA tests, to resolve disputes. The Court ruled that such orders do not violate the right to personal liberty under **Article 21** if a strong *prima facie* case is made out, as the right to privacy is not absolute, must be balanced with interest of justice.

7. Limitation in DNA Profiling:

Though DNA is considered a highly authentic and reliable form of evidence, certain limitations are observed herein,

7.1 Procedural and Institutional Constraints

DNA is highly sensitive to environmental factors like heat and moisture. Improper packaging or failing to meet the **48-hour transportation window** to a laboratory can render a sample scientifically unreliable. Courts may reject or diminish the weight of DNA evidence are procedural failures during the investigation. Any break in the documented movement of a sample, from the crime scene to the laboratory, can lead to claims of tampering or swapping. Due to a severe shortage of accredited laboratories and trained experts, delays of several months are common, which often leads to the degradation of biological samples.

7.2 Legal and Evidentiary Limitations

Indian law treats DNA as an "expert opinion" rather than an absolute fact. In most criminal cases, DNA evidence is considered corroborative rather than conclusive. Courts typically require other substantive evidence (like witness testimony) to support a conviction. There is no specific legislation governing the standards for DNA profiling. Admissibility currently relies on judicial discretion under Section 39 of the Bharatiya Sakshya Adhiniyam, 2023 . DNA can prove a person was present at a scene or in contact with a victim, but it cannot establish **mens rea** (guilty intent). It does not explain the *circumstances* of how the DNA was deposited.

¹⁴(2017) 10 SCC 1; AIR 2017 SC 4161

¹⁵ AIR 2003 SC 3450, 2003 (3) ALT 41 SC

7.3 Technical Interpretative Issues

Scientific results are not always straightforward for the judiciary to interpret. A "match" does not mean a 100% certainty; it is a statistical probability of a random match. If not communicated clearly by experts, judges may over-rely on or misinterpret the result. In cases with multiple contributors (e.g., gang rape or crowded crime scenes), partial or complex DNA mixtures can be difficult to interpret, often yielding inconclusive results.

8. Research gap:

1. Lack of Dedicated Legislation

The most critical gap is the absence of a comprehensive law governing DNA profiling. So far DNA profiling has been admitted under the broad umbrella of 'expert opinion', but it lacks the specific scientific validation. And there is no rigid judicial interpretation for the same.

2. Procedural & Institutional Inefficiencies

Research shows a disconnect between scientific potential and judicial reality. Chain of Custody Issues; Approximately 30% of forensic-based criminal acquittals in India are attributed to procedural lapses, such as improper collection or sample tampering during the 48-hour delivery window to laboratories and sometimes samples are subject to contamination. Proper procedural guidelines and protocols must be followed. Guidelines should be converted into law.

3. Infrastructure Deficit and training Gap

India has a severe shortage of forensic DNA labs, holding only about 9 labs as of recent reports, resulting in massive case backlogs and testing delays that can compromise sample integrity. There is a lack of scientific literacy among law enforcement and judicial officers, leading to errors in interpreting complex DNA profiles, especially in cases of degraded or partial samples.

4. Evidentiary Weight vs. Conclusive Proof

There is no codified "Daubert Standard" in India to assess the reliability of new scientific techniques. DNA is still largely treated as corroborative evidence rather than conclusive proof. Research is needed on how judges resolve conflicts when DNA evidence contradicts strong direct testimony. In the absence of a "genetic truth" mandate, some courts prioritize social legal presumptions while others prioritize DNA results, creating a "Pandora's box" in family and inheritance law.

9. Future Scope:

The future of DNA profiling in India isn't just about better lab tech; it's about whether the public actually trusts the system to be accountable. Right now, DNA is often a powerful "extra" in a case. Moving forward, India needs to transition toward a more structured, codified system where scientific proof isn't just an option, but a standard—backed by airtight legislation. The biggest hurdle? We lack a dedicated DNA law. Without a clear statute, we're left in a grey area regarding how data is stored, who consents, and how privacy is guarded. A unified code would fix the "patchwork" approach across different states and labs, cutting down on risks like sample tampering or the nightmare of genetic data misuse. We also must talk about the "boots on the ground" reality. India's forensic infrastructure is stretched thin. We need more accredited labs and, frankly, better-trained experts. If a police officer or a doctor isn't trained to handle biological samples perfectly, the best technology in the world won't matter—the evidence will be ruined before it ever hits a centrifuge. Faster testing isn't just a convenience; it's what keeps a sample from degrading beyond use. Finally, the legal mind

must evolve alongside science. Judges shouldn't just look at a DNA report as a "magic bullet." They need forensic literacy to question mixed samples or statistical probabilities. As we move toward AI-assisted analysis and Next-Gen Sequencing, the guardrails of Article 21—privacy and personal liberty—become even more critical. Science must advance, but it must stay tethered to constitutional morality

Conclusion:

DNA profiling has become a golden Standard' for forensic evidence. However, it remains in the hands of judiciary for the integrity and reliability of the evidence considered. To maintain the DNA as a reliable tool for justice, the legal system must strive to balance its high probative value with a rigorous "zero- error" approach to handle it. But the fact the inevitable that DNA evidence is only as infallible as the humans who collect, preserve, and present it.

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