

WHITE BLACK LEGAL LAW JOURNAL ISSN: 2581-8503

1-124 + 23.023

Peer - Reviewed & Refereed Journal

The Law Journal strives to provide a platform for discussion of International as well as National Developments in the Field of Law.

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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

FORENSIC SCIENCE IN CRIMINAL INVESTIGATION IN INDIA

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ABSTRACT

Forensic science is the most important aspect of criminal investigation as it allows authorities to identify suspects and also helps determine when and how a crime was committed. The word "forensic science" means "about law" and logically forensic science involves the use of scientific methods for legal investigations. It helps to establish perfect evidence in law regarding the guilt of the accused. The definition of forensic science is very broad because it includes DNA analysis, fingerprints, autopsy, pathology, toxicology and many other things that help determine the cause of death and incriminate people. In addition, forensic evidence is a subject in accordance with the provisions of Indian law. Its mission is to guide criminal investigators and provide accurate information to judges so that they can have full confidence in making decisions about crimes and conflicts. Forensic science is an excellent branch of science that has been used in criminal and civil investigations in recent years. Fingerprint analysis, DNA analysis, bombs and explosives, firearms, etc. It contains all the famous scientific methods such as.

The field of forensic science has achieved significant scientific advances over the past twentyfive years. Forensic science is one of the most important aspects of any criminal investigation, as it can help the police with everything from positively identifying a suspect to establishing when and how a crime was committed.

Crime has increased in modern times, and along with technological advancement, the type and technique of crime has also changed. As a result, it is important that the police and investigation machinery use forensic science to detect crime and that they remain updated with the latest technologies and different types of crime. On the other hand, since intelligent criminals are quick to use science for their criminal acts, police investigators can no longer rely on their ageold intelligence skills. As a result, forensic science must be used in criminal investigation to find out what kind of thing it is, what type it is and to detect the crime.

KEYWORDS: FORENSIC SCIENCE, CRIMINAL INVESTIGATION, DNA, CRIME, EVIDENCE, CRIMINALS

INTRODUCTION

The term 'Forensics' came from the word 'forensics' meaning which is related to the courts, debate, and discussion about the public. Science is the knowledge where things will be tested, experimented on, and can be verified repeatedly without changes. The term forensic science can be defined as the scientific discipline which helps the criminal justice system after the analysis of the articles with the use of material science to go to the criminal and in turn the justice¹.

This science works closely with the offenses rape, murder, cyber-crimes, and nowadays with civil cadre cases too. it also deal with the basic principles of all physical and natural sciences and has evolved many domains e.g. anthropometry, computers, DNA and brain mapping, fingerprinting, etc². Justice delivery system consists of courts and other related to the court that coincides with forensic science. It is always required to connect crimes to criminal and achieve convictions while safeguarding the rights of the innocent with a balanced approach that combines both instincts and scientific reasoning. Forensic science serves as a crucial tool in this process by providing objective and reliable evidence, ultimately contributing to the pursuit of justice³. The purpose of this article to find the existing relationship between the Indian judicial system, forensic science, and crimes.

DEFINITION

To obtain the desired information in the context of justice from physical evidence, various branches of science such as chemistry, biology, physics, medical science etc. are mainly used and this is the basic foundation of forensic science. Thus, "Forensic science is the science in which the knowledge of various sciences is used for the purpose of law." It is not a basic science but a combination of various sciences. The word forensic is derived from the Latin word forensic meaning public, which is closely related to forum. Forum used to be the place where

¹. Roux, C.; Crispino, F. and Ribaux, O. (2012): From forensics to forensic science. Current Issues in Criminal Justice, 24(1) p. 7-24.

². Goswami, G. and Goswami, S. (2022): DNA in criminal adjudication. Handbook of DNA Forensic Applications and Interpretation: Springer, p. 67-87.

³. McCartney, C. (2004): Forensic DNA sampling and the England and Wales national DNA Database: A sceptical approach. Critical Criminology, 12(2), p 157-78.

Roman courts used to conduct their sessions, due to which the science related to justice came to be called forensic science. In Hindi it is called forensic science or legal science.

NEED

According to the official data of the last decade, about 93 percent of the criminals in our country are released in the court due to lack of evidence. Therefore, forensic science is needed in the judicial process due to the following reasons.

Social: In the past years, revolutionary changes have taken place in communication, transportation and information technology. Population has increased due to increased industrialization in cities. Common people have become indifferent towards crime and criminals, due to which they pretend to be unaware of the crime despite knowing everything about it. In such a situation, only scientific evidence of forensic science can be helpful.

Public indifference: In big cities, people around the crime scene are also unaware of the unknown person and his activities. Many times, the death/murder of a person is revealed due to the foul smell of the rotting body. In such a situation, forensic science is of special importance for investigation.

Technological development: In today's era, criminals are adopting modern methods of committing crime. In these circumstances, it becomes necessary for the investigating officers to adopt scientific methods for investigation.

Wide area of crime: At present, interstate and international crime has become common. Cyber, smuggling, illegal drug trade, financial scams and fraud, terrorism etc. are prominent among them, for the effective control of which forensic science is required.

Criminal investigation and its functions

By definition, investigation includes all steps taken to obtain evidence by a police officer and any other person (other than a judge) who has been empowered to do so by a magistrate.⁴ Investigation is the study, survey and research of facts, events, incidents and circumstances, both interconnected and unconnected, with the aim of arriving at a provable conclusion.⁵ When

⁴. Section 2(h) of Code of Criminal Procedure, 1973.

⁵. Charles, M. Alifano (2006): Fundamentals of Criminal Investigation, http://www.worldwidelawenforcement.com/docs/FUNDAMENTLAS%20OF%20CRIMINAL%20INVESTSIG ATION.pdf

one investigates, he thoroughly gathers and evaluates data, while analysing and examining it. As a result, instead of conjecture, speculation or assumption, investigation is based on a rigorous and thorough observation.⁶



Forensic Techniques and Technologies

The most commonly used forensic techniques today are fingerprint DNA analysis and ballistics. Fingerprint identification by comparing unique patterns and fingerprints found at crime scenes with patterns and fingerprints recorded in various police records. Fingerprinting is one of the oldest forensic techniques but continues to be used for its benefits. Compared to fingerprinting, DNA analysis can help identify people who may be at the scene of a crime. This involves comparing DNA found at the crime scene (usually in blood, saliva, hair, semen, or other samples) to DNA profiles in police records. DNA is now routinely collected from convicted criminals or convicts.

Ballistic analysis examines firearms and ammunition. It cannot identify a person at the scene, but it can link a specific bullet used in a crime to a specific weapon. If a gun can be linked to a person by purchasing documents, fingerprints, or DNA, it can also be used to detect a person's presence at a crime scene. Recently, advanced technologies such as artificial intelligence have begun to change the scientific method. AI can process large amounts of data quickly and is especially good at pattern recognition. AI is already making clinical trials more efficient and

⁶. Ibid

accurate, and will likely find more applications. Although there are risks associated with the use of such technologies, it is necessary to use artificial intelligence and reduce these risks due to its benefits.

ROLE OF FORENSIC SCIENCE IN CRIMINAL INVESTIGATION

1. Crime Investigation

Forensic science is performed at the crime scene and detailed analysis is performed under expert supervision. They accurately identify, collect and collect physical evidence including fingerprints, blood, hair, clothing, weapons and more. Experts reconstructed the pattern of events that led to the abuse, taking into account the environment and patterns of evidence. This process forms the basis for establishing the research principle.

2. Collection and preservation of evidence

The collection and preservation of evidence should be done in accordance with good practice. Forensic experts ensure that evidence is managed to the best of their ability to prevent it from being contaminated, destroyed or used. All certificates passed through the documents have been verified and approved as genuine and visible to the jury. Regular evidence testing involves thinking about the preservation and transportation of evidence from the scene of the crime to the forensics or laboratory and finally to the courts. The effective collection and preservation of forensic evidence plays an important role in supporting the credibility and integrity of the criminal justice system. These interventions promote justice and protect individual rights by helping to ensure that evidence is appropriately examined and presented in the court process.

3. Laboratory Analysis

An improvement in laboratory analysis will be made based on the evidence collected. Many specialties in forensic science are beginning to make an impact, including DNA analysis, toxicology, ballistics, and digital forensics. Experts use advanced equipment and technology to carefully analyze evidence. For example, DNA testing can link victims, victims, or crime scenes, while toxicology testing can detect the presence of drugs or toxins in the body.

4. Fingerprint Examination

Fingerprint examination is an important part of forensic science. Pattern identification of bumps on the skin creates a unique fingerprint for each person. Forensic experts link

latent fingerprints at the scene to known fingerprints on file to begin making a connection to the suspect. This model has proven to be important in many cases, creating a connection between the individual and the field.

5. Uncovering Digital Viruses

Digital signatures have become an essential part of today's criminal investigation, and forensics is still important in uncovering complex networks of digital evidence. As crime increases in electronic footprints, forensic experts are taking advantage of this digital technology by using the latest technology and cutting tools to extract and analyze the electronic evidence left behind by criminals. The combination of technology and analysis has made forensic science a vital tool for extracting digital evidence and uncovering today's crimes.

6. Decoding gun evidence

In the field of forensic science, detailed analysis of ballistic evidence is a decisive analysis method that can reveal the source understanding of armed crime situations. Ballistic tests require careful examination of the bullet, its casing, and the unique pattern it leaves behind. By following modern scientific methods and techniques, forensic experts can uncover these subtle signs, clarify the true nature of a dangerous situation and support the overall understanding of the scene.

7. Forensic Anthropology Specialization

Forensic Anthropology focuses on the identification of human remains, especially in deteriorating cases. Experts examine the skeletons to determine age, gender, appearance and possible cause of death. This information helps identify the victims and predispose to their deaths.

8. Crime Scene Reconstruction

Forensic experts reconstruct the crime scene by combining evidence, investigations and scientific analysis. The system allows police to understand the process of the crime, the role of the people involved and possible targets. Crime mitigation helps researchers and legal experts develop legal explanations.

9. Expert evidences

The statements of experts, especially experts in the field of investigation and forensic medicine, have an important place in the judicial process. With their deep knowledge and extensive training, these individuals play an important role in facilitating the understanding of the science and evidence presented to judges and panels. The combination of intelligence and employment law helps expert witnesses provide honest

and informed opinions, bridging the gap between complex criminal investigations and the understanding of those chosen to prosecute.

10. Reviving Unsolved Cases

Influenza often results from a protracted debriefing process, but hope has been regained through the application of forensic science. Recent cases have been repeated and improved thanks to the methods and techniques developed in the field of forensic sciences.

Meaning and Importance of DNA Evidence

DNA, often referred to as the building block of life or the genetic blueprint, was first described in 1953 by scientists Francis H. Crick and James D. Watson. Crick and Watson discovered the double-helix structure of DNA, which looks like a twisted ladder, and established DNA's importance as the substance that makes up the genetic code of living beings. The pattern of molecules that make up a person's DNA determines how that person's life takes form. Whether it's a skin cell, a sperm cell or a blood cell, every cell in a person's body contains the same DNA. No two individuals have the same DNA blueprint, unless they are identical twins.

Admissibility value of DNA evidence

Deoxyribonucleic acid, or DNA, is a double-stranded long molecule that resembles a twisted rope ladder or double helix. The sides of the ladder are made up of phosphate and deoxyribose sugar units that alternate, while the linkages are made up of bases such as adenine (A), thymine (T), guanine (G) and cytosine (C). Amino acids and bases, which are the keys to defining the genetic blueprint, make up the majority of DNA. Each cell in the human body contains a little bit of DNA. The average person has 250 micrograms of DNA and each nucleus contains about 5 pictograms of DNA. Micrograms of DNA are the ideal amount for fingerprinting. DNA can be recovered from a variety of sources, including hair, cigarette butts, blood, razor clippings and saliva. As a result, obtaining samples is extremely simple, and the samples can then be evaluated in a laboratory to determine whether there is a genetic connection. DNA analysis has become a typical type of evidence in criminal trials. It is also used in civil cases, especially in cases where it is necessary to establish the paternity of the identified.⁷

Despite the fact that several procedures exist for forensic matching and identification of an

⁷. https://medlineplus.gov/genetics/understanding/basics/dna/

individual, there are two types of such testing systems. These tests are known as restriction fragment length polymorphism (RFLP) and polymerase chain reaction (PCR) testing. The RFLP testing procedure, in general, demands a large amount of DNA free from contamination to provide proper conclusions. Small amounts of DNA samples are not suitable for RFLP testing, while PCR testing requires a small amount of DNA sample. Since it is a very sensitive test, even the smallest contaminants at a crime scene can alter or affect the findings.

Since it requires a fairly large amount of DNA, RFLP is not used as widely as before, as new and more efficient DNA analysis techniques have emerged. Also, RFLP⁸ does not work well with samples that have been affected by environmental factors such as dirt or mold. RFLP testing has now been replaced by PCR-based testing. It is essentially an amplification technique as a small amount of material can be amplified to the desired amount. It involves repeated replicating of the target region⁹.

Admissibility of DNA in criminal cases

Certain issues have been raised with DNA testing. It is claimed that it violates both the "right to privacy" and the "right against self-incrimination".¹⁰ However, the use of DNA tests to estimate the scope of a crime has become increasingly important in recent years.

In the cases of *Govind Singh v. State of Madhya Pradesh*¹¹ and *Kharak Singh v. State of Uttar Pradesh*¹², it was established that FRs are not always truthful and are subject to limitations. Consequently, it does not violate Article 20. (3). However, there have been several incidents involving DNA tests.

In the case of *K. Damyanti v. State of Orissa and others*¹³, the Court emphasised the need to establish a balance between the rights of the accused and the investigation and information-gathering process using DNA tests. In addition, certain criteria were established for the following issues:

It is necessary to identify the extent to which the accused was involved in committing the crime.

⁸. Yawer Qazalbash (Edn. 2006): DNA Evidence and its Admissibility, Modern Law House, p. 6

⁹. Segment of the DNA which has to amplified or replicated

¹⁰. Article 20 of Indian Constitution Act.

¹¹. AIR 1975 SC 1378

¹². AIR 1963 SC 1295

¹³. P. (Criminal) 198 of 2003

- > The size and scope of the crime.
- The consent of the accused is required; but, if it is refused, the reason for it must be explained.
- > The refusal must be documented.
- It is also important to consider the mental health, age and physical condition of the accused.

In Priyadarshini Mattoo,¹⁴ on 23 January 1996, a 25-year-old law student was raped and killed at her home. The offender in this case, Santosh Kumar Singh, had been stalking and harassing her for years. The deceased had lodged several complaints against him, including threats, stalking and harassment. The deceased's repeated allegations against the accused infuriated him and he lodged a false complaint with the Delhi University authorities, stating that she was pursuing two degrees at the same time. As a result, the University delayed the results of the deceased and sent her a show-cause letter, to which she was to respond at the earliest. In his own right, the accused pursued the case against the deceased. The deceased in her explanation stated that she had obtained M.Com in 1991 and had not yet completed her LLB. Thereafter, the accused took advantage of her being alone at home one morning and raped her, strangulated her with an electric wire and smashed her face with a motorcycle helmet so hard that she became unrecognizable. DNA tests revealed that the accused had raped and killed the deceased as the DNA of the sperm found in the vaginal swab of the deceased matched with the DNA taken from the blood sample of the accused.¹⁵

According to the trial judge, the CBI had faked the DNA test in the rape case as it was not obtained in accordance with court procedure and hence could not be used as evidence under Section 45 of the Indian Evidence Act.¹⁶ Despite Santosh being convicted as the "committer of the crime", the court had to acquit him due to the "benefit of doubt". This controversial murder case caused widespread outrage and received a lot of media coverage.¹⁷

The Tandoor murder case is widely considered one of India's most gruesome murders. Naina Sharma¹⁸, wife of former Youth Congress member Sushil Sharma, was suspected of having an

¹⁶. Section 45 of India Evidence Act, 1872

¹⁴. Ibid

¹⁵. Digvijaya Singh (2012): Top 10 Controversial Murder Cases in India, http://www.newsypas.com/top-10-controversial-murder-cases-in-india/1369/

¹⁷. Ibid

¹⁸. 2007 CriLJ 4008

extramarital affair with a deceased acquaintance Matloob Karim. On July 2, 1995, Sushil killed Naina and mutilated her body after being angered by their friendship and then dumped it in the earthen stove of the Bagia restaurant. Sharma surrendered to the authorities on 18 October 2013 after hiding for a week and was sentenced to life imprisonment by the Supreme Court. This was the first time DNA fingerprinting was used to investigate a crime in India.¹⁹

*Assassination of Rajiv Gandhi*²⁰ In this case, DNA testing identified Dhanu, who was the 'human bomb'. She then bent down to kiss his feet before detonating an RDX-containing explosive belt hidden under her clothes. The explosion that followed killed Gandhi, his assassins, and 14 others. According to Justice Thomas of the Supreme Court of India, the assassination was carried out because of LTTE commander Prabhakaran's personal animosity against Gandhi.

*Kunhiraman Case*²¹ Kunhiraman lived next door to Vilasini and was a wealthy eligible bachelor. Manoj was born after she became pregnant, but she kept her pregnancy and birth a secret. The authorities found out about the situation, and she was charged, but acquitted. At the Centre for Cellular and Molecular Biology in Hyderabad, she requested a DNA test to ascertain the paternity of the child.

CONCLUSION

Forensic science is becoming an important tool in the pursuit of justice. Combining the principles of science with the analytical process not only helps solve the problem of crime but also ensures accountability to victims by proving innocence. From investigating the facts of a crime to presenting expert evidence, the forensic expert's role contributes to a variety of crime-solving situations. This strong foundation supports the important role of forensic science in today's world by supporting the rule of law and the necessity of justice. Moreover, under Indian law, forensic certificates can be issued without any compulsion. His work is twofold; To guide people in criminal investigation practices and provide clear information to judges, increasing their confidence in making decisions about criminal acts and acts of civil conflict. Today, forensic science is a science and technology that still has applications in criminal and civil

¹⁹. Rajiv Gandhi was assassinated in May 1991

²⁰. Assassination of Rajiv Gandhi, Wikipedia (The Free Encyclopedia), http://en.wikipedia.org/wiki/Assassination_of_Rajiv_Gandhi

²¹. (1991) DMC 499; (1991) 3 Crimes 860 (Ker)

investigations. It involves a configuration of high-level scientific methods such as but not limited to fingerprint analysis, DNA analysis, ballistics, law enforcement and firearms investigation.

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