

# The Crucial Role of Forensic Science in Solving Modern-Day Crimes: An Analysis of the Criminal Justice System

**Nidhi Bishnoi**

Research Scholar, Faculty of Law, Apex University, Jaipur

**Dr. Uma Shanker Sharma**

Research Supervisor, Faculty of Law, Apex University, Jaipur

## Abstract

Today's criminal justice system relies heavily on forensic science because it enables investigators to collect and examine physical evidence from places of crime in order to identify individuals and determine their guilt or innocence. It aids the court in coming to an intelligent decision. Thus, it lessens the likelihood of any injustice. It is currently widely adopted all over the world. From its earliest roots in ancient civilizations to the contemporary methods used to obtain and analyze physical evidence, forensic science has undergone a tremendous evolution over time. In order to identify suspects and determine their guilt or innocence, "forensic science" has come out essential to the "criminal justice system". The following research paper seeks to determine the significance of "forensic science" in solving modern-day crimes in the criminal prosecution. It also examines the difficulties & restrictions faced by forensic science, as well as the potential for mistakes or incorrect interpretation of the available evidence. There are still constraints and difficulties that need to be resolved in forensic science, despite its advancements. The report finishes with suggestions for potential future studies to get around these challenges and guarantee that forensic science continues to be useful in resolving modern-day crimes.

**Keywords:** Criminal Investigation, Forensic Science, Criminal Justice System, Modern-Day Crimes<sup>1</sup>

---

<sup>1</sup> 1 Dr. (Mrs.) Seema Kashyap, Anirudh Sood, "Administration Of Criminal Justice And Role Of Forensics In India: A Study," International Journal of Innovative Research and Advanced Studies (IJIRAS) Volume 5 Issue 4, April 2018. [https://www.ijiras.com/2018/Vol\\_5- Issue\\_4/paper\\_14.pdf](https://www.ijiras.com/2018/Vol_5- Issue_4/paper_14.pdf)

2 Admin (2018) How forensic science has evolved over time, IFF Lab. Available at: <https://ifflab.org/history-of-forensic-science/>.

3 Gowsia Farooq, Sheeba Ahad, "Role of Forensic Science in Criminal Investigation: Admissibility In Indian Legal System And Future Perspective," International Journal of Advance Research in Science and Engineering, Volume no.7, Issue 4, March 2018 <http://data.conferenceworld.in/ClusterUniversityConference/269.pdf>.

4 Walls, H.J., Walls, H.J. and Walls, H.J. (1968) 'forensic science by walls, H J, 'Forensic Science by Walls, H J. Available at: <https://www.biblio.com/forensic-science-by-walls- h-j/work/1489357>.

5 Innes, Brian. Bodies of Evidence: The fascinating world of forensic science and how it helped solve more than 100 true crimes. United States: Amber Books Ltd, 2012.

6 How forensic science has evolved over time, IFF Lab. Available at: <https://ifflab.org/history-of-forensic-science/>.

7 Anirudh, "Criminal Justice and Role Of Forensics In India"<sup>70</sup>

10 Pradeep Nandrajog (no date) State vs Sajeet Kumar on 13 October, 2014 - Indian kanoon. Available at: <https://indiankanoon.org/doc/26906043/>.

11 Sarangi, M. P "Top 5 Cases Cracked by Forensics in India." Forensic Yard. (2020, December 13), from <https://forensicyard.com/forensics-evidence-in-criminal-cases/>

12 Richa Srivastava, Case comment on Priyadarshini Matoo Case. India, legal S. (no date) Available at: <https://www.legalservicesindia.com/article/644/Case-Comment-on- Priyadarshini-Matoo-case.html>.

13 Khan, S. (no date) The growing role of Forensic Science in Criminal Investigation: Admissibility in the

## Introduction

As crime rates rise, it is increasingly important for the criminal justice system to provide immediate justice to crime sufferer and their families. A significant step forward in the development of criminal justice has been the use of technology in the investigation of crimes. Police employ scientific methods and instruments to identify the suspected criminal, recreate the spot where the crime occurred, and create significant connections. On the contrary, courts take into account this concrete proof, which is otherwise unfalsifiable, and decide the guilt or innocence of the criminal with more precision. The degree to which technological instruments are used in criminal investigations has somehow come to be linked to the legal judicial system's operation effectiveness. The court's primary responsibility is to execute time-bound justice and punish offenders. The increased importance of science and its use in criminal investigations has made it simpler to conduct scientific investigations and administer justice when it is due. Scientific evidence is essential for each instance that is up for trial in a court of law in order to establish the suspect's innocence or determine the appropriate legal punishment. Forensic science is the discipline of science that supports the use of scientific concepts for the efficient administration of the criminal justice system. The legal system is aiming to offer scientific findings in cases in order to make the process easier.<sup>1</sup>

The term "forensic" is a Latin word "forensis," that implies forum or public discussion.<sup>2</sup> "Forensic science" is generally utilized in combination with any academic field pertaining to the judicial system. To put it simply, the area of "forensic science" is the integration of "technological scientific techniques" & concepts into judicial & legal issues. *It can be described more broadly as the scientific discipline concerned with the recognition, identification, individualization, and evaluation of physical evidence through the application of natural science concepts and methodologies for the administration of criminal justice.*

According to the "U.S. Department of Energy's Midwest Forensics Resource Centre," forensic science is "*Forensic science is the application of natural sciences to the procedures of law. In practice the subject of forensic science draws its Principles and Methods from the subjects like physics, chemistry, biology and other science subjects*"<sup>3</sup>

Numerous disciplines & thousands of forensic scientists with expertise in ranging from DNA to dentistry along with instruments are now part of the highly developed field of forensic science thanks to the incredible scientific developments and advancements in this field.

## Criminal investigation forensic science evolution

Today, the branch of "forensic science" is continuously evolving with the advancement of

---

Indian legal system and future perspective, JETIR. Available at:

<https://www.jetir.org/view?paper=JETIR2201538> .

14 Khan.S, " The growing" 235.

15 Khan.S, " The growing" 235

16 Farooq and Ahad, "Role" 225.

17 Khan.S, " The growing" 235

20 Farooq and Ahad, "Role" 223.

21 The DNA technology (use and application) regulation bill, 2019 (2023) PRS Legislative Research. Available at: <https://prsindia.org/billtrack/the-dna-technology-use-and-application-regulation-bill-2019> .

22 Official website of District Court of India (no date) Home/District Court in India. Available at: <https://districts.ecourts.gov.in/> .

technology as an element of the current criminal justice system. Surprisingly, the value of forensic science may be traced back to ancient civilizations. Forensic science was initially applied in ancient Greek & Roman society. These cultures achieved significant advances in pharmacology and medicine in general. The Chinese book “Hsi Yuan Lu” – “*The Washing Away of Wrongs*”, written the thirteenth century, is the earliest known treatise on forensic medicine. This piece emphasized the significance of investigating the crime scene above all else, claiming that “*the difference of a hair is the difference of a thousand li*” (a li is a Chinese mile). This saying illustrates the value that French criminologist Edmond Locard placed on trace evidence at the beginning of the 20th century. Today, all scene-of-crime investigators are aware of this value.<sup>4 5</sup>

In ancient India, medical advice was extensively applied to legal obligations. “Sir William Herschel” was among the first legal advisor to encourage the use of “fingerprints” for criminal identification. In order to stop families from obtaining funds following a pensioner's death, he started registering government pensioners' fingerprints in 1858 and used thumbprints as a security mechanism on paperwork. Following the “Council of the Governor General” accepted a Commission report suggesting the idea that “fingerprints” should utilized in the categorization of perpetrator documentation, a “Fingerprint Bureau” was founded in Calcutta (Kolkata), India, in 1897. Indian fingerprint specialists “Azizul Haque” and “Hem Chandra Bose” are credited with the first creation of a fingerprint classification system that was later given Sir Edward Richard Henry's name. In 1968, the Ministry of Home Affairs of the Government of India established a “Forensic Science Laboratory” for the Delhi Police and the “Central Bureau of Investigation” (CBI). In 1894, the Troup group in England accepted that no two people had the same fingerprints, while a different group suggested using fingerprinting for criminal identification in 1900. Argentina in 1890, and in 1902, in England, courts began to accept “fingerprint” evidence. DNA can be used to investigate and prove the existence of crimes and the guilt of the perpetrators. The earliest law stating that a qualified medicinal expert's evidence is requested in situations of suspected murder, injury, hanging, drowning, infanticide, poisoning, and abortion was the Caroline Code, which was established in 1533 by the “German emperor Charles V.” Following that, the commonly held opposition to corpse dissection was a barrier for doctors for a while, but it was eventually overridden. The first person to identify bullet trails in gunshot victims was the 16th-century “French surgeon Ambroise Paré”(d. 1590). Giovanni Morgagni is credited with founding contemporary morbid anatomy in 18th-century Italy.<sup>6</sup>

With the creation of the Indian Police Department's Central Forensic Science Laboratory (CFSL) in Kolkata in 1897, forensic science began to gain significance in modern times in India. With technological improvements and the utilization of scientific procedures in crime investigation, the field of forensic science in India has grown tremendously over the years. Now, with the advancement of technology, the crime pattern is changing. Criminals are getting smart and taking advantage of technological innovations and developments. So, to deal with modern, technologically advanced offenders, police and investigating authorities must be up-to-date on new concepts, technologies, and scientific approaches. Forensic science's multidisciplinary and multi-professional nature makes it potentially useful in criminal cases. Today, India has a number of forensic science institutes, including the

“Central Forensic Science Laboratory” (CFSL), state-based forensic science laboratories, and commercial forensic laboratories. DNA analysis, toxicology, ballistics, cyber forensics, and other specialized services are provided by these institutions.<sup>7</sup>

### **Forensic science methods and applications in criminal justice**

The forensic team utilizes technology throughout the forensic science procedure to examine samples, conduct tests, and hopefully, resolving crimes. Sensitivity, accuracy, and speed criteria are met by the forensic sciences. Given that the quantities of materials used in different crimes have shrunk to infinitesimally small levels, the equipment and procedures used must be extremely sensitive. For instance, traditional poisoning investigations involve extensive the grinding process, cleaning, identification, and quantification procedures on viscera and organs. In a poisoning case, it isn't sufficient to know which lethal drug includes the barbiturate; it is also necessary to figure out which one is known to be connected to the offender. A multitude of techniques are used in forensic science for recognising a substance, including microscopy, blue material, and images of the crime scene and the offender. One of the most recent advancements in the field is the use of infrared and electron microscopes. Additionally, photography is utilized to depict undetectable residues, stains, and other things. Test evaluation, fingerprint recognition or verification, chemical or drug analysis, and body fluid management are all examples of measurements. It is crucial to emphasize that forensic scientists are able to carry out much of their job because of the confluence of technology and science. To process test results, numerous technologies are integrated with the sciences, including biology, chemistry, and mathematics. As a result, the modest researcher should conduct a thorough investigation of the nature and use of these modern forensic scientific tools, paying special attention to DNA testing, narcoanalysis testing, and polygraph testing and whether they are eligible or not.

### **Research method**

A study of official record data that was prospectively collected after criminal proceedings served as the main technique of data gathering for this project. Crime incidents and their legal proceedings helped me understand the importance and challenges that forensic science faces before the law. Indian history related to laws and provisions helped in seeing the evolution of “forensic science” in criminal prosecution. All the data is thoroughly researched and analyzed to present the result of the research paper.

An extensive analysis of data from the Indian judiciary and a number of case studies were used to construct a research approach for identifying the “role of forensic science in contemporary criminal investigation.” The approach was created to give a thorough and in-depth review of how “forensic science” is used in criminal prosecution and to assess how well it works to solve contemporary crimes.

The first step in the research method involved gathering information from the Indian judiciary, including data on the quantity and variety of cases in which forensic evidence was used, the most popular types of forensic evidence, and the consequences of cases in which forensic evidence was presented.

In the second step, a selection of case studies representing a variety of offenses—including murder, sexual misconduct, cybercrime, and other forms of crimes—were chosen.

In the final step, judgements about the utilization of “forensic science” in contemporary Indian crime investigation were reached after synthesising the data and case study findings. The research approach made it possible to analyse forensic science's role in criminal investigations in India in great detail and gave useful information on how well forensic evidence works to solve contemporary crimes.

### **Forensic Science in Indian Administration**

*Article 20(3) of the Indian Constitution* grants an accused individual the right to be innocent until proven guilty. This privilege was established to prevent someone from being forced to respond to a question or produce something that would increase their risk of being found guilty of a crime. Now the question arises: is the person forced to give fingerprints, photographs, footprints, etc.?

This problem is solved by the constitutional bench of the Supreme Court; they have said that these types of forensic tests will only be called evidence after they are thoroughly evaluated, as they can be of great help to the accused in getting off the charge.

A 2005 amendment to the 1973 Code of Criminal Procedure made it possible to get a variety of medical data from suspects after arrest. A medical examination of an accused person may be performed after their arrest, according to “Section 53 of the Criminal Procedure Code” of 1976, provided there are “reasonable grounds for thinking” that the examination could reveal evidence of the crime. The use of an expert's testimony by the court to interpret handwriting or finger expressions is addressed in “Section 45 of the Indian Evidence Act”.

In accordance with “Section-46,” even if a fact is usually meaningless, it might be considered relevant in court if it is supported by expert testimony.<sup>8</sup>

A list of government-recognized scientific experts who can help in the creation of a report in any case to speed up a trial or inquiry is provided in “Section 293 of the Code of Criminal Procedure”.

The right to have an arrestee evaluated by a medical professional who can also be considered an expert is provided by Sections 53 and 54. According to Section 27 of the Prevention of Terrorism Act, any accused person who is reasonably suspected of performing an act in violation of this Act may have samples of their handwriting, fingerprints, footprints, photographs, blood, saliva, sperm, and voice requested in writing from the CJM.<sup>9</sup>

### **Role and Impact of Forensic Science in Crime Investigation**

A forensic scientist's responsibilities include gathering crucial tangible proof from the crime scene, analyzing it in a lab, and testifying as an expert in court. In the diverse subject of forensic science, crime scenes are investigated and evidence is gathered for use in court cases. It provides a substantial amount of information for criminal prosecutions and is used to verify compliance with international treaties on WMD. In criminal prosecutions and investigations, forensic science concentrates on the materials used to identify people, places, and times. The prosecuting officer, who must assess whether or not forensic science is properly applied in the handling of a criminal case, is the most crucial figure for males. In order to establish connections between the crime, the perpetrator, the victim, the police, the crime weapon, and the time it occurred, forensic scientists compare and analyze various items.

If we see some criminal cases where forensic science has come in handy in resolving the criminal cases. For instance, in **State v. Sujeet Kumar (2014)**, the accused was proven guilty of sexual abuse by the evidence collected through DNA profiling.<sup>10</sup>

### **State vs. Jasbir Singh ( Geeta and Sanjay Chopra Kidnapping & Murder Case, 1979)**

In this case, when accused Ranga and Billa were caught and they confessed their crimes but later they withdrew their claims. The forensic department then helped the police identify them and connect them to the crime site. The wounds on Billa's skull and Ranga's hand, according to forensic experts, were sustained about 15 days ago. Both suspects' hair was discovered on the bodies of youngsters. The muck in the automobile and the mud at the crime scene matched. The suspects' and children's fingerprints were also discovered in the vehicle.

11

### **Ms. Priyadarshini Matoo Case**

Due to how it was handled, the Priyadarshini Matoo Case ended up being among the most contentious lawsuit in the country. *"Though I know he is the man who committed the crime, I acquit him, giving him the benefit of doubt,"* said Additional Sessions Jury G.P. Thareja. The accused is the son of IPS officer who has retired, exploited his position to get an acquittal in the case of the alleged rape & murder of "Priyadarshini Matoo," a law student, age 25. The CBI conducted a probe of the cause. The Trial Court exonerated the offender after the documentary and circumstantial evidence was presented, ruling that the prosecution's evidence was false, manufactured, and inadmissible in accordance with "Section 45 of the Indian Evidence Act, 1872". There was a widespread outcry since the district court's decision was incorrect. The "Delhi High Court," which heard the CBI's appeal, reversed the decision and found Santosh Kumar Singh guilty of crimes covered by "Sections 302 and 376 of the Indian Penal Code." He received a death sentence. However, the accused appealed in Supreme court and Santosh Kumar Singh was found guilty of raping Priyadarshini Mattoo and killing her; however, the Supreme Court reduced the death penalty to life in prison because of various grounds that favoured the appellant.<sup>12</sup>

A crucial component of every criminal investigation conducted in India is forensic science due to the precision of the evidence gathered utilising it and the use of scientific principles.

This shows that how forensic science in aid in serving the justice. A crucial component of every criminal investigation conducted in India is forensic science due to the precision of the evidence gathered utilising it and the use of scientific principles. The Indian Judiciary also praised the role of the same.<sup>13</sup>

### **Harpal Singh v. State (2010)**

In the mentioned case, according to the "section 302 of the Indian Penal Code," the person in question was found guilty of killing his wife and son. After being observed with some deceased people, the appellant was charged with murdering the victims first. It was mentioned that collecting handwriting samples, fingerprints, or palm prints was not the same as offering evidence in the Supreme Court's Constitution Bench ruling. The appellant confessed his crime to the witness over the phone, and the alleged offence belonged to him. The conviction was maintained and the appeal was denied.

Overall, these cases show how important forensic science is to criminal investigations and

court proceedings in India. Forensic scientists can contribute to the discovery of the truth and the administration of justice by conducting unbiased, scientific analyses of physical evidence. It's crucial to keep in mind, though, that forensic science has its limitations and can face difficulties. For instance, the precision of forensic analysis can be impacted by the quality of the information obtained at the scene of a crime, and the correct interpretation of the findings is occasionally up to debate. To ensure the validity of their conclusions, forensic scientists must be adequately qualified, accredited, and bound by strict norms and procedures.

**Several forensic science fields that support the criminal justice system** Several “forensic science” disciplines, including forensic entomology, toxicology, ballistics, chemistry, odontology, anthropology, DNA profiling, fingerprinting, forensic engineering, forensic psychiatry, and document examination, are used in criminal investigations.

### **Forensic Entomology:**

It focuses mostly on researching bugs and other arthropods. Through the detection of various medications and poisons, it finds use in inquiries into deaths. It also identifies applications for locating an incident, determining the duration of adult or child neglect, and identifying offenders; the frequency and duration of the injuries. Although “forensic entomology” is still in its evolving stage in India, research analyst are always exploring & testing new ideas in this area. This is a positive development that prepares the door for future development & evolution of “forensic entomology” in the country, particularly in relation to criminal law.<sup>14</sup>

### **Forensic Toxicology:**

Toxicology, also known as the science of poisons, is the investigation of poisons. Walls suggests that toxicology can be categorized into:

1. “Clinical toxicology”: identifying poisoning symptoms and taking the appropriate corrective action;
2. “Chemical Toxicology”: the finding of the poison in post-mortem material, blood tests, etc. For instance, involuntary intoxication may be used as a justification for a crime under “Section 85 of the Indian Penal Code,” 1860. If a substance was strong enough to impair judgement, forensic toxicology can help to ascertain whether the individual in question was under its influence. The main goal of forensic toxicology in criminal investigations is to determine if a person died from deadly overdose or poisoning. Additionally, it has identify instances of (DFSA) "Drug Facilitated Sexual Assault" in Western nations. In many circumstances, the victims scarcely recall anything, but toxicological testing can be utilised to determine whether the medicines mentioned above were present in their system. According to “Indian Penal Code,” 1860, intoxication with chemicals that endanger life or health is likewise punishable under “Section 320.”<sup>15</sup>

As a result, forensic toxicology has several uses and applications in criminal law. The study of elements' and compounds' harmful effects on living things is known as toxicology. In the context of probes into medical-legal deaths, which combine scientific technology with legal context & numerous human performance difficulties, forensic toxicology encompasses a wide range of disciplines that aid in determining the presence and meaning of various drugs and poisons. The three major goals of these investigations are as follows:

- a) Determine whether the toxicants in question have the potential to be fatal.
- b) Determine whether the toxicants under investigation in toxicology are capable of altering behaviour.<sup>16</sup>

### **Criminal psychology (Forensic):**

*"The study of human behaviour in legal settings or relevant legal environment"* is how it has been defined.

It involves the use concerning psychiatry in the execution of justice. Assessments of mental disorders and criminal propensity are the main topics in criminal law. The term "forensic psychology" has gained more popularity in recent years than it may have done before the 1980s.

*According to "Section 84 of the Indian Penal Code, 1860," "Nothing is an offence which is done by a person who, at the time of doing it, by reason of unsoundness of mind, is incapable of knowing the nature of the act, or that he is doing what is either wrong or contrary to law."*

In order to ascertain whether a person's mental instability was serious enough to impair their judgement to the point where they were unable to recognise the exact nature of the offence they had committed, forensic psychology is available.

A qualified witness called as a result of "Section 45 of the Indian Evidence Act, 1872" could give testimony regarding a statement of truth or their view in a particular area of competence. An expert "forensic psychiatrist" can testify as a truth or an authority testimony. To "help the trier of fact understand the proof or identify a fact in issue," is the forensic psychiatrist's job description. When a court hearing a crime is confronted with issues relating to madness or an argument for advocacy or when a in-depth comprehension and professional expertise in a certain psychological topic are needed, it's possible to seek assistance from "forensic psychiatric" specialists seeking their expert opinion.<sup>17</sup>

### **Forensic Anthropology**

The study of people and human behaviour is known as anthropology. The study of anthropology is a vast field with several subfields. It is not confined to any one area. This broad field is primarily divided into three primary categories, namely: 1.Osteology in forensics 2. Criminal archaeology 3. "forensic Taphonomy."

The study of individual bones and the skeleton as a subject is called osteology. The systematic collection & excavation of human remains and other forensic evidence from crime scenes is known as archaeology. The study of variations that affect the remains of people at the moment of death and beyond, including trauma, putrefaction, and environmental changes, is known as taphonomy.

They are especially helpful when identifying the root cause for mortality during a criminal investigation and in murder cases. Its use has expanded significantly during the past few years. It enables the recognition of people from CCTV footage or photographs. Disasters have struck India on numerous occasions, including the "Gujarat earthquake in 2001," the "Indian heat wave in 2002," "the Indian Ocean tsunami in 2004," and others. "Forensic anthropology" is helpful in identifying victims died in these disasters and incidence. Furthermore, it assists in resolving felony instances involving fatalities.



### **DNA Testing**

One of the most well-known and important advancements in forensic science in the past few decades is DNA testing. The terms "DNA fingerprinting" and "Genetic Typing" are also used to describe it. In the area of criminal investigations, it has numerous applications.

- Determination of sexual assaulters in situations of sexually assaults & gang rapes,
- Detection of the dismembered ashes of deceased victims in the event of blasts, fire, etc.
- Establishing a individual's presence where the scene of crime occurred; identifying suspects; and determining a defendant's guilt or innocence before the hearing.

Each of these represent some "forensic science" disciplines that are extremely helpful when analysing criminal activity. In the early years of Criminal Jurisprudence, scientific research had a major role in the development of this area. However, attempts were underway that would establish novice technology expressly to fight modern varieties of crimes as the area progressed and its use in criminal investigation increased. The development of "forensic science in India," particularly with reference to the law of criminal justice, can be accelerated by the ongoing push for technological innovation. DNA profiling is anticipated to become a more effective tool in the battle against crime as technology advances.

### **Document Analysis**

The document department of "forensic science" deals with a wide range of issues related to white collar crimes, including the analysis of writing style and signatures, the detection of forgery, the discovery and decoding erasures or obliterations of writings, the decipherment of rubber seals and postal cancellation seals, etc. Examining printed material, typescripts, reading invisible ink, looking through burned documents, and figuring out the chronological order of two overlapping pen inks are all examples of how to examine printed material.

### **Forensic dentistry (Odontology)**

When dental expertise is used in the legal processes, the field of "forensic science" known as forensic dentistry is involved. Sometimes the terms forensic dentistry and forensic odontology are used interchangeably.

In the interest of justice, forensic odontology can be further described as the examination, assessment, and correct treatment of the evidence that is brought before a court of law. By looking at the teeth and prosthetics, a forensic dentist, also known as an odontologist, can determine the cause of death. Typically, this kind of analysis is done on murder and disaster victims. The aforementioned discipline of forensic science comes in handy if there are large-scale disasters or whenever age or bite marks need to be determined.

### **Forensic Chemistry:**

The biologist is often the next major standalone department in a forensic laboratory, after the chemistry department.

Paint and glass are the types of items that are typically gathered up after car accidents or hit-and-run incidents. Additionally, the chemist is in charge of inspecting and matching impressions, such as tyre, shoe or foot, and tool prints that are typically left at crime scenes around the process of illicit entry.

A procedure based on evidence, forensic science integrates ideas from many different scientific disciplines as well as cutting-edge medical technologies. The ability to gather biological specimens while taking crucial safety precautions is necessary for forensic experts. Due to the employment of new, contemporary, and complex methods, it is today difficult to resolve an offence lacking a new systematic procedure. Currently expanding quickly, forensic science can assist in solving enigmatic crimes.

### **Result and Discussion**

Every criminal investigation must ultimately be decided by a court of law. The entire investigation procedure will be ineffective if the court is not properly informed of the forensic results. Therefore, managing the forensic evidence in the courtroom is just as crucial as managing the crime scene, followed by laboratory inspection & identification. The courtroom forensics rely on more than just the professional's capacity to present expert testimony, but also on the judiciary's level of forensic knowledge.<sup>18</sup> The entire forensic process is hijacked if the honorable judge is unaware of the high-tech forensic applications. Now, judicial officials often attend awareness seminars on the most recent developments in forensic investigative methods and the fields in which they are used. They converse with the forensic specialists in their offices, and they also go to the forensic labs to learn more about recent forensic breakthroughs. Awareness about the field of forensic science is needed to utilize its full potential in criminal investigation. This awareness campaign should include all society as well as people associated with the judicial system from investigators to the judicial system.

### **Future Scope of Forensic Science**

Investigators in criminal cases have found using forensic science to be extremely helpful. It frequently has the potential to make a difference in whether the accused is exonerated or found guilty during the trial before the law. It uses highly precise techniques that increase the efficiency of the interrogation process. Criminal investigations comprise a thorough examination of the data, the testament, and the sequence of incidents that led to the crime. Some investigations involve a large number of sufferers, suspects, and offenders. For the agencies, this oftentimes causes the process quite challenging.

Although criminal prosecutions and investigations use forensic science primarily, it additionally obliquely addresses people, places, and events through the use of materials. However, there are few instances of criminological science being used in the framework for law enforcement, and the legal examination and arraignment process is now in terrible shape in India, with numerous hearings and high-level officials having an equitable treatment rate of over 90%. Therefore, the techniques employed by forensic analysts are no longer applicable.

Third-degree procedures are becoming less effective and more dangerous for criminals to use in the current courtroom as well as for people in general. Due to its extensive and varied scope, forensic science has evolved into a crucial "workhorse" for achieving justice for the people. Only a small percentage of crimes in India are investigated, and those who perpetrate them are punished, with few instances ending in conviction or release.

The parameters that promote "forensic science" uses in criminal prosecution:

- **Social Variations:** The civilization is evolving in profound ways, and doing so quickly. India underwent a significant transformation, evolving from an imperial colony to a democratic republic. Every aspect of modern life, including communication and transportation, has been revolutionized. On the one hand, the satellite communication that is assisting intelligence services has also proven beneficial to criminal brains, thus, this revolution has not just influenced negative people but also positive ones.<sup>19</sup>
- **Advancement in the knowledge of technology:** Since the average person today has more technical expertise, crime-committing tactics have also become more sophisticated. As a result, methods and approaches for countering the stated crime need to be modernized and enhanced in order to keep up.
- **Stronger evidence:** When physical evidence is evaluated by an expert, it is usually done so in a way that is quite objective; for example, if a “fingerprint” is discovered at the crime scene, it is assumed to belong to just one individual. If that individual turns out to be the person in question, he will need to explain why he was there. In a similar vein, a bullet found in a dead person can only be linked to one specific handgun. If the accused actually owns this gun, he is responsible it becoming a crime weapon, and proof is almost attainable at all times.<sup>20</sup>

### **Some approaches that define the relevance of forensic science in criminal legal system**

The “Malimath Committee Report” from 2003 and the PIL, the Supreme Court suggested implementation of the directive in the “Malimath Committee Report” both emphasised the significant potential for the implementation of “forensic science” in the criminal prosecution and Indian law.

### **“2003 Malimath Committee Report”**

The Government of India conducted the historic Malimath Committee Report in 2003 to assess the country's legal system for criminals and make recommendations for improvements. The report cited the modernisation and advancement of the forensic field in India as one of its main recommendations.

The opinion quoted as *"The application of forensic science to crime investigation must commence from the stage of the very first visit by the IO to the crime scene so that all relevant physical clues, including trace evidence, which would eventually afford forensic science examination, are appropriately identified and collected."*

The research emphasised the requirement for sophisticated forensic methods to assist with the prosecution and investigation of contemporary crimes, especially ones involving terrorism and cybercrime. The committee advised setting up cutting-edge forensic labs in each state of India, as well as creating a nationwide database of DNA to assist in identifying and monitoring the movements of suspects.

The report also emphasised the necessity for sufficient funds and resources to enable the successful application of forensic science throughout criminal investigations, as well as the need of appropriate educational and professional development for forensic scientists.

### **DNA Technology Regulation Bill (2019)**

A ground-breaking piece of legislation, the DNA Technology (Use and Application) Regulation Bill, 2019, has the power to completely change how forensic science is applied in

Indian criminal investigations. The “National DNA Data Bank” will act as an extensive archive for DNA profiles gathered from scenes of crime, individuals suspected, and previously convicted criminals across the nation. This bill calls for its creation. Even in situations where there is no additional pertinent evidence, law enforcement authorities will be able to rapidly and correctly identify criminals & link them to many crimes because to this.

The legislation also establishes stringent criteria regarding the implementation of genetic information in criminal investigations, guaranteeing that DNA samples are collected, examined, and stored in a fair, ethical, and open manner. It calls for the creation of a “DNA Profiling Board,” that will supervise the application of DNA technology and guarantee that all DNA testing labs adhere to exacting criteria of quality.<sup>21</sup>

The measure also recognises the value of data security and privacy and contains safeguards to protect the rights to privacy and personal information of people whose DNA samples are taken and kept in the “National DNA Data Bank.”

### **Guidelines for Forensic Science Laboratories (FSLs), 2016**

The FSLs Guidelines of 2016 outline the criteria for physical infrastructure, tools, and personnel and also offer particular standards and references for forensic analysis and testing. The rules for gathering, preserving, and analysing evidence in various criminal proceedings, including murder, sexual assault, and cybercrime, are included here. For the establishment, accrediting, and supervision of FSLs across the nation, these rules offer detailed instructions and best practises.

The standards also outline specific steps for the analysis and understanding of forensic data like ballistics, DNA, and fingerprints. These methods are intended to reduce the danger of prejudice or errors in the evaluation and interpretation of forensic evidence, as well as to ensure the correctness and reliability of such evidence in court proceedings.<sup>22</sup>

### **Conclusion**

The use of basic science techniques and methodologies for various forensic assessments of various crimes is known as “forensic science.” To further the cause of justice, the Forensic Science Laboratory in Assam offers essential assistance to investigating organizations in numerous ways. Working with evidence from a variety of crimes, including murder, rape, blood, saliva, weapons, ammunition, explosives, and explosive chemicals, as well as alcohol, hashish, opium, contaminated fuel, kerosene, diesel, etc., makes forensic science a hazardous and deadly field of study. They also look at the fake specimens and signatures, and they analyze all the photographs of the material exhibits. To establish or refute their connection to a specific crime or criminal, all tangible exhibits uncovered during an inquiry must be carefully evaluated.

In practise, the forensic scientists must evaluate the physical evidence associated with various types of crimes, taking into account pertinent provisions of the Indian Penal Code and other laws. The study of forensic science is geared towards reducing crime. It is a flexible tool that has been used in both the execution of justice and the investigation of crimes. Law enforcement needs forensic science since it is used to evaluate the likelihood of crimes and determine a person's guilt or innocence. The needed conviction rate has not been attained using the conventional ways of criminalizing offenses.

Criminal investigations can be aided by forensic science, which also benefits today's society. With time, its significance is growing, and there are many fields of forensic science that can aid in crime scene investigation and criminal detection.

## References

- [1] Dr. (Mrs.) Seema Kashyap, Anirudh Sood, “*Administration Of Criminal Justice And Role Of Forensics In India: A Study*,” International Journal of Innovative Research and Advanced Studies (IJIRAS) Volume 5 Issue 4, April 2018. [https://www.ijiras.com/2018/Vol\\_5-Issue\\_4/paper\\_14.pdf](https://www.ijiras.com/2018/Vol_5-Issue_4/paper_14.pdf) “The History of Forensic Science and it's evolution - IFF Lab.” n.d. Incognito Forensic Foundation.. <https://ifflab.org/history-of-forensic-science/>.
- [2] Admin (2018) *How forensic science has evolved over time*, IFF Lab. Available at: <https://ifflab.org/history-of-forensic-science/>.
- [3] Gowsia Farooq, Sheeba Ahad, “*Role of Forensic Science in Criminal Investigation: Admissibility In Indian Legal System And Future Perspective*,” International Journal of Advance Research in Science and Engineering, Volume no.7, Issue 4, March 2018 <http://data.conferenceworld.in/ClusterUniversityConference/269.pdf>.
- [4] Walls, H.J., Walls, H.J. and Walls, H.J. (1968) *forensic science by walls, H J, 'Forensic Science by Walls, H J*. Available at: <https://www.biblio.com/forensic-science-by-walls-h-j/work/1489357>.
- [5] Innes, Brian. *Bodies of Evidence: The fascinating world of forensic science and how it helped solve more than 100 true crimes*. United States: Amber Books Ltd, 2012.
- [6] Sarangi, M. P. (2020, December 13). *Top 5 Cases Cracked by Forensics in India*. Forensic Yard. from <https://forensicyard.com/forensics-evidence-in-criminal-cases/>
- [7] Nandrajog, P. (n.d.). *State vs Sujeet Kumar on 13 October, 2014*. Indian Kanoon. from <https://indiankanoon.org/doc/26906043/>
- [8] Richa Srivastava, *Case comment on Priyadarshini Matoo Case*. India, legal S. (no date) Available at: <https://www.legalservicesindia.com/article/644/Case-Comment-on-Priyadarshini-Matoo-case.html>.
- [9] Khan, S. (no date) *The growing role of Forensic Science in Criminal Investigation: Admissibility in the Indian legal system and future perspective*, JETIR. Available at: <https://www.jetir.org/view?paper=JETIR2201538>.
- [10] *Official website of District Court of India* (no date) *Home/District Court in India*. Available at: <https://districts.ecourts.gov.in/>