

## THE SIGNIFICANCE OF DNA IN THE INDIAN CRIMINAL JUSTICE FRAMEWORK

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### *Abstract*

*The advancement of scientific technology has led to profound changes in the daily lives of individuals. While these changes have brought about numerous benefits in terms of lifestyle and conveniences, they have also posed considerable challenges for law enforcement agencies, which must address the ways in which criminals exploit technology to engage in unlawful activities. The utilization of scientific methods within the realm of criminal investigations is referred to as Forensic Science. Technological innovations have significantly influenced multiple facets concerning the efficiency of the justice system. The discovery of DNA has led to new lines of inquiry, and the settlement of many civil and criminal cases has been considerably improved by developments in DNA technology and its incorporation into legal procedures. Proponents of forensic DNA testing argue that DNA analysis is largely devoid of errors, suggesting that advancements in DNA technology represent a significant enhancement in the pursuit of truth, the prosecution of offenders, and the exoneration of individuals wrongfully convicted. Forensic DNA testing has been a game-changer, allowing for the accurate identification and prosecution of many criminals who would have otherwise eluded justice. This article examines the implications of recognizing DNA as valid evidence within the legal framework and offers a comprehensive evaluation of the status of DNA testing in India. This study investigates the domain of DNA identification and its utilization in criminal investigations and judicial processes. It analyzes the primary benefits and drawbacks associated with the growing significance of DNA identification in the context of criminal justice, particularly within India.*

**Keywords:** *DNA Criminal Justice, Criminal Trials, Evidence, Expert Witness, Forensic Science.*

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## 1. INTRODUCTION

DNA is an abbreviation that represents Deoxyribonucleic Acid. In the body of an individual, every cell—excluding red blood cells and gametes—houses the complete "genetic blueprint" encoded within its DNA.<sup>2</sup> Guanine, Cytosine, Adenine, and Thymine—commonly shortened to G, C, A, and T—are the only four essential bases that make up the genetic program. The twenty amino acids that are necessary for living creatures to function as building blocks are represented by these bases, which are arranged into groups of three called codons.<sup>3</sup> Amino acids are subsequently connected to creating proteins. Certain codons function as "stop codons," indicating that the translation of the amino acid sequence should conclude.<sup>4</sup> Despite significant advancements in recent years and a comprehensive understanding of the genetic code, biologists continue to face challenges in deciphering how this code is expressed. Notably, while liver and brain cells share the same genetic information, the manifestation of that information in each cell type is markedly distinct.<sup>5</sup> The segment of DNA responsible for protein synthesis clearly differs among individuals; otherwise, all humans would exhibit the same physical characteristics.<sup>6</sup>

Found in almost all the body's cells, DNA is the molecular blueprint that houses all an individual's genetic information. Every person has a unique DNA, except for identical twins.<sup>7</sup> The growing prevalence and endorsement of DNA technology as a form of evidence present numerous challenges for the criminal justice system.<sup>8</sup> Nonetheless, discussions persist regarding the degree to which guilt can be deduced from a seemingly positive match. DNA evidence, while valuable, cannot conclusively establish all components of a criminal offense.<sup>9</sup>

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<sup>2</sup> Khan, F. A. (2018). Genes and genomics. In *Biotechnology Fundamentals* (pp. 27-74). CRC Press.

<sup>3</sup> Goel, P., & Padole, M. (2019). Bioinformatics: an application in information science. In *First International Conference on Artificial Intelligence and Cognitive Computing: AICC 2018* (pp. 223-238). Springer Singapore.

<sup>4</sup> Swart, E. C., Serra, V., Petroni, G., & Nowacki, M. (2016). Genetic codes with no dedicated stop codon: context-dependent translation termination. *Cell*, 166(3), 691-702.

<sup>5</sup> Weiskirchen, R., Weiskirchen, S., & Tacke, F. (2019). Organ and tissue fibrosis: Molecular signals, cellular mechanisms and translational implications. *Molecular aspects of medicine*, 65, 2-15.

<sup>6</sup> Penke, L. (2010). Bridging the gap between modern evolutionary psychology and the study of individual differences. *The evolution of personality and individual differences*, 243. Tooby, J., & Cosmides, L. (1990). On the universality of human nature and the uniqueness of the individual: The role of genetics and adaptation. *Journal of personality*, 58(1), 17-67.

<sup>7</sup> Cheung, K. M., Ho, D. W., & Song, Y. Q. (2010). DNA is the blueprint of our human body. Variations in DNA are the source for the phenotypes of different individuals. The two most common types of variations, also called polymorphisms, are microsatellites and single nucleotide polymorphisms (SNPs) in our DNA. *The Growing Spine: Management of Spinal Disorders in Young Children*, 49.

<sup>8</sup> Oosthuizen, T., & Howes, L. M. (2022). The development of forensic DNA analysis: New debates on the issue of fundamental human rights. *Forensic Science International: Genetics*, 56, 102606.

<sup>9</sup> Meintjes-Van der Walt, L., & Dhliwayo, P. (2021). DNA Evidence as the Basis for Conviction. *Potchefstroom Electronic Law Journal/Potchefstroomse Elektroniese Regsblad*, 24(1).

Typically, its primary function is to associate a suspect with the crime scene.<sup>10</sup> In instances of sexual assault, it may provide additional insights; however, it remains insufficient in resolving the critical question of consent.<sup>11</sup>

## 2. DNA PROFILING VIS-A-VIS THE INDIAN LEGAL FRAMEWORK

DNA evidence requires meticulous collection, preservation, and documentation to ensure its admissibility in court. The accompanying documentation must demonstrate to the judge that the evidence is both reliable and credible.<sup>12</sup> In India, there exists no dedicated legislation that offers investigative agencies and judges' explicit direction regarding the procedures to follow when handling DNA evidence.<sup>13</sup> The Indian Evidence Act of 1872, and the Code of Criminal Procedure of 1973 lack specific provisions that pertain to forensic science, scientific investigation, or advancements in technology.<sup>14</sup> The lack of these provisions poses considerable difficulties for investigators employing modern techniques to ascertain the culpability of the accused. A police officer, in accordance with Section 53 of the Code of Criminal Procedure 1973 (now Section 53 of BNSS, 2023), may seek the assistance of a medical professional in good faith to investigate.<sup>15</sup> The current regulations do not permit a complainant to acquire biological samples, including blood or semen, for the purpose of initiating a criminal complaint against the alleged perpetrator.<sup>16</sup>

The 2005 amendment to the Criminal Procedure Code, facilitated by the endorsement of a medical expert, established two new provisions that empower the investigating officer to collect DNA samples from both the victim and the suspect.<sup>17</sup> The components contribute to the medical assessment of the assault victim and the evaluation of individuals accused of rape by a healthcare professional. The Supreme Court's and many High Courts' inconsistent decisions

<sup>10</sup> Kayser, M. (2015). Forensic DNA phenotyping: predicting human appearance from crime scene material for investigative purposes. *Forensic Science International: Genetics*, 18, 33-48.

<sup>11</sup> Small, J. L. (2020). Conceptualizing consent: How prosecutors identify sexual victimization in statutory rape cases. *Law & Social Inquiry*, 45(1), 111-131.

<sup>12</sup> Nurse, K. R. D. (2018). *Forensic Experts' Best Practices in DNA Collection, Analysis and Testimony: A Delphi Study* (Doctoral dissertation, The University of the Rockies).

<sup>13</sup> Airen, D. (2022). Relevancy of Forensic Evidence in Indian Criminal Justice System and Analysis. Available at SSRN 4290003. See also, Bishnoi, A. (2020). The DNA Technology (Use & Application) Regulation Bill, 2019 Vis-a-Vis Data Privacy. *Pragyaan: Journal of Law*, 68.

<sup>14</sup> Goswami, G. K., & Goswami, S. (2022). Legal contours for DNA evidence. In *Handbook of DNA Forensic Applications and Interpretation* (pp. 89-101). Singapore: Springer Nature Singapore.

Trehan, P. (2022). Role of Forensic and Scientific Methods in Criminal Investigation. *Global Journal of Enterprise Information System*, 14(4), 37-45.

<sup>15</sup> Shah, P. Custodial police interrogation of suspects in India. In *Routledge International Handbook of Investigative Interviewing and Interrogation* (pp. 214-223). Routledge.

<sup>16</sup> Gonu, V. K. (2021). *Crimes against Women: Investigation Techniques*.

<sup>17</sup> The Code of Criminal Procedure (Amendment) Act, 2005 <https://www.mha.gov.in/sites/default/files/2022-09/TheCCP%28Amendment%29Act%2C2005%5B1%5D.pdf>

in several cases have left the admissibility of this evidence unclear. While judges acknowledge the scientific reliability and definitive nature of DNA testing, there are instances where such evidence is excluded due to legal or constitutional restrictions, as well as considerations of public policy.<sup>18</sup> The Indian Evidence Act of 1872, and the Code of Criminal Procedure of 1973 lacked specific provisions that pertain to issues concerning science and technology. Consequently, it is imperative to reevaluate these legal frameworks and their associated regulations.

The advent of DNA technology has presented significant challenges to various individuals' legal and practical entitlements, including the "Right to Privacy" and the "Right Against Self-Incrimination".<sup>19</sup> Judges have often shown hesitance in admitting evidence derived from DNA testing, largely due to concerns surrounding its reliability. Article 21 of the Indian Constitution asserts that the Right to Life and Personal Liberty includes the Right to Privacy<sup>20</sup> Article 20(3) additionally safeguards individuals from being compelled to provide self-incriminating testimony in legal proceedings, indicating that a defendant is not obligated to disclose information that may be detrimental to their case.<sup>21</sup> The Supreme Court has consistently maintained that the right to life and personal liberty is not unconditional.<sup>22</sup>

### 3. CONVERGENCE OF DNA ANALYSIS AND PRODUCTION OF EVIDENCE

Recent developments in the intersection of science and law are primarily characterized by a growing dependence on DNA profiling and the implementation of electronic audio and video technology for documenting police interrogations of suspects.<sup>23</sup> Both significant advancements have been extensively acknowledged in scholarly literature and deemed crucial for transforming the landscape of evidence production. Certainly, these two significant alterations are regarded together to counteract the ongoing issues related to evidentiary challenges, such as ambiguous identity and police statements. Although these changes have drawn criticism from a variety of quarters, it has been suggested that the "more nuanced, detrimental

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<sup>18</sup> Jana, A., & Singh, K. (2022). FORENSIC DNA PROFILING IN INDIA: AN EMERGING HUMAN RIGHTS HAZARD. INDIAN JOURNAL, 1(1), 22.

<sup>19</sup> Joy, S., Bastian, T. S., Selvamani, M., & Abraham, S. (2018). India-National DNA offender database as tool for criminal surveillance: Need for public debate!!!. *Journal of Medicine, Radiology, Pathology and Surgery*, 5(3), 11-14.

<sup>20</sup> Chowdhury, M. (2023). Demystifying Article 21: Heart and Soul of the Indian Constitution. *Issue 3 Int'l JL Mgmt. & Human.*, 6, 3418.

<sup>21</sup> Sahoo, S. (2022). Protection of Right against Self-Incrimination. *Part 2 Indian J. Integrated Rsch. L.*, 2, 1.

<sup>22</sup> Hussain, P. M. (2021). Constitutional Rights in India An Assessment of Judgments of Justice PN Bhagwati. *Journal of Constitutional Law and Jurisprudence*, 4(2), 9-24.

<sup>23</sup> Ravichandran, S. I. (2023). *Genomic Carcerality: Science, Technology & Law in the Emergence of Bio/Surveillance* (Doctoral dissertation, University of Illinois at Chicago).

consequences of this phenomenon" have gone largely unreported in the body of research on criminal justice, even in spite of the increasing impact of science in this field.<sup>24</sup> There are important questions that arise when DNA evidence is used in court, especially because lawyers may not fully comprehend scientific principles.<sup>25</sup> Ongoing discussions surrounding the generation of evidence in criminal trials and the investigative techniques employed by law enforcement remain central to academic and theoretical discourse.

### 3.1 Admissibility of DNA Evidence

One major issue with the legal system is the admissibility of DNA evidence. Presenting such evidence requires striking a compromise between the state's interests and the accused's legal rights. This necessity underscores the importance of adhering to legal standards that ensure the proper collection of DNA samples. The judiciary has the authority to weigh the possible prejudices of DNA evidence against its probative value in order to determine whether it is admissible. DNA evidence has been implicitly acknowledged in several convictions established in India, as outlined in Section 45 of the Indian Evidence Act, 1872.<sup>26</sup> The corresponding Section according to the new criminal laws would be Section 39 of Bharatiya Sakshya Adhiniyam, 2023. This section pertains to expert opinions, stating that "when the court is required to form an opinion on a matter of foreign law, science, or art, or regarding the identity of handwriting (or fingerprints), the opinions of individuals with specialized knowledge in those areas are considered relevant facts."

In *Ananth Kumar vs. State of Andhra Pradesh*<sup>27</sup> the Andhra Pradesh High Court ruled that while the Criminal Procedure Code does not explicitly provide for the collection of blood samples, there is no prohibition against obtaining such samples from an accused under Section 53 of the Code. The Court noted that the collection of blood and semen samples falls within the examination of an arrested individual, asserting that "the examination by a medical practitioner must logically encompass testing of blood, sputum, semen, urine, etc."

Further, the Court concluded that Section 53 allows for the use of reasonable force necessary to conduct such examinations. It was concluded that, notwithstanding any potential discomfort,

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<sup>24</sup> Suruchi Yadav, Impact of Forensic Science on Indian Criminal Justice, International Journal of Legal Science and Innovation [Vol. 6 Iss 3; 1151] <https://ijlsi.com/wp-content/uploads/Impact-of-Forensic-Science-on-Indian-Criminal-Justice.pdf>

<sup>25</sup> Cashman, K., & Henning, T. (2012). Lawyers and DNA: Issues in understanding and challenging the evidence. *Current issues in criminal justice*, 24(1), 69-83.

<sup>26</sup> *Supra* note 13.

<sup>27</sup> *Ananth Kumar Naik vs The State Of Andhra Pradesh on 6 July, 1977 (1977CRILJ1797)*.

blood or semen samples may be collected from an arrested individual in compliance with Sections 53 and 54 of the Criminal Procedure Code. Now they could be considered under the BNSS, corresponding Sections being 53 and 54) Additionally, in the case of *Jamshed vs. State of Uttar Pradesh*<sup>28</sup> the Division Bench of the Allahabad High Court, referencing the Supreme Court's ruling in *State of Bombay vs. Kathi Kalu*, affirmed that conducting blood and urine tests is not prohibited by Article 20(3) of the Constitution. The courts ruled that medical evidence primarily constitutes opinion rather than definitive proof, rendering it insufficient as substantive evidence. The assessments performed by the physician overseeing the autopsy, in conjunction with the findings from the forensic science laboratory, are regarded as credible and acceptable within a legal framework. The Supreme Court of India has emphasized that, in the absence of any intrinsic flaws in the medical report, the court is not able to replace the doctor's opinion with its own. There exists significant uncertainty in India concerning the criteria and legal structures that judicial bodies ought to apply when assessing DNA evidence<sup>29</sup>. The judiciary in numerous countries recognizes the potential of DNA evidence to conclusively determine an individual's innocence or guilt in criminal cases<sup>30</sup>. While India is not lagging in this regard, the integration of DNA technology into the investigative process and the justice delivery system has not yet been fully embraced.

### 3.2 Limitations of DNA's Evidence

The application of DNA technology within the field of criminal justice is undeniably essential; however, it has faced considerable criticism from various viewpoints.<sup>31</sup> The task of arriving at a conclusive understanding of how DNA evidence affects the constitutional rights to a fair trial and the prohibition of self-incrimination in India continues to pose considerable challenges. Additionally, concerns regarding the statistical probabilities associated with DNA evidence further complicate the discourse. There are ongoing debates regarding the feasibility of securing a conviction based solely on probability, irrespective of how unlikely it may be for two individuals to possess identical profiles.<sup>32</sup> Even in a scenario where scientific methods are

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<sup>28</sup> *Jamshed vs State Of U.P.*, on 17 May, 2024 (2024:AHC:89309).

<sup>29</sup> Rathore, G., & Jain, R. (2023). Use Of DNA As Evidence In Court System With Current Perspective In India. *Journal of Namibian Studies: History Politics Culture*, 38, 886-919.

<sup>30</sup> Srivastava, A., Harshey, A., Das, T., Kumar, A., Yadav, M. M., & Shrivastava, P. (2022). Impact of DNA evidence in criminal justice system: Indian legislative perspectives. *Egyptian Journal of Forensic Sciences*, 12(1), 51. See also, Thierry, M. B. (2016). Improving Rwandan criminal justice through forensic DNA evidence: an appraisal. *Beijing L. Rev.*, 7, 400.

<sup>31</sup> Walsh, S. J. (2023). Forensic science in the criminal justice system: The good, the bad and the academy. *Australian Journal of Forensic Sciences*, 55(3), 285-294.

<sup>32</sup> Biedermann, A., Champod, C., Jackson, G., Gill, P., Taylor, D., Butler, J., ... & Taroni, F. (2016). Evaluation of forensic DNA traces when propositions of interest relate to activities: analysis and discussion of recurrent concerns. *Frontiers in genetics*, 7, 215.

flawless, the results of forensic analyses remain vulnerable to human mistakes and the potential for evidence to be altered or compromised.

The foundational vision of justice within the criminal justice system ought to strike an appropriate equilibrium between safeguarding civil liberties, upholding the presumption of innocence, and ensuring the procedural rights of individuals, while also addressing the state's imperative to identify, penalize, and rehabilitate those who commit crimes.<sup>33</sup> Individuals possess a reasonable expectation of privacy concerning the information contained within their DNA samples, irrespective of the method of collection or acquisition.<sup>34</sup> The concern emerges when the analysis of an individual's DNA extends beyond mere identification purposes. In *Hiibel v. Nevada*<sup>35</sup> the United States of America's Supreme Court held that individuals do not possess a constitutional right to refuse to disclose their identity. Nevertheless, it was determined that law enforcement officials are prohibited from detaining an individual without reasonable suspicion solely for the aim of acquiring that person's identity. Therefore, to emphasize the findings from the case, even if DNA evidence is utilized solely for identification, there remain constraints on the actions police may take to procure DNA for identification purposes. Before collecting DNA evidence, law enforcement must provide a legally valid reason or a reasonable suspicion.<sup>36</sup> It is imperative to understand that DNA collection serves purposes beyond identification; it can be used for investigative purposes and yields evidence that is both exculpatory and inculpatory.<sup>37</sup>

DNA evidence does not establish the perpetrator's intent to commit a crime; however, it can indicate their presence or involvement in the criminal act.<sup>38</sup> This type of evidence is instrumental in investigations, as it assists in eliminating possible suspects, a process that is especially valuable considering the various methods through which crimes are executed. Further, it is unreliable to depend on DNA data that has been compromised due to inadequate

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<sup>33</sup> Базарова, Д. (2024). Constitutional guarantees of individual rights in criminal proceedings. *Общество и инновации*, 5(4), 137-154.

<sup>34</sup> Mittelstadt, B. D., & Floridi, L. (2016). The ethics of big data: current and foreseeable issues in biomedical contexts. *The ethics of biomedical big data*, 445-480.

<sup>35</sup> Treacy, M. D. (2005). *Hiibel v. Sixth Judicial District Court of Nevada: Is a Suspect's Refusal to Identify Himself Protected by the Fifth Amendment*. *New Eng. L. Rev.*, 40, 897.

<sup>36</sup> Hamid, H. B. B. A. (2022). Understanding the Impact of DNA Evidence in the Criminal Justice System. *JMCL*, 49, 43.

<sup>37</sup> McCartney, C. (2017). DNA and identification. In *The Routledge handbook of technology, crime and justice* (pp. 417-435). Routledge.

<sup>38</sup> Henry, T. K. S., & Jurek, A. L. (2020). Identification, corroboration, and charging: Examining the use of DNA evidence by prosecutors in sexual assault cases. *Feminist Criminology*, 15(5), 634-658.

sample quality, damage incurred during processing, or exposure to biological factors.<sup>39</sup> It is essential to store the samples provided with great care to prevent any contamination from the crime scene, as this is a vital aspect of DNA profiling.<sup>40</sup>

Several challenges arise in the execution of DNA testing. The potential for test results to be tampered with cannot be disregarded, particularly when individuals possess the requisite tools and expertise to alter outcomes.<sup>41</sup> The potential for human error exists in the processes of collecting, analyzing, and cataloging DNA samples, which are further exacerbated by inadequate infrastructure, ineffective management, financial constraints, and instances of corruption within forensic laboratories.<sup>42</sup> This issue is encountered in numerous countries globally, including India.<sup>43</sup> The integrity of the sample is crucial for conducting an accurate analysis. Factors such as exposure to sunlight, temperature fluctuations, inadequate storage conditions, and improper handling at the crime scene can lead to sample degradation, ultimately resulting in unreliable outcomes.<sup>44</sup>

### 3.3 DNA Technology's Revolutionary Effect on the Criminal Justice System

Progress in DNA technology is profoundly impacting legal systems, leading to revisions of numerous laws worldwide.<sup>45</sup> This evolution is reshaping investigative procedures and the management of unresolved cases. The significance of innovation in this context is paramount, as legislation is continuously being introduced, modified, and repealed to enhance the advantages offered by DNA technology in identifying perpetrators, securing convictions, and exonerating those wrongfully accused.<sup>46</sup> The influence of DNA technology on the criminal justice system is evident in the establishment of legislation that governs the procedures for the

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<sup>39</sup> Ezekannagha, C., Becker, A., Heider, D., & Hattab, G. (2022). Design considerations for advancing data storage with synthetic DNA for long-term archiving. *Materials Today Bio*, 15, 100306.

<sup>40</sup> Dash, H. R., & Das, S. (2018). Microbial degradation of forensic samples of biological origin: potential threat to human DNA typing. *Molecular biotechnology*, 60(2), 141-153.

<sup>41</sup> Lovejoy, C. A., Li, W., Reisenweber, S., Thongthip, S., Bruno, J., De Lange, T., ... & ALT Starr Cancer Consortium. (2012). Loss of ATRX, genome instability, and an altered DNA damage response are hallmarks of the alternative lengthening of telomeres pathway. *PLoS genetics*, 8(7), e1002772.

<sup>42</sup> Pedersen, B. S., & Quinlan, A. R. (2017). Who's who? Detecting and resolving sample anomalies in human DNA sequencing studies with peddy. *The American Journal of Human Genetics*, 100(3), 406-413.

<sup>43</sup> Sankar, D. (2024). Unravelling the legal conundrum of DNA profiling in India: an analysis of its adoption, implementation and unresolved issues. *International Journal of Electronic Finance*, 13(3), 336-351.

<sup>44</sup> Sharma, A., Kumari, P., Rai, A. R., Nagar, V., Sharma, V., Gautam, A., ... & Sankhla, M. S. (2024). Forensic Sample Collection and Preparation. *Advances in Analytical Techniques for Forensic Investigation*, 35-67.

<sup>45</sup> Babikian, J. (2023). Justice in Flux: Evolving Legal Paradigms in Response to Technological Advancements. *Journal for Social Science Studies*, 1(1), 1-16.

<sup>46</sup> Toglia, M. P., Berman, G. L., Todorovic, K., Rumschik, D. M., & Thibodeau, S. L. (2022). Lessons Learned from Wrongful Convictions: Implications for Judicial Reform and Innocence Research. In *Advances in Psychology and Law* (pp. 111-144). Cham: Springer International Publishing.

collection, utilization, preservation, admission, and development of DNA databases.<sup>47</sup>

DNA evidence is essential in the realm of criminal investigations and judicial processes. Its utilization has become indispensable in the analysis of violent crimes and sexual offenses.<sup>48</sup> Moreover, recent technological advancements have expanded the utility of DNA analysis to include the investigation of less severe crimes as well.<sup>49</sup> In the early stages of the *Aarushi Talwar*<sup>50</sup> murder investigation, forensic techniques such as fingerprint analysis were utilized, alongside the extraction of DNA from garments that bore blood stains. Additionally, multiple fingerprints were discovered on the glasses within the residence at the time of the homicide. A series of narco-analysis tests were conducted on Aarushi's father due to suspicions raised by the Central Bureau of Investigation<sup>51</sup>; however, following the absence of any matching evidence, Aarushi's father was subsequently released.<sup>52</sup>

## 4. FINDINGS

### 4.1 Improved Accuracy in Criminal Investigations

DNA evidence has greatly improved the accuracy of criminal investigations, providing scientific, reliable, and objective methods of suspect identification. By clearing from suspicion innocent individuals based on genetic profiling, it reduces the chances of false convictions.

### 4.2 Role in Vindicating the Innocent

DNA analysis has played a central role in many wrongful conviction cases by providing evidence that can exonerate falsely accused persons.

The introduction of DNA technology for post-conviction review is increasing fairness within the justice system.

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<sup>47</sup> Oosthuizen, T., & Howes, L. M. (2022). The development of forensic DNA analysis: New debates on the issue of fundamental human rights. *Forensic Science International: Genetics*, 56, 102606.

<sup>48</sup> Amankwaa, A. O., & McCartney, C. (2021). The effectiveness of the current use of forensic DNA in criminal investigations in England and Wales. *Wiley Interdisciplinary Reviews: Forensic Science*, 3(6), e1414.

<sup>49</sup> Katsanis, S. H. (2020). Pedigrees and perpetrators: uses of DNA and genealogy in forensic investigations. *Annual review of genomics and human genetics*, 21(1), 535-564.

<sup>50</sup> Mishra, S. (2021). A Study of Direct Evidence and Circumstantial Evidence with Special Reference to Aarushi Talwar Case. *Issue 3 Int'l JL Mgmt. & Human.*, 4, 950.

<sup>51</sup> Lokaneeta, J. (2022). NARCO VIDEOS, FORENSIC PSYCHOLOGISTS AND THE TRUTH-TELLING APPARATUS. *Acts of Media: Law and Media in Contemporary India*, 181.

<sup>52</sup> Hariharan, V. (2022). TRUE LIES AND FALSE TRUTHS. *Acts of Media: Law and Media in Contemporary India*, 167. See also, Shukla, R. (2010). Arushi's murder: Ambivalence in the parent-child relationship. *International Journal of Applied Psychoanalytic Studies*, 7(4).

### 4.3 Building Up Prosecution and Defense

Prosecution uses DNA evidence to establish guilt beyond a reasonable doubt, especially in connection with rape, murder, and powerful bodies committing violent crime.

Defense lawyers use DNA results to disprove false accusations and to support an alleged alibi.

### 4.4 The Impact on Cases of Sexual Assault and Rape

DNA testing has become important when perpetrating sexual assault due to biological evidence linking the perpetrator to the scene of the crime. DNA databases can be used to trace recidivists and assist law enforcement agencies in exposing other offenders from further criminal activities.

### 4.5 Problems of Implementation

**4.5.1 Legal and Ethical Issues:** The issue of privacy, protection of data, and misuse of DNA databases has remained a major problem.

**4.5.2 Absence of a Well-Defined DNA Law:** Though the Criminal Procedure (Identification) Act, 2022, allows for the collection of DNA samples, India does not have a dedicated DNA Protection and Privacy Act.

**4.5.3 Infrastructure and Knowledge Gaps:** Many forensic laboratories in India are dogged by challenges relating to backlog, deficiency of trained staff, and varying testing standards.

### 4.6 Need for a National DNA Database

Though the DNA Technology (Use and Application) Regulation Bill was introduced, it still awaits implementation due to the argument of individual privacy.

A well-regulated DNA database would realize further drives into criminal tracking whilst keeping individual rights secured.

## 5. RECOMMENDATIONS

It is imperative for legislators to implement a comprehensive national law governing the administration of DNA testing and its admissibility in judicial proceedings.<sup>53</sup> The lack of

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<sup>53</sup> Nakta, V., & Dahiya, S. (2024). GENETIC JURISPRUDENCE: REIMAGINING INDIAN LEGAL SYSTEM'S APPROACH TO DNA EVIDENCE AND PRIVACY PROTECTIONS. *Panjab University Law Review*, 63(1).

statutory clarity has resulted in confusion and uncertainty among investigative agencies and lower courts.<sup>54</sup> Further steps should be taken with a view to amending existing laws to incorporate provisions regarding permitting blood tests for generating DNA profiling.

It is essential to establish a national authority tasked with the regulation and oversight of DNA profiling laboratories. The procedures and criteria for post-conviction DNA testing should be integrated into Indian legislation. The collection of DNA samples should not occur as a standard practice; rather, it should be advised only when pertinent information relates to a particular criminal case. Furthermore, DNA samples from suspects should be obtained only with the prior consent of a judicial officer.

Investigative agencies should receive adequate training to address contamination challenges effectively. It is essential to uphold a proper chain of custody. Additionally, the legal community must undergo thorough training and awareness programs to mitigate problems such as the prosecutor's fallacy.

## 6. CONCLUSION

The advancements in DNA technology have created novel avenues within the realm of criminal investigations. Additionally, this progress has provided significant scientific validation to the criminal justice system. The emphasis on DNA as a form of evidence is linked to a wider examination of the function of forensic science within the realms of law and criminal investigations. The research on this topic is evidently interconnected with and carries significant consequences for the wider examination of the methods of producing evidence and the overarching evidentiary standards. The integration of DNA and diverse forms of scientific evidence has generated significant concern about the potential increase in police power and the unexamined endorsement of a conservative methodology for crime control within the context of the criminal justice system. The concerns raised are certainly justified, considering the persistent attack on the right to remain silent, a fundamental protection for individuals who could be perceived as "guilty."

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<sup>54</sup> Rao, S., & Sandeep, M. N. (2021). Legislations to combat child sexual abuse in India: A critical analysis with special reference to loopholes and challenges in its implementation.

