
DNA EVIDENCE IN CRIME SCENE INVESTIGATION: LEGAL CHALLENGES AND HUMAN RIGHTS CONCERN

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ABSTRACT

The DNA evidence has significantly transformed the criminal law because it has provided the means through which individuals could be identified in a forensic manner. It is able to establish guilt and innocence. Its usage however, poses tricky ethical and legal concerns especially in India. This paper evaluates the use of DNA evidence through an analysis of its scientific base, the legal principles that guide the concept on whether it will be acceptable in the court, and evident human rights issues that it entails. The discussion relies on the major Indian court cases and an analogy with the rest of the global legal practice. The courts have been highly prolific in laying down standards and issue critical decisions that consider scientific truth instead of legal presumptions. Through the discussion, the issue of proper chain of custody has been emphasized as critical as a way of avoiding wrongful convictions. Any small replacement to this chain will affect the credibility of the evidence. The threats to one of the key human rights, to the basic right to privacy, are discussed in the article, and it is accepted in Article 21. Accumulations and storage of DNA data profiles undermine this right, particularly given the proposed legislations which might result in the establishment of a massive system of surveillance at the expense of having a database of individuals who may not have been found guilty. The moral implications derived out of using the DNA of dead persons and relatives are also not negligible. The article addresses the fine line between the interest of a state in criminal solutions, and a personal right against self-incrimination and a right to bodily integrity. Courts have held that no such objective can be obtained without a physical DNA sample, by force as such physical evidence is not testimonial evidence. The possibility of wrongful convictions because of poor evidence made through some procedural mistake and the analytical peculiarities is a very burning issue that questions the right to a fair trial. In this article, it is argued that although the introduction of DNA technology is an effective application, the efficacy requires a powerful, rights-safeguarding legal structure in India. This type of legislation must provide us with standardized criteria of collecting consent, restrict the use of

DNA to mere purposes and an automatic process of erasing DNA profiles of the people who have not been convicted must be provided. It must also demand having an independent regulator within which the DNA database is governed to prevent abuse of the technology, making it fall into becoming a tool of mass surveillance and systemic injustice.

Keywords: DNA Evidence, Forensic Science, Criminal Justice, Legal Challenges, Miscarriage of Justice, Biological Samples.

1. INTRODUCTION

DNA evidence has changed criminal justice system. It has been a central figure in modern forensic science thanks to its never-before-seen abilities of identifying the individuals using the biological remains, which have led to thousands of convictions and, what is more significant, to the release of the innocent. Being a forensic instrument, it definitely offers window to the truth with a form of scientific certainty that was previously unheard of. This Article provides a critical discussion of how the Indians apply the DNA evidence, its scientific foundation, its legal provisions regarding admissibility and the total confrontation of issues that are posed regarding the DNA evidence and its admissibility of the evidence by the individuals. The discussion is based on the significant Indian case law and the comparison with the other global legal systems.¹

2. THE FORENSIC DNA ANALYSIS ON SCIENTIFIC BASIS

In order to properly evaluate the legal issue regarding the use of DNA evidence, you need to possess a fundamental concept behind its science. Forensic DNA analysis is not an exercise that rapidly sequences the entire genome of a particular individual but is focused on selected and variable portions.²

A. The DNA Molecule and STR profiling:

DNA is a two-strand molecule consisting of four bases, i.e., Adenine (A), Guanine (G), Cytosine (C), and Thymine (T).³ Although the DNA of humans is usually nearly identical, and their DNA of course differs by only 0.1%, forensic science is focused on what actually varies.

¹ *State of Bombay v. Kathi Kalu Oghad*, AIR 1961 SC 1808; *Selvi v. State of Karnataka*, (2010) 7 SCC 263; *Maryland v. King*, 569 U.S. 435 (2013).

² J.M. Butler, *Forensic DNA Typing: Biology, Technology, and Genetics of STR Markers*, Elsevier Academic Press, 2nd edn., 2005, p. 21.

³ *Ibid.*, p. 33.

Most important among the latter are the Short Tandem Repeats or short repeated sequences of DNA bases. Replications of positions of some alleles at some chromosomal positions (loci) vary among individuals.⁴ Examination to enable a unique numerical profile to be created with an individual, a subset of STR loci is examined at the forensic laboratory. The statistical chance that two people chosen randomly will in fact be sharing the same profile, based upon them, is exceedingly low, in the range of one in a quadrillion or more, and this is the basis of its enormous probative value.⁵

B. Types of Biological samples:

DNA analysis can use various biological samples in the crime scene with varying weight. Such samples include blood, semen, saliva, hair with roots and skin cells (also known as touch DNA).⁶ The semen and blood are good samples because most of them are rich in DNA, thereby making it less tedious to get a complete profile.⁷

Touch DNA is, conversely, a variant of skin cell DNA found on objects (e.g. doorknobs or tools) and thus has minute quantities of DNA and is readily contaminated; therefore, it is harder to be analysed.⁸

C. The Forensic Process:

The process of forensics is initiated by obtaining a biological specimen of a crime scene. The DNA is extracted and isolated out of the sample; the amplification of certain STR loci is done using Polymerase Chain Reaction (PCR) to make millions and millions of copies of DNA. The resultant amplified DNA is then assessed to determine repeats each of those locus and results as a profile. Matching is the next step and the profile is compared to that of the suspect or a DNA database is searched against the profile. Results of this process are not scientifically true unless samples are not compromised and laboratory tests are accurate.

3. COLLECTION, HANDLING AND ANALYSIS ISSUES

Forensic science DNA analysis is faced by major problems in its three major stages. The

⁴ *State of Bombay v. Kathi Kalu Oghad*, AIR 1961 SC 1808.

⁵ J.M. Butler, *Advanced Topics in Forensic DNA Typing: Interpretation*, Elsevier, 2015, p. 48.

⁶ B.R. Sharma, *Forensic Science in Criminal Investigation and Trials*, *ibid.*, p. 525.

⁷ *State of Maharashtra v. Suresh*, (2000) 1 SCC 471.

⁸ N. Linacre and S. Tobe, "An Overview to Forensic DNA Typing," (2011) *Forensic Science Review*, Vol. 23(1), p. 1.

environmental degradation and contamination of evidence during collection and handling are also highly susceptible compared to other stages of process, necessitating strong standards like the appropriate package and a sterile tool.⁹ Low-quantity samples of DNA (touch DNA) capable of giving partial profiles and mixtures of DNA of two or more individuals requiring difficult, sometimes interpretive, interpretation cause problems at the analysis and interpretation stage. These issues together with the possibility of human error prevent that the validity of DNA evidence is not assured and is instigated by the quality of the entire forensic procedure.¹⁰

4. THE LAW AND EVIDENTIAL PROBLEMS IN INDIA

The admissibility rules and the standards of proof are established as the legal history of the DNA evidence. In India, the application of the legal system has hitherto been regulated by prevailing principles as there is no generic statute on DNA as yet among other things, and this has been worked through to a substantial degree by judicial interpretation.

A. Admissibility Under The Bharatiya Sakshya Adhiniyam, 2023:

The general rule of expert evidence of Section 39 sets the admissibility of DNA evidence in an Indian court. There is nothing in the section that derails the allowance of expert opinions affecting matters of 'science or art'.¹¹ This is a general legal door which has contributed towards acceptance of DNA analysis.

The decision of *S. J. Choudhary v. State Delhi Administration*¹² reading of Section 39 on the part of Delhi High Court the Delhi High Court interpreted Section 39 to mean any systematic body of knowledge. This was the decision that justified the use of DNA testing as expert evidence and prepared the path of widespread adoption by subsequent legal decisions. The point continues, however, to be whether an ancient statute of general nature is sufficient to regulate a highly advanced new technology, or whether it requires a specific, focused law to handle its new legal and ethical concerns.

⁹ J.M. Butler, *Forensic DNA Typing: Biology, Technology, and Genetics of STR Markers*, Elsevier Academic Press, 2nd edn., 2005, p. 89.

¹⁰ Saks, M.J. and Koehler, J.J., "The Coming Paradigm Shift in Forensic Identification Science," (2005) 309 Science 892; and *Kanchanben v. State of Gujarat*, (2020) 4 SCC 812.

¹¹ *The Bharatiya Sakshya Adhiniyam, 2023* (47 of 2023), s. 39.

¹² AIR 1984 SC 618.

B. Chain of Custody and Procedural Integrity:

The integrity of scientifically valid evidence might be questionable in a legal context since it might not be manifested. A good record is required at every step of the evidence's handling from its collection at the crime scene, to its analysis in the forensic laboratory, to demonstrate that the sample was not tampered with or contaminated.¹³ Failure to maintain this chain, by due collection, storage or transportation, may render the evidence inadmissible, or ruin its probative value to a larger extent.¹⁴ This requirement has never been undermined in the Indian courts. The Supreme Court of India in one of its land mark rulings focus on the necessary role of the integrity of the process, and declared that the chain of the custody is interrupted this tastes more harm to the credibility of the evidence. This legal practice has been used to put pressure on the police and forensic laboratories in to stricter standards.

Through a marred investigation, The Supreme Court reiterated the need to carry out an investigation that is thorough and unbiased to prevent cases of miscarriages of justice.⁵ The court stressed that the forensic samples were to be sealed and preserved improperly and they would be inadmissible.

C. The Superiority of Science over Presumption:

Indian judiciary has demonstrated that it is ready to attach more importance on scientific truth compared to the principles of law. This was violently demonstrated in a civil affair of *Nandlal Wasudeo Badwaik v. Lata Nandlal Badwaik*¹⁵. The Supreme Court had to deal with a case pitting a DNA test report and a legal presumption at loggerheads. The Court had to weigh the DNA evidence which proved that the husband was not a biological father of a child against the Section 116.¹⁶ The Court affirmed, which remains famous, that “where there existed a conflict between a type of conclusive evidence that was contemplated by law, and a type of evidence, based upon scientific progress fixed on the statement of the entire community, such controversy evidence should be superior”. This landmark case was important in giving the DNA tests the so-called evidentiary authenticity, as it confirmed its power to establish the truth despite its

¹³ Directorate of Forensic Science Services, *Standard Operating Procedures for Evidence Collection and Chain of Custody*, Ministry of Home Affairs, 2020.

¹⁴ *Krishna Kumar Malik v. State of Haryana*, (2011) 7 SCC 130.

¹⁵ AIR 2014 SC 932.

¹⁶ *The Bharatiya Sakshya Adhiniyam*, 2023 (47 of 2023), s. 116.

conflict with a legal doctrine.¹⁷

D. The Problems of DNA Mixtures and Low-Template DNA:

Forensic science currently is generally faced with complex samples, such as a DNA mixture with genetic material of more than a single individual, or low-template DNA (LTDNA) scenarios, where amounts of DNA in a sample are measurably small. With these scientific facts comes a new set of legal problems. The explanation of such complex profile is not the question of a simple, objective task but subjective, according to the opinion of the forensic scientist. This subjectivity may open the gate to legal challenges of test reliability and that of human error.¹⁸ One stake that defence counsel might make against such an expert opinion is that statistical coincidence in a complex mixture may not be as strong as coincidence in a monolithic sample. These technical worries can push the judges to act like the barrier, and be highly vigilant in reviewing the methods and opinions presented by expert witnesses on deciding which evidence can be scientific and lawful.

5. THE CONCERN OF HUMAN RIGHTS AND CONSTITUTIONAL DIMENSIONS

When DNA technology is used, it brings forth serious human right concerns that transcend the provisions of the evidence rules and serious constitutional principles. DNA profiling is incredibly powerful, thus making a sensitive balancing act needed by the interest of the state in investigating and prosecuting crime as opposed to the fundamental rights of a person.

A. The Data Protection and the Right of Privacy:

Collecting and retaining DNA profiles is an act that possesses a direct violation of the right to privacy; a fundamental right that was declared as valid by the Supreme Court of India in Justice K.S. Puttaswamy (Retd.). v. Union of India.¹⁹ The Court believed that privacy is a critical component of personal right to life and liberty as it is defined in Article 21 and it can be curtailed only on a situation on which a law has been enacted which satisfies concepts of legality, necessary, and proportionality. DNA profile is an extremely personal soft copy of information. One such personal data that is very sensitive is a DNA profile. Whereas fingerprints are merely

¹⁷ *Nandlal Wasudeo Badwaik v. Lata Nandlal Badwaik*, AIR 2014 SC 932.

¹⁸ N. Linacre and S. Tobe, "An Overview to Forensic DNA Typing," (2011) *Forensic Science Review*, Vol. 23(1), p. 6.

¹⁹ (2017) 10 SCC 1

a name under which something can be recognized, the DNA profile represents a wealth of genetic data which could be used to reveal the origin of a specific individual, his / her ties to other loved ones and their vulnerability to certain illnesses. Any gain of it in a national registry, as indicatively referred to in The DNA Technology (Use and Application) Regulation Bill, 2019, should, therefore, restrain scrupulously the Puttaswamy principles.²⁰ The Bill has been criticized on the basis of its inadequate privacy protections, particularly in the area of broad definition of the 'DNA Data Bank', of absence of proper checks and balances as to the employment as well as misuse of information.²¹ These privacy concerns are further complicated by the application of genetic genealogy databases by law enforcement authorities as well as the application of the so-called familial searching, which raises some ethical concerns related to the consent and allows conducting extensive genetic surveillance massively.²²

B. Right to bodily integrity and non-coercion:

The right of bodily integrity has become embedded in article 21 as part of the right to life and personal liberty.²³ This right of forcing an individual to provide a biological sample constitutes a direct challenge of the act. Even though having a court order to compel somebody to take a sample is by general assessment deriving as legal, the collection procedure needs to be voluntary. In the use of DNA 'dragnets' that require volumes of people to voluntarily submit a sample, this is morally offensive. This risk of confusion between consent and coercion is destructive to real-life lives because it can infringe on the right of a human being to have an autonomy over his or her body. The case of *Rajender Kumar v. state of Himachal Pradesh*²⁴ an example in which a court permitted a rights to the integrity of the body, to weigh against the requirement to provide effective criminal investigation using Sections 51²⁵ and 52²⁶ BSA, 2023, the Himachal Pradesh High Court pronounced the constitutional validity of a court-ordered DNA test. The conclusion of the court was that a justifiable suppression of individual

²⁰ *The DNA Technology (Use and Application) Regulation Bill, 2019*, Bill No. 128 of 2019, Ministry of Science and Technology, Government of India.

²¹ Centre for Internet and Society, "Analysis of the DNA Technology (Use and Application) Regulation Bill, 2019," available at <https://cis-india.org/internet-governance/blog/dna-technology-bill-2019-analysis> (last visited Oct 26, 2025).

²² Human Rights Watch, "India: DNA Bill Threatens Privacy Rights," August 21, 2019, available at <https://www.hrw.org/news/2019/08/21/india-dna-bill-threatens-privacy-rights>

²³ *Common Cause (A Regd. Society) v. Union of India*, (2018) 5 SCC 1.

²⁴ *Rajender Kumar v. State of Himachal Pradesh*, 2024 SCC OnLine HP 2173.

²⁵ *Bhartiya Sakshya Adhiniyam*, 2023, No. 47 of 2023, s. 51.

²⁶ *Id.*, s. 52.

freedom to a just investigation is justifiable.

C. The Right Against Self-Incrimination (Article 20(3)):

Article 20(3) states that, ‘No person accused of an offence shall be compelled to be a witness against himself’.²⁷ One of the primal legal battles has dealt with the issue of whether giving one a DNA sample constitutes a testimony. In *Kathi Kalu Oghad*²⁸, the Supreme Court squarely aligned itself with a distinction in physical evidence (fingerprints, blood and DNA samples) versus the testimonial evidence (confessions and statements). The Court held the fact that the person is forced to provide a physical sample does not amount to a violation of Article 20(3) due to the fact that the person is not being forcibly managed to testify against him. It is established jurisprudence, which forms the foundation of constitutional law to necessitate DNA samples.²⁹

D. The Miscarriage of Justice/Right to Fair Trial:

Criminal jurisprudence, being based on the right to a fair trial, is its main pillar. The probative value of DNA evidence is very high and coupled with the widely believed unreliability of the evidence, has risk of a miscarriage of justice in case the evidence is partial.³⁰ A wrongful conviction could be caused by procedural errors such as contamination or a broken chain of custody. Similarly, errors in the analysis, especially in cases where mixture of complex DNA have been used or where there are low quantities of the DNA to be analysed, would give rise to interpretation of the evidence.³¹ The misuse of pure evidence can lead to a wrongful conviction of a person; this is a serious find against the right of an impartial trial of an individual and therefore it should never be extensively relied upon as tainted evidence. The importance of the judiciary as a data gate provider is therefore critical in the prevention of the misuse of this very powerful instrument.³²

E. The privacy of the deceased and family members:

DNA evidence acquisition and application also extend beyond that immediate and personal

²⁷ Constitution of India, art. 20(3).

²⁸ *State of Bombay v. Kathi Kalu Oghad*, AIR 1961 SC 1808.

²⁹ *Selvi v. State of Karnataka*, (2010) 7 SCC 263.

³⁰ *Krishan Kumar Malik v. State of Haryana*, (2011) 7 SCC 130.

³¹ National Forensic Sciences University, “Best Practices for DNA Evidence Collection and Handling,” Ministry of Home Affairs, 2022.

³² *Maneka Gandhi v. Union of India*, (1978) 1 SCC 248.

individual who is of interest in an investigation. The DNA profile of an individual entails carrying the genetic data with common access to relatives, which includes the privacy of the complete family of the individual.³³ This is particularly so when you have the case of familial searching, where by law enforcement searches through a database on the partial match to a sample blood of a crime scene in hope that it has a relative to the suspect.³⁴ This practice will in essence make innocent family members a part of investigation without them knowing and without personal suspicion. Also, the use of DNA of unidentified bodies or a crime scene to create a family tree and determine relatives who are alive creates some basic ethics concerns on the privacy rights of the deceased and the other unintended living relatives.

6. COMPARATIVE GLOBAL LAW

Jurisdiction and moral conditions pertaining to use and application of DNA hints vary widely globally and provide explanations on how various legal civilizations and constitutional ideals approach a standardized scientific way.

A. The United States:

The admissibility of scientific evidence as presented by the US legal system holds much respect in regard to the Daubert standard, which requires judges to act as gatekeepers and to assure the scientific validity of evidence.³⁵ Combined DNA Index System (CODIS) is a huge database system that is controlled by FBI.³⁶ It has extended not only to convicted felons, but also to arrestees, a practice just teemed by the U.S. Supreme Court in Maryland³⁷. The Court determined that it was constitutional police booking procedure to take and examine a cheek swab of an arrestee, and equated the procedure to that of fingerprinting. This ruling cemented the growth of DNA collection, and the police showed the interest in cold cases deserved a higher level of protection, as opposed to their privacy rights.³⁸

³³ Centre for Internet and Society, "Privacy and Genetic Information: Ethical and Legal Concerns," (2021), available at <https://cis-india.org>

³⁴ Human Rights Watch, "India: DNA Bill Threatens Privacy Rights," August 21, 2019, available at <https://www.hrw.org/news/2019/08/21/india-dna-bill-threatens-privacy-rights>

³⁵ *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).

³⁶ Federal Bureau of Investigation, "Combined DNA Index System (CODIS) and the National DNA Index System (NDIS)," FBI, U.S. Department of Justice (2023).

³⁷ *Maryland v. King*, 569 U.S. 435 (2013).

³⁸ Erin Murphy, "License, Registration, Cheek Swab: DNA Testing and the Divided Court," *Harvard Law Review*, Vol. 127 (2013), pp. 161–174.

B. The United Kingdom:

A major case of the European Court of Human Rights was the radical re-ordering of UK legislation regarding DNA evidence. In *S and Marper*³⁹, ECHR found that the retention of DNA samples of individuals who were not convicted (though had been arrested) was (Article 8 ECHR)⁴⁰ in violation of the right to privacy. This unrestricted and retaliatory scope of retention operations particularly against innocent persons the court reasoned out, was an excessive government burrowing into the personal lives of its own people. This decision forced the UK to adopt what is seen as a more privacy- compliant rule in which the DNA database of the innocent must be removed within a designated timeframe which in comparison with the other side of the Atlantic is a dream. As a law to effect this new regime, The Protection of Freedoms Act 2012 was passed.⁴¹

C. India:

India is in a peculiar cross. In the absence of a comprehensive legislation, the judiciary has been proactive in addressing the regulation of the DNA evidence. The Supreme Court cases concerning chain of custody, primacy of science and the essence of the basic right to privacy have constructed a confused judicial infrastructure.⁴² Although judicial activism has played a significant role in ensuring that the rights have been safeguarded, there is inconsistency as there is no clear mandate in the form of a law. Had it been passed, the DNA Technology (Use and Application) Regulation Bill, 2019, would become a game-changer, though its current form raises as many questions as it answers in terms of privacy and human rights and has sparked an outcry of demand to redraft it into a rights-sensitive system⁴³. *Kattavellai*⁴⁴ demonstrated the insistence by judiciary on scientific. On the ground of such gross procedural irregularities and a defective chain of custody that led to the inadmissibility of the DNA evidence, the Supreme Court of India set the man on death row free. The ruling of the Court also stipulated mandatory instructions nationwide related to the collection of DNA, the maintenance of DNA, and the safe keeping of DNA. These recommendations emphasize the importance of a chain of

³⁹ *S and Marper v. United Kingdom*, (2008) ECHR 30562/04 and 30566/04.

⁴⁰ European Convention on Human Rights, art. 8.

⁴¹ The Protection of Freedoms Act, 2012 (U.K.), c.9.

⁴² *Nandlal Wasudeo Badwaik v. Lata Nandlal Badwaik*, AIR 2014 SC 932.

⁴³ The DNA Technology (Use and Application) Regulation Bill, 2019 (Bill No. 128 of 2019).

⁴⁴ *Kattavellai @ Kattabomman v. State of Tamil Nadu*, (2022) SCC OnLine SC 987.

custody that is maintained impeccably as a Chain of Custody Register, and make procedural integrity no more basic than scientific precision.⁴⁵

7. DATA PROTECTION, RETENTION, AND EXPUNGEMENT IN INDIA

In India, the legal framework of DNA profiles is still developing, which poses major challenges in terms of data protection, retention, and expungement.⁴⁶ The lack of a concrete law has seen these concerns being dealt with through judicial precedents and the provisions of an ongoing bill.

There is no exhaustive law for a national DNA database in India today. The Bharatiya Nagarik Suraksha Sanhita, 2023 (BNSS) permits collection of biological samples but is silent on guidelines regarding the storage or handling of resulting DNA profiles.⁴⁷ This is a legal problem that has created uncertainty and unevenness in practice. The objective of the proposed DNA Technology (Use and Application) Regulation Bill, 2019, is to plug these loopholes. But it has been criticized for permitting retention of DNA profiles of arrestees and non-convicts, a practice which is attacked as violating the right to privacy accorded by the Supreme Court in the Puttaswamy case⁴⁸. This is the practice of keeping information about the unconvicted. It can result in the development of a very large surveillance database.

Without proper legal guidelines, the retention and expungement procedures for DNA profiles tend to be complex and confusing. Expungement is not automatic, and the subjects may need to undergo a long and expensive legal proceeding to have their data deleted, even if they are found not guilty. This is a very heavy administrative burden for the individual, and especially difficult for members of marginalized communities who may not have the means to understand and navigate the legal system. The absence of an independent and transparent body to regulate the DNA data bank is also a major administrative hurdle, as it becomes impossible to question the retention or abuse of one's genetic information.⁴⁹ Such a law must make specific provision

⁴⁵ Press Information Bureau, Government of India, "Supreme Court Directions on DNA Evidence and Chain of Custody," Ministry of Home Affairs, 2022.

⁴⁶ Vidhi Centre for Legal Policy, *DNA Technology (Use and Application) Regulation Bill, 2019: A Privacy Perspective*, (New Delhi: Vidhi Policy Brief, 2020).

⁴⁷ The Bharatiya Nagarik Suraksha Sanhita, 2023 (45 of 2023), s. 349.

⁴⁸ *Justice K.S. Puttaswamy (Retd.) v. Union of India*, (2017) 10 SCC 1.

⁴⁹ Internet Freedom Foundation, "IFF's Concerns on the DNA Bill: A Threat to Genetic Privacy," December 2021, available at <https://internetfreedom.in>

for purpose limitation, so that DNA profiles are applied only for the intended purpose for which they have been gathered.

The most urgent reform is to institute a rigorous data retention policy with automatic expungement of DNA profiles of individuals who are not found guilty of an offense.⁵⁰ Also, an autonomous regulatory body, vested with the power to enforce privacy standards and monitor the database, is indispensable to uphold data protection principles and ensure that the genetic data is not misused.

8. FUTURE DIRECTIONS AND REFORMS FOR DNA EVIDENCE IN INDIA

The domain of forensic DNA is ever-changing, and with advancing technology, so do the legal and ethical issues. Future directions in DNA technology offer possibilities as well as challenges that are deep and require immediate legislative and judicial reforms in India.⁵¹

A. Technological Advancements and Their Implications:

Technological developments like Massively Parallel Sequencing (MPS), or next-generation sequencing, are going to revolutionize DNA analysis.⁵² As opposed to the present STR analysis that only examines a limited number of loci, MPS is able to scan a much larger segment of the genome. This may not only yield a more conclusive match but also identify a person's physical characteristics, including ancestry, hair color and eye color, and even facial structure. Even though this might be an effective tool for producing leads in criminal investigations, it also poses serious ethical concerns regarding the scope of information that can be gathered on individuals by the state and the risk of establishing a new kind of genetic profiling.⁵³

B. Judicial Oversight:

Indian courts and legal experts have repeatedly demanded more stringent judicial oversight and increased capacity building to guarantee the ethical deployment of DNA evidence. Without a particular law, the judiciary has played a proactive role. One of the key recommendations is to

⁵⁰ National Human Rights Commission (NHRC), *Advisory on Use and Retention of DNA Data in Criminal Investigations*, Government of India, 2022.

⁵¹ R.K. Tiwari, "Emerging Trends in Forensic DNA Profiling: Challenges and Legal Reforms in India," (2022) 64 *Journal of the Indian Law Institute* 347.

⁵² Butler, J.M., *Advanced Topics in Forensic DNA Typing: Methodology*, (Academic Press, 2012), p. 35.

⁵³ N.S. Nappinai, *Technology Laws Decoded*, (2nd Ed., LexisNexis, 2021), p. 423.

have a clear legal regime that mandates a court order for obtaining DNA samples so that there will be a check on the power of the police. In addition to that, capacity building in the police force and forensic labs is an urgent need to ensure that proper collection, handling, and analysis of samples take place. The judiciary must itself be trained to properly examine advanced scientific evidence and avoid excessive dependence on DNA as an absolute source of facts.⁵⁴

C. Need for Legislative Reforms:

Most importantly, India needs a proper legislative framework to regulate DNA technology. The DNA Technology (Use and Application) Regulation Bill, 2019, is in the right direction, but it has to be made stronger to address pressing ethical issues. A strong law should encompass:

- a. **Explicit Consent Mechanisms:** Proper provisions for obtaining consent for the collection of DNA samples.
- b. **Purpose Limitation:** Strong control over what DNA profiles are allowed to be utilized for, excluding genetic study or other non-law enforcement purposes.
- c. **Data Protection and Expungement:** An explicit policy of data retention and an open procedure for automatic deletion of DNA profiles for persons who are not convicted of an offense.
- d. **Independent Oversight:** Creation of an influential, independent authority to oversee the national DNA database and provide assurance of compliance with privacy and ethical requirements.
- e. **Sanctions for Misuse:** Severe penalties for unauthorized collection, use, or disclosure of DNA data in order to discourage misuse.

Without such a broad law, legal and ethical issues will continue to overwhelm judicial and administrative solutions, exposing individuals to misuse of their genetic information.⁵⁵

⁵⁴ R. Basu, "Judicial Scrutiny of Scientific Evidence: The Case of DNA in India," (2020) 62 *Journal of the Indian Law Institute* 112.

⁵⁵ Vidhi Centre for Legal Policy, *Reforming India's DNA Law: Privacy, Oversight and Accountability*, (Policy Paper, 2022).

9. CONCLUSION

DNA evidence is an unparalleled tool of the cause of justice, but just like the unfamiliar strength comes with an ethical weight that needs to be very solemn. The use of this technology is responsible as it determines whether the criminal justice system can be said to have credibility to convict the guilty and clear the innocent against the pressure of protecting personal liberties. Something comprehensive and rights oriented must be legislated in India in the future. It is not just necessary that such a system establishes accurate standards when collecting, storing and analysing DNA evidence but also establish control measures concerning the proliferation of databases where genetic information is stored minus any valid reasons. It must also establish crystal-clear rules regarding new mechanisms like familial searching and ensure that use of DNA evidence is not compulsory or dictated as it must not violate the rights of the fundamental privacy of the body and integrity. It may be able to exonerate the innocent and condemn the guilty yet, when powerful legal and ethical safeguards are not in place; it may become an instrument of mass surveillance and governmental oppression.