

## Criminal Justice System and the Role of Forensic Science in India

**\*Chattrapal Singh**  
**\*\*Dr. Pratik Jangid**

### Introduction

The criminal justice system (CJS) in India is a complex and multi-layered framework aimed at ensuring justice by investigating crimes, prosecuting offenders, and delivering fair judgment. In this context, forensic science has become an indispensable tool that provides scientific support to legal processes. It helps in uncovering evidence that is otherwise imperceptible to the human eye, contributing to a more reliable, unbiased, and accurate justice delivery mechanism.

In recent decades, the role of forensic science has expanded significantly in India, particularly with advances in technology. From DNA analysis to cyber forensics, the application of forensic methodologies has transformed how crimes are investigated and prosecuted. This article discusses the significance of forensic science in the Indian criminal justice system, highlighting its evolution, challenges, and future prospects.

### Structure of the Indian Criminal Justice System

India's criminal justice system is derived from the colonial era, primarily governed by three key statutes: the Indian Penal Code (IPC) of 1860, the Code of Criminal Procedure (CrPC) of 1973, and the Indian Evidence Act (IEA) of 1872. The system comprises four main pillars: the police, the judiciary, prosecution, and correctional institutions.

- **The Police:** The police are responsible for maintaining law and order, preventing crimes, and conducting investigations. Forensic science plays a crucial role at this stage, as forensic experts assist in gathering, preserving, and analyzing evidence from crime scenes.
- **Judiciary:** Courts serve as the final arbiter of justice, where evidence is scrutinized. The introduction of forensic evidence, such as DNA profiles, ballistic reports, or fingerprint analysis, strengthens cases and helps deliver more accurate judgments.
- **Prosecution and Defense:** Prosecutors and defense attorneys present evidence in court. Forensic reports often become the focal point of criminal trials, with both parties interpreting the findings to support their claims.

- **Correctional Institutions:** After conviction, forensic psychological assessments may guide correctional programs. Additionally, forensic medicine can play a role in post-mortem analyses in custodial deaths.

### Evolution of Forensic Science in India

The use of forensic science in India dates back to the early 20th century when basic fingerprinting techniques were employed to solve crimes. One of the earliest cases using fingerprint analysis was the Mohan Singh v. Emperor (1930), where fingerprint evidence helped convict the accused. Over the years, with the advancement of scientific methodologies, the Indian legal system began recognizing the increasing importance of forensic evidence.

### Key Forensic Techniques in Indian Courts:

1. **Fingerprinting:** Fingerprinting is one of the oldest and most reliable forensic techniques used in criminal and civil investigations. The practice of fingerprinting in India dates back to the late 19th century when Sir Edward Henry, Inspector-General of the Bengal Police, developed a classification system for fingerprints, later known as the "Henry Classification System." This system revolutionized crime investigation and continues to be a foundational tool in forensic science.

In criminal cases, fingerprints are collected from crime scenes, weapons, and other objects, and then compared with the suspect's prints to establish a match. Fingerprint evidence is critical because no two individuals, even identical twins, have the same fingerprint patterns. It is often used to place suspects at the scene of a crime or confirm their involvement in illegal activities. Fingerprinting is also widely used in civil matters, such as verifying identity in immigration cases, legal contracts, and even employment background checks.

With the advent of technology, automated fingerprint identification systems (AFIS) have been introduced to store and retrieve fingerprint data more efficiently. AFIS helps law enforcement agencies compare fingerprints against large databases to identify suspects, making investigations faster and more accurate.

2. **Ballistics:** Ballistics is the scientific study of firearms, bullets, and projectiles, which is vital in solving cases involving shootings or other firearm-related crimes. Ballistic analysis includes examining bullet trajectories, the type of firearm used, and the distance from which a shot was fired. By comparing bullet casings or the unique rifling marks left on a bullet as it passes through the barrel of a gun, forensic experts can match a specific firearm to a crime scene.

Ballistics also extends to the analysis of gunpowder residues found on a suspect's hands or clothing, which can prove whether an individual fired a weapon. In India, ballistics evidence has been instrumental in solving high-profile murder cases and acts of terrorism where firearms were involved. For instance, in terror-related shootings, tracing the origin of weapons and matching them with bullets recovered from crime scenes have been crucial in linking suspects to

---

## Criminal Justice System and the Role of Forensic Science in India

*Chattrapal Singh & Dr. Pratik Jangid*

their crimes.

3. **DNA Profiling:** DNA profiling is one of the most groundbreaking advancements in forensic science. DNA (Deoxyribonucleic Acid) is a unique genetic code present in every cell of the human body, making it a powerful tool for identifying individuals. DNA profiling was introduced in India in the late 20th century, and it has since become a game-changer in criminal investigations and legal disputes.

In criminal cases, DNA samples are typically collected from blood, hair, saliva, semen, or skin cells left at a crime scene. DNA is then extracted, analyzed, and compared with the suspect's DNA to determine whether there is a match. DNA profiling is particularly crucial in solving cases of rape and sexual assault, where biological evidence can directly link a perpetrator to the victim. Similarly, DNA evidence has been used in murder cases to match the suspect's DNA with traces found on the victim or at the scene.

Beyond criminal cases, DNA profiling has gained prominence in civil matters, such as paternity disputes. In India, DNA testing has been used to establish biological parentage in cases involving inheritance claims, adoption issues, and immigration.

4. **Toxicology:** Toxicology involves the study of poisons, drugs, and other toxic substances, making it particularly relevant in cases of unexplained deaths, poisonings, or drug abuse. Forensic toxicologists analyze biological samples—such as blood, urine, or tissue—from victims to detect the presence of toxic substances like alcohol, narcotics, or poisons.

In India, toxicology has played a vital role in investigating suspicious deaths, particularly in cases involving pesticide poisoning, drug overdoses, or poisoning in dowry-related deaths. Toxicologists can identify the type of substance involved, its concentration in the body, and whether it contributed to the death. This helps investigators establish whether a death was accidental, suicidal, or homicidal.

Additionally, forensic toxicology is employed in cases of drunk driving, drug-related crimes, and doping in sports. In India, toxicological evidence is also crucial in medical negligence cases, where it can help determine if the administered drugs or treatment caused harm to the patient.

5. **Forensic Medicine (Post-Mortem Reports):** Forensic medicine, particularly post-mortem examinations (autopsies), is fundamental in determining the cause and manner of death. Forensic pathologists conduct autopsies to examine the deceased's body, studying external and internal injuries, diseases, or toxic substances that may have led to death. In India, post-mortem reports are vital in solving criminal cases, especially in cases of homicide, suicide, accidents, and custodial deaths.

Autopsies help establish whether a death was natural, accidental, or homicidal. For instance, stab wounds, gunshot injuries, or blunt force trauma found during an autopsy can confirm murder, while drug overdose or asphyxiation may suggest suicide. In dowry death cases, post-

---

### Criminal Justice System and the Role of Forensic Science in India

*Chattrapal Singh & Dr. Pratik Jangid*

mortem reports often provide crucial evidence regarding the victim's injuries or poisoning.

Forensic medicine also extends to cases of rape and sexual assault. Medical examinations of victims can provide critical evidence, such as injuries or biological traces, that support the prosecution's case. Additionally, in cases involving infant deaths, forensic medicine can determine whether death occurred due to natural causes or foul play.

With the rise in technology-related crimes, such as cybercrimes and financial fraud, forensic science in India has expanded to include digital forensics, which deals with the recovery and investigation of material found in digital devices and networks. Forensic techniques are integral to modern crime-solving in India and have proven their value in delivering accurate, scientific evidence in both criminal and civil courts. By combining traditional methods like fingerprinting with advanced technologies like DNA profiling, forensic science continues to evolve, enhancing the Indian criminal justice system's ability to deliver justice effectively and efficiently.

### **Role of Forensic Science in Criminal Investigations**

Forensic science is a cornerstone of criminal investigations in India. Its role extends across various stages of crime detection and prosecution:

- **Crime Scene Investigation:** Forensic experts play a critical role in securing crime scenes and ensuring the proper collection and preservation of physical evidence. This can range from biological samples to trace materials like fibers or hair, which can be crucial in solving crimes.
- **Evidence Analysis:** Laboratories analyze the collected evidence using scientific methods. DNA, bloodstains, fingerprints, gunshot residues, and chemical substances are subjected to rigorous analysis that helps form the foundation for the investigation.
- **Chain of Custody:** Ensuring that evidence is handled and transferred properly from the crime scene to the lab and eventually to the courtroom is critical. Any tampering or mismanagement of forensic evidence can lead to cases being dismissed on technical grounds.
- **Linking Suspects to Crimes:** Forensic analysis often provides the scientific basis to link a suspect to a crime or rule out a person's involvement. In rape cases, for example, DNA evidence can decisively identify the perpetrator.
- **Corroboration of Testimony:** Forensic reports are often used to corroborate or refute witness testimonies, ensuring that decisions are based on objective evidence rather than subjective interpretations.

### **Challenges in the Use of Forensic Science in India**

Despite the significant role of forensic science, several challenges hinder its optimal application in the Indian criminal justice system:

---

## **Criminal Justice System and the Role of Forensic Science in India**

*Chatrapal Singh & Dr. Pratik Jangid*

- **Lack of Infrastructure:** Many forensic labs in India are understaffed, underfunded, and lack modern technology. The backlog of cases and delays in forensic reports often hamper timely justice.
- **Expertise and Training:** There is a dearth of adequately trained forensic experts, especially in newer fields like cyber forensics and digital evidence recovery. This leads to errors in evidence collection and analysis.
- **Judicial Awareness:** The judiciary's understanding of forensic science, especially its limitations, is often limited. Incorrect interpretations of forensic reports can lead to miscarriages of justice.
- **Reliability and Admissibility:** There have been instances where the accuracy of forensic evidence, especially in cases relying on narco-analysis or voice spectrography, has been called into question. The admissibility of such evidence remains a contentious issue.
- **Forensic Laboratories:** India has a limited number of forensic laboratories, most of which are government-run. The long waiting period for forensic reports often results in delayed trials and justice.

### Conclusion and suggestion

Looking ahead, India's criminal justice system must embrace technological advancements such as artificial intelligence, machine learning, and biometric systems, which can revolutionize forensic investigations. Moreover, legal reforms to streamline the admissibility of forensic evidence, along with adequate investments in training and infrastructure, will be crucial in ensuring that forensic science contributes effectively to the delivery of justice.

Here are some suggestions for improving the integration of forensic science within the Indian criminal justice system:

- **Strengthen Legislation on DNA Profiling:** India should expedite the passage and implementation of the DNA Technology (Use and Application) Regulation Bill, which aims to regulate DNA profiling for criminal investigations. This will provide a clear legal framework for the collection, storage, and use of DNA evidence, ensuring privacy and ethical considerations are addressed.
- **Standardization of Forensic Evidence Procedures:** A comprehensive legal guideline should be introduced for the standardization of forensic evidence handling, from crime scene to courtroom, ensuring consistency across the country. This includes the proper chain of custody, documentation, and storage of evidence to prevent tampering or contamination.
- **Clear Rules on Admissibility:** The Indian Evidence Act, 1872 should be updated to include specific provisions regarding the admissibility of new forensic techniques like digital

---

### Criminal Justice System and the Role of Forensic Science in India

*Chattrapal Singh & Dr. Pratik Jangid*

forensics, voice spectrography, and brain-mapping technologies. This will reduce ambiguity and ensure judges have clear legal standards for accepting forensic evidence.

- **Training for Judiciary:** Judges should undergo regular training in forensic science to improve their understanding of complex forensic evidence, its limitations, and its applicability. This will lead to more informed decision-making in trials where scientific evidence plays a key role.
- **Collaboration with Private Forensic Labs:** Law enforcement agencies should be allowed to collaborate with accredited private forensic labs to reduce delays in forensic reports. Clear legal guidelines should be established for using private forensic services while maintaining transparency and integrity in investigations.
- **Creation of Special Forensic Courts:** Establish specialized forensic courts where forensic evidence is crucial to the case, such as in cybercrime, sexual assault, or complicated homicide cases. Judges with expertise in scientific evidence should preside over these courts to expedite justice.
- **Amendments to IT Act, 2000:** With the rise in cybercrimes, the Information Technology (IT) Act, 2000 should be amended to provide a more robust framework for collecting, preserving, and presenting digital evidence in court. New legal standards for digital forensics, such as ensuring the authenticity of electronic evidence, should be established.
- **Legal Regulation for AI and ML in Forensics:** Laws regulating the use of artificial intelligence and machine learning in forensics (e.g., facial recognition, predictive policing) should be introduced to prevent misuse and ensure ethical use of technology.
- **Ensure Access to Forensic Experts for Defendants:** Defendants should have the legal right to seek independent forensic analysis to contest the prosecution's forensic evidence. Clear procedural rules should be framed to ensure both the prosecution and defense have equal access to forensic expertise.
- **Establish More Regional Forensic Labs:** Legal provisions should encourage the establishment of more regional forensic labs to reduce the burden on existing facilities. This will help expedite forensic reports and reduce delays in trials.
- **Mandatory Forensic Audits in High-Profile Cases:** In high-profile criminal cases, such as terrorism or major fraud cases, mandatory forensic audits should be legally required to ensure comprehensive investigation.
- **Integrate Forensic Science in Legal Education:** Law schools should include forensic science as part of their curriculum, helping future lawyers and judges better understand scientific methods and evidence interpretation. This will create a more forensic-literate legal community.

---

### Criminal Justice System and the Role of Forensic Science in India

*Chattrapal Singh & Dr. Pratik Jangid*

- **Regulation of Narco-Analysis and Lie Detector Tests:** Clear legal guidelines should be set to regulate the use of controversial techniques like narco-analysis, brain mapping, and polygraph tests, ensuring that these methods are used ethically and with the consent of the subject.
- **Regulation of Forensic Databases:** Legal measures should be enacted to protect the privacy of individuals whose data (e.g., DNA, fingerprints) is collected for forensic purposes. Proper safeguards should be in place to prevent misuse, such as unauthorized access or discrimination based on genetic information.

By implementing these suggestions, the integration of forensic science into the Indian criminal justice system can be enhanced, ensuring that evidence-based, fair, and timely justice is delivered.

**\*Research Scholar**  
**\*\*Assistant Professor**  
**Department Law**  
**JRN Vidhyapeeth University,**  
**Udaipur (Raj.)**

#### References

1. Basu, S. (2020). Fingerprint Analysis in Criminal Investigations. New Delhi: Oxford University Press.
2. Chaudhary, R., & Sinha, A. (2021). DNA Profiling and Its Role in the Indian Legal System. Mumbai: Thomson Reuters.
3. Kumar, A., & Singh, R. (2022). Forensic Toxicology and Its Applications in India. International Journal of Forensic Sciences, 12(3), 45-58.
4. Malik, P. (2021). Challenges in Forensic Science Infrastructure in India. Journal of Criminal Justice, 29(2), 118-125.
5. National Crime Records Bureau. (2020). Annual Report: Crime Statistics and Forensic Science in India. Government of India.
6. Saksena, K. (2019). Judicial Understanding of Forensic Evidence in India: An Analysis. Indian Journal of Law and Justice, 15(4), 33-49.
7. Singh, C. (2023). Criminal Justice System and the Role of Forensic Science in India. [Unpublished manuscript].
8. Singh, C. (n.d.). Criminal Justice System and the Role of Forensic Science in India.

---

#### Criminal Justice System and the Role of Forensic Science in India

*Chattrapal Singh & Dr. Pratik Jangid*