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## ***ABOUT US***

WHITE BLACK LEGAL is an open access, peer-reviewed and refereed journal providededicated to express views on topical legal issues, thereby generating a cross current of ideas on emerging matters. This platform shall also ignite the initiative and desire of young law students to contribute in the field of law. The erudite response of legal luminaries shall be solicited to enable readers to explore challenges that lie before law makers, lawyers and the society at large, in the event of the ever changing social, economic and technological scenario.

With this thought, we hereby present to you

# **“ENHANCING THE FORENSICS EVIDENCE IN CRIMINAL INVESTIGATION: ADMISSIBILITY IN INDIAN LEGAL SYSTEM AND FUTURE PERSPECTIVE.”**

AUTHORED BY - PROF. JYOTI AWANA  
& ADV. DEEPAK KUMAR

## **Abstract**

Forensic science is the backbone of criminal investigations within India's legal framework. It's not just about examining crime scenes; it's a multidisciplinary field that brings together various scientific branches to uncover evidence, establish facts, and shed light on criminal activities<sup>1</sup>. Its significance in India is immense, providing objectivity, precision, and trustworthiness in unravelling truths and achieving justice.

Forensic biology plays a vital role by analysing biological evidence like DNA to identify individuals involved in a crime. Toxicology examines substances to understand their effects on the body, crucial in cases involving poison or drugs. Ballistics deals with firearms and ammunition, determining trajectories and linking weapons to crimes. Digital forensics focuses on electronic devices to recover data and trace digital footprints. Forensic psychology delves into understanding criminal behaviour, aiding in profiling suspects and analysing motives.

In the Indian context, forensic science encompasses an extensive range of disciplines. Forensic biology, toxicology, ballistics, digital forensics, and forensic psychology are among the critical branches. These disciplines offer a diverse set of tools and methods that assist investigators in gathering evidence, reconstructing events, identifying potential suspects, and validating investigative theories.

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<sup>1</sup> B.R. Sharma, “Scientific Criminal Investigation” (Lexis Nexis 2<sup>nd</sup>edn, 2016)

## 1. Introduction

“Nothing matters but the facts without then the science of criminal investigation is nothing more than a guessing game “.

- By Blake Edward

The highly developed area of forensic science in the United States uses modern technology and specialised fields such as digital forensics, ballistics testing, fingerprint recognition, and DNA analysis. Coordinated databases facilitate data sharing, which strengthens investigative capabilities. Examples of these databases are the Combined DNA Index System (CODIS) and the National Integrated Ballistic Information Network (NIBIN). Strict guidelines for expert testimony are upheld by the American court system, which strongly emphasizes the admission of forensic evidence<sup>2</sup>.

Forensic science in Asian nations, like Japan, combines old techniques with new technology. Even though DNA testing and fingerprints are widely used, more conventional methods like anthropometry (measuring the body) and odontology (dental forensics) are still useful. In Japan, the forensic science system places a high value on following the law, taking careful notes, and examining tangible evidence<sup>3</sup>.

## 2. Statement of Problem

The research problem at the heart of this dissertation delves into the hindrances restricting the optimal utilization of forensic science within Indian criminal investigations.

It scrutinizes the underuse of forensic evidence in legal proceedings, the antiquated technology prevalent in forensic methodologies, deficiencies in forensic laboratory equipment, inadequate training for forensic professionals, and potential legal barriers impeding the effective application of forensic discoveries within Indian court systems.

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<sup>2</sup> United Nations Office on Drugs and Crime, “Strengthening forensic science capacity for effective criminal justice in the Sahel region” (*United Nations: Office on Drugs and Crime*) <<https://www.unodc.org/>> accessed 5 January 2024

<sup>3</sup> Inoue, M., Nishi, K., Katoh, T., & Nagao, M., “Forensic science in Japan: A review” (2016) 259 *Forensic Science International* 135



### **3. Research Methodology**

The research methodology employed in this study is predominantly theoretical, following a doctrinal approach.

The approach is descriptive, analytical, and critical, blending explanatory and exploratory methods to comprehensively evaluate the role and impact of forensic science in Indian criminal investigations.

### **4. Research Objectives**

1. To investigate the present status of forensic science implementation in Indian criminal investigations, evaluating the infrastructure, technologies, and methodologies employed.
2. To identify challenges and limitations hindering the efficient utilization of forensic science within Indian criminal justice, including technological limitations, forensic backlogs, and legal constraints.
3. To assess the influence and efficacy of forensic science in resolving criminal cases within India, specifically examining its role in achieving just and equitable trial outcomes.
4. To devise recommendations and strategies to overcome the identified challenges, encompassing advancements in technology, training programs, legal reforms, and enhanced collaboration between forensic entities and law enforcement.
5. To forecast potential advancements and innovations in forensic science and their prospective impact on the Indian criminal investigation landscape, ensuring continuous improvement and adaptation to evolving criminal activities.

### **5. Research Questions**

1. How forensic science is presently utilized in criminal investigations in India, and what are the existing challenges faced by its integration?
2. What particular barriers and restrictions prevent forensic science from being applied effectively in the Indian legal system, and how do they affect the legal system as a whole?
3. How significantly does the use of forensic science in Indian criminal processes help to maintain justice and ensure fair trials?

4. What unconventional solutions and tactical adjustments may be suggested to get beyond the noted obstacles and strengthen the position of forensic science in Indian criminal investigations?
5. How can advancements and emerging technologies in forensic science be leveraged to tackle evolving criminal activities and strengthen investigative practices within the Indian landscape?

## **6. Global Perspective on Forensic Science in Criminal Investigation**

### **6.1) The Role of Forensic Examination in Trials in China**

In China, forensic science is essential to criminal investigations since it helps collect and analyse evidence for court cases. The nation's legal framework, which includes a number of laws and regulations, governs the use of forensic science in criminal investigations. Its goals are to protect the rights of those participating in judicial procedures and guarantee the dependability and correctness of forensic evidence.

Interesting figures were obtained from field research on forensic exams in China's criminal court system in Beijing, Qingdao, and Hohhot. Based on the total number of cases and expert findings, the average number of conclusions per case was 2.4. Remarkably, the mean quantity of expert rulings per instance exhibited fluctuations throughout time, with figures of 1.32 for 2005, 2.79 for 2006, and 3.15 for 2007. Among the various forensic examination methods, forensic autopsy exhibited the highest application frequency, constituting 35.04% of total expert conclusions, followed by DNA testing at 22.44%, and injury assessment at 15.75%<sup>4</sup>. These findings underscore the increasing significance of scientific evidence in modern legal proceedings, with forensic examination emerging as a crucial tool for trial fact-finding. However, despite its invaluable contributions, reliance on forensic evidence also presents challenges in certain cases.<sup>5</sup>

### **6.2) Evolution of DNA Testing Law in China**

With the creation of DNA banks run by the Ministry of Justice, China's regulations pertaining to DNA

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<sup>4</sup> Zhang B and Li Y, "The Role of Forensic Examination at Trials in China" (*Journal of forensic science and medicine*, January 1, 2015) <[https://journals.lww.com/jfsm/Fulltext/2015/01020/The\\_Role\\_of\\_Forensic\\_Examination\\_at\\_Trials\\_in.11.aspx](https://journals.lww.com/jfsm/Fulltext/2015/01020/The_Role_of_Forensic_Examination_at_Trials_in.11.aspx)> accessed 5 January, 2024

<sup>5</sup> Ibid

testing have advanced significantly. These banks simplify a number of legal procedures and set the stage for a national DNA registry. China's DNA testing rules are characterized by many key elements

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- **Mandatory Sampling for Convicted Offenders:** In an effort to avoid such incidents and facilitate investigations, DNA samples from those found guilty of sexual offences must be submitted to the register.
- **Prosecutorial Authority in DNA Testing:** During criminal investigations, prosecutors have the right to force people to submit to DNA testing, enabling law enforcement to obtain crucial evidence for criminal prosecutions.
- **Storage Duration Guidelines:** DNA samples are often kept for ten years, along with written and photographic records. This time frame guarantees that genetic data will be accessible for future use and any follow-up studies.
- **Post-Imprisonment Sampling:** After serving a term longer than five years in jail, those found guilty of crimes could be required to submit non-invasive DNA samples, which would increase the efficiency of DNA databases in tracking and preventing recidivism.

DNA testing is invasive, which has raised concerns about human rights despite advances in the technology and its use in criminal justice. DNA testing regulations are heavily influenced by international human rights norms, particularly those pertaining to privacy and family life.

### **6.3) Case Study**

This case underscores the significance of ongoing reforms in China's forensic evidence system, aimed at safeguarding forensic professionals from state interference and preventing the use of unlawfully obtained evidence to convict innocent individuals. There has been a clear attempt to improve the independence of forensic professionals, as seen by the 2005 Decision of the Standing Committee of the National People's Congress on Administration of Forensic Identification, which included provisions to safeguard witnesses. Despite these initiatives, further actions are deemed necessary to ensure the autonomy and safety of forensic specialists and to counteract biased authorities' influence over the credibility of their findings.<sup>6</sup>

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<sup>6</sup>Supra Note 13

A positive development occurred in 2013 with the introduction of the new Criminal Procedure Law (CPL), which barred unlawfully obtained evidence and provided protection for expert witnesses in court proceedings. However, this change primarily focused on upholding general human rights rather than specifically safeguarding forensic evidence. China's judicial system is undergoing broader transformations aimed at rectifying past practices prioritizing administrative convenience and suppressing public dissatisfaction over truth-seeking in convictions. Historically, confessions carried more weight than tangible evidence, fostering a system where officials prioritized securing convictions for personal advancement. The pressure to achieve high conviction rates often led to inaccurate reports and wrongful convictions<sup>7</sup>. The new Criminal Procedure Law was implemented in 2013, which was a great move. (CPL), which excluded evidence collected unlawfully and protected expert witnesses testifying in court. But this change was more about protecting human rights in general than it was about protecting forensic evidence in particular. China's court system is undergoing larger changes that aim to replace past practices that put administrative convenience and public dissatisfaction suppression ahead of discovering the truth via convictions. Confessions of guilt have historically been given greater weight than hard evidence, creating a system in which officials prioritized getting convictions for their own development<sup>8</sup>.

#### **6.4) Achievements and progress**

China's forensic reform strategy focuses on establishing independent scientific institutes to improve the forensic investigation system. These institutes aim to provide forensic analysis not only to law enforcement and prosecutors but also to defense lawyers.

#### **6.5) Prospective Trends of Development**

Establishing independent, non-government affiliated centres for casework and research is necessary to advance forensic science in China. Regulations should prevent police from using in-house specialists to analyze evidence, fostering independence in the forensic sector. Social institutes should handle a larger portion of forensic workload currently managed by police, including evidence identification.<sup>9</sup>

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<sup>7</sup> Supra Note 13

<sup>8</sup> Jiang Na and Wang Yue, "The Latest Developments of Forensic Science Reform in China" (2019) 8(1) Global Journal of Arts and Advancement <chromeextension://efaidnbmninnibpcjpcgiclfndmkaj/https://juniperpublishers.com/gjaa/pdf/GJAA.MS.ID.555727.pdf> accessed 7 January, 2024

<sup>9</sup> Supra Note 21

## **6.6) The Role of Forensic Examination in Trials in United States of America**

Forensic science is crucial to the US criminal justice system because it offers crucial evidence that facilitates the investigation and settlement of criminal cases. A vast body of research, techniques, and instruments known as "forensic science" are used by law enforcement, courts, prosecutors, and defence teams to uncover the truth and administer justice. It is used to judicial matters and is founded on scientific ideas. Forensic science is a broad field that includes many different subfields, including as toxicology, digital forensics, ballistics, DNA analysis, fingerprint analysis, and trace evidence analysis.

The extraction, purification, and analysis of DNA samples taken from biological evidence constitute DNA analysis, a fundamental component of contemporary forensic science. This evidence, which may be anything from blood and saliva to hair and tissue, aids in victim identification, establishes connections between suspects and crime scenes, and elucidates familial links. The Federal Bureau of Investigation's (FBI) upkeep of the Combined DNA Index System (CODIS) is extremely beneficial to criminal investigations<sup>10</sup>, which is a vital tool for organizing and contrasting DNA profiles from various sources.

Moreover, ballistics, a crucial branch of forensic science, conducts painstaking examinations to identify the kinds of firearms used, the trajectory of the bullets, and the circumstances that led up to shooting occurrences.

## **6.7) DNA Testing in the United States: The Frye Standard and Federal Rule 702**

As scientific understanding expanded in the 20th century, the legal system worked to create a set of uniform standards for judging whether scientific evidence may be used in court. The historic ruling in 1923 was a significant turning point in the effort to achieve uniformity in the evaluation of scientific evidence in *Frye v. United States*<sup>11</sup>. In the *Frye* case, the defendant attempted to prove his innocence during the murder trial by using a systolic blood pressure lie detector test. This landmark decision set precedents that would impact how forensic science would advance in the US criminal justice system going forward by defining rules for the admission of scientific theories and procedures in court<sup>12</sup>.

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<sup>10</sup> National Academy of Sciences, *Strengthening Forensic Science in the United States: A Path Forward* (2009) <<https://www.ojp.gov/pdffiles1/nij/grants/228091.pdf>> accessed 4 February, 2024

<sup>11</sup> *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923)

<sup>12</sup> *Ibid*

### **6.8) The Combined DNA Index System: An Effective Instrument for Criminal Cases**

The complex Combined DNA Index System (CODIS) is a DNA database maintained by the Federal Bureau of Investigation (FBI) in the United States<sup>13</sup>. A variety of DNA profiles from various sources, including arrestees, convicted felons, and forensic evidence from crime scenes, are included into CODIS. This advanced technology allows law enforcement agencies to compare and match DNA samples for investigative purposes.

The US Supreme Court discussed the validity of taking DNA samples from those detained for severe crimes in the historic case of *Maryland v. King* (2013)<sup>14</sup>. The Court decided that law enforcement officials might take a cheek swab sample of an arrested person's DNA under certain situations.

### **6.9) Forensic laboratories**

The criminal justice system relies heavily on forensic laboratories to provide essential scientific studies that support criminal case investigation and resolution. These labs follow stringent quality control procedures and are frequently accredited by ISO 17025 standards<sup>15</sup>.

### **6.10) Most Recent Reforms**

An important turning point in the endeavour to improve the legitimacy and dependability of forensic science procedures in the United States was the 2009 NAS Report. It called for extensive changes, notably emphasizing the need for accreditation of all forensic service providers based on internationally recognized standards<sup>16</sup>. This advice was made in an effort to allay worries over the accuracy and uniformity of forensic analyses performed in various laboratories.

### **6.11) The role of Forensic Examination in trials in United kingdom**

The relevance of accurately processing and reporting forensic science evidence from crime scenes to court proceedings is underscored by the critical role it plays in solving criminal cases. In the UK, forensic science services are managed by a number of criminal justice systems, each having its own service providers in England and Wales, Northern Ireland, and Scotland. Although Scotland and

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<sup>13</sup> Supra Note 31

<sup>14</sup> *Maryland v. King*, 569 U.S. 435 (2013)

<sup>15</sup> Supra Note 29

<sup>16</sup> Supra Note 31

Northern Ireland have government-financed services under the direction of the Scottish Police Authority and Forensic Science Northern Ireland, respectively, England and Wales operate on a competitive market framework that was established after the McFarland Review in 2002. This market has fragmented, with 43 police forces (80%) and three large private organisations supplying the majority of services: Eurofins Forensic Services, Key Forensic Services, and Cellmark Forensics, Inc. Regulation is necessary given this heterogeneous ecosystem, and the Forensic Science Regulator (FSR)

### **6.12) Establishment and Function of the Forensic Science Authority**

The role of FSR was established in 2007 to ensure the provision of high-quality forensic science services across the criminal justice system in England and Wales. The role of the FSR became increasingly important after the Forensic Science Service (FSS) closed in 2012 and forensic science services were transferred to a fully privatised sector.

### **6.13) The National DNA Database of the United Kingdom's Function in Criminal Investigations**

The National DNA Database (NDNAD) of the United Kingdom, which facilitates the collection, storage, and analysis of DNA samples for use in criminal investigations, is a vital tool for modern law enforcement. One of the largest DNA databases in the world, the NDNAD was established in 1995 and is crucial to the investigation of crimes in the United Kingdom. PACE, or the Police and Criminal Evidence Act of 1984<sup>17</sup> and the Criminal Justice Act 2001<sup>18</sup>, among other pieces of legislation, give law enforcement organizations in the UK the authority to collect DNA samples from persons in certain situations.

### **6.14) Implementation of Standards through Accreditation**

Maintaining and improving the standard of forensic science services offered by the criminal justice system in the United Kingdom is the aim of the Forensic Science Regulator (FSR) office.

### **6.15) Accreditation Process and Standards**

To guarantee that forensic science providers fulfill the necessary quality criteria and have the

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<sup>17</sup> Government of the United Kingdom, Police and Criminal Evidence Act 1984 (1984), <<https://www.legislation.gov.uk/ukpga/1984/60/contents>>

<sup>18</sup>Government of the United Kingdom, Criminal Justice and Police Act 2001, (2001), <<https://www.legislation.gov.uk/ukpga/2001/16/contents>>

technical know-how to do particular tasks, accreditation is crucial. As the official accrediting agency designated by the government, UKAS carries out evaluations to confirm the technical proficiency, assets, and infrastructure of suppliers. In order to guarantee continued performance at the necessary level, accreditation is a continuous procedure that includes yearly surveillance inspections and reassessments every four years<sup>19</sup>.

### **6.16) Miscarriages of Justice**

The litmus test for the quality system outlined by the FSR is its ability to prevent injustices resulting from errors in forensic scientific evidence. Referrals to the FSR are cases of quality failures that are graded according to risk level and reported to the Criminal Justice System (CJS). Even with UK Accreditation Service (UKAS) accreditation, there are still issues as evidenced by recent occurrences such data tampering by private forensic toxicology service Randox Testing Services (RTS)<sup>20</sup>.

### **6.17) Impact of international of international cases on forensic science development**

Numerous global incidents have demonstrated the value of DNA profiling and fingerprinting in improving the administration of justice in a variety of situations, including the identification of unidentified perpetrators, the confirmation of innocent people's confessions, the discovery of forgeries, and the acquittal of falsely accused parties. Here are some notable cases:

- **Anna Anderson Case:** Anna Anderson presented herself as Russia's Grand Duchess Anastasia, the daughter of the country's last emperor, Nicholas II. Her tissue and hair strands, however, did not match those of the Imperial dynasty, as demonstrated by DNA testing conducted in 1984.
- **Richard Buckland Case:** Richard Buckland was wrongfully accused of murder and rape in 1997 but was later exonerated.
- **Timothy Wilson Spencer Case:** Timothy Spencer, known as The South Side Stranger, became the first person in Virginia to be executed using DNA testing in 1988.
- **Gary Dotson Case:** Gary Dotson was wrongfully convicted of rape and kidnapping in 1979 but was released in 1985 after DNA evidence proved his innocence.
- **Allan Legere Case:** Allan Legere, known as the Monster of the Miramichi, was the first individual in Canada to undergo DNA fingerprinting.

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<sup>19</sup> Ibid

<sup>20</sup> Supra Note 48



- **Case Involving Use of Plant's DNA:** DNA evidence in 1992 confirmed the burial of Nazi doctor Wolfgang Gerhand in Brazil, shedding light on his atrocities during World War II.
- **Kirk Noble Bloodsworth's Case:** Kirk Noble Bloodsworth, the first American to be sentenced to death using DNA fingerprinting, was later exonerated after his DNA did not match that found at the crime scene.
- **Mia Zapta's Case:** DNA profiling in 2003 identified Jesus Mesquita as the suspect in Mia Zapta's rape and murder case in Seattle.

## **7. Evolution of forensic Science in India**

### **7.1) Historical Perspective of Forensic Science in Law**

A thorough comprehension of any topic requires an investigation into its foundations. Not only does history capture the past, but it also acts as a link between the present and the future, necessitating preservation for future generations. As a historical field, forensic medicine has developed over time to mirror the advancement of humankind.

Many people refer to Archimedes as the founder of forensic science because of his significant contributions to the field's early research. A merchant by the name of Soleiman used forensic techniques in the seventh century to refute untrue assertions on the makeup of a crown, illuminating the early uses of forensic science. In the 700s, courts in ancient China accepted fingerprints as identification proof, and in the 1000s, Quintillion, the Roman prosecutor, employed a similar technique to settle murder cases<sup>21</sup>.

### **7.2) Jurisprudence of Forensic Science**

Forensic science is a process used by legal experts to resolve factual disputes in criminal and civil processes, according to Black's Law Dictionary. In the current day, this field of study has expanded into a broad category that includes forensic exams and scientific investigations.

### **7.3) Development of DNA Profiling in India**

An important development in Indian forensic science was the introduction of DNA profiling, which

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<sup>21</sup> Supra Note 54

was made prominent in a case involving politician Rohit Shekhar Tiwari, the son of N.D. Tiwari<sup>22</sup>. The application of DNA profiling in the legal dispute surrounding Rohit Shekhar's paternity conclusively established his biological relationship with N.D. Tiwari. This landmark case underscored the transformative capabilities of DNA profiling in resolving paternity disputes and accurately establishing familial connections through scientific analysis.

Since its inception in the 1980s, DNA profiling technology has revolutionized forensic investigations globally. In India, it has emerged as an invaluable tool in criminal investigations, providing irrefutable evidence that has led to successful convictions. Notably, in the UK, DNA profiling has proven to be reliable in forensic investigations; it was i **Present Legal Scope of DNA Profiling in India** According to the Constitution, it is the responsibility of the people to cultivate an inquisitive spirit and aim for excellence in all activities. This can be accomplished in accordance with article 51A sub-articles (h) and (j) by applying scientific and technological techniques.

Section 955 of the IEA 1872 permits the presentation of a factual point of view to the public by use of factual information. It says that an expert's evidence is relevant under section 51 if it relates to a certain subject.

In contrast, Section 46 discusses the different data and statistics that are based on the judgements of specialists. The remaining question is whether, under certain circumstances, this technique may be appropriately guided and executed. For example, a medical professional may test a suspect for rape for DNA under CrPC Section 53-A58.

#### **7.4) Nemo Debet Proderese Ipsum**

The Indian Constitution's Article 20(3) discusses the significant legal issue of self-incrimination in relation to DNA technology. The debate in India around DNA fingerprinting an A Constitutional panel of eleven justices decided in the historic State of Bombay v. Kathi Kalu Oghad& others<sup>23</sup> case that an accused person cannot be forced to reveal evidence against oneself beyond what they have willingly divulged. d privacy rights has been greatly influenced by court rulings. In the case of Justice K S Puttaswamy (Retd.) v. Union of India, the Supreme Court also discussed questions relating to the

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<sup>22</sup>Rohit Sekar v. N.D. Tiwari (2012), AIR 2012 (Delhi)151

<sup>23</sup> State of Bombay v. Kathi Kalu Oghad& others, AIR 1961 SC 1808

interpretation of private rights under Article 21 of the Constitution<sup>24</sup>.

### **7.5) Development of DNA Fingerprints in India**

While serving as the Bengal police force's Inspector General in 1891, Sir Edward Richard Henry made a significant contribution to the development of DNA fingerprint technology in India. Henry was inspired to recognize the potential of fingerprinting as a tool for identifying those involved in criminal activity by the contributions made by Sir William Herschel. By instituting a methodical approach to documenting incidents and gathering fingerprints from crime sites, he laid the foundation for forensic science in India. The fingerprint bureau was established in 1897, a crucial milestone that coincided with the historic *Emp. v. Kangali*<sup>25</sup> case in 1898. This case, which included accusations of murder and robbery, demonstrated how important trustworthy evidence like fingerprints is to criminal investigations. The fingerprints were recognized by the court as crucial evidence, highlighting their importance in establishing guilt or innocence. The case was the violent murder of Hridayanath Ghose, a tea garden manager whose body was found in his home in Jalpaiguri, Bengal. Ghose's former prisoner Janak Ranjan Singh rose to prominence as a main suspect due to his criminal record and circumstantial evidence.

### **7.6) Challenges in Indian investigations**

There are significant deficiencies in the way people involved in crimes in India are investigated and prosecuted. Many offenders avoid punishment even in the most serious crimes, which adds to the rising crime rates.

### **7.7) Impact of Social Change**

Democracy's quick rise to power has brought about ongoing changes in society, most notably the growth of the industrial complex driven by transportation innovations. As a result of the subsequent urbanization millions of people moving to cities in search of better living conditions modern research techniques are required.

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<sup>24</sup> Justice K S Puttaswamy (Retd.) v. Union of India, (2015) 8 SCC 735

<sup>25</sup> *Kangali case*, <<https://ncrb.gov.in/sites/default/files/aibe/Land%20mark%20cases.pdf>> accessed January 17, 2024

## **8. Forensic Techniques and Methodologies**

### **8.1) Fingerprint Analysis**

The process of fingerprint analysis entails comparing distinct patterns and fingerprints at the crime scene to those registered in various legal databases. Despite being one of the oldest forensic methods, fingerprint analysis is still used today because it is the most efficient forensic technique. Fingerprint evidence is utilized to ascertain if a person is associated with the crime or was present at the scene of crime. Additionally, it aids the investigating officer in identifying the criminal's prior arrest or conviction record.

### **8.2) Ballistic forensics**

Forensic ballistics is the study of ballistic velocity, mobility, angular movement, and the consequences of projectile units, such as bombs, missiles, and bullets. Ballistics is currently divided into three categories: internal, exterior, and terminal.

- 1. Internal Ballistics-** Interior ballistics is the study of the physical processes that take place
- 2. External Ballistics-** The motion of a bullet in a resistive material is studied in exterior ballistics. A body's flight is determined by its mass and form, gravity, beginning velocity, and
- 3. Terminal Ballistics-** When the projectile reaches its destination, it enters the terminal ballistics regime. It is now the ballisticsian's responsibility to guide it to its destination the kind after the internal ballisticsian sent it into the air and the external ballisticsian pursued and guided it during its struggle

### **8.3) DNA Profiling**

A person can be identified at the molecular level by means of DNA profiling. The use of DNA evidence in criminal investigations has increased recently. DNA testing has made it feasible for law enforcement to identify offenders and solve complex crimes like rape, murder, and murder that involves rape, among other crimes.

### **8.4) Narco–Analysis and Polygraph Test**

As science and technology evolved, more advanced techniques for detecting lies have emerged, eliminating the need for the police to use "third degree torture."

### **8.5) Forensic Toxicology**

The study of toxicology focuses on the harmful consequences that chemicals have on living things. Human performance concerns (such as driving while drunk, compliance, and other connected topics), the detection and interpretation of drugs and poisons in medical-legal death investigations, and other related subjects can all be assisted by combining a variety of related disciplines, forensic toxicology goes one step further. The three primary goals of these investigations are:

- Determine whether any substances are present and have the potential to cause death.
- Determine whether any substances are present and have the potential to alter behaviour.
- Determine whether chemicals are present and whether they are part of a valid usage or exposure, such as exposures from employment or prescribed medications.

### **8.6) Forensic Odontology**

The use of dentistry in criminal and civil cases by law enforcement organizations within a criminal justice system is known as forensic dentistry. This context indicates the functions that forensic dentists play in identifying discovered human remains and complete or fragmented bodies. In addition, forensic dentists play a vital role in establishing the age, race, occupation, dental history, and socioeconomic status of individuals who have yet to be identified.

### **8.7) Forensic Anthropology**

"Forensic Anthropology" is a specific subfield of physical anthropology that is further defined as the application of anthropology's theory and system to legal concerns, particularly those pertaining to skeleton recovery and analysis.

### **8.8) Forensic Entomology**

Forensic entomology is the study of employing insects and other arthropods in criminal investigations. Insects or arthropods can be found in a decomposing vertebrate carcass or carrion. The post-mortem index, which is a measurement of the time between death and corpse finding, can be obtained by using these insect colonists to ascertain the reason and manner of death, movement of the body, association of suspects at the death site, and time interval between death and corpse discovery.<sup>26</sup>

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<sup>26</sup> Isaac Joseph and Deepu G Mathew, 'The use of insects in forensic investigations: An overview on the scope of forensic entomology' (2011) 3(2) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3296382/> accessed 10 April, 2024

## **8.9) Forensic Psychiatry**

"Forensic psychiatry" is a branch of psychiatry that uses clinical and scientific expertise to address legal issues in civil, criminal, and legislative contexts. India and other developing nations are still in the initial stages of the development of forensic psychiatry.

## **9. Legislative framework in India**

### **9.1) The Constitution of India**

The Constitution of India provides certain rights and remedies to a person who is arrested or facing criminal charges. The provisions in the constitution guarantees that no one can be coerced into providing information that could lead to their incrimination. It serves as a defence against forced testimonies or confessions that can be used against the accused in court. Following India's independence, scientific evidence was incorporated to the Constitution. U/a 246, as read with the Seventh Schedule, organizations and agencies providing scientific or technological support for the investigation or identification of criminal acts are listed under Union List entry 65(c).<sup>27</sup>

#### **1. Article 20(3) - Right against Self-Incrimination**

Article 20(3) provides protection against self-incrimination. It originates from a maxim "nemo tenetur prodre accusare seipsum", which means "No man is obliged to be a witness against himself." Law considers an accused person innocent until and until their guilt is proved beyond a reasonable doubt. Article 11, "Right to the presumption of innocence," in the UDHR stipulates that "Everyone charged with a penal offence has the right to be presumed innocent until proven guilty according to law in a public trial at which he has had all the guarantees necessary for his defence."<sup>28</sup>

Art. 20 clauses (3) guarantees a fundamental right that shields those charged with crimes from being forced to testify against themselves through testimonial coercion.

#### **2. Article 21- Right to Life and Personal Liberty**

Article 21 of the Indian Constitution provides right to life and personal liberty. This fundamental right includes a variety of safeguards to protect people's dignity and well-being. A man's right to life

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<sup>27</sup> Art. 246 read with schedule VII, The Constitution of India

<sup>28</sup> Universal Declaration of Human Rights, United Nations High Commissioner For Human Rights, [http://www.icnl.org/research/library/files/Transnational/UNIVERSAL\\_DECLARATION\\_OF\\_HUMAN\\_RI\\_GHTS.pdf](http://www.icnl.org/research/library/files/Transnational/UNIVERSAL_DECLARATION_OF_HUMAN_RI_GHTS.pdf) accessed 12 April, 2024

encompasses all the facts of life that give his life purpose, fulfilment, and value. It is essential to our basic existence as human beings.

## **9.2) The Code of Criminal Procedure, 1973**

“The code of criminal procedure” is the procedural law that governs the trial of criminal cases in India. The law contains provisions that deal with various aspects of investigation and trial. CRPC is the bedrock of Indian procedural laws regulating criminal investigations and trial, specifically section 53 and 54.

### **1. Examination of accused by medical practitioner at the request of a police officer**

- a) The conditions and process under which an accused individual may be put through a medical examination while a criminal investigation continues are outlined in Section 53. Examining the accused at a officer’s request is covered in this section. When someone is arrested on suspicion of committing a crime, a police officer has the right to request a doctor to examine them if he has cause to believe that performing such examination will reveal more info

### **2. Examination of person accused of rape by medical practitioner**

The provision of Section 53A was inserted through amendment act of 2005. The provision was added to facilitate the collection of evidences from accused body in rape cases. According to this provision when a person is arrested on the charges of rape or sexual offences,

### **3. Examination of arrested person by medical officer**

**Section 54-** It is a requirement that a person be examined by a medical officer upon being placed under custody. The medical officer is also required to keep a record of the examination, including any marks of violence or injuries sustained by the apprehended individual. Additionally, the law states that only female medical professionals may examine a female arrested person's body.

### **4. Medical examination of victim of rape**

**Section 164A** – The investigation and trial of criminal cases involving sexual assault or rape relies substantially on the medical examinations of rape victims and suspected victims of sexual offences.<sup>29</sup>

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<sup>29</sup> Barn, Ravinder, and Ved Kumari. “Understanding Complainant Credibility in Rape Appeals: A Case Study of High Court Judgments and Judges’ Perspectives in India.” (2015)The British Journal of Criminology [.https://www.jstor.org/stable/43819291](https://www.jstor.org/stable/43819291) accessed 18 March, 2024

In order to increase the likelihood of identifying the culprit, victims of sexual assault should be medically examined during criminal procedures.<sup>30</sup>

### **Section 293- Reports of certain government scientific experts**

The admissibility of reports from government scientific experts are addressed in this section. Under particular circumstances and instances, forensic reports or scientific analyses of government expert may be admitted as evidence in court.<sup>31</sup>The court can also summon and examine such expert as to the subject matter of his report.

### **9.3) Indian evidence Act, 1872**

Forensic evidence is crucial to the criminal investigation and case adjudication process in the Indian criminal justice system. The use and admission of evidence, including forensic evidence, in Indian courts is governed by the “Indian Evidence Act of 1872”.

The Indian Evidence Act of 1872 addresses the applicability of an expert's opinion in a specific case in sections 45 to 51.

#### **1. Expert Opinion**

Section 45 provides the admissibility of opinion of experts. This section is specifically relevant with regard to forensic evidence and other technical and scientific judgements offered in court. This provision permits the court to take expert opinions into account when making decisions about certain cases. “Foreign law, science, art, and the identity of handwriting or finger impressions” are some examples of these topics.

#### **2. Facts bearing upon opinions of expert**

**Section 46-** This section states that when expert opinions are relevant, even non-relevant facts become relevant if they corroborate or contradict those judgments.

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<sup>30</sup> Siddharth Arya & Varun Maheshwari, ‘Gender Inclusivity in Criminal Law: A Dive Into CRPC’ 2(2) IJCLSI <https://ijclsi.in/static/media/Gender%20Inclusivity%20in%20Criminal%20Law%20A%20Dive%20Into%20CRPC%20-%20Siddharth%20Arya%20&%20Varun%20Maheshwari.9a60f937.pdf> accessed 18 March, 2024

<sup>31</sup> Prapti Kothari, ‘Exploring the Role of Forensic Science in Indian Criminal Justice System’ (2023) [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=4565177](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4565177) accessed 15 April, 2024



### **3. Opinion as to Handwriting**

**Section 47** – This provision deals with the opinion of expert as to handwriting of a person. In determining who wrote a document, the Court will take into account the opinion of any person who is familiar with the handwriting of the person by whom the document is purported to be written or signed, as to whether or not the document was written or signed by that person.

### **4. Admissibility of Electronic Records**

**Section 65B** – This provision deals with the electronic evidence and its admissibility. The admissibility of electronic evidence, including forensic reports pertaining to digital forensics, is expressly addressed in Section 65B.

### **5. Presumption as to documents produced as record of evidence**

**Section 65B** – This provision deals with Presumption of authenticity of official reports and documents. Reports and certificates issued by government officials are presumed to be authentic and accurate u/s 80 of the Indian Evidence Act. This may be significant in situations when forensic reports are produced and included in official records.

### **6. Cross-Examination**

**Section 138** – The provision deals with the examination in chief, cross examination and re-examination. The right to cross-examine witnesses, including expert witnesses, has been provided by Section 137.

### **7. Additional principles governing admissibility and reliability of forensic evidence**

The courts in our country have traditionally operated under the guiding principle that they require expert assistance when dealing with forensic evidence cases. Consequently, experts in a given field serve as the court's friend or amicus curie. Since they are experienced about their fields, the opinions of experts are crucial. The courts have requested assistance, and forensic evidence plays an important role in this process.<sup>32</sup>

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<sup>32</sup> Nisha Kumari, 'Forensic Evidence and Their Admissibility' (2020) 2(2) IJLSI <<https://www.ijlsi.com/wp-content/uploads/Forensic-Evidence-and-Their-Admissibility.pdf>> accessed 15 April, 2024

Following conditions are there for admitting an expert's opinion by the courts –

- a) that the concerned dispute cannot be resolved without expert's opinion, and
- b) the person expressing opinion is fit to be called an expert,
- c) the statements or opinion of experts or reports must meet the prescribed standards of reliability;
- d) the expert statements are relevant and of probative value;

#### **9.4) Indian penal code, 1860**

Its rules specify penalties for a broad variety of illegal or unlawful acts and identify and categorize criminal offences.

##### **1. Crimes against Persons (Sections 299-377 IPC)**

Forensic evidence, including post-mortem reports, DNA analysis, and forensic pathology, can be extremely helpful in homicide and assault cases in establishing the type of injuries sustained, the reason behind death, and the identity of the perpetrator.

##### **2. Sexual Offenses (Sections 375-376E IPC)**

Sexual offenses, particularly sexual assault and rape, are heinous offenses that have a lasting effect on a victim's physical, mental, and emotional health. Forensic science becomes an indispensable instrument in the fight for justice, assisting in the investigation and adjudication of these crimes. The identification of the criminal and the provision of proof supporting the commission of the crime are accomplished by the meticulous gathering,

#### **9.5) Other special laws**

The application of forensic science extends beyond conventional criminal investigations covered by regular penal codes, as it intersects with a variety of particular legislation. Forensic science is essential to the enforcement and decision-making of special laws, which target particular kinds of crimes or govern specific facets of society.

##### **1. Cyber laws**

The need for cybercrime legislation to address offenses committed in cyberspace has increased with the development of technology. In India the offences related to computer or computer network is

governed by Information Technology Act,2000.

## **2. Narcotics and Drug Laws**

When it comes to drug offenses and narcotics, forensic science is extensively used. In India offences related to drugs and narcotics are governed by Narcotic Drugs and Psychotropic

## **3. Forensic Accounting and Financial Laws**

Forensic accounting may be utilized in cases involving financial crimes like embezzlement, fraud, or money laundering. Investigative methods are used by forensic accountants to review financial documents, track down money, and spot inconsistencies. substance (NDPS) Act (1985).

## **4. Environmental Laws**

There is a growing trend in which environmental offenses such as pollution, unlawful dumping of hazardous waste, and crimes against animals are being investigated using forensic science and its wide range of tools and practices.

## **5. Family and Domestic Laws**

In the area of family and domestic law, forensic science is essential to resolving conflicts between families and addressing legal concerns. Forensic techniques particularly DNA analysis provide vital evidence to support judicial decisions and guarantee that justice prevails in matters involving families, ranging from paternity testing to child custody disputes and cases of domestic violence.

## **6. Juvenile justice laws**

Forensic evaluation is frequently necessary in juvenile delinquency proceedings in order to identify the underlying causes of a minor's engagement in criminal activity. In order to develop an understanding of juvenile behaviour and decision-making processes, forensic psychologists and social workers assess the mental well-being, cognitive development, and social environment of their clients.

## **9.6) RECENT BILLS OR LEGISLATIONS**

### **The DNA Technology (Use and Application) Regulation Bill, 2019**

“The DNA Technology (Use and Application) Regulation Bill, 2019 aims to regulate the use and

application of DNA technology for the purpose of identifying certain groups of people, such as victims, perpetrators, suspects, under trials, missing people, unidentified deceased people, and for matters related or incidental to any of the aforementioned categories”.<sup>33</sup>

The primary objective of the "DNA Technology (Use and Application) Regulation Bill, 2019" is to increase the use of forensic technologies based on DNA in order to bolster and assist the legal system of the country. The Bill is divided into nine chapters that include matters such as DNA Data Bank, DNA Regulatory Board, Accreditation of DNA Laboratories, and Obligations of DNA Laboratory. The Bill also has a Schedule with a list of topics related to DNA testing.

The Bill provides out punishments for a number of offenses, such as: (i) disclosing DNA information; (ii) utilizing a DNA sample without permission; and (iii) gaining unauthorized access to information contained in DNA data Bank, or (iv) altering, contaminating, destroying, or tampering biological evidence, etc. For example, revealing DNA information can make a person liable to three years in prison and a fine of up to one lakh rupees. On the other hand, destroying, altering, contaminating, or tampering with biological evidence can result in up to five years in prison and a fine of up to two lakh rupees, etc.

### **9.7) the Criminal Procedure (Identification) Act, 2022**

According to “the Criminal Procedure (Identification) Act, 2022”, “Those who have been arrested or found guilty of a crime may provide certain personally identifying information to law enforcement and prison staff. This information could include behavioural characteristics, biological samples and their analysis, iris and retinal scans, photos, fingerprints, and other imagery. “The Act gives the National Crime Records Bureau (NCRB) the authority to gather, store, process, share, disseminate, and destroy measurement records as dictated by regulations (from state governments, union territory (UT) administrations, or other law .The following categories of people may be forced to provide their "measurements" by police officer-<sup>34</sup>

- Anyone mandated to provide security in exchange for keeping peace or good behaviour
- Any individual who has been held in accordance with a statute pertaining to preventive detention;

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<sup>33</sup>Ibid

<sup>34</sup> Section 3, The Criminal Procedure Act 2022

- Anybody convicted of a crime under an existing law.”

S. 5 of the Act widens the class of individuals from whom taking measures may be required. According to S. 5, the Magistrate may order "any person" to provide measures if they believe it would be "expedient" to do so in order to conduct an inquiry or action under the CrPC or any other applicable law.

### **9.8) Bhartiya nagrik suraksha sanhita, 2023**

The Act establishes a requirement that all crimes involving a seven-year or longer imprisonment penalty require a "forensics expert" to collect forensic evidence at the crime scene. The clause specifies a five-year timeline for putting the provision into effect.<sup>35</sup>

In order to ensure appropriate forensic evidence collection from crime scenes in major cases, the inclusion of this clause is a critical step. States currently use different procedures when gathering evidence. “Police officials may also call scientific staff from forensic science laboratories (FSLs) or District/Mobile Forensic Science Units (DFSU/MFSU) for crime scene visits, depending on the particulars of the case.” This clause further expanded the scope of term “forensic expert” by including private forensic experts in its ambit.

## **10. Judicial pronouncements and their impact**

### **10.1) Admissibility of Scientific Tests**

In the landmark decision of *Selvi v. State of Karnataka*, the Supreme Court of India carefully addressed the admissibility of scientific testing, including brain mapping, and polygraph tests, within the framework of criminal investigations<sup>36</sup>. This significant case altered the perception of forensic science in the criminal justice system by illuminating the subtle constitutional issues and procedural safeguards associated with such forensic techniques.

### **10.2) Forensic Analysis in Criminal Prosecutions**

The use of forensic science proved to be crucial in the well-known case of *Sushil Kumar v. State (N.C.T of Delhi)* in the pursuit of justice following a horrific tragedy. Sushil Kumar was charged with killing his wife brutally; sadly, her burnt bones were found in a tandoor oven. Acknowledging the

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<sup>35</sup>Section 176(3) of Bhartiya Nagrik Suraksha Sanhita 2023

<sup>36</sup> *Selvi v State of Karnataka*, [2010] 7 SCC 263

importance of forensic evidence in supporting their case, the prosecution employed thorough forensic investigation to uncover the truth behind the crime.

### 10.3) Assessment of Expert Opinions

The judiciary addressed the difficult problem of contested signatures and handwriting in the landmark case of *S.P.S. Rathore v. CBI & Anr.*<sup>37</sup>, which clarified the complex assessment of expert views in the field of forensic science. The case started with claims made against a former police officer, S.P.S. Rathore, that he had sexually assaulted a youngster.

### 10.4) Expert testimony and cross – examination of FSL report

Expert testimony and the cross-examination of the Forensic Science Laboratory (FSL) Report proved to be crucial components in a noteworthy case that was presented before the prestigious Court of Ms. Pooja Aggarwal, Ld. MM, Rohini Courts. The case unfolded against the backdrop of a tragic incident wherein a 20-year-old male fell victim to a brutal murder, inflicted with a sharp knife through stabbing by a group of five other individuals.

The forensic evidence that was produced in court was an essential component in determining the truth and ensuring that the victim and their family received justice.

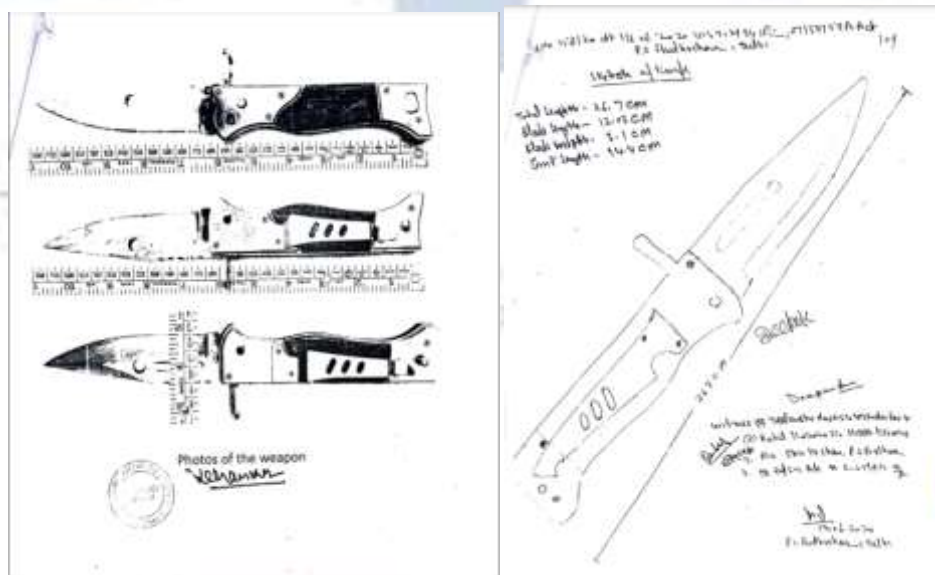


Fig 1.1

<sup>37</sup> *S.P.S. Rathore v CBI & Anr*, [2011] 6 SCC 616

## **10.5) Judicial Approach towards DNA Tests**

### **1. DNA and paternity test –**

The mere fact that one of the parties in a paternity issue challenges the other does not automatically mean that the court will order a DNA test. It is recommended that the court initially order the parties to provide proof of their paternity claims. It is important to provide each party with the chance to use alternative methods to support or refute the factual allegations made regarding fatherhood.

### **2. First Paternity Dispute Solved by DNA Test in India**

For the first time, a paternity dispute was resolved by DNA testing in India in the historic case of *Kunhiraman v. Manoj. Kunhiraman*<sup>38</sup>, a rich single man, was involved in court cases when his single neighbor Vilasini gave birth to a son called Manoj. Based on expert judgements and the evidence given, the court approved DNA testing notwithstanding Kunhiraman's objections to being listed as the father on the birth certificate.

### **3. Current Status on Paternity in India**

The legal environment surrounding paternity disputes in India has changed significantly in the last several years, especially with regard to the acceptance and application of DNA testing as a parentage-determining method.

### **4. DNA Test as Proof of Legitimacy**

In many cases, fathers must submit to DNA testing in order to maintain their child's paternity. It's now acknowledged that consenting to DNA testing is necessary to preserve the child's status, despite early worries about rights abuses. The significance of DNA testing in determining paternity is shown by court cases like *Mohamed Mahasin sk v. Sayeda Khatun Bibi*<sup>39</sup> and *Sunil E. Trambake v. Leelavathi S. Trambake*<sup>40</sup>.

### **5. Admissibility of DNA Test**

The idea of non-invasive testing is to protect people from being forced to do tests against their will in order to gather evidence. In the 2006 case *Sanjay Singh v. State of Delhi*, the Centre for Cellular and

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<sup>38</sup>*Kunhiraman v. Manoj. Kunhiraman*, II (1991) DMC 499; (1991) 3 Crimes 860 (Ker)

<sup>39</sup> *Mohamed Mahasin sk v. Sayeda Khatun Bibi*, I (2006) DMC 48

<sup>40</sup> *Sunil E. Trambake v. Leelavathi S. Trambake*, 2006 AIHC 1668 (1670) Bom

Molecular Biology (CCMB) investigated the deceased's swabs<sup>41</sup>, whereby the defendant was accused of killing a Delhi University law student.

## **6. DNA Presumption of Legitimacy**

A child needs their parents to acknowledge them as parents in order to be valued in society. However, in England, Section 12 of the Civil Evidence Act, 1968, stipulates that in affiliation proceedings, the person stated as the child's father is presumed to be the child's legal father until someone makes a strong case to refute this claim.

## **7. Role of DNA Testing in Police Investigations**

While court-ordered tests under Section 173(8) serve investigative purposes, police can do medical examinations at an individual's request under Section 53 of the CrPC. Respect for the fundamental values of the constitution, as upheld in *K. Damayanti v. State of Orissa & others*<sup>42</sup>, is essential. Even in the face of urgent investigative demands, this guarantees procedural justice and safeguards individual liberty.

## **8. Legal Precedents and Constitutional Guarantees in DNA Testing**

Significant court rulings have influenced the legal environment around DNA testing in India. In *HaribhaiChanabhai Vora v. KeshubhaiHaribhai Vora*<sup>43</sup>, the Gujarat High Court rejected the idea of mandatory DNA testing, upholding people's right to privacy and respect for their bodies.

## **9. DNA Testing and Constitutional Rights**

The intersection of modern forensic technology like DNA testing with constitutional rights presents complex legal challenges in India. Courts find it difficult to strike a careful balance between upholding the Constitution's protection of fundamental rights and using scientific advancements to the administration of justice.

## **10. Balancing Public Interest and Individual Rights**

The conflict between the public interest and individual rights is at the core of court-ordered DNA

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<sup>41</sup> *Sanjay Singh v. State of Delhi*, 2007 Cri.L.J. 964 (Del)

<sup>42</sup> *K. Damayanti v. State of Orissa & others*, 2004 Cri.L.J. 4003

<sup>43</sup> *HaribhaiChanabhai Vora v. KeshubhaiHaribhai Vora*, AIR 2005 Guj 157



testing. DNA evidence can be extremely useful in establishing the truth and upholding justice, but making people submit to such testing creates issues with respect to their privacy, their physical integrity, and the presumption of innocence. Articles 20(3) and 21 of the Indian Constitution defend people's right to privacy, personal liberty, and immunity from coercion.

### **11. Refusal to Undergo DNA Testing**

Serious legal ramifications may arise from refusing to conduct DNA testing to establish paternity, especially in maintenance proceedings governed by Section 125 of the Code of Criminal Procedure (CrPC). Significant rulings in instances like *K. S. Selvaraj v. P. Jayakumari*<sup>44</sup> and *Dwarika Prasad Satpathy v. Bidyut Prava Dixit*<sup>45</sup> have clarified the legal ramifications of refusing to submit to DNA testing.

### **12. Adverse Inference and Compulsion of Medical Tests**

The possibility of unfavorable inference in situations when subjects decline to participate in testing is a crucial component of court-mandated DNA testing. The legal assumption that might be made against a party for not cooperating with court orders or producing evidence is known as an adverse inference.

### **13. Compliance with Court-Ordered DNA Testing: Legal Ramifications and Ethical Considerations**

Noncompliance with court-ordered DNA testing can lead to severe legal consequences, including adverse judgments and penalties. Courts have consistently underscored the imperative of upholding judicial integrity by imposing sanctions on individuals who refuse to comply with DNA testing directives.

### **14. Judicial approach towards narco –analysis in India**

Narco-analysis presents particular ethical and legal issues. Even though it can provide important information for criminal investigations, its use raises concerns about personal autonomy, the right to self-incrimination, and the reliability of evidence obtained under duress. The Bombay High Court

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<sup>44</sup> *K. S. Selvaraj v. P. Jayakumari*, 2000 CriLJ 4748, II (2001) DMC 13

<sup>45</sup> *Dwarika Prasad Satpathy v. Bidyut Prava Dixit*, 1999 (8) JT SC 329

emphasized in *Ranjit Singh Brahamjeet Singh Sharma v. State of Maharashtra and another*<sup>46</sup>, the constitutional freedom of persons to decline self-incriminating processes, as guaranteed by Article 20(3).

### **10.6) Judicial Response on DNA Finger Printing**

The Indian judiciary has reacted to the use of DNA evidence in criminal cases in a cautious but progressive way that ensures that ethical and procedural fairness are taken into consideration while also appreciating the technology's potential as a reliable form of evidence. Despite early skepticism and worries about its reliability, early decisions like *Emperor v. Sahdeo*<sup>47</sup> and *People v. Jennings*<sup>48</sup> set the precedent for allowing DNA evidence as a form of identification.

### **10.7) Expert Testimony and Judicial Scrutiny**

Expert testimony is necessary for the acceptance and evaluation of DNA evidence in criminal trials. To assess and interpret DNA profiles, present findings to the court, and assist in establishing a link between the accused and the crime scene, specialised knowledge and experience in forensics are usually needed.

## **11. CONCLUSIONS AND SUGESTIONS**

Although forensic science is vital to criminal investigations, there are several obstacles that might prevent it from working as intended. One major obstacle is the speed at which technology is developing; in order for forensic specialists to stay up to date with the latest methods and techniques, they must undergo constant training.

Crime has continued throughout history, making it difficult to identify and capture offenders. But with to developments in science and technology, forensic science is now able to play a significant part in criminal investigations. To identify and capture criminals, this profession uses a variety of methods, including brain fingerprinting, ballistic analysis, and DNA profiling.

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<sup>46</sup> *Ranjit Singh Brahamjeet Singh Sharma v. State of Maharashtra and Another*, AIR 2005 SC 2277

<sup>47</sup> *Emperor v. Sahdeo*, 1904 Cr. L.J. 220

<sup>48</sup> *People v. Jennings*, 43 LRA(NS) 1206 (1911)

The study and preservation of tangible evidence is the main emphasis of forensic science, but as technology advances, conventional approaches have become antiquated. Nevertheless, some methods such as dactylography continue to be useful in identifying criminals, especially when it comes to sexual offences. However, DNA profiling came about as a result of the necessity for more sophisticated techniques to distinguish between people with certainty.

The development of DNA profiling by Sir Alec Jeffreys transformed forensic science. He illustrated how DNA is unique and that, except from monozygotic twins, the likelihood of two people having the same DNA is quite low. He also emphasised the importance of non-coding DNA, which differs from person to person. DNA profiling is a vital method for identification in forensic investigations since it can extract DNA from a variety of body tissues, including blood, saliva, and hair.

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