



The Role of DNA Evidence in Sexual Offences in India: Admissibility, Procedural Integrity, and Constitutional Imperatives

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Abstract

The technique of DNA profiling has been characterised as the “gold standard” in forensic science, providing an objective method for identification in light of the fact that the testimony evidence presented in sexual offence cases is quite often unreliable. This article asserts that, despite the high evidential value of DNA evidence in the Indian Criminal Justice System, it is undermined by inadequate procedural safeguards and legislative gaps. DNA evidence is accepted in court as an expert opinion under the provisions of the Bharatiya Sakshya Adhiniyam 2023, while its collection is governed by the Bharatiya Nagarik Suraksha Sanhita 2023. Despite the resolution of the constitutional challenge to Article 20(3), the issues of privacy and the indefinite storage of DNA data remain controversial. The courts emphasise strict compliance with the principles of Chain of Custody and the mandatory disclosure of the Random Match Probability; however, empirical data are inconclusive in most cases due to the late medical examination and preventable destruction of evidence.

Keywords: DNA Evidence; Sexual Offences; Chain of Custody; Bharatiya Sakshya Adhiniyam; Right to Privacy; DNA Technology Regulation Bill

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Introduction: DNA Evidence as the “Gold Standard” in the Indian Criminal Justice System

Context and Necessity: The Evidentiary Gap in Sexual Offences

Sexual offences continue to be one of the most prevalent and under-prosecuted types of crimes in India. They include rape and other sexual offences against



women under the Bharatiya Nyaya Sanhita, 2023 (earlier known as the Indian Penal Code, 1860), as well as offences against children under the Protection of Children from Sexual Offences (POCSO) Act, 2012. National statistics reveal the extent of the problem: the conviction rate in rape cases dropped from 32.2% to 27.8% during the years 2017 to 2019, with more than 1,45,632 such cases yet to be tried by the end of 2019 (NCRB, 2020). A substantial number of these cases involve victims who are children, which explains why the POCSO Act holds such an important position in the context of this essay due to the evidentiary difficulties associated with it.

In these broader categories of sexual offences, the offence takes place without the presence of witnesses and, hence, any prosecution becomes highly dependent upon testimony which is either subject to coercion, hostile witnesses, or simply a lack of corroboration. Scientific advancements such as DNA profiling have helped overcome some of these challenges by providing an objective, scientifically based basis for including or excluding suspects in a case (Chhikara, 2020).

The DNA of every individual is distinct, and through DNA profiling, an investigator can determine or exclude a link among the accused, the victim, and the crime scene in ways that testimony alone cannot. The use of DNA profiling in India is an effort to increase the integrity of criminal proceedings rather than merely an infatuation with a new technology. The power of DNA evidence lies in the fact that it is not only a means of convicting a guilty party but also a means of exonerating an innocent party, and that is exactly why it requires a balanced legal framework.

Scope, Methodology, and Thesis Statement

The present work is based on the doctrine approach wherein it is based on the Constitution of India, the statutes (the Bharatiya Sakshya Adhiniyam, 2023, and the Indian Evidence Act, 1872; the Bharatiya Nagarik Suraksha Sanhita, 2023, and the Code of Criminal Procedure, 1973), judicial precedents, and forensic science literature. The study looks into the statutory provision for the



admission of DNA evidence, its constitutional legitimacy, judicial guidelines regulating its admission, the most notable being Chain of Custody and Random Match Probability, practical problems facing its admission in sexual offence investigations, and the controversy surrounding the pending DNA Technology (Use and Application) Regulation Bill, 2019.

The main thesis that is put forth in the present work is that while DNA evidence has relevance in the prosecution of sexual offences in India, this relevance is undermined due to procedural defects and lack of forensic infrastructure, along with the absence of relevant legislation, which, if the current pending bill is not amended, will lead to a gross violation of the Right to Privacy.

The use of the doctrinal method in this case is preferred over the socio-legal and empirical approaches owing to the nature of the paper's key issues, which concern whether there is sufficient legislative justification for DNA evidence under the BSA and BNSS, as well as the constitutional validity of the proposed Bill. The empirical evidence in Section II comes from various publications and government statistics, not from any research conducted for this paper. The socio-legal research, which would rely on surveys carried out on investigators, forensic analysts, and victims of sexual abuse, among others, would be useful in supplementing the analysis carried out here, especially regarding the reasons for the procedural shortcomings discussed in Section II.

Technical Foundations and Forensic Application in Sexual Assault Cases

Locard's Principle and Trace Evidence Collection

Examinations of sexual assault depend on Locard's Exchange Principle, which states that any contact involves the exchange of something. In cases like this, there is usually a trace left behind by an assailant unintentionally in the form of biological matter such as semen, saliva, blood, hair, or even skin cells passed on through contact ("touch DNA") on the victim's body or even clothes ("Forensic investigations and crime lab processes"). It is up to the forensic



examiner to detect and collect biological samples to profile DNA and determine whose it is (Doshi, 2022). Since touch DNA samples are very minute, collection should be done immediately before they deteriorate.

DNA Profiling Methodology and Interpretation

DNA profiling for forensic science purposes has gone beyond the initial restriction fragment length polymorphism method. The procedure now involves using PCR to analyse STRs, enabling a complete profile to be generated even if the DNA is highly degraded or only a minute amount is present. Comparing two DNA profiles can yield one of the following results: a match, an exclusion, or an inconclusive result. If the profiles are found to be alike, they will be considered to have come from the same biological source.

A match can be tricky to interpret, since the fact that a profile is obtained cannot, in itself, reveal how the DNA ended up in that particular place. And that is when the Hierarchy of Propositions comes into play: it takes the discussion away from the existence of the profile itself (“source” level) towards direct vs indirect transfer (“activity” level). It is important because touch DNA, due to its minuscule amounts, can be transferred through indirect contact, even when the suspect had no physical contact with either the victim or the object of interest. To put it simply, finding someone's DNA at a crime scene sounds impressive, but that doesn't prove guilt in itself.

Empirical Reality: The Bottleneck in Profile Generation

The scientific reliability of DNA profiling means little if investigators cannot collect a usable sample in the first place, and this is where the Indian system struggles most. A study of 142 sexual assault cases illustrates the scale of the problem (Titus, 2023).

Where a viable biological sample was actually recovered (in 39 of the 142 cases, or 27.46%) DNA profiling did its job: the assailant was included in 27 cases (19.01%) and excluded in 12 (8.45%). These figures confirm that the



underlying science is sound whenever it has something to work with (Pal, Kumari, & Devi, 2023).

The difficulty is that in 103 cases (72.54%), profiling could not even be attempted because no spermatozoa or other biological traces could be detected on the exhibits (Titus, 2023). That figure, which is nearly three-quarters of the sample, is the real bottleneck, and it has little to do with laboratory science. It instead points to failures at the crime scene and during the medico-legal examination. If viable evidence cannot be secured in most cases, DNA's "gold standard" status remains largely theoretical for Indian sexual offence investigations.

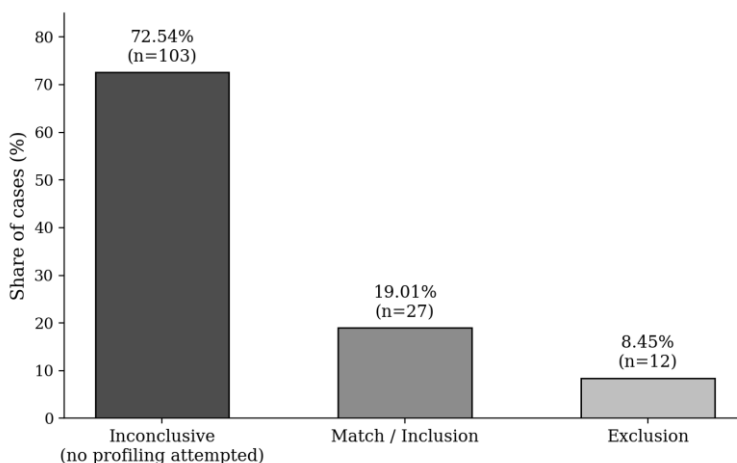


Figure 1: Outcome Distribution in the 142-Case DNA Profiling Study
Source: (Titus, 2023; Pal, Kumari, & Devi, 2023)

Delay compounds the problem. Only 18 cases (12.68%) saw a medico-legal examination on the first day after the assault, and in 29 cases (20.42%) the survivor had already bathed or washed their clothes, both of which destroy or degrade the evidence investigators most need (Pal, Kumari, & Devi, 2023).



National Crime and Forensic Infrastructure Data

In this regard, the 142-case study offers a good example, but national statistics clearly indicate that this is not a lone case. NCRB statistics reveal that the conviction rate for rape crimes reduced from 32.2% to 27.8% from 2017 to 2019, with 1,45,632 cases of rape being pending as of the end of 2019 (NCRB, 2020), and this is in line with an evidential database that is often too weak to prove the conviction.

The forensic capacity required to bridge this gap is insufficient. There are currently 7 CFSLs, 32 SFSLs, and 97 RFSLs in India (Ministry of Home Affairs [MHA], 2024a), and the 7 CFSLs have processed 69,826 cases over the past five years, leaving a substantial backlog (MHA, 2024a). In general, Kathane, Singh, Gaur, and Krishan (2021) estimated that there were 0.7 to 0.8 million cases that were pending within Indian forensic laboratories up to 2021, and it takes about 6 months to 2 years to process the DNA and toxicology reports, which are factors that undermine CoC and timeliness criteria discussed in this paper later on.

However, government initiatives to tackle this issue have been initiated, although they seem inadequate to solve the problem entirely. Under the Nirbhaya Fund Scheme for development of DNA profiling and Cyber forensics facilities, 30 States and Union Territories have received approvals for projects worth Rs. 245.29 crore. Additionally, the National Forensic Science University (NFSU) which was constituted by the Act of Parliament in 2020 has been expanded through additional campus facilities to train forensic manpower (MHA, 2024b). Furthermore, under the Scheme for Modernisation of Forensic Capacities, which is an initiative involving expenditure of Rs. 2,080.5 crore, 32,000 investigation officers, prosecuting lawyers, and medical officers have been trained, and 18,020 SAFE kits have been supplied across the country (Talukdar, 2025). Despite being significant steps, when compared to the backlog of cases amounting to hundreds of thousands, these initiatives highlight that, instead of solving the issue of the paper, infrastructural and



training requirements, and not science itself, constitute the bottleneck for the use of DNA evidence in Indian sexual offence trials.

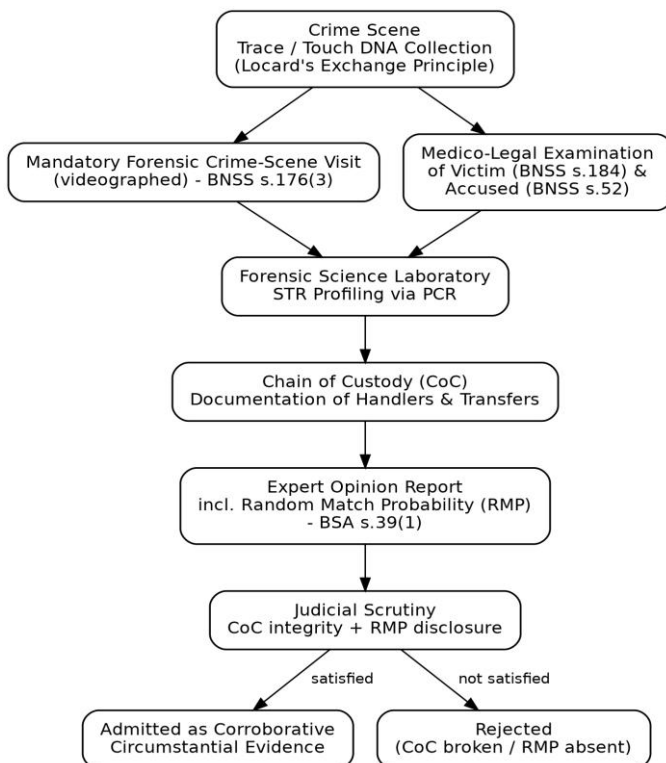


Figure 2: The DNA Evidence Pathway, From Crime Scene to Courtroom (Source: Self-Created)

Statutory Basis and Procedural Mandates

DNA as Expert Opinion under the Bharatiya Sakshya Adhiniyam, 2023 (BSA)

There are no separate laws governing the admissibility of DNA evidence in India; hence, the courts have to rely on the available evidentiary provisions.



The relevant section in this regard is Section 39(1) of the Bharatiya Sakshya Adhiniyam, 2023, which states that wherever an issue of foreign law or science or art or as to identity of handwriting or finger impressions or any other field is involved, expert opinion would be relevant.

Section 39(1) is slightly broader than its antecedent, Section 45 of the Indian Evidence Act, 1872, owing to the addition of the phrase “or any other field.” Despite being highly scientific and objective and possessing high probative value, DNA profiling is considered expert opinion; hence, a court must consider it alongside all other evidence and cannot accept it independently. It works as strong circumstantial evidence, confirming or discrediting other facts of the case.

Mandatory Collection under the Bharatiya Nagarik Suraksha Sanhita, 2023 (BNSS)

The Indian Criminal Procedure Code, 1973, has been substituted by the Bharatiya Nagarik Suraksha Sanhita, 2023, which provides for the procedures of collecting biological samples in cases of sexual offences.

DNA Sample Collection Procedures

The BNSS continues from Section 52 of the old Section 53A of the CrPC that mandates the examination of those arrested for rape or attempted rape, with the inclusion of collecting material “for DNA profiling.” There is one thing that must be mentioned as an improvement: under the BNSS, any police officer can order the conduct of the examination, whereas the CrPC limited the request to Sub-Inspector and above-rank officers.

The examination of the victim is governed by Section 184 of the BNSS (old Section 164A of the CrPC). The section requires the collection and preservation of forensic evidence, including DNA, with the consent of the woman or another person who can give consent on her behalf.

Procedural improvement through legislative strengthening and continuing deficiency



The BNSS Act does indeed include some meaningful procedural improvements. The BNSS Act section 176(3) demands that there be an expert visit to the crime scene to film the procedure for any crime that carries a punishment of more than seven years in prison, including the crime of rape, and this is obviously meant to ensure some consistency in the collection of the evidence at the very source. Similarly, section 184(6) requires that the medical practitioner send the victim's report to the investigating officer within seven days.

This is indeed a procedural improvement in the collection and documentation of evidence, but the basic deficiency remains: neither the BNSS Act nor the previous Act provides a uniform procedure for the subsequent storage and handling of the DNA samples and profiles collected. The courts have continued to fill this deficiency through the common law by rigorously applying the chain-of-custody requirement.

The Call for Specific Legislation

The demand for dedicated DNA legislation predates the new codes and stems from the inadequacy of the old Indian Evidence Act and the fragmented CrPC. The BNSS and BSA go some way toward addressing this, but they are not a substitute for the standalone legislation needed to govern centralised data banking and quality control and that remains the task of the still-pending DNA Technology (Use and Application) Regulation Bill.

The BNSS closes some procedural gaps by making forensic investigation mandatory: under Section 176(3), any offence carrying a sentence of seven years or more requires a forensic expert to visit the scene, with the process recorded on video, a direct response to the long-standing problem of poor sample handling. Sections 52 and 53 similarly formalise how biological samples are collected from an accused, replacing the CrPC's piecemeal approach with a clearer basis for police action.

The BSA, for its part, modernises the law of evidence to accommodate scientific proof. Section 39 recognises DNA analysis as expert opinion, and



the Act also broadens the definition of “document” to cover electronic and digital records, treating them as primary evidence which is a change that matters because laboratory records and test reports are generated digitally, and this reform helps establish their integrity for chain-of-custody purposes.

What neither statute does is create the specialised institution needed for a national DNA data bank, a long-standing recommendation of the Malimath Committee and a feature of systems such as the United States’ CODIS. The Criminal Procedure (Identification) Act, 2022, allows biological samples to be collected and stored, but it is the stalled 2019 Bill that would create a dedicated DNA Regulatory Board to oversee lab standardisation, quality control, and privacy safeguards. The BNSS and BSA have strengthened the ground on which DNA evidence stands, but the call for a specific law governing its infrastructure and privacy dimensions remains unanswered.

Aspect	Old Law (IEA, 1872 / CrPC, 1973)	New Law (BSA, 2023 / BNSS, 2023)
Admissibility of DNA analysis	IEA s.45: expert opinion limited to “foreign law, science, art, handwriting or finger impressions”	BSA s.39(1): same categories, plus the residual phrase “or any other field”
Medical examination of accused	CrPC s.53A: examination could only be requested by an officer not below the rank of Sub-Inspector	BNSS s.52: any police officer may request the examination
Medical examination of the victim	CrPC s.164A: collection and preservation of forensic evidence, subject to consent	BNSS s.184: same substantive requirement, subject to consent, is retained
Crime-scene forensic visit	No statutory requirement for a forensic expert to visit the crime scene	BNSS s.176(3): mandatory, video graphed forensic visit for offences carrying 7+ years’ imprisonment
Timeline for medical report	No statutory deadline for forwarding the victim’s medical report	BNSS s.184(6): report must reach the investigating officer within seven days



Aspect	Old Law (IEA, 1872 / CrPC, 1973)	New Law (BSA, 2023 / BNSS, 2023)
Status of electronic/digital records	IEA definition of “document” does not clearly extend to electronic records	BSA expands the definition of “document” to include electronic and digital records as primary evidence
Centralised DNA data bank	Not addressed: left to the separate, still-pending DNA Technology (Use and Application) Regulation Bill, 2019	Not addressed either: the same legislative gap persists under the new codes

Table 1: Comparative Overview of DNA-Related Provisions under Old and New Criminal Laws (Source: Self-Created)

Constitutional Scrutiny: Article 20(3) and the Privacy Imperative

The Right Against Self-Incrimination (Article 20(3))

Compulsory DNA profiling was argued to be covered by Article 20(3), which states that no accused person can be compelled to be a witness against himself. It was argued that forcing an individual to provide his biological specimen amounted to self-incrimination. This question was answered by the Supreme Court in *State of Bombay vs. Kathi Kalu Oghad (1961)*, where it held that compulsion within Article 20(3) is testimonial, which means forcing the accused to make a statement, and thus physical evidence like fingerprints, body measurements, and biological specimens is not included in that right. In *Selvi vs State of Karnataka (2010)*, this rationale has been reaffirmed even for scientific and forensic tests. Therefore, any DNA test conducted under the lawful authority of a court or statute (Section 53A of CrPC, now Section 52 of BNSS) is not violative of Article 20(3).

The Right to Life and Personal Liberty (Article 21) and Privacy

The live constitutional debate has since moved from self-incrimination to privacy under Article 21. In *Justice K.S. Puttaswamy (Retd) v. Union of India*



(2017), privacy was recognised as a fundamental right; therefore, any state action involving genetic data is subject to strict scrutiny. Genotypic data are highly sensitive and may contain information about family ties and predisposition to certain diseases, not only identity. Courts have to weigh the right to privacy and bodily integrity against the state's interest in prosecuting criminal acts. In order for any infringement of privacy to be justified constitutionally, it has to be just, reasonable, lawful, and proportionate to a legitimate aim. Collecting a genetic sample during the investigation of a serious crime will most likely satisfy these conditions. The more difficult part of this issue concerns the retention of DNA profiles after the investigation is completed. Insofar as the retention of information on acquitted individuals, suspects, and undertrials is concerned, however, there is an entirely different story to be told. Should the logic be that the information may turn out to be relevant in some unrelated case in the future, the use of such a database for solving crimes has become secondary to the more general act of surveillance by the state – an issue which *Puttaswamy's* proportionality principle is unlikely to permit.

Judicial Admissibility Standards: from Scientific Match to Legal Reliability

Early Acceptance and Definitive Proof

Without any statutory directions, the judiciary had traditionally relied on DNA evidence with a great deal of trust, if not always critical trust. Thus, in the case of *Santosh Kumar Singh v. State through CBI (2010)*, the Supreme Court referred to DNA reports as an “exact science” that could not be challenged and was enough by itself to support a conviction. The overall judicial approach was that a match between the crime scene and the defendant's DNA proved a shared biological origin.

The Mandate for Statistical Rigor: Random Match Probability (RMP)

However, despite its seemingly unequivocal nature, DNA testing is a probabilistic process, except in the case of identical twins. Estimating the



likelihood of the match is necessary to determine the reliability of the test result and is known as the calculation of the Random Match Probability (RMP) or Likelihood Ratio (LR), which indicates how unique this profile is in the general population (Doshi, 2022). The absence of such information from the forensic reports was recognized by the courts as increasing the probability of falling into the trap of the so-called “prosecutor’s fallacy,” assuming the defendant's guilt based on the uniqueness of his profile.

This problem was settled in *Manoj v. State of Madhya Pradesh (2023)*. In this case, the Supreme Court stipulated that a forensic expert presenting the results of the comparison should also provide the calculation of the random occurrence ratio, and that the absence of such data would render the report insufficient to provide clinching evidence.

Case Study: DNA in Conviction for Sexual Offences (Mukesh v. State (NCT of Delhi))

The case of Mukesh v. State (NCT of Delhi) (2017), which originated from the Delhi gang-rape incident of 2012, could probably be the best example of the weight of DNA evidence as proof of the crime. The apex court placed a lot of emphasis on the DNA evidence linking the accused to the victim as well as the crime scene. It was called unimpeachable evidence linking the accused to the crime scene. Since there was no explanation of the presence of the DNA of the accused at the crime scene, silence became a seal of his conviction.

The Gatekeeper of Admissibility: Chain of Custody (Coc) and Contamination

The Chain of Custody Imperative

The validity of scientific evidence depends on the process by which it was obtained. Chain of Custody (CoC) is a record of all individuals who have come into contact with a biological sample, along with all transfers it has undergone from its collection to its arrival at the court.



The continuity of the Chain of Custody is treated as a prerequisite by the courts for admissibility of the evidence because there is no meaning in the quality controls in a laboratory when the sample's path to it cannot be established.

Procedural Lapses and Judicial Rejection: The Rahul Mandate

A case such as *Rahul v. State of Delhi (2022)*, wherein there is a breach in the chain despite a very serious case of sexual offense, illustrates the consequences that follow. In this particular case, the DNA samples were a perfect match to the evidence presented against the accused, but the court acquitted the accused because the samples had been stored in unauthorized police custody for two months.

The takeaway from the case is simple: a breach in the Chain of Custody destroys any scientific certainty as far as the law is concerned. It is necessary for the court to ensure that the sample collected is the same sample tested, and that any unexplained retention of samples by the police does not undermine that assurance.

Practical Impediments to Evidence Preservation

These procedural inadequacies, elaborated in Section II, are responsible for the empirical failures listed above. Only 12.68% of victims were tested the same day they suffered the sexual assault, which allows enough time for either bacterial/fungal damage or the loss of evidence itself (Pal, Kumari, & Devi, 2023). After the assault, other activities, such as bathing or washing one's clothes, can contribute to the destruction of evidence and help explain the 72.54% inconclusive rate.

The judiciary's response is to establish a strict deadline for this procedure: the specimen must be delivered to the Forensic Science Laboratory within 48 hours and accompanied by a chain-of-custody document.



Legislative Reform: Analysis of the DNA Technology (Use and Application) Regulation Bill, 2019

Structure and Objectives of the Bill

The DNA Technology (Use and Application) Regulation Bill, 2019 was introduced to address the statutory lacuna mentioned above and to establish a specific regime for regulating DNA technology in India, including how DNA profiles are collected, analyzed, and used to establish the identity of various categories of individuals. This bill provides for a DNA Regulatory Board to set quality standards and accredit laboratories, and to establish National and Regional DNA Data Banks. Significantly, this data bank is not confined only to convicted offenders; rather, it includes suspects, undertrial prisoners, missing persons, and unidentified deceased bodies as well.

Controversies: Privacy, Consent, and Proportionality Failure

The method of collection and retention provided for by the Bill has faced many constitutional challenges. Under Section 21, there may be no need for written consent to collect any bodily substance where the accused person is punishable for life or over seven years; in other cases, a magistrate may authorize the collection against an individual's will.

The reason behind such criticisms is the danger of infringement of privacy rights which were established in the case of *Puttaswamy*. It is due to the nature of people whose genetic profiles are retained in the database created by the Bill. The retention of profiles of suspects, undertrials, or acquittals without having any of them found guilty is a serious violation of privacy that cannot be justified. In the case of acquittal, a person should have his or her genetic information deleted, not preserved, because of its potential future use in another investigation. This way, the purpose of the database will shift from crime-solving to permanent surveillance.

Such a database, obviously, entails the risk of abuse, hacking, and surveillance that will also concern a person's family. Until the Bill confines



retention only to those who are actually convicted of the offense, with an explicit mechanism of destroying the information within a specific period for others, this will continue to be its major constitutional flaw.

Conclusion and Policy Recommendations

Summary: The Imperative for Integrated Reform

In the case of India's use of DNA evidence in response to sexual offenses, the situation is a difficult one for two reasons: the potential value that such evidence could hold, despite procedural inadequacy and constitutional doubts. Regarding self-incrimination, the issue has already been decided; the privacy issue, especially the national database, has yet to be considered.

The fact of the matter is that the more pressing issue is not the validity of the science, but the investigators' ability to provide evidence that holds up in the first place. With an inconclusive rate of 72.54%, it becomes apparent that policymakers would do well to shift their focus from the debate over the database to enforceable Chain of Custody standards.

Policy Recommendations for a Robust DNA Regime

Reconciliation between scientific robustness and legal acceptability necessitates integrated reforms in both legislative, judicial, and investigative fields:

- 1. Legislative drafting in adherence to the Constitution.** The DNA Technology Bill, 2019 needs to be drafted in a way that it abides by the principles of necessity and proportionality laid down in *Puttaswamy*. The data must be retained for those convicted, while the profiles of suspects, undertrials, and acquitted individuals must be destroyed according to a definite timeline.
- 2. Statistical transparency requirement.** According to the precedent of *Manoj v. State of Madhya Pradesh*, it is necessary for the court to require the inclusion of the RMP and LR to accept DNA evidence.



3. Ensuring Chain of Custody. There must be National Standard Operating Procedures for the process of collecting, documenting, and transferring the biological evidence, and the 48-hour period for transportation of the evidence collected to forensic laboratories should strictly be adhered to, as well as keeping a verifiable Chain of Custody register, as per the *Rahul v. State of Delhi* case.

4. Investment in first responder training and infrastructure. The problem of 72.54% of procedural failures can be overcome only through investment in training of police, first responders, and medical practitioners for evidence collection, and using the Sexual Assault Forensic Examination (SAFE) kit protocol along with advice to victims on evidence preservation.

5. Autonomy and Accountability of Forensics. The independent body proposed in the 2019 Bill must be established to establish lab protocols, conduct blind proficiency tests, and audit processes to avoid examiner bias, contamination, and internal error.

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