

INTERNATIONAL JOURNAL OF LAW
MANAGEMENT & HUMANITIES
[ISSN 2581-5369]

Volume 9 | Issue 2

2026

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DNA Evidence and its Impact on Wrongful Convictions in Criminal Justice: A Critical Analysis

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ABSTRACT

The advent of DNA evidence has revolutionized the field of criminal justice by introducing a highly reliable scientific method for identifying perpetrators and exonerating the innocent. This paper critically examines the role of DNA evidence in addressing wrongful convictions, while also evaluating its limitations and the challenges associated with its application. Wrongful convictions, often arising from mistaken eyewitness testimony, false confessions, prosecutorial misconduct, or flawed forensic practices, undermine the integrity of the justice system and erode public confidence. In this context, DNA evidence has emerged as a powerful corrective tool, capable of both securing convictions of the guilty and overturning miscarriages of justice.

The analysis begins by exploring the evolution of DNA profiling and its growing acceptance in courts of law. Since its introduction in the late 20th century, DNA testing has become a gold standard in forensic science due to its accuracy and objectivity. However, the paper also adopts a critical perspective by addressing the limitations and potential misuse of DNA evidence. While often perceived as infallible, DNA evidence is not immune to errors. Issues such as contamination, improper handling, laboratory mistakes, and misinterpretation of results can compromise its reliability. Additionally, systemic barriers such as limited access to post-conviction DNA testing, inadequate legal representation, and procedural restrictions often prevent wrongfully convicted individuals from obtaining relief. The overreliance on DNA evidence may also overshadow other crucial aspects of investigation, potentially leading to tunnel vision among law enforcement agencies.

In conclusion, this study argues that while DNA evidence has significantly contributed to reducing wrongful convictions and enhancing the accuracy of criminal justice outcomes, it is not a panacea.

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I. INTRODUCTION

Wrongful convictions represent one of the most serious failures of the criminal justice system. It must be fair and no innocent person should be punished for a crime that they didn't commit. There are many developments among that DNA evidence has become apparent as one of the best tools for identifying the wrongdoers. In DNA analysis it allows the investigators to connect the biological substance such as blood strains, hair or saliva which has been found at the crime scene to a specific person with a high degree of conviction.

Various structural factors which has been contribute to the wrongful convictions in India, including incorrect investigation practices, custodial threats, insufficient legal representation, and expert evidence. These failures also excessively affects the individuals from socio-economically backgrounds, who often lack the resources to challenge investigative or forensic irregularities.

DNA profiling is considered one of the most exact forensic techniques which is used to prove the identity in criminal investigations. Since its introduction in the late twentieth century, DNA evidence has been used to overturn numerous wrongful convictions worldwide. In India the DNA evidence was first introduced in the civil context through dispute regarding the paternity in the year 1980s and it was majorly expanded in the main streams of criminal investigations. The growth of the DNA profiling becomes a broader one towards the technology and evidences which is completely based on the adjudication.

The primary aim of this study is to research and critically examine the main role of DNA evidence in our criminal justice system. And also it is used to analyze the impact on identifying and preventing the wrongful convictions. This study also seeks to understand us how the scientific development of DNA analysis has been improved the accuracy of the criminal investigations and also the judicial decision makings.

Objective of the Study

The main objective of the study is to examine the concept and causes of wrongful convictions in criminal justice systems. The DNA evidence plays an important role in the criminal justice system and also helps us to identify and prevent the wrongful convictions. Another objective is to analyse the scientific and legal framework governing by the DNA evidence in criminal trials and also it evaluate the role of DNA evidence in wrongfully convicted individuals.³

This study also aims to identify the procedural and legal challenges in the use of DNA evidence

³ Richard Saferstein, *Criminalistics: An Introduction to Forensic Science (11th ed., Pearson Education, 2015)*

and also suggest reforms for improving the reliability and use of DNA evidence in criminal investigations. Finally this study mainly highlights the importance of the power of forensic practices and legal protection to ensure the fairness, accuracy and justice within the criminal justice system.

Scope and Limitation of the Study

This study mainly focuses on examining the main role and impact of DNA evidences in addressing of the wrongful convictions within the criminal justice systems. The study include:

- Analyzing the concept and the significance of the DNA evidences
- Explores the legal and scientific frameworks which governs the use of DNA evidence in criminal justice system.
- It evaluates the challenges and procedural issues involved in the collections, preservation and admissibility of DNA evidence.⁴

Despite its comprehensive approach, the study has certain limitations:

- It differentiate the forensic infrastructure, legal practice, and technological resource across.
- It focuses on the scientific procedures and technological complexities which involved in the forensic DNA analysis.
- It mainly focuses on the legal and theoretical aspects of DNA evidence rather than the detailed scientific procedures.

II. CAUSE OF WRONGFUL CONVICTIONS IN CRIMINAL JUSTICE

A. Eyewitness misidentification

Eyewitness misidentification is one of the leading cause of wrongful conviction in the criminal justice system. Often eyewitness are expected to identify the wrongdoers of crimes based on memory, which is incredibly malleable. Under suggestive police practice, intense pressure or over time, an eyewitness is more likely finds difficulty in recalling the details about what they saw.

B. False confessions and custodial pressure:

A false confession means it is "an admission to a criminal act, it is usually accompanied by a

⁴ Brandon L. Garrett, *Convicting the Innocent: Where Criminal Prosecutions Go Wrong* (Harvard University Press, 2011).

Barry A. J. Fisher, *Techniques of Crime Scene Investigation* (7th ed., CRC Press, 2004).

narrating the crime how and when does it occurs that the confessor did not commit. It becomes difficult to prove the innocence when the Police often do not keep records of them, or, if the confessed offenders are convicted.

C. Investigation errors and procedural misconduct:

Investigation errors and procedural misconduct are the major significant factors which highly contributes to the wrongful conviction of the innocent in the criminal justice system. Investigation errors happen when the authority member fails to collect the evidence properly, improper preservation, or when they rely on assumption rather than objective facts during the investigations. These actions undermine the fairness of criminal proceedings and may result in innocent individuals are being convicted.

D. Misinterpretation or misuse of forensic evidence:

The misuse or misrepresentation of the forensic evidence has been identified as one of the major factor which contributed to the wrongful convictions in the criminal justice system.⁵

III. SCIENTIFIC AND LEGAL FRAMEWORK OF DNA EVIDENCE

The DNA evidence has become one of the most important reliable scientific tool in the modern criminal investigations and also it plays an vital role in addressing the problem of the wrongful convictions within the criminal justice system. DNA evidence constitutes opinion evidence under **Section 39 of the Bharatiya Sakshya Adhiniyam 2023**. This classification requires courts to evaluate DNA evidence with the same rigorous standards applied to expert testimony, ensuring that the scientific foundation and methodology meet established legal requirements.

A. The Process of DNA Profiling: A Step-by-Step Overview:

1. sample collection
2. DNA extractions
3. DNA Quantifications
4. PCR Amplification
5. Capillary Electrophoresis
6. Data Analysis
7. Statistical analysis

⁵ *Raja v. State of Karnataka*, (2016) 10 SCC 506, *Ajay Kumar v. State of Bihar*, (2010) 12 SCC 736

B. Procedures for collection, preservation, and analysis of DNA samples

When it comes to the collection, preservation and analysis of DNA samples as experts in the field, we should understand the critical importance of proper handling and storage of DNA samples. Proper documenting each DNA sample ensures its traceability, facilitates identification, and maintains the integrity of the sample throughout the entire process.

- **Collector's Name:** Should Clearly identify the individual responsible for collecting the DNA sample.
- **Date/Time of Collection:** Should Record the exact date and time when the sample was collected to establish a timeline.
- **Agency Case Number:** Then assign a unique case number to each sample, linking it to relevant case information.
- **Description of Item:** Provide a detailed description of the DNA sample, including its source and any distinguishing features.

C. Chain of custody and forensic protocols⁶

Chain of custody is one of the most important thing in an forensic report, at the same time, the most critical process of documenting evidence, in criminal and civil law, the term “**chain of custody**” refers to the order in which evidence was dealing with during the investigation of a case. The Chain of Custody is an important where the critical component of forensic evidence management, it ensures the integrity and authenticity of the particular evidence from collection to presentation in court room. The chain of custody is a big process where begins at the crime scene, where the forensic investigators collect and document the evidence, by following the strict protocols to prevent contamination or tampering of the evidence.⁷

IV. JUDICIAL INTERPRETATION OF FORENSIC EVIDENCE

Judicial interpretation of forensic evidence in India reflects a gradual shift from cautious acceptance to strong reliance, coupled with insistences on the procedural integrity and scientific reliability. Under **Bharatiya Sakshya Adhiniyam, 2023** the forensic evidence is primarily governed by **section 39 and 40**, which treats expert opinion as relevant but not conclusively, thereby requiring judicial scrutiny.

In *State of H.P v. Jai Lal*, the supreme court held that expert evidence must be tested like any

⁶ Kattavellai @ Devakar v. State of Tamil Nadu

⁶ Supreme court of India- directions regarding proper documentations and chain of custody of DNA samples

⁷ Supreme court of India- directions regarding proper documentations and chain of custody of DNA samples

other evidence and is only advisory in the nature, not binding on courts. This principle was reaffirmed in *Ramesh Chandra Agarwal v. Regency Hospital Ltd.* Where the court emphasized the credibility of expert opinion depends on the expert's competence, methodology, and reasoning.

Some notable cases that exemplifies the role of forensic evidence in Indian courts

1. Jessica Lal Murder Case (1999)
2. Sohrabuddin Sheikh Encounter Case (2005)
3. Aarushi Talwar Murder case (2008)
4. Nirbhaya Gang Rape case (2012)
5. Jai Prakash v. State of Uttarakhand

A. DNA Evidence as a Transformative Tool in Criminal Justice

One of the most significant findings of this study is that DNA evidence has fundamentally reshaped the criminal justice system by introducing a scientific method that minimizes subjectivity. Unlike traditional evidence such as eyewitness testimony, which is often influenced by perception and memory, DNA profiling provides objective biological data. This has led to a paradigm shift in the way guilt and innocence are determined.

B. Role of DNA Evidence in Exonerating the Innocent

The study reveals that DNA evidence has played a crucial role in identifying wrongful convictions and correcting miscarriages of justice. Post-conviction DNA testing has exposed serious flaws in earlier investigations, including reliance on coerced confessions and flawed forensic practices.

A key finding is that wrongful convictions often stem from systemic issues rather than isolated errors. DNA evidence has acted as a corrective mechanism, not only freeing innocent individuals but also highlighting institutional shortcomings. This has strengthened the demand for accountability within law enforcement and judicial bodies.

V. CONCLUSION

DNA evidence has undeniably revolutionized the criminal justice system by enhancing accuracy and reliability. Its ability to both convict the guilty and exonerate the innocent makes it a powerful tool in the pursuit of justice. The effectiveness of DNA evidence depends on the strength of the legal and institutional framework within which it operates. Comprehensive legislation, improved forensic infrastructure, and trained professionals are essential for its

proper implementation. While DNA technology enhances crime detection, it also raises concerns about privacy and misuse. A balance must be struck between the interests of the state and the rights of individuals to ensure ethical use of genetic information.

Ultimately, the goal of the criminal justice system is to deliver fair and accurate outcomes. DNA evidence, when used responsibly, can significantly contribute to this objective. However, it should function as part of a broader system that values fairness, transparency, and accountability. In conclusion, DNA evidence represents both an opportunity and a responsibility. Its proper use can prevent wrongful convictions and strengthen public confidence in the justice system. At the same time, its misuse or over-reliance can create new challenges. Therefore, a cautious, balanced, and well-regulated approach is essential to ensure that justice is truly served.

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