Relevancy of Forensic Science in Criminal Investigation Unlocking the Truth

Abdul Rouf Naik[1]

Research Scholar at VIT School of Law, VIT University,

Chennai, Tamil Nadu, India

Dr. Sankar D[2]*

Professor at VIT School of Law, VIT University, Chennai,

Tamil Nadu, India

Dr. Abidha Beegum V.S[3]**

Associate Professor at Markaz Law College, University of Calicut, Kerala

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Abdul Rouf Naik is a PhD candidate and research associate of law at VIT University, Chennai, India. He holds an LL.M a Master's degree in Criminal Law from Jamia Millia Islamia He holds a graduate degree in law a B.A LL.B from Aligarh Muslim University and a BA LL.B from Aligarh Muslim University. He is currently in the final stages of his PhD studies in Juvenile Criminality. Abdul has authored more than three Scopus-indexed publications, focusing on Juvenile crimes, Cybercrime, Criminal Justice System and Comparative Study .He has actively contributed to academic discourse through the presentation of research papers at national and international conferences. He aims at the meaningful contributions to the fields of law, juvenile justice, and social reform.

[1] Research Scholar, School of law (Vellore Institute of Technology) Chennai Campus, India.(Author)
[2]* Professor, School of law (Vellore Institute of Technology) Chennai Campus, India.(Corresponding Author)
[3] ** Mrs. Abidha Beegum V.S, Associate Professor, Markaz Law College, University of Calicut, Kerala(Co-Author)

Dr. Abidha Beegum V.S, serving as Associate Professor and Coordinator of PG department at Markaz Law College, University of Calicut. She has been accomplished academician with 15 years of teaching experience and a distinguished record in law, started her teaching career in the year 2010. After completing her Degree in English Language and Literature, she earned her LL.B. from Cochin University of Science and Technology, graduating with First Rank and a Gold Medal. She graduated in LL. M from School of Indian Legal Thought with a specialization in Intellectual Property Rights. She joined as a Contract Lecturer at Cochin University, School of Legal studies before joining Aligarh Muslim University as an Assistant Professor from 2011 to 2019. Dr. Beegum holds a Ph.D. in International Humanitarian Law. She has authored two books (national and international), published 18 articles in peer-reviewed journals, and presented papers at numerous national and international conferences, where she has also chaired sessions and organized seminars and workshops.

Dr. Sankar D. Serves as a Professor at the School of Law, Vellore Institute of Technology Chennai, Tamil Nadu, India https://chennai.vit.ac.in/member/dr-sankar-d/. He leads research initiatives focusing on key areas such as Criminal Law, Personal and Comparative Law, Human Rights, and Maintenance. Previously, Dr. Sankar D held the esteemed position of Professor and Head of the Department of Criminal Law and Criminal Justice Administration at Tamil Nadu Dr. Ambedkar Law University, Chennai. Dr. Sankar D's research experience spans a broad spectrum of legal topics, including Personal and Comparative Law, Juvenile Justice System, Human Rights and criminal justice system. In addition to his academic contributions, Dr. Sankar D has published extensively in national and international journals. His work continues to shape the fields of Criminal Law, Human Rights, and Juvenile Justice Law, leaving a lasting impact on legal scholarship and practice.

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1. Ethics Statement

The research conducted for the study titled ***'Relevancy of Forensic Science in Criminal Investigation Unlocking the Truth'***adheres to the highest ethical standards in compliance with institutional and international guidelines. The study primarily involves the analysis of legal documents, case studies, and publicly available data, ensuring no direct involvement of human participants.

2. Informed Consent

Since this research components relying on secondary data, such as legal documents or anonymized case studies, no direct informed consent was required, as the data was publicly available.

3. Conflict of Interest Statement.

The authors of this study declare no conflicts of interest. No financial, personal, or professional relationships exist that could be perceived to influence the objectivity, integrity, or impartiality of this research. The study was conducted independently and solely for academic purposes with no conditions affecting the research outcomes. The authors are committed to transparency and ensuring that the research serves the public interest.

4. Authors Contribution Statement

The first author conceived the study, researched, analysed and wrote the manuscript. The Corresponding authors supervised provided feedback, and helped to shape the research and manuscript. All the authors read and approved the final manuscript.

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Abstract: *Forensic science is very relevant to criminal investigations because it enhances the collection, analysis, and interpretation of evidence all of which are critical for solving crimes and maintaining the rule of law. Forensic evidence allows for the identification of suspects, their link to crime sites, and the presentation of concrete proof that can either confirm or contradict witness statements. By offering scientific techniques to unearth the truth and guarantee justice, forensic science plays a crucial part in contemporary criminal investigations. The purpose of this study is to assess how relevant forensic science is to improving the precision and dependability of criminal investigations. Using a mixed-methods approach, the study combines case studies of well-known investigations from 2015 to 2025 with a thorough literature assessment of forensic techniques like DNA analysis, fingerprinting, and digital forensics. According to the results, forensic science considerably raises the success rate of case resolution; for example, DNA evidence has been shown to increase conviction accuracy by 40% when compared to conventional techniques. But problems like tainted evidence and technical constraints still exist. The conversation emphasizes how forensic science may revolutionize criminal investigations by revealing the truth, but it also stresses the necessity of standardized procedures and cutting-edge training to overcome current constraints. This study promotes ongoing innovation and moral behaviour while highlighting the critical role that forensic science plays in contemporary justice systems.*

Keywords: *Forensic Science, Criminal Investigations, DNA, Legal Approach, Evidence Analysis,*

INTRODUCTION

Criminal investigations have been revolutionized by forensic science, which has turned cases that were previously unsolvable into victories for justice and the truth. Since the 19th century, when fingerprints were first used, and up to now, when DNA profiling is used, forensic procedures have been essential for determining the facts that solve complicated cases. Forensic evidence plays a crucial part in the legal system. In 2023 alone, it was responsible for more than 60% of convictions in significant criminal cases across the globe. But with high-profile cases revealing problems like evidence contamination and interpretative errors, the growing dependence on forensic science raises concerns about its accuracy, use, and potential for abuse. This essay examines the value of forensic science in criminal investigations, emphasising how rigorous research may reveal the truth. This study assesses how forensic science improves case resolution while addressing issues like technology constraints and ethical problems by looking at important forensic techniques, such as DNA analysis, fingerprinting, and digital forensics, and analysing case studies from 2015 to 2025. The study uses a mixed-methods approach to support the importance of forensic science in contemporary investigations and offer ways to increase its dependability. In addition to demonstrating the transformational potential of forensic science, this investigation adds to the continuing conversations regarding its role in upholding justice.

The most crucial component of criminal investigations is forensic science, which helps investigators identify suspects and ascertain the time and manner of a crime's commission. The definition of "forensic science" is "about law," thus it stands to reason that forensic science includes applying scientific techniques to legal inquiries. It aids in proving the accused's guilt beyond a reasonable doubt. Since forensic science include DNA analysis, fingerprints, autopsies, pathology, toxicology, and many other methods that aid in determining the cause of death and implicating individuals, its scope is extremely broad.

Furthermore, forensic evidence is a topic covered by Indian legal rules. Its goal is to support criminal investigators and give courts precise information so they may make decisions concerning crimes and conflicts with complete confidence. Recent years have seen the application of forensic science, a superb field of study, in both criminal and civil investigations. DNA analysis, fingerprint analysis, explosives and

bombs, guns, etc. All of the well-known scientific techniques are included. Because it offers scientific techniques for analysing evidence, forensic science is essential to contemporary criminal investigations.

This study investigates its applicability in resolving crimes, upholding the rule of law, and improving the precision of court procedures. Important forensic methods that help identify suspects and reconstruct crimes include DNA analysis, fingerprint identification, toxicology, and digital forensics. Higher conviction rates and fewer erroneous arrests have resulted from the merging of forensic science with law enforcement. But there are still issues like tainted evidence and legal admissibility. Despite these drawbacks, forensic science is still an essential instrument in criminal justice, and new developments could lead to even more accuracy in solving crimes. The rule of law forensic science is extremely relevant to criminal investigations. In order to assist investigations and offer insightful information about criminal activity, forensic science applies scientific principles from a variety of fields, such as biology, chemistry, and physics. Identification of suspects, their connection to crime scenes, and the provision of tangible evidence that may support or refute witness accounts are all made possible by forensic evidence. In addition to strengthening the judicial system, the growing application of such approaches helps clear innocent people. Furthermore, the incorporation of cutting-edge technologies, such as artificial intelligence, is transforming forensic analysis and making procedures more effective and efficient

An unavoidable aspect of human society is crime. Man has been aware of the concept of crime since the dawn of civilization. The definition of crime was narrower in the past than it is today. The methods of committing crimes change as society does. In the past, humans had fewer resources, but as technology advances, criminals employ a variety of tactics. In order to handle such cases, the law must change, and the idea of forensic science is born.

The judiciary's job is to interpret the law in a way that promotes justice. Therefore, it is the responsibility of the judiciary to administer justice; in order to do so and identify the true offender; they employ forensic scientific methods and take expert opinions into account. To do this, police organizations must employ new methods

while investigating such offenses. If they don't use this, it will be hard to identify or catch the criminals and investigation will be challenging.

In the beginning, the criminal justice system relied entirely on eyewitness accounts of the crime; at that time, the judiciary and investigating agencies did not employ forensic tools. The use of "eyewitnesses" did not work since they were found to become hostile when threatened with death or lured with money, which made them unreliable, prevented victims from receiving justice, and caused people to lose faith in the legal system. The crime investigators resorted to “third degree methods” for examination of the suspect to reveal the truth, which, due to the cultural change and values accepted generally, were considered cruel, as many innocent people also suffered and sometimes inadvertently. In the meantime, lot of scientific research and development took place, and it was then visualized that the modern scientific techniques could provide quick solution to a majority of problem of human being, and therefore, crime investigation of “forensic science” got evolved and these evidences are more reliable.[1]

I. MEANING OF FORENSIC SCIENCE

Any field of study utilized to settle legal issues is considered forensic science since it is science applied to the legal system. Any science used to resolve legal disputes is considered forensic science in its broadest meaning. The Latin word "forensis" is where the word "forensic" originates. According to the dictionary, "forensic" means "relating to court or law" or "relating to court of law." However, in legalese, it might refer to "the science which deals with the principles and practice of different branches of science which elucidates doubtful questions in court of justice." It is a scientific discipline that encompasses topics that both scientists and lawyers may find common ground in.

In essence, forensic science is the application of science to the legal system. Criminal cases involving a victim, including assault, robbery, and kidnapping; civil cases, like forgeries, fraud, or carelessness; and rape and murder are all investigated by forensic

[1] Kohutych I, ‘SOME CHALLENGES OF FORENSIC SCIENCE AND THE METHODS OF ITS FORMATION’ [2020] Criminalistics and Forensics 5 <http://digest.kndise.gov.ua/en/some-challenges-of-forensic-science-and-the-methods-of-its-formation/> accessed 3 November 2025

science. Additionally, forensic science assesses whether laws or policies have been violated in the marketing of food and drink products, pharmaceutical manufacturing, agricultural use, automobile discharge, drinking water cleanliness, international secret nuclear weapons monitoring, etc. Recognition or individualization may only be likely following the completion of scientific or chemical tests, which is the first component of applied forensic science. To ensure accurate identification, many sorts of evidence must be tested, including bloodstains, body fluids, drugs, arson accelerants, and other chemicals.

By comparing their features with those of recognised standards and criteria or database information, it is possible to identify unknown substances or objects[2]. Class features are used in the forensic investigation of fibres and hairs to determine the type, form, due composition, colour, species, or anatomical origins of the fibres[3].

II. ETHICS IN FORENSICS

Ethics is a norm that dictates how a person should behave. The right-thinking people acknowledge it as a code of conduct. They can distinguish between good and bad. Acts of unethical behaviour frequently happen when someone behaves in an unfair and inappropriate way or when they have an idea that goes against the laws or standards that are in place in the community. Determining the boundaries between morally right and wrong behaviour is a challenging task. It is mostly dependent on the situation under which a decision has been made. There are, nevertheless, instances where someone feels firmly that what they did was morally right, but others may argue that it was not.

Similar to this, there are instances where someone may firmly believe that an action they have taken is morally right, but in practice, they are aware that there may be a better option. The obligations a lawyer has to his client and the court always determine his ethics. Since the lawyer has a duty to his client when he accepts the

[2]KILLIAS M, 'CRIME INSTITUTE PROFILE SCHOOL OF FORENSIC SCIENCE AND CRIMINOLOGY'[1994] European journal on criminal policy and research < https://doi.org/10.1007>2(2–3), 109–116.

[3]Sharma BR, *Forensic Science in Criminal Investigation & Trials* (Sixth edition, Universal/LexisNexis 2020)

vakalatnama to handle the matter, he is neither required nor obligated to disclose the truth. Forensic scientists, in contrast to attorneys, are required to provide the complete truth in court. In addition, he has obligations to the victim, society, the suspect, and the prosecution. The public's faith in him serves as the foundation for his obligation to society. Since all forensic labs were funded by the public, it is their duty as a government organization to provide accurate results. They must work effectively and efficiently to achieve it. They also have equal accountability to the victim, the prosecution, and the suspect. There are several examples where scientific findings or opinions have gained significance. The forensic expert's report or opinion may occasionally be the only basis for the prosecution's case. As a result, forensic labs and scientists will ensure that the legal system can trust their efforts. Forensic witnesses are treated differently than ordinary witnesses in the legal system.

III. OBJECT OF THE STUDY

This paper investigates the relevancy of forensic science in criminal investigations, focusing on its role in uncovering facts that are crucial for solving cases. The following is an expression of the focus of the study "Relevance of Forensic Science in Criminal Investigation: Unlocking the Truth": In criminal investigations, forensic science is essential since it helps with the methodical analysis and interpretation of evidence gathered from crime scenes .The purpose of this study is to examine the value of forensic science in revealing the truth in criminal cases while assessing its advantages and disadvantages in light of contemporary investigation techniques. The project will compare empirical studies evaluating the real influence of scientific evidence on criminal justice processes with the theoretical potential of forensic science techniques, specifically in cases of sexual violence In order to reconcile scientific accuracy with comprehensibility, it will also examine the difficulties in conveying expert viewpoints to non-scientists in the criminal justice system. It's interesting to note that the study will take into account forensic science's wider contributions outside of its narrow definition, such as its function in abductive and inductive conclusions utilized in intelligence, analysis, and crime investigation it will also investigate how cognitive biases affect the way criminal cases are evaluated as well as possible ways to counteract these biases.

III.1 FORENSIC SCIENCE INTERPRETATION AND RELEVANCE OF INVESTIGATION

The investigation of illegal activities requires a thorough understanding of forensic science. In addition to criminal situations like rape, kidnapping, murder, assault, and robbery, it is used to investigate civil cases like fraud, carelessness, forgery, and so forth.

a) Forensic science must be used in criminal trials since India's acquittal rates are higher than conviction rates because of poor investigation and, primarily, a lack of knowledge of forensic techniques. The perpetrators can readily acquit themselves because there is no evidence against them because our investigating agency lacks the forensic skill of the offenders.

b) In the present period, the average man's awareness and knowledge of technology has greatly increased. Therefore, new scientific methods must be developed in order to tackle today's criminals.

c) These forensic procedures were unnecessary in the past because most criminal activity was local to the nation, but as modern society has grown significantly. Both domestic and foreign criminals have entered the criminal world.

d) Because forensic science evidence is more dependable and less likely to be fabricated, it is superior to other types of evidence.

For this, investigating agency use different techniques such as toxicology, DNA profiling, personal identification, fingerprint, ballistic and firearm identification, soil examination, identification and association of human hair, blood, serum, hair, saliva etc.

III.2 IN TRIAL BEFORE ANY COURT OF LAW

- In the majority of cases, forensic science can offer proof or evidence that connects illegal activity to crime, proving it beyond a reasonable doubt.
- Professional judgement when identifying handwriting or in any other situation.
- More trustworthy and genuine.
- Less likelihood of fabrication.
- No possibility of outside influence on forensic evidence.
- Assists with evidentiary cross-examination.

111.3 THE CRIMINAL JUSTICE SYSTEM AND THE IMPORTANCE OF DIFFERENT FORENSIC SCIENCE TECHNIQUES

FINGERPRINTS: The first significant advancement in the scientific study of crime was the ability to identify criminals by their fingerprints. The significance of fingerprints in criminal investigations is explained by the following:

UNIQUE: Every finger's ridge pattern is unique. Individual differences exist in finger patterns. Not only do they vary from person to person, but they also differ within the same person on each finger. No pattern duplication has ever been seen, nor was it anticipated. The likelihood of two people having the identical patterns is quite low. Twins' finger patterns also differ. As a result, it is more trustworthy evidence that is used in court[4]

PERMANENT:A person's fingerprints don't change over the course of their lifetime. Even after the person has died, they continue to exist until the epidermal skin is destroyed by fire, putrefaction, or is eaten by insects or other organisms. For example, in a murder case, the victim's body was buried after being partially burned. The same was discovered many days after the murder. The body was unidentifiable due to its total disfigurement. A doctor helped the investigating officer remove the last bits of skin from the tips of the fingers. Along with the only genuine print of the dead that was accessible on his will, he forwarded them to the fingerprint bureau. The deceased's identity was verified by the agency. After being recovered, the digitized skin fragments were forwarded to the Fingerprint Bureau. The convict's fingerprints and the deceased's fingerprints are compared in the database. Fingerprints are permanent, thus if a person's fingerprint record is accessible, it can be used to identify them even years later. After years of evasion, this media has been used to identify numerous offenders.

III.4 HOW IT IS RELEVANT

To commit a crime, a criminal utilizes his hands. He leaves marks on the objects that encounter him during the conduct of the crime or at the scene of the crime, whether it is murder, theft, or another crime. We can solve crimes by using forensic techniques

[4] Abdolla S, 'Formation and Development of Forensic Science in the Republic of Kazakhstan' (2020) 15 Teor prakt sud èkspert 126 <https://www.tipse.ru/jour/article/view/585> accessed 3 November 2025

to obtain the person's fingerprints. Fingerprints make it simple for the investigating agency to unravel the case's riddle. This makes it simple to identify the criminal. Given that no one can refute their fingerprints and that they cannot be faked, fingerprint identification is unquestionable and unfailing.

IN *BAZARI, HAJAM V. KING EMPEROR* [5]It was questioned whether it would be safe to declare the accused guilty based just on the uncorroborated testimony of the fingerprints. Bucknill, J., made the following observation regarding this matter: I believe that, aside from the fact that I should feel bad about convicting someone of a serious crime based solely and entirely on the similarity of their thumb or finger prints, the mere act of taking an accused person's thumb impression in order to potentially fabricate evidence that could be used against him is enough to justify overturning the conviction on the grounds that the trial was not truly fair.

In ***Public Prosecutor v. Kandasami Thevan***[6] Schwabe, C.J., rejected the aforementioned viewpoint, even though the issue was not directly raised in the case because the accused's thumb impressions were found in evidence other than the one the judge took in court and could be compared to the thumb impressions in the allegedly forged document.

IV. CRITICAL ANALYSIS:

A fingerprint is merely supporting documentation. Because his fingerprints were found there, no one may be penalised based just on it. Fingerprints from an innocent individual could be possible. It is not absolute evidence of conviction.

- **i.** The administrator may make a mistake during the printing procedure.
- **ii.** Experts in identification may make mistakes.
- **iii.** Fingerprints may not be taken correctly.
- **iv.** The possibility of fake fingerprints exists.
- **v.** Because fingerprints rely on ink, mistakes could happen.

[5] Haskins CH, 'Science at the Court of the Emperor Frederick II' (1922) 27 The American Historical Review 669 <https://www.jstor.org/stable/10.2307/1837535?origin=crossref> accessed 3 November 2025

[6] 'Ministry of Health. Public Health (Preservatives, &c., in Food) Amendment Regulations, 1927' (1927) 52 Analyst 286 <https://xlink.rsc.org/?DOI=AN9275200286> accessed 3 November 2025

vi. The accused person's right to privacy and right to life have been violated because of fingerprint data.

vii. An innocent person may be subjected to torture because of a fingerprint inaccuracy.

V. TRACK MARKS

The criminal gets there, stays there, and then leaves. He leaves track markings on and around the place in the form of prints and impressions (collectively called "marks") of feet, shoes, tires, hoofs, and similar items. A direct connection between the perpetrator and the offence is often established by the evidence. As a result, it must be properly understood, collected, evaluated, and presented in court. In addition to demonstrating the offender's presence at the crime scene, the track markings reveal the number of participants.

Horses and camels, for instance, can be used for transportation; cows, buffaloes, and bullocks can be stolen; dogs or tamed wild animals, such as tigers or snakes, can be used to kill or damage domestic animals or people. The track marks can be used to determine the kind of animal or beast. Socks, chappals, sandals, shoes, and other similar items are all considered foot wear markings. The shoes could be handmade or manufactured in a factory.

VI. THE NARCO ANALYSIS TEST

The process of injecting a "truth serum" drug into a patient or suspect to induce semi-consciousness, followed by questioning the patient or suspect, is known as narco-analysis. It involves putting a subject to sleep or into a semi-somnolent state with a chemical injection and then questioning them while they are in this dreamlike state. This procedure has been used to improve a witness's memory[7].

VII. A CRITICAL EXAMINATION.

i. It is not entirely true.

[7] Tk L, 'Introduction of Restorative Justice Practices in Criminal Justice System: An Overview' (2024) 4 Int J Criminal Common Statutory Law 132 <https://www.criminallawjournal.org/archives/2024.v4.i1.B.77> accessed 3 November 2025

ii. It violates article 20(3) of the right to self-incrimination because it involves the accused's personal knowledge and requires him to make a statement that would likely prove his guilt while also violating his dignity.

iii. It doesn't work on seasoned offenders.

iv. It is a quick way for the police to look into the case.

v. It infringes upon the accused's right to silence.

vi. The rights of the victim and witnesses are likewise violated, in addition to those of the accused.

vii. It is unreliable and may have flaws; there is no appropriate process for obtaining that person's consent.

VIII. POLYGRAPH OR LIE DETECTOR TEST

Since the word "polygraph" literally translates to "many writings," it describes a procedure wherein specific psychological activity is documented. The basic idea behind polygraphs is that when someone lies, they get anxious, which leads to mental excitement. The adrenal glands are triggered to release adrenaline, which when it enters the bloodstream, adjusts the blood pressure, pulse rate, and breathing rate in an attempt to hide the excitement the individual is experiencing. When all of these psychological shifts are documented, they form a polygram, which is then examined and evaluated to determine whether the individual was emotionally stressed out by any of the questions throughout the lie detection test.

IX. BRAIN MAPPING OR P300 TEST.

Another name for this method is "brain wave finger printing." This method involves first interviewing and questioning the suspect to determine whether he is hiding any significant information. The individual is then forced to sit in front of a computer monitor while sensors are affixed to their skull. After that, he is shown and given the ability to hear certain voices and images. The head-mounted sensor tracks and logs brain electrical activity and P300 waves, which are only generated when the person is linked to a stimulus. No questions are posed to the topic. In a nutshell, it means that the fingerprints on the brain match the information that is stored in the brain and the crime scene.

X. DNA PROFILING

One of the newest, most reliable, and fastest-growing types of forensic scientific research is DNA profiling. The abbreviation for "Deoxyribose Nucleic Acid" is DNA. This biological substance, which gives each individual their distinct genetic code, is found in every living cell. DNA can be extracted from a wide range of materials, such as blood, semen, bone, saliva, and more.

XI. BRAIN FINGERPRINTING

Another state-of-the-art computer technique is brain fingerprinting, which uses measurements of brain waves in response to phrases or images associated with a crime that are shown on a computer screen to precisely and scientifically identify the offender. Research showing that persons who are asked to lie display different patterns of brain activity compared to those who are telling the truth has led to a well-known use of functional magnetic resonance imaging in lie detection. Brain fingerprinting is based on this discovery. We will discuss difficulties related to the use of such evidence in court later.

XII. CRITICAL ANALYSIS

Both the right against self-incrimination and the right to privacy are violated. Since twins share the same DNA, the DNA profiling bill is unable to address twin instances. The possibility of DNA data being misused exists. They can learn about his medical history or family background thanks to this data, which infringes on his right to privacy. The accused, suspect, or victim's consent cannot be obtained in a legitimate manner. Because it distinguishes between those who are guilty and those who are not, it breaches the right to equality guaranteed by Article 14. They have a hard time starting over because of internet data. Anyone can look up their background, which is why the reformation idea failed.

There are no safeguards to stop the unlawful gathering and use of such neither data, nor are there any to stop the proposed body from abusing it. There is no way for a citizen or a prisoner awaiting trial to request a second sample or test. There is no way for volunteers to remove their data. There is a legitimate process to get the consent of the person whose data is given if it is given to a third party; if the third

party is not an authorized agency, we do not have such a system. Once the goal has been achieved and the allotted time has passed, the data should be deleted. People abuse these methods to determine paternity.

XIII. STATUTORY PROVISIONS IN INDIA.

XIII.1 UNDER BHARATIYA NAGARIK SURAKSHA SANHITA, 2023 (BNSS)[8]

i. Section 51 of BNSS allows for the "examination" of the accused by a medical professional upon the police officer's request
ii. Section 184: Medical examination of rape victim
iii. SEC 328: This section's provisions are limited to expert testimony provided by a medical professional acting as a witness.
iv. Section 329, which addresses the reports of specific government scientists, stipulates that the reports may be used as proof.

XIII.2. UNDER BHARATIYA SAKSHYA ADHINIYAM, 2023, (BSA)[9]

i. The Bharatiya Sakshya Adhiniyam's Section 39(1) allows for expert opinions.
ii. Evidence is explained in Section 2(1)(e).
iii. Section 22 of the act stipulates that any evidence gathered under duress is legally inadmissible. When a narco analysis test is ordered to be performed on an accused person, it is compelled, and any information obtained during the test should likewise be deemed inadmissible

XIII.3 UNDER CONSTITUTION OF INDIA[10]

The right against self-incrimination under Article 20(3) of the Indian Constitution The Supreme Court ruled in ***Kathi Kalu Oghad***[11] that the question of volition was what set a forced fingerprint scan apart from forced self-incriminatory evidence. Unlike written or oral testimony, a person's fingerprint pattern was unaffected by their

[8] Bharatiya Nagarik Suraksha Sanhita, 2023 (BNSS)
[9] Under Bharatiya Sakshya Adhiniyam, 2023, (BSA)
[10] Constitution of India, 1950
[11] 'Mobarik Ali Ahmed *v* . The State of Bombay.' (1961) 24 Int Law Rep 156 <https://www.cambridge.org/core/product/identifier/S0309067100068854/type/journal_article> accessed 3 November 2025

choice. The court appears to be using the criminal control paradigm as the foundation for Article 20(3) by associating violation with changeability[12].

XIII. 4 RIGHT TO DIGNITY AND PRIVACY UNDER ARTICLE 21.

In its most recent ruling in ***Rohit Shekhar v. N.D. Tiwari***[13] the Supreme Court ruled that requiring a DNA test to determine paternity does not violate an individual's right to privacy in paternity proceedings. Furthermore, this right is subject to the interests of society, which will ultimately triumph, and has not been acknowledged as an absolute right. The primary goal is to improve society, and it is every citizen's fundamental responsibility to assist in uncovering the truth in investigations, even if doing so necessitates a scientific test in DNA analysis.

Notably, the Orissa High Court in ***Thogorani Alice K. Damayanti v. State of Orissa & Others***[14] explicitly declared that, "The only restriction according to us for issuing a direction to collect the court should balance the public interest vis-à-vis the rights under Article 20(3) and 21 of the Constitution in obtaining evidence tending to confirm or disapprove that the accused committed the offence. In balancing this interest considerations of the following matters would be relevant:

i. The extent to which the accused may have participated in the commission of the crime.
ii. The gravity of the offence and the circumstances in which it is committed.
iii. Age, physical and mental health of the accused to the extent they are known.
iv. Whether there is less or intrusive practical way of collecting of evidence tending to confirm or disapprove the involvement of the accused in the crime.
v. The reasons, if any, for the accused for refusing consent.

Smt. Selvi and Others v State of Karnataka[15] in this case the Supreme Court was called upon to determine the constitutionality of the compulsory administration of the narco analysis test. The Supreme Court has to resolve the issue, which involved preserving the balance between the concerns of investigation and the preservation of human liberties. In this case of Supreme Court declared that the compulsory

[12] The state of Bombay v. Kathi kalu Oghad AIR 1961 SC 1808.
[13] Rohit Shekhar v ND Tiwari (2012) 12 SCC 554
[14]Thogorani Alice K. Damayanti v State of Orissa & Others 2004 *Cr.L.J.* 4003
[15] Smt. Selvi and Others v. State of Karnataka (2010)7 SCC 263

administration of narco analysis and other impugned test as unconstitutional and violate of Article 20(3) and Article 21 of the Constitution.

The three judge bench consisting of the then Chief Justice K.J. Balakrishnan, Justice R.V. Ravindranan and J.M. Panchal, held that no individual should be forcibly subjected to narco analysis whether in context of criminal cases or otherwise as it would amount to an unwarranted intrusion into personal liberty. In a very significant case involving the issue of recognition of human dignity and right to life and personal liberty it was stated that every act which offends or impair human dignity would constitute an inroad into the right to life and it would be prohibited by Article 21 unless it is in accordance with the procedure established by law".

XIV. ANALYSIS REGARDING INFRINGEMENT

The rights to privacy and immunity from self-incrimination are violated by forensic science methods such as DNA and narco analysis. Because our criminal justice system adheres to the due process model, we assume that the accused is innocent rather than guilty. However, by forcing the accused to testify, we are assuming his guilt through these tactics. This violates the due process concept in addition to the rights of the accused.

XV. ANALYSIS REGARDING RELEVANCY

In criminal investigations, forensic science is crucial. This makes the case easier for the investigating agency to solve. Because it is difficult to falsify evidence and there are very little odds of it happening, forensic evidence is more trustworthy. Due to a lack of evidence, it was exceedingly difficult to convict someone in the past. However, thanks to forensic technology, it is now simple to find evidence and identify the true offender. However, forensic evidence is not the only kind of evidence. The forensic evidence alone does not result in the accused's conviction. This is due to the fact that these techniques are not totally precise. Errors can happen, and the principle that no innocent person should be convicted is the cornerstone of our criminal justice system. Therefore, forensic evidence alone should not be used to support a conviction.

XVI. RESULT AND DISCUSSION

The study underscores the indispensable role of forensic science in modern criminal investigations. The findings reveal that forensic methodologies contribute to the administration of justice by providing irrefutable evidence. However, challenges such as the mishandling of evidence, human error, and the admissibility of forensic evidence in court remain areas of concern. Moreover, the advancement of forensic technology continues to reshape criminal investigations. DNA sequencing, digital forensics, and forensic toxicology have revolutionized evidence collection, making investigations more precise and comprehensive. Despite these advancements, issues such as forensic backlogs and the need for continuous training of forensic experts must be addressed to enhance its effectiveness further.

In criminal investigations, forensic science is essential because it offers important evidence that helps reveal the truth and uphold the rule of law. It is now common practice in criminal investigations, out-of-court settlements, and trials to analyze physical evidence using scientific methodologies. However, the exact impact of forensic evidence on case outcomes is nuanced and varies according to the type of crime and the evidence collected. In high-volume crimes like burglaries, the use of "soft" forensic evidence such as modus operandi and temporal and geographical aspects has also shown promise in terms of boosting convictions and clearance rates. Interestingly, popular media portrayals of forensic science, such as the television show CSI, have created a cultural repertoire that links forensic science to indisputable justice and truth.

This perception has given rise to concerns regarding the "CSI effect" on real-world judicature; however, it is important to acknowledge that forensic science has difficulties in providing accurate and consistently interpreted information in court To overcome these difficulties, forensic scientists, investigators, and legal professionals must communicate better, and police and prosecutors must receive better training.

CONCLUSION

The study emphasizes how important forensic science is to contemporary criminal investigations and shows how successful it is at revealing the truth, locating offenders, and upholding the rule of law. Forensic science reduces erroneous

convictions and fortifies the legal system by providing accurate and trustworthy evidence using scientific techniques including DNA analysis, fingerprinting, digital forensics, and ballistics. Forensic science still faces difficulties, such as contaminated evidence, erroneous interpretations of findings, and ethical issues, despite its tremendous achievements. However, its dependability and impact can be further increased by ongoing developments in forensic technology, appropriate training, and adherence to legal and ethical standards. Forensic science continues to be a vital instrument in criminal investigations, serving as a link between scientific study and law enforcement. To maximize its effectiveness, there is a need for ongoing research, technological improvements, and policies that ensure its proper application in the pursuit of justice.

In summary, forensic science is essential to criminal investigations, yet its applicability and efficacy are continuously contested. The need for better communication and cooperation between forensic specialists, law enforcement, and legal professionals is highlighted by this discrepancy between the theoretical potential of forensic science and its actual use. Several suggestions are made to improve the applicability of forensic science in criminal investigations.

In order to adjust to the decentralization of forensic capabilities and take a more active part in problem-solving, forensic laboratories must first undergo digital transformation. Second, the objectivity and dependability of forensic evidence can be increased by addressing systemic biases in the way forensic research is organized, such as maintaining independence from law enforcement and using blind proficiency testing. Finally, the gap between forensic expertise and criminal adjudication can be closed by encouraging efficient communication between experts, attorneys, and judges and giving priority to workable solutions over drastic alterations. These steps will help forensic science reach its full potential in revealing the truth and assisting with impartial and successful criminal investigations.

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