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# A STUDY ON PROBLEMS WITH FORENSIC EVIDENCE IN CRIMINAL CASES

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## CHAPTER-I

## 1. INTRODUCTION

### 1.1 INTRODUCTION

The criminal justice system in India relies heavily on forensic science, yet its reliability is significantly undermined by systemic weaknesses. Thematic analysis reveals four primary challenges: inadequate professional training, technological deficiencies, legal framework constraints, and procedural inconsistencies in evidence handling and interpretation. Forensic investigations are largely dominated by DNA profiling (40.6%) and fingerprint analysis (29.6%), but variations in methodology raise concerns about evidentiary integrity.

Recent DNA exoneration cases and laboratory controversies have intensified scrutiny of forensic practices, exposing risks of misuse and wrongful convictions. While these critiques highlight structural dysfunction, they also indicate clear pathways for reform. Strengthening technological infrastructure, standardizing methodologies, enhancing professional training, and revising legal safeguards are essential to improving evidence reliability and ensuring more accurate judicial outcomes.

### 1.2 SCOPE AND OBJECTIVE OF THE STUDY

The primary objective of this paper to identify the problems in forensic evidence and the following also objectives of this study,

- Analyses the role of technology in forensic evidence
- Analyses the problem in forensic evidence
- Examine the causes of wrongful convictions due to false or misleading forensic evidence
- Analyses how forensic evidence are admitted in the legal proceedings
- Examining the important role forensic evidence plays in criminal investigations

### 1.3REVIEW OF LITERATURE

The reliability and application of forensic scientific evidence in India have been critically examined in contemporary scholarship. The literature reflects both the growing importance of forensic evidence in criminal adjudication and the systemic challenges undermining its credibility.

Charan and Manikyam (2023) highlight the central role of forensic techniques—particularly DNA analysis—in rape and homicide investigations, while identifying limitations such as improper evidence collection, contamination, and laboratory delays, which may result in miscarriages of justice.[114]

[114] Charan & Manikyam, *Constraints of Forensic Science in Rape and Homicide Cases in India* (2023).

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Dinkar (2015) similarly underscores structural deficiencies, including outdated technology and lack of standardization across forensic laboratories, noting instances where faulty forensic evidence contributed to wrongful convictions.[2][115]

Chawla (2023) emphasizes the evidentiary influence of forensic science in modern trials but points to inconsistent methodologies and inadequate professional training as factors diminishing judicial confidence.[3][116]

Gupta et al. (2021) observe that despite its probative value, forensic evidence remains underutilized due to low case referrals and institutional inefficiencies, advocating procedural and legal reforms.[4][117]

Tak (2021) further examines forensic medicine and digital forensics within the Indian legal framework, stressing the need for infrastructural development, research advancement, and standardized practices.[5][118]

Collectively, the literature reveals that while forensic science holds substantial potential to strengthen criminal justice delivery in India, its reliability depends upon modernization, accreditation, uniform protocols, and enhanced professional training.

## 1.4 HYPOTHESIS

Problems with forensic evidence in criminal cases include mishandling, contamination, lack of standardization, and reliance on subjective methods, all of which can lead to wrongful convictions or acquittal.

- Inadequate training to the forensic examiners lead to mistake in evidence collection, analysis(human error).
- Forensic examiners unintentionally introduced bias that's contributing compromise in evidence.
- Forensic laboratories may lack sufficient funding or resources that's compromise the ability to conduct accurate analysis.

## 1.5 RESEARCH QUESTIONS

1. Inadequate training to the forensic examiners leads to wrongful convictions?

2. The impact of false or misleading forensic evidence on wrongful convictions?

3. Problems with Forensic evidence leads to miscarriage of justice?

## 1.6 RESEARCH METHODOLOGY

The methodology adopted for the study is doctrinal. The document analysed includes,

- Primary resources such as judicial precedents, authoritative textbooks etc.
- Secondary sources of data such as existing datasets, news, encyclopedias, articles authored by experts, authoritative books on law, internal resources.

## 1.7 LIMITATION OF THE STUDY

- Limited Access to Data.: Forensic data can be sensitive and restricted, limiting access to researchers and students.
- Need for Practical Experience: Forensic science requires hands-on experience and practical training, which can be challenging to replicate in an academic setting.
- Rapidly Evolving Field: Forensic science is a rapidly evolving field, with new techniques and technologies emerging regularly, which can make it challenging to keep up with the latest developments.

## 2. CHAPTERISATION

Following are the Chapters the thesis has been divided into, and each chapter being further divided accordingly.

## CHAPTER-II

## 2.1 EVOLUTION OF FORENSIC SCIENCE

### 2.1.1 DEVELOPMENT OF FORENSIC SCIENCE IN INDIA

The development of forensic science in India reflects a gradual evolution from ancient medico-legal awareness to modern scientific institutionalization. Early references in the

[115] Dinkar, *Shortcomings in Forensic Scientific Evidence in India* (2015).
[116] Chawla, *Role of Forensic Evidence in Contemporary Criminal Justice* (2023).
[117] Gupta et al., *Utilization of Forensic Science in Criminal Investigations in India* (2021).
[118] Tak, *Forensic Science and Legal Framework in India* (2021).

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Arthashastra by Kautilya indicate that principles of crime detection and medico-legal inquiry were recognized in ancient India, including an early understanding of fingerprint uniqueness.

Modern forensic science, however, began during the colonial period with the establishment of the world's first fingerprint bureau in 1897 at Calcutta. The legal foundation for expert evidence was laid by the Indian Evidence Act, which formally recognized expert testimony. Post-independence consolidation occurred with the establishment of India's first forensic science laboratory in 1952, marking the institutional integration of science into criminal investigations and judicial processes.

**Early Forensic Developments in India**

The institutional foundations of forensic science in India began with the establishment of the first Chemical Examiner's Laboratory in 1849 in the Madras Presidency. Similar laboratories were later set up in Calcutta (1853), Agra (1864), and Bombay (1870), primarily conducting toxicological, biological, and chemical analyses to assist criminal investigations.[119]

In 1892, influenced by the anthropometric identification system developed by Alphonse Bertillon, an Anthropometric Bureau was established in Calcutta to maintain physical measurement records of criminals.[120]

A decisive advancement occurred in 1897 with the establishment of the world's first Fingerprint Bureau in Calcutta. The recognition of fingerprint permanence by William Herschel and the classification system introduced by Edward Henry led to the replacement of anthropometric methods with fingerprint identification.[121]

**Specialized Forensic Units in India**

The expansion of forensic science in India led to the creation of specialized units addressing emerging forms of crime.

The **Department of Explosives** was established in 1898 with the appointment of the first Chief Inspector of Explosives at Nagpur. It developed expertise in examining the causes of explosions—whether accidental or deliberate—and later established regional offices in Calcutta, Bombay, Agra, Madras, and Gwalior. Its scientific input significantly aided police investigations and informed regulatory frameworks under the Explosives and Petroleum laws.[122]

The **Government Examiner of Questioned Documents (1904)** was founded in Shimla, initially handling sensitive political documents and later expanding to criminal and civil matters, including document forgery and wartime censorship.[123]

The **Serology Department (1910)**, established in Calcutta, pioneered forensic analysis of blood and seminal stains, strengthening evidentiary support in criminal trials.[124]

Further specialization occurred with the creation of Footprint (1915) and Note Forgery (1917) Sections under the Criminal Investigation Department (CID), enhancing identification and counterfeit detection capabilities.

Finally, the **Ballistics Laboratory (1930)** was set up to examine firearms and ammunition, responding to the rise in gun-related offences and leading to similar facilities across various provinces.

**Academic and Research Advancements**

- Institute of Criminology & Forensic Science (1971):

Founded in Delhi, this institute aimed to train in-service personnel and engage in research,

[119] Historical records on the establishment of Chemical Examiner's Laboratories in British India (1849–1870).
[120] Adoption of Bertillon's anthropometric system in India and establishment of the Anthropometric Bureau, 1892.
[121] Development of fingerprint identification in India and establishment of the Fingerprint Bureau, Calcutta, 1897.
[122] Establishment of the Department of Explosives, 1898, and subsequent regional expansion under British India.
[123] Creation of the Government Examiner of Questioned Documents, Shimla, 1904.
[124] Establishment of the Serology Department, Calcutta, 1910.

ultimately transforming into an academic institution.

- Indian Academy of Forensic Sciences (1960):

This organization promoted the exchange of knowledge through seminars, journals, and collaborations, thereby enhancing forensic science research in India.

- Teaching Forensic Science in Universities:

Despite facing initial obstacles, forensic science was incorporated into university programs, with institutions such as the University of Sagar, Madras, and Patiala providing specialized courses.

**Strengthening Forensic Infrastructure**

- Forensic Science Division at BPR&D (1983)

This division was established to oversee forensic activities on a national scale, fostering scientific progress and standardization throughout the nation.

- Central Forensic Science Laboratories (1990s):

The function of CFSLs was redefined to establish quality standards, assist state laboratories, and uphold national forensic benchmarks.

- Master Plan for Restructuring (1983):

Laboratories underwent restructuring into specialized divisions, thereby enhancing their capabilities in areas such as biology, chemistry, ballistics, and toxicology, among others.

**Role of Forensic Science in Crime Investigation**

Forensic science performs a foundational function in criminal investigation by ensuring that scientific methods guide evidence handling, analysis, and courtroom presentation.

1.**Collection and Preservation of Evidence**
At the crime scene, experts systematically identify, collect, and preserve physical evidence—such as fingerprints, bloodstains, hair, weapons, and clothing—while preventing contamination. Proper chain of custody and documentation safeguard evidentiary integrity and protect the rights of the accused.

2. **Laboratory Analysis**
Specialized forensic disciplines—including DNA analysis, toxicology, ballistics, and digital forensics—employ advanced scientific instruments to examine collected materials. DNA profiling can link suspects to crime scenes, toxicology detects poisons or drugs, and ballistic analysis connects firearms to projectiles.

3.**Fingerprint Examination**
Fingerprint identification, based on the uniqueness and permanence of ridge patterns, enables experts to match latent prints from crime scenes with database records, thereby directly associating individuals with criminal acts.

4.**Digital Forensics**
With the rise of cybercrime, forensic experts extract and analyze electronic data, digital signatures, and electronic footprints to uncover concealed networks of criminal activity.

5.**Ballistic and Firearm Examination**
Ballistics analysis involves studying bullets and cartridge cases to determine weapon origin and reconstruct firearm-related incidents.

6.**Forensic Anthropology**
This specialization focuses on the identification of skeletal remains, determining age, sex, and cause of death, particularly in cases involving decomposed bodies.

7.**Crime Scene Reconstruction**
By integrating physical evidence with scientific reasoning, forensic experts reconstruct the sequence of events, assisting investigators and courts in understanding how the crime occurred.

8.**Expert Testimony and Cold Case Review**
Forensic specialists present expert opinions in court to clarify complex scientific findings. Advances in forensic methodologies also enable the reopening and resolution of previously unsolved cases.

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## CHAPTER III

### 3.1 FORENSIC EVIDENCE

#### 3.1.1 CLASSIFICATION OF FORENSIC EVIDENCE

Forensic evidence is categorized into various types,

1. Biological evidence generally encompasses blood (whether in its liquid state or as swabs taken from bloodstains) and saliva. Additional forms include seminal fluid, urine, and sweat, among others.

**Mukesh and Another v. State (NCT of Delhi)**[125]

**Facts:**
The appellants were convicted and sentenced to death for the 2012 gang rape and murder case. The prosecution relied significantly on DNA evidence alongside other corroborative materials.

**Findings:**
The Supreme Court affirmed the conviction and emphasized the evidentiary value of DNA profiling. Referring to Sections 53A and 164A of the Code of Criminal Procedure, 1973, the Court observed that DNA examination of rape accused and victims is statutorily recognized. It held that a DNA report should ordinarily be accepted unless specifically challenged on grounds such as defects in sampling, quality control, or tampering.

**Anil v. State of Maharashtra**[126]

**Facts:**
The appellant was convicted for sexual assault and murder of a minor. While the conviction was upheld, the Supreme Court commuted the death penalty to life imprisonment for thirty years without remission.

**Findings:**
The Court accepted STR and Y-STR DNA profiling conducted by a qualified expert, holding the methods scientifically validated. It ruled that where DNA samples from a crime scene match those of a suspect, a common biological origin may be inferred. The Court recognized DNA profiling as reliable, subject to adherence to proper laboratory standards and procedural safeguards.

**Weapons Evidence**

Weapons evidence includes firearms (handguns, revolvers, rifles), ammunition (cartridge cases, bullets, fragments, unfired rounds), gunshot residue, and sharp-edged weapons such as knives. Forensic ballistics examines these materials to determine the type of weapon used, whether a specific firearm discharged a particular bullet or casing, and, in some cases, the possible shooter.

In United States v. Green, the court held that a forensic expert may testify regarding similarities between bullet casings but cannot conclusively state that a bullet was fired from one specific firearm to the exclusion of all others. This principle underscores that ballistic evidence is comparative and probabilistic rather than absolutely conclusive, a position reaffirmed in subsequent judicial decisions.

Fingerprint Evidence: This encompasses the fingerprints from both hands of the accused or the victim, including both latent and patent fingerprints as forms of evidence.

**State of Punjab v. Balbir Singh (1994)**[127], established the principle that the prosecution is required to prove its case beyond a reasonable doubt in narcotics-related cases. The court highlighted the necessity of following due process and upholding the presumption of innocence until guilt is established.

**In Naresh Kumar Giri v. State of M.P. (2011)**[128], the Supreme Court examined the critical role of forensic evidence and accurate drug analysis in confirming the identity of seized substances. The court underscored the importance of employing scientific methods in narcotics cases.

[125] (2017) 6 SCC 1
[126] (2014) 4 SCC 69
[127] 1994 AIR 1872
[128] Cr.A. No.494 of 1998

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**Footprint Evidence in Criminal Trials**

**1. Pritam Singh v. State of Punjab**[129]

**Facts:**
The appellants challenged their murder conviction and death sentence. Footprints at the crime scene matched shoes recovered from Pritam Singh Fatehpuri's residence, and footprints made by Pritam Singh Lohara in jail corresponded with impressions collected from the scene.

**Findings:**
The Supreme Court held that footprint identification is a basic and not fully conclusive science. While such evidence cannot independently sustain a conviction, it may serve as corroborative circumstantial evidence. In this case, the footprint evidence was accepted as a valid supporting link when read alongside other incriminating material.

**Shankaria v. State of Rajasthan**[130]

**Facts:**
In a double homicide case, foot-moulds from the crime scene were compared with specimen moulds of the accused. An expert testified that the moulds matched.

**Findings:**
The Supreme Court reiterated that footprint science is not fully developed and cannot alone justify conviction. However, it is a relevant corroborative circumstance. In this case, the footprint evidence strengthened other incriminating evidence, including the appellant's confession, thereby supporting the conviction.

**Fundamental Principles of Forensic Science**

Forensic science derives its evidentiary value from established scientific principles that ensure relevance and admissibility in courts. The key principles are:

- **Individuality:** Every object or person is unique (e.g., fingerprints), enabling identification.
- **Locard's Exchange Principle:** Formulated by Edmond Locard, it states that whenever two objects come into contact, there is a mutual transfer of trace material.
- **Law of Progressive Change:** All physical evidence and crime scenes undergo change over time, necessitating prompt documentation and preservation.
- **Principle of Comparison:** Only like objects can be compared; proper control samples are essential.
- **Principle of Analysis:** Accurate results depend on correct sampling, packaging, and scientific examination.
- **Law of Probability:** Conclusions are expressed in terms of likelihood rather than absolute certainty.
- **"Facts Do Not Lie" Principle:** Material or scientific evidence often carries greater reliability than oral testimony and holds substantial probative value.

**LEGAL PROVISIONS**

**3.1.3 LEGAL PROVISIONS SUPPORTING CRIMINAL INVESTIGATION**

**Constitutional Provisions: Article 20(3)**

Article 20(3) of the Constitution of India guarantees that no person accused of an offence shall be compelled to be a witness against themselves. "Compulsion" in this context refers to legal duress—pressure through threat, unlawful detention, or harm. The provision safeguards the right to silence and ensures that the burden of proof rests on the prosecution.[131]

The Supreme Court has clarified that an accused cannot be forced to provide testimonial evidence in the witness box. However, while refusal to provide certain bodily samples (such as blood) was historically viewed as protected from adverse inference,

[129] AIR 1956 SC 415
[130] (1978) 3 SCC 435
[131] M.P. Sharma v. Satish Chandra (scope of protection against self-incrimination).

the broader jurisprudence distinguishes between testimonial compulsion and the collection of physical evidence.[132] The protection under Article 20(3) applies strictly to self-incriminatory testimony and does not prevent disclosure of information relating to others.

Overall, Article 20(3) serves as a constitutional shield against coercive investigative practices, preserving procedural fairness and the integrity of criminal trials.

**Application of Forensic Science in Criminal Investigations**

Delays in criminal trials in India have underscored the need for scientific intervention in investigations. Forensic science integrates disciplines such as biology, chemistry, and medicine to enhance the efficiency and accuracy of criminal justice processes. Investigating officers collect physical evidence at the crime scene, which is then examined in forensic laboratories; the resulting expert reports are admissible in court subject to procedural compliance.

In Rojo George v. Deputy Superintendent of Police, the Court observed that conventional investigative techniques may prove inadequate in dealing with technologically sophisticated crimes, thereby acknowledging the relevance of modern scientific methods in criminal investigations.

Overall, forensic science accelerates fact-finding, strengthens evidentiary reliability, and supports judicial determination.

**The Right Against Self-Incrimination**

Self-incrimination arises when an accused person is compelled to provide evidence against themselves. Under Article 20(3) of the Constitution of India, no person accused of an offence can be compelled to be a witness against themselves. This embodies the right to silence and reinforces the principle that the burden of proof lies on the prosecution.

Courts have clarified the contours of this protection. In V.S. Kuttan Pillai v. Ramakrishnan,[133] the Court held that proper legal procedure, such as issuance of a warrant, is required to search or seize documents from the accused. In Kalawati v. State of H.P.,[134] it was ruled that voluntary statements made without coercion do not attract Article 20(3). Similarly, State of Bombay v. Kathi Kalu Oghad[135] clarified that voluntarily given self-incriminatory statements do not amount to compelled testimony. The protection is confined to criminal proceedings, as affirmed in Vidya Verma v. Shri Narain.

Statutorily, Section 53 of the Code of Criminal Procedure permits medical examination of an accused under lawful authority when it may yield evidence. Section 161(2) CrPC requires truthful answers during police questioning but allows refusal to answer questions that may incriminate the accused.

Thus, Article 20(3) read with Section 161(2) CrPC safeguards the accused from coercive self-incrimination while permitting lawful investigative procedures consistent with due process.

**Right to Remain Silent**

The right to remain silent is rooted in the common law maxim *nemo debet prodere se ipsum* (no one is bound to incriminate themselves) and is constitutionally protected under Article 20(3) of the Constitution of India. It ensures that an accused cannot be compelled to answer self-incriminating questions and is integral to a fair trial.

However, the Supreme Court in State of Bombay v. Kathi Kalu Oghad[136] clarified that compelling an accused to provide physical evidence such as fingerprints, blood, or semen samples does not violate Article 20(3), as these are not "testimonial" acts but physical evidence.

[132] Selvi v. State of Karnataka (distinction between testimonial compulsion and physical evidence).

[133] 1980 AIR 185
[134] 1953 AIR 131
[135] 1961 KER LT 74, 64 BOM LR 240
[136] AIR 1961 SC 1808, 1962 SCR (3) 10

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**Admissibility of Forensic Evidence in Courts**

Sections 39–45 of the Bharatiya Sakshya Adhiniyam recognize expert opinion as relevant evidence when courts require specialized scientific or technical knowledge. Experts—such as medical practitioners, chemical examiners, ballistic analysts, and fingerprint specialists—assist courts in matters beyond ordinary judicial competence.

For admissibility, expert evidence must:

- Be given by a qualified expert;
- Meet minimum standards of reliability;
- Be relevant and probative;
- Fall within the expert's recognized field of expertise.

Section 293 of the Code of Criminal Procedure allows courts to rely on reports from specified government scientific experts (e.g., Chemical Examiners, Fingerprint Bureau Directors, Forensic Science Laboratory officials) without necessarily requiring their personal appearance, unless deemed necessary.

Globally, courts have struggled with standards for scientific evidence. In the United States, Frye v. United States established the "general acceptance" test for admissibility of expert scientific testimony, marking a foundational development in evidentiary law.

**Challenges in Forensic Evidence**

**1. Fingerprint Identification**

- **Expert Disagreement:** Studies show that even experienced analysts may not reach consistent conclusions when comparing prints, raising concerns about reliability.
- **Bias:** Contextual information about a suspect can unconsciously influence examiners' conclusions.
- **Human & System Error:** Although systems like AFIS reduce manual comparison, they are not error-free and remain dependent on human interpretation.
- **Latent Print Limitations:** Surface type (e.g., metal, porous materials) and environmental exposure affect print quality and completeness.
- **Aging & Contamination:** Over time, fingerprints degrade and are vulnerable to interference or tampering.
- **Lack of Uniform Standards:** No universal benchmark exists regarding the minimum number of matching ridge characteristics required for identification.
- **Security Risks:** Fingerprints can be lifted, replicated, or manipulated, as demonstrated by biometric breaches involving hackers such as Jan Krissler and groups like Chaos Computer Club.

**2. DNA Analysis**

- **Contamination:** May occur during collection, handling, or laboratory processing, leading to inaccurate attribution.
- **Degradation:** Heat, moisture, and time can damage DNA, resulting in incomplete or unreliable profiles.
- **Low Quantity/Quality:** Trace samples increase risks during amplification and analysis.
- **Mixed Samples:** Multiple contributors complicate interpretation, especially in sexual assault cases.
- **Storage & Handling Issues:** Improper preservation compromises evidentiary integrity.
- **Lack of Standardization:** Variations in collection and preservation protocols across laboratories affect consistency and comparability.

**3. Bloodstain Pattern Analysis (BPA)**

- **Environmental Impact:** Temperature, humidity, surface type, and cleaning attempts can alter stains.
- **Contamination Risks:** Mishandling may compromise integrity.

- **Interpretative Complexity:** Similar patterns may arise from different scenarios, making reconstruction subjective.
- **Technological Constraints:** Detecting latent stains and extracting DNA from aged samples can be difficult.
- **Human Bias:** Cognitive bias may affect interpretation if analysts are exposed to case details.

**4. Toolmark Examination**

- **Subjectivity:** Traditionally reliant on examiner judgment, leading to inconsistencies.
- **Variable Influences:** Tool orientation, surface material, and force affect mark characteristics.
- **Limited Validation:** Need for stronger empirical research on error rates and reproducibility.
- **Need for Objectivity:** Adoption of technologies such as 3D scanning can enhance precision.
- **Reporting Standards:** Uniform documentation protocols are necessary to improve transparency and credibility.

**5. Challenges Faced by Digital Forensics**

Digital forensics confronts substantial operational, technical, and legal challenges.

**1. Technical and Human Resource Constraints:** The discipline requires advanced technical expertise, yet there is a shortage of adequately trained forensic analysts. Rapid technological evolution further necessitates continuous upskilling.

**2. Data Volume and Complexity:** The exponential growth of digital data complicates evidence identification and filtration. Modern devices, cloud systems, and networked environments are technically complex, making interpretation difficult.

**3. Encryption and Security Measures:** Widespread use of strong encryption restricts lawful access to digital evidence, limiting investigative capability.

**4. Data Integrity Issues:** Digital evidence is vulnerable to corruption, loss, or alteration over time, raising concerns about authenticity and chain of custody.

**Challenges Identified by National Institute of Standards and Technology (NIST)**

1. **Accuracy and Reliability:** Development of statistically robust measures to validate complex forensic techniques, particularly when evidence quality varies.
2. **Innovative Analytical Methods:** Creation of advanced, algorithm-driven and AI-assisted techniques to improve speed, precision, and insight in forensic analysis.
3. **Science-Based Standards:** Establishment of uniform standards, guidelines, and conformity assessment frameworks to ensure consistency across laboratories and jurisdictions.
4. **Implementation of Advancements:** Promotion and adoption of improved methods, standards, and technologies to enhance the validity and reliability of forensic science practices.

**Impact of Issues with Forensic Evidence**

Deficiencies in forensic evidence can profoundly disrupt the criminal justice system.

**1. Wrongful Convictions:** Erroneous analysis or misinterpretation of evidence—despite the high evidentiary value often attributed to DNA—can result in innocent individuals being imprisoned or even sentenced to death. Such miscarriages of justice allow actual perpetrators to remain free, undermining both deterrence and victim redress.

**2. Procedural Delays and Financial Burden:** Flawed forensic evidence frequently leads to appeals, retrials, or mistrials. These processes strain judicial infrastructure, consume public resources, and may require substantial state compensation for wrongful convictions.

**3. Psychological and Social Consequences:** Wrongful convictions inflict severe emotional trauma on the accused and their families, including social stigma, economic hardship, and long-term psychological harm. Victims likewise suffer when justice is delayed or denied.

**4. Erosion of Public Confidence:** High-profile forensic failures diminish trust in courts, investigative agencies, and forensic experts. Public skepticism may extend to the broader scientific community involved in criminal adjudication.

**5. Damage to Scientific Credibility:** The continued use of inadequately validated techniques—such as bite mark comparison or microscopic hair analysis—risks discrediting more scientifically robust disciplines, including DNA profiling.

**In sum**, unreliable forensic evidence produces systemic consequences: miscarriages of justice, institutional inefficiency, reputational harm to science, and enduring societal distrust.

## JUDICIAL PRONOUNCEMENT

**Priyadarshini Mattoo Case (1996):**[137]

The original conviction of Santosh Kumar Singh was annulled because of questionable forensic evidence, especially regarding DNA reports. The defense effectively contested the credibility of the DNA evidence, resulting in a commutation of the sentence from death to life imprisonment. This case underscores the essential importance of precise and dependable forensic analysis in achieving fair convictions.

**K. M. Nanavati vs. State of Maharashtra (1959):**[138]

Commander Nanavati's initial acquittal by a jury was reversed due to judicial mistakes, which included misdirection and possible jury bias. This case resulted in the substitution of jury trials with bench trials in India, underscoring the impact of forensic and testimonial evidence on the results of trials.

**State of Uttar Pradesh vs. Rajesh Kumar (2008):**[139]

The Allahabad High Court acquitted the defendant based on unreliable forensic evidence, particularly regarding the management and examination of blood samples. This case underscored the necessity of adhering to proper forensic protocols to avoid wrongful convictions.

**State of West Bengal vs. Dinesh Dalmia (2005):**[140]

The Bombay High Court annulled a conviction due to unreliable forensic evidence, specifically the improper handling of DNA samples. This case emphasized the need for rigorous standards in forensic investigations to ensure justice is served.

**Shopian Rape and Murder Case (2009)**[141]

Issue: The discovery of two deceased women ignited widespread protests concerning alleged custodial rape and murder.

Forensic Problem: Government doctors fabricated medical evidence that falsely indicated rape. This led to extensive protests and political unrest in the Kashmir Valley.

Outcome: The doctors involved were subsequently dismissed; the CBI concluded that no rape occurred.

## 4.1 CHAPTER IV

### 4.1.1 Suggestion

Although forensic evidence is indispensable in criminal investigations, its reliability is often weakened by subjectivity (e.g., bite mark or handwriting analysis), insufficient scientific validation, contamination, cognitive bias, and overstatement of conclusions in court.

To strengthen evidentiary integrity:

- Implement standardized and uniform protocols across laboratories.

[137] Cr. Ap. 87 of 2007
[138] 1962 AIR 605
[139] Civil Appeal No. 9140 of 2019
[140] AIR 2007 SUPREME COURT 1801
[141] 561-A No. 66/2010

- Subject forensic techniques to rigorous empirical validation.
- Increase adoption of objective, technology-driven and data-based tools.
- Ensure continuous professional training and blind proficiency testing.
- Educate judges and lawyers regarding methodological limitations.

**4.1.2 Conclusion**

Forensic evidence remains central to modern criminal justice, yet its effectiveness is compromised by subjectivity, bias, contamination, and lack of scientific robustness. These deficiencies risk wrongful convictions and erode public trust. Strengthening scientific rigor, institutional standards, and examiner training is essential to ensure fairness, accuracy, and judicial credibility.