



Evaluating The Role of DNA Evidence in Criminal Trials: Analyzing Admissibility, Reliability, And Judicial Impact in Karnataka

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ABSTRACT

This study critically evaluates the role of DNA evidence in criminal trials within the jurisdiction of Karnataka, India, focusing on its admissibility, scientific reliability, and influence on judicial outcomes. DNA profiling has increasingly become a cornerstone of modern forensic science, offering unparalleled precision in linking suspects to crime scenes. However, its utility in courtrooms is contingent upon stringent legal standards and procedural safeguards. Drawing upon legislative frameworks such as the Bharatiya Sakshya (Second) Bill, 2023, and relevant judicial precedents, this research examines how Karnataka's criminal justice system integrates DNA evidence in trial processes. The study adopts a doctrinal and empirical approach, analysing court rulings, forensic protocols, and stakeholder perceptions, including legal professionals, forensic experts, and investigating officers. Key challenges such as chain of custody, expert interpretation, and potential biases are also explored. The findings reveal that while DNA evidence is often decisive in securing convictions or acquittals, its effectiveness is undermined by infrastructural limitations, inconsistent judicial understanding, and procedural lapses. The study concludes with recommendations for legislative refinements, forensic capacity-building, and judicial sensitization to enhance the evidentiary value and ethical application of DNA technologies in criminal adjudication.

Keywords: DNA evidence, criminal trials, forensic science, admissibility, Bharatiya Sakshya Bill, forensic ethics.

Introduction

Forensic science has emerged as a cornerstone in the modern criminal justice system, providing scientific methods and techniques to investigate crimes, identify perpetrators, and exonerate the innocent. Among the various branches of forensic science, DNA profiling has revolutionized the field by offering unparalleled accuracy in identifying individuals based on their unique genetic makeup. DNA profiling, also known as DNA fingerprinting, involves analysing specific regions of an individual's DNA to create a unique genetic profile that can be used for identification purposes. This technique has become indispensable in criminal investigations, paternity disputes, and disaster victim identification, among other applications.

The advent of DNA profiling has significantly enhanced the ability of law enforcement agencies to solve crimes that were previously considered unsolvable. By analyzing biological evidence such as blood, saliva, hair, and skin cells, forensic scientists can link suspects to crime scenes with a high degree of certainty. Moreover, DNA evidence has been instrumental in exonerating wrongfully convicted individuals, thereby highlighting the importance of forensic science in ensuring justice.

In India, the application of forensic science, particularly DNA profiling, has gained momentum in recent years. The country's diverse population, coupled with the increasing complexity of criminal activities, has necessitated the adoption of advanced forensic techniques to address the challenges the criminal justice system faces. Karnataka, a state in southern India, has been at the forefront of integrating forensic science into its law enforcement practices. With a growing number of forensic laboratories and trained professionals, Karnataka has made significant strides in leveraging DNA profiling to solve crimes and deliver justice.

The origins of forensic science can be traced back to ancient civilizations, where rudimentary methods were used to investigate crimes and determine guilt or innocence. However, the formalization of forensic science as a distinct discipline began in the late 19th and early 20th centuries, with the development of techniques such as fingerprint analysis, ballistics, and toxicology. These methods laid the foundation for modern forensic science and established the importance of scientific evidence in criminal investigations.

In India, the adoption of DNA profiling in forensic investigations began in the late 1990s, with the establishment of specialized forensic laboratories and DNA analysis techniques. The DNA Technology (Use and Application) Regulation Bill, which seek to regulate the use of DNA technology in criminal investigations, was withdrawn and the IPC was replaced by the Bharatiya Nyaya (Second) Sanhita Bill, 2023; the CrPC of 1973 was replaced by the Bharatiya Nagarik Suraksha (Second) Sanhita, 2023 whereas the Indian Evidence Act of 1872 was replaced by the Bharatiya Sakshya (Second) Bill, 2023. These legislations aim to establish a legal framework for collecting, storing, and using DNA data, ensuring that the rights of individuals are protected while enabling law enforcement agencies to utilize DNA evidence effectively.

Karnataka, a state in southern India, has emerged as a trailblazer in the adoption and application of forensic science, particularly DNA profiling, in criminal investigations. Over the years, the state has made significant strides in integrating advanced forensic techniques into its law enforcement practices, setting a benchmark for other regions in India. With a robust infrastructure of forensic laboratories, skilled professionals, and progressive policies, Karnataka has positioned itself as a leader in leveraging forensic science to enhance the accuracy and efficiency of its criminal justice system.

Karnataka boasts several state-of-the-art forensic laboratories equipped with cutting-edge technology for DNA analysis. These facilities are staffed by highly trained professionals specializing in forensic biology, genetics, and related fields. The Karnataka Forensic Science Laboratory (KFSL), located in Bangalore, is one of the most prominent forensic institutions in the country. The KFSL is equipped with advanced instruments such as Polymerase Chain Reaction (PCR) machines, genetic analysers, and automated DNA extraction systems, enabling it to handle complex forensic cases with precision and reliability.

The KFSL has played a pivotal role in solving numerous high-profile criminal cases by providing critical DNA evidence that has successfully prosecuted offenders. For instance, in cases of sexual assault, homicide, and property crimes, DNA profiling has been instrumental in linking suspects to crime scenes, identifying victims, and exonerating the innocent. Beyond its operational role, the KFSL is also actively involved in research and development, contributing to advancing DNA profiling techniques and forensic science. This dual focus on practical application and innovation ensures that Karnataka remains at the forefront of forensic science in India.

Objectives of the Study

The following objective was formulated to guide the study:

- To examine the role and importance of DNA evidence in criminal trials, including its admissibility, reliability, and impact on judicial outcomes.

Research Methodology

This research adopted an interpretive and positivistic research paradigm, relying on observing and analysing existing texts. The study took a critical approach to the existing law in India and its progenitors, such as the United Kingdom and the United States of America, as well as all available literature on forensic evidence and its relation to judicial decision-making. This paper's most crucial theoretical principle was to study the courts' approach in the decision-making process of criminal cases in developed countries and examine their similarities and differences with India.

Study Design

The research method was primarily analytical, and the methodology adopted was doctrinal. As the research title suggested, the study was only possible by analysing select cases and observations from the Hon'ble Supreme Court and the High Court chronologically. The aim was to assess and explore the privileges and shortcomings in the criminal justice system concerning forensic evidence by stimulating insights incorporated into the analysis. Decisive cases that changed the law regarding accepting or rejecting forensic evidence in court were also studied. Although case law was distinguished from statute law, statute law was sometimes considered the primary source of law, especially when the Supreme Court gave judgments interpreting the statutes.

This was a crucial feature of the common law system, and researching case law formed an integral part of the legal research process. Case law was based on judges' reported decisions in cases before them. In their decisions, the judges laid out the relevant facts of the case and the legal reasoning that was applied while deciding the case. Under common law, there was a hierarchy of authority in judgments. Those made by superior courts formed precedents, and inferior courts were required to follow these precedents. Therefore, the reported decisions of judges in cases formed an essential part of the law.

The research combined historical, empirical, comparative, and critical methods. It extensively used legal libraries, especially the I.L.I. Law Library and N.L.U. Delhi deserved special mention.

Data Collection Procedure

The study was based on primary and secondary sources, such as statutes, reported judgments in journals, books, and articles on forensic science, including e-journals, among others. The role of forensic evidence in criminal cases in India was analyzed by studying the decisions of the Superior Courts available in sources such as *Supreme Court Cases*, *Criminal Law Journal*, *S.C.C. Online*, *Manupatra*, etc., where evidence like DNA, fingerprints, ballistics, and toxicology had been used.

Review of Literature

Sanjeev Kumar and Deeksha (2020)¹ in their study "Use of Scientific and Modern Techniques in Forensic Science and Their Utility in Criminal Justice System: An Indian Perspective," they offer a complete exploration of the intersection between forensic Science and the criminal justice system in India. The authors address What is forensic, the application of forensic Science, Technologies used in forensic Science, DNA, Admissibility of DNA in the Indian legal system, NARCO analysis test or truth serum test, Admissibility of NARCO analysis test, Polygraph or lie detector test, Fingerprints, Types of prints, Latent fingerprints, Patent fingerprints, Plastic fingerprints, Handwriting. The authors examine the critical role that advanced scientific methods play in solving complex crimes and ensuring accurate answers. This article also sheds light on the legislative framework for the applicability of forensic science in criminal justice with the help of case laws. While the report is highly informative, some readers might find certain sections overly technical and demanding. Despite this, the article contributes significantly to understanding the significance of forensic science within the Indian legal framework.

Shubhi Mack and Ishita Chatterjee (2021)² state that forensic science includes using physical and natural sciences to investigate civil or criminal cases. It is used for multivariate purposes such as inspecting criminal crimes such as rape, murder, drug tracking, and civil cases as wilfully destroying the natural environment. It includes using modern technologies such as DNA testing, fingerprint profiling, and narco tests so that the facts related to the crime and the suspect are identified. The study identifies that, as per the Indian Evidence Act (IEA) 1872, evidence has been classified into different parts, such as Oral, Documentary, Primary, and Judicial Evidence, which play a vital role in the investigation process. The study found that forensic investigations are beneficial as they track the implications of illegitimate substances and recognize the residues by reconstructing the crime scene. Forensic investigations also help identify the victim and learn about the crime's reasons or the perpetrator's conduct. "The Role of Forensic Evidence in the Criminal Justice Delivery System in India" comprehensively explores the complex relationship between forensic evidence and the Indian criminal justice system. The article carefully studies the evolution of forensic practices in India and their integration into the criminal justice system. The review showcases how forensic evidence serves as the solid foundation of modern investigations, transforming how crimes are solved and culprits are brought to justice. It guides the Indian criminal justice system towards equity, accuracy, and responsibility. It is an imperative read for legal professionals, policymakers, and anyone seeking insight into the harmonious occurrence of Science and Law in pursuing justice.

According to **Priya Sharma et al. (2021)**³, "Forensic Examination of Electronic Signatures: A Comparative Study" is an accurately crafted and insightful work examining the complex world of electronic signatures. Here, the authors address the Material and Methods, Results and discussion, dimensions, spacing between letters, Spacing between words, Alignment, Arrangement, Initial and terminal strokes, Connections, Pen lifts, Diacritics, Embellishments, Tremors, Simplifications, Forms, and formation of letters. With the changing ways of writing and signature production, the means of producing forged writing or signatures are also bound to change. This has brought new challenges for handwriting examiners. In the present study, a comparative analysis of electronically captured signatures with pen-paper signatures has been performed to study the effect of changes in writing media. The study educates readers about the technical aspects and emphasizes the legal and ethical dimensions that digital forensics professionals must navigate. The study excels in providing an in-depth comparative analysis. A more extensive exploration of emerging electronic signature technologies could have enriched the content. "Forensic Examination of Electronic Signatures" is a valuable resource that significantly contributes to understanding digital forensics.

¹ Sanjeev Kumar & Deeksha, "Use of Scientific and Modern Techniques in Forensic Science and Their Utility in Criminal Justice System: An Indian Perspective" 4 *Career Point University, Hamirpur* 2456 (2020).

² Shubhi Mack & Dr. Ishita Chatterjee, "Role of Forensic Evidence in Criminal Justice Delivery System in India" 8 *Nat. Volatiles & Essent. Oils* 5765-5770 (2021), available at <https://www.nveo.org/index.php/journal/article/download/1239/1084/1265> (last visited on 5 March 2025).

³ Priya Sharma, Mohinder Singh & Om Prakash Jasuja, "Forensic Examination of Electronic Signatures: A Comparative Study" *Forensic Science Journal* (2021).

Dipo Dunsin et al. (2022)⁴ state that Digital investigators often have difficulty spotting evidence in digital information. It has become hard to determine which source of proof relates to a specific investigation. A growing concern is that the various processes, technology, and specific procedures used in the digital investigation are not keeping up with criminal developments. Therefore, criminals are taking advantage of these weaknesses to commit further crimes. Artificial intelligence (AI) is invaluable in identifying crime in digital forensics investigations. It has been observed that an algorithm based on AI is highly effective in detecting risks, preventing criminal activity, and forecasting illegal activity. "The Use of Artificial Intelligence in Digital Forensics and Incident Response (DFIR) in a Constrained Environment" is an interesting article that navigates the linking of cutting-edge technology and the demanding landscape of digital forensics and incident response (DFIR). With a focused lens on uneasy environments, the article explores how artificial intelligence (AI) revolutionizes how professionals tackle complex challenges. The author's accurate Analysis of real-world scenarios highlights AI's role in optimizing resource allocation and streamlining investigations. Here, the author addresses Digital forensics, Artificial intelligence, Artificial superintelligence, Limited memory, Optimisation, Machine learning, Supervised learning, Deep learning, Research methodology, The proposed DFIR framework, Implementation and testing, FTK integrity checks, Results, and discussion. This article serves as an alert for professionals seeking innovative ways to enhance their DFIR capabilities, showcasing the power of AI in uncovering insights from numerous data sets. Its comprehensive approach and insightful case studies make it an indispensable guide to understanding and harnessing AI's prowess within constrained DFIR environments.

According to **Ayush Kumar Verma and Krishnan Ramanathan (2022)**⁵ "Data Privacy Preservation in Digital Forensics Investigation" is an illuminating article that navigates the complex intersection of digital forensics and data privacy concerns. In a digital forensic investigation, the investigators extract evidence from different types of digital media. However, the extraction method unlocks the way for digital forensic investigators to infringe on the individual's privacy. To detect fraud, an investigator collects and analyses the digital evidence connected to the scam that has taken place and presents it in court to prove a conviction. The authors adeptly divide digital forensics' ethical and legal dimensions, growing the importance of respecting individual privacy rights while extracting essential evidence. With an accurate exploration of current techniques, tools, and methodologies, the article provides invaluable insights into the delicate balance that investigators must strike. Moreover, the article underscores the significance of encryption and anonymization in preserving data privacy throughout the forensic process. Real-world case studies further illustrate the practical application of these principles, highlighting their role in maintaining the integrity of investigations while upholding privacy rights. In an era where data breaches and privacy concerns flourish, this article serves as a timely resource for professionals in the digital forensics field, legal experts, and policymakers. It supports the approach that safeguarding privacy need not come at the cost of practical investigations, emphasizing the importance of ethical practices and the responsible use of technology in pursuing justice. In doing so, it offers a thoughtful roadmap for a more privacy-conscious future in digital forensics.

Thakare V et al. (2023)⁶ reported Forensic Science Laboratories deal with many cases under various acts, including murder, accidents, poisoning, cheating, rape, paternity, illicit liquor, ballistics, cybercrime, and many more. The authors describe the Environment Protection Act (E.P. Act), enacted in 1986 to protect and improve the environment. The primary role of forensic science laboratories is to assist the judicial system with examining physical, chemical, and biological evidence. The examination reports generated by forensic experts help punish criminals involved in many criminal cases. Besides the social cases, criminal acts related to environmental issues are now considered. Hence, keeping this point in mind, the National Green Tribunal (NGT) has taken different actions to control activities that are harmful to the environment in India.

Role and Importance of DNA Evidence in Criminal Trials

Forensic evidence plays a crucial role in disproving criminal allegations against an accused individual. This type of evidence is indispensable when analysing significant case studies. When forensic evidence is introduced in court, it is highly influential, often leading to a verdict in favour of the defendant due to its scientific nature, which is resistant to tampering and alteration, unlike other forms of physical evidence. Under Bharatiya Sakshya (Second) Bill, 2023⁷. The court may rely on expert opinions on foreign law, science, art, fingerprints, handwriting, or identification. With specialized knowledge, these experts provide insights based on their research rather than firsthand accounts of the crime. Although they are not direct witnesses, their expertise is

⁴ Dipo Dunsin, Mohamed C. Ghanem & Karim Ouazzane, *The Use of Artificial Intelligence in Digital Forensics and Incident Response (DFIR) in a Constrained Environment*, held on (August 2022).

⁵ Ayush Verma & Krishnan Ramanathan, *Data Privacy Preservation in Digital Forensics Investigation*, AIP Conference Proceedings, held on (2022), available at <https://doi.org/10.1063/5.0109813> (last visited on 5 March 2025).

⁶ Thakare V., Phadke R., Kapgate K., Kohpare J. & Pande A., *Forensic Science Analysis as an Emerging New Dimension of Environmental Issues*, Regional Forensic Science Laboratory, Dhantoli, Nagpur, India, held on (2 May 2023), available at <https://juniperpublishers.com/jfsci/pdf/JFSCI.MS.ID.555960.pdf> (last visited on 5 March 2025).

⁷ Bharatiya Sakshya (Second) Bill, 2023

considered vital. The court heavily depends on these expert opinions, as they offer valuable guidance from their extensive experience and knowledge in their respective fields.

The Narco analysis test does not hold evidentiary value in courts. However, it has recently been utilized as an investigative tool. The Supreme Court, in the case of *Selvi & others vs. State of Karnataka & Anr*,⁸ ruled that Narco analysis tests should not be conducted without the accused's consent, as it violates Article 20(3) and Article 21 of the Criminal Procedure Code. In the case of *Machindra v. Sajjan Galfa Rankhamb and Others*.⁹ The court examined the medical evidence and determined that forensic evidence plays a crucial role in criminal cases involving offenses against the human body. The court also identified instances where medical evidence holds no value and is not useful to the court.

Definition of Evidence

Evidence is a form of material or information presented in court to support or challenge an argument during a legal proceeding. It is utilized to establish facts and facilitate the judicial process. Evidence encompasses many items such as documents, fingerprints, DNA test results, witness testimonies, photographs, and CCTV footage. These items are collectively referred to as evidence and play a crucial role in the judicial system. However, statements made by legal practitioners, such as lawyers, are not considered evidence. Additionally, lawyers cannot serve as witnesses in cases they are representing. The arguments made by legal practitioners aim to interpret and contextualize the evidence presented, but these arguments themselves do not constitute evidence. The Bharatiya Sakshya (Second) Bill, 2023, provides a comprehensive legal framework for understanding what constitutes evidence¹⁰. This Act is more than just a piece of legislation; it forms the backbone of the evidentiary legal system in India, outlining the rules and guidelines for the admissibility and evaluation of evidence in court. Section 3 of the Bill states that only relevant facts can be presented as evidence in court. A fact in issue is any fact that determines the existence, nature, or extent of a claim, liability, or disability involved in the legal proceedings. DNA evidence is crucial in criminal trials as it directly connects the accused to the crime scene. For instance, DNA found on a weapon or a victim's clothing can establish the perpetrator's identity, making it relevant. The section also emphasizes that evidence cannot be presented if it contradicts any other law in force, such as provisions under Civil Procedure. Therefore, while DNA evidence is vital in proving the facts, its admissibility must align with all existing legal frameworks and safeguards governing evidence presentation. This ensures that only legally permissible evidence is considered in court.

Forensic evidence, also known as scientific evidence, is derived from scientific methods and procedures. This type of evidence is obtained through observations, experiments, and analysis conducted by forensic experts. Common examples of forensic evidence include fingerprints, DNA test results, blood samples, and other scientific analyses. Forensic evidence is critical in modern legal proceedings as it provides objective and reliable information that can corroborate or refute claims made in court. The rigorous scientific processes in obtaining forensic evidence ensure its accuracy and reliability, making it a powerful tool in pursuing justice.

Types of Forensic Evidence and Their Admissibility

DNA Evidence

DNA evidence is one of the most powerful tools in forensic science due to its high accuracy in identifying individuals. DNA profiling involves analysing genetic material to create a profile that can be matched with samples collected from a crime scene or other sources.

Legal Precedents:

- **State of Maharashtra v. Prakash Mangal Gopal (1994)**¹¹: This landmark judgment acknowledged the reliability of DNA profiling in forensic investigations. The court recognized that DNA evidence could provide conclusive results regarding the identity of individuals involved in criminal activities.
- **Gautam Kundu v. State of West Bengal (1993)**¹²: In this case, the Supreme Court of India held that DNA evidence could be used to ascertain the paternity of a child. The court emphasized the scientific accuracy and reliability of DNA testing, making it a critical tool in legal disputes involving paternity and identity.

DNA evidence has gained widespread acceptance in Indian courts due to its high degree of accuracy and reliability. Landmark judgments such as *State of Maharashtra v. Prakash Mangal Gopal (1994)* and *Gautam Kundu v. State of West Bengal (1993)* have recognized the value of DNA profiling in criminal investigations and paternity disputes. The admissibility of DNA evidence depends on the strict adherence to scientific protocols, the qualifications of the expert, and the maintenance of a clear chain of custody.

⁸ Selvi & others vs. State of Karnataka & Anr, (2010) 7 SCC 263

⁹ Machindra v. Sajjan Galfa Rankhamb and Others, (2017) 13 SCC 491.

¹⁰ Bharatiya Sakshya (Second) Bill, 2023, S.3.

¹¹ State of Maharashtra v. Prakash Mangal Gopal, AIR 1994 SC 1599

¹² Gautam Kundu v. State of West Bengal (1993)

Fingerprint Analysis

Fingerprint analysis is a well-established forensic technique used to identify individuals based on the unique patterns of their fingerprints. This method has been a cornerstone of forensic science for over a century.

Legal Precedents:

- **State of Madhya Pradesh v. Sukhdev Singh (1992)**¹³: The Supreme Court upheld the admissibility of fingerprint evidence provided by a qualified expert. The court emphasized the reliability of fingerprint analysis in criminal investigations.

Fingerprint analysis remains a cornerstone of forensic science, with its admissibility well established under Section 45 of the Bharatiya Sakshya (Second) Bill, 2023 (Nagarik). The Supreme Court's decision in *State of Madhya Pradesh v. Sukhdev Singh (1992)* affirmed the reliability of fingerprint evidence, provided it is collected and analyzed by qualified experts following established protocols.

Handwriting Analysis

Handwriting analysis involves examining the unique characteristics of an individual's handwriting to verify the authenticity of documents and identify forgeries. This type of forensic evidence is frequently used in cases involving disputed signatures and handwritten documents.

Legal Precedents:

- (Nagarik) **Bharatiya Sakshya (Second) Bill, 2023, Section 73**¹⁴: This section allows the court to direct any person to write any words or figures for the purpose of comparing the disputed handwriting with the admitted handwriting.
- **State (Delhi Administration) v. Pali Ram (1979)**¹⁵: The Supreme Court emphasized the admissibility of handwriting evidence, provided the expert is competent and the analysis is thorough. The court recognized the importance of a detailed and systematic examination of handwriting characteristics.

Handwriting analysis is a crucial tool in verifying the authenticity of documents and detecting forgeries. Section 73 of the Bharatiya Sakshya (Second) Bill, 2023 (Nagarik) allows courts to direct handwriting comparisons, and the Supreme Court's ruling in *State (Delhi Administration) v. Pali Ram (1979)* emphasized the importance of expert competence and thorough analysis in the admissibility of handwriting evidence.

Ballistics

Ballistics is the science of projectiles and firearms, which involves analyzing bullets, cartridge cases, and firearms to determine their characteristics and match them to a specific weapon.

Legal Precedents:

- (Nagarik) **Bharatiya Sakshya (Second) Bill, 2023, Section 45**: This section includes expert opinion on ballistics, recognizing the specialized knowledge required to analyze firearm-related evidence.
- **Hanumant Govind Nargundkar v. State of Madhya Pradesh (1952)**¹⁶: The Supreme Court considered ballistic evidence significant in establishing the guilt of the accused. The court highlighted the importance of expert testimony in explaining the technical aspects of ballistics.

Ballistics, the science of projectiles and firearms, plays a vital role in cases involving firearms. Section 45 of the Bharatiya Sakshya (Second) Bill, 2023 (Nagarik) includes expert opinions on ballistics, and the Supreme Court's decision in *Hanumant Govind Nargundkar v. State of Madhya Pradesh (1952)* highlighted the significance of ballistic evidence in establishing guilt. The admissibility of ballistic evidence relies on the qualifications of the expert and the scientific validity of the methods used.

Digital and Electronic Evidence

With the rapid advancement of technology, digital and electronic evidence has become increasingly important in legal proceedings. This type of evidence includes data from computers, smartphones, and other electronic devices.

Legal Precedents:

- **Information Technology Act, 2000**: This Act provides the legal framework for the admissibility of electronic evidence, including provisions for digital signatures and electronic records.

¹³ *State of Madhya Pradesh v. Sukhdev Singh (1992)*

¹⁴ Bharatiya Sakshya (Second) Bill, 2023, S.73

¹⁵ *State (Delhi Administration) v. Pali Ram (1979)*

¹⁶ *Hanumant Govind Nargundkar v. State of Madhya Pradesh (1952)*

- **Bharatiya Sakshya (Second) Bill, 2023, Sections 61¹⁷ and 63¹⁸:** These sections specifically address the admissibility of electronic evidence and the role of expert opinions in evaluating such evidence.
- **Anvar P.V. v. P.K. Basheer (2014)¹⁹:** This landmark case clarified the conditions under which electronic evidence can be admitted in court. The Supreme Court emphasized the need for proper certification under Section 65B of the Indian Evidence Act²⁰, which requires electronic evidence to be accompanied by a certificate identifying the device and explaining the process used to produce the evidence.

With the increasing reliance on technology, digital and electronic evidence has become essential in legal proceedings. The Information Technology Act, 2000, along with Sections 61 and 63 of the Bharatiya Sakshya (Second) Bill, 2023, provides the legal framework for the admissibility of electronic evidence. The Supreme Court's ruling in *Anvar P.V. v. P.K. Basheer (2014)* clarified the conditions for admitting electronic evidence, emphasizing the need for proper certification and documentation to establish authenticity and integrity.

Section 61 of the BSB2 states that electronic records will be treated with the same legal effect, validity, and enforceability as physical documents. It removes any previous concerns about the admissibility of digital or electronic records merely due to their format. This is a critical provision for criminal trials involving DNA evidence because DNA test results and forensic reports are increasingly stored in digital formats, such as smartphones, computers, or cloud storage systems²¹. The BSB2 ensures that such electronic records, when produced following the prescribed protocols, hold the same legal weight as traditional paper documents. In essence, DNA results processed and stored electronically are no longer treated as secondary evidence but as primary evidence, ensuring they are admissible in court.

Section 63 outlines the process and conditions under which electronic records, such as DNA test results stored digitally, can be presented in court as primary evidence. This section is particularly relevant to forensic DNA evidence that is electronically stored in optical or magnetic media, semiconductor memory, or other digital forms. The section establishes that computer outputs, including DNA test reports, shall be deemed as documents under specific conditions²². The conditions for this admissibility include:

1. **Regular Creation of Data:** The electronic record must have been created during the regular use of the computer or communication device over the period the data was processed for criminal investigations or forensic activities. For example, if DNA test results were routinely processed or recorded using a computer or communication device for investigative purposes, it meets the first condition.
2. **Reliability of the Device:** The computer or communication device must have been functioning properly throughout the period when the data was recorded or processed. If a device was malfunctioning, it could potentially affect the accuracy of the DNA test results stored on it, and such evidence might be contested in court.
3. **Consistency in Data Input:** Information such as DNA data must have been regularly fed into the device during the period of activity. This ensures the continuity and consistency of the data, especially in DNA testing, which requires precision and standardization in sample handling and analysis.
4. **No Disruption in Processing:** The section stipulates that the computer device or communication device used to process the DNA data must not have had disruptions that could compromise the accuracy of the information contained in the record. In case of equipment failure or malfunctions, the reliability of the DNA evidence may be questioned.

Section 64 emphasizes the need for proper certification when electronic records (such as DNA test reports) are presented in court²³. The certificate must identify the electronic record containing the statement and explain how it was produced, provide details of the devices used in producing the electronic record, confirming that the record was generated from a computer or communication device and ensure that the record complies with the conditions outlined in Section 63 regarding its creation, storage, and accuracy. The certification process enhances the credibility of electronic DNA evidence, ensuring that it was properly handled and not tampered with. This procedure is designed to provide safeguards against manipulation or contamination of digital records, a concern particularly pertinent to DNA evidence, which can be vulnerable to tampering during storage or handling.

Role of DNA Evidence under Bharatiya Nagarik Suraksha (Second) Sanhita, 2023

The Bharatiya Nagarik Suraksha (Second) Sanhita, 2023, is relevant to DNA evidence collection and its admissibility during criminal trials, especially in sexual offenses, violent crimes, and terrorism-related cases.

¹⁷ Bharatiya Sakshya (Second) Bill, 2023, S.61

¹⁸ Bharatiya Sakshya (Second) Bill, 2023, S.63

¹⁹ *Anvar P.V. v. P.K. Basheer* (2014)

²⁰ Indian Evidence Act, 1872 S.65B

²¹ Bharatiya Sakshya (Second) Bill, 2023, S.61

²² Bharatiya Sakshya (Second) Bill, 2023, S.63

²³ Bharatiya Sakshya (Second) Bill, 2023, S.64

DNA evidence's role in confirming a suspect's identity and linking the accused to a crime scene is vital in ensuring justice.

Section 35 grants police officers the authority to arrest individuals suspected of committing cognizable offenses²⁴. In cases involving serious crimes such as sexual assault or murder, DNA profiling can be crucial in establishing a link between the accused and the crime scene. During the arrest, biological samples such as semen, hair, and blood may be collected for forensic analysis, helping to confirm the accused's involvement in the offense. DNA evidence obtained at this stage is fundamental in strengthening the prosecution's case or challenging the defense's claims.

Section 36 requires police officers to inform the arrested individual of their rights, including the right to legal representation and the right for a relative or friend to be notified of their arrest²⁵. During the arrest or subsequent police interrogation, DNA samples can be taken from the accused. These samples can provide critical evidence that may support the police's version of events or help refute claims made by the accused. DNA evidence collected during this phase is vital for establishing the credibility of the investigation and the accuracy of the forensic analysis.

Section 37 mandates the creation of a police control room in every district and police station to maintain records of arrested individuals, including their names, charges, and custody status²⁶. This provision is important for ensuring the transparency and accountability of the arrest process. Furthermore, it is essential for safeguarding evidence, including DNA samples taken from arrested individuals. Proper documentation and storage of DNA evidence are crucial for its subsequent use in court.

Section 51 grants police officers the authority to request a medical examination of an arrested person if they believe that the examination could yield evidence of the commission of a crime²⁷. This is particularly significant in cases like rape, where biological evidence such as semen, hair samples, or blood may be found on the accused or the victim. The DNA profiling of such samples can provide definitive proof linking the accused to the crime. Forensic officers can compare the DNA profiles obtained from the accused with those collected from the victim or the crime scene to establish or rule out the accused's involvement in the offense.

Section 52 specifically addresses the examination of the accused in cases of rape or attempted rape²⁸. The inclusion of DNA profiling under this section is crucial in confirming or excluding the presence of the accused at the crime scene. In cases where physical evidence such as semen or blood stains is available, the DNA report prepared by the medical examiner must document the findings, including the DNA samples collected from the accused. These DNA reports play an essential role in linking the accused to the crime and ensuring the credibility of the forensic evidence presented in court.

Section 53 extends the medical examination procedures to all arrested individuals, not limited to those accused of sexual offenses²⁹. In all cases, the examination may include the collection of DNA samples such as sweat, blood, hair, and finger nail clippings, all of which can be used in comparison with DNA evidence found at crime scenes. The forensic analysis of these samples helps confirm or disprove the involvement of the arrested individual in the crime, strengthening the evidence base for criminal investigations and court trials.

Section 54 allows for a court order to be issued for the identification of the arrested person if DNA evidence is considered necessary for the investigation³⁰. This is especially important in cases of sexual assault, where DNA profiling can help identify the accused if the victim or witnesses are unable to do so. The identification process may involve DNA samples found at the scene or on the victim, which can then be matched with the DNA profile of the accused. This helps confirm the accused's involvement in the crime and ensures the proper identification of the suspect.

Section 54 also specifies that in cases where the identification involves a mentally or physically disabled person, the identification process must occur under the supervision of a Magistrate. The DNA identification process in such cases must be carried out in a manner that is comfortable for the person making the identification. This provision is essential for ensuring the accuracy and fairness of the identification process, particularly when DNA evidence is a key part of the investigation. The use of audio-video recordings further ensures transparency in the identification procedure, preserving the integrity of the process for use in legal proceedings.

Challenges in the Admissibility of Forensic Evidence

The role of forensic evidence in the legal system is undeniably pivotal, offering scientific analyses and objective data to support or refute claims in court. However, the admissibility of forensic evidence is fraught with

²⁴ Bharatiya Nyaya (Second) Sanhita, 2023, S.35

²⁵ Bharatiya Nyaya (Second) Sanhita, 2023, S.36

²⁶ Bharatiya Nyaya (Second) Sanhita, 2023, S.37

²⁷ Bharatiya Nyaya (Second) Sanhita, 2023, S.51

²⁸ Bharatiya Nyaya (Second) Sanhita, 2023, S.52

²⁹ Bharatiya Nyaya (Second) Sanhita, 2023, S.53

³⁰ Bharatiya Nyaya (Second) Sanhita, 2023, S.54

challenges that must be meticulously addressed to maintain the integrity of the judicial process³¹. These challenges include ensuring scientific reliability and validity, maintaining an unbroken chain of custody, vetting expert qualifications and biases, and enhancing judicial awareness and understanding of forensic science.

Scientific Reliability and Validity

Indian courts frequently rely on precedents and the expertise of forensic professionals to determine the scientific reliability of evidence. For example, in the landmark case of *State of Maharashtra v. Prakash Mangal Gopal* (1994), the Supreme Court of India recognized the reliability of DNA profiling, setting a precedent for its admissibility in subsequent cases. The court's decision underscored the importance of adhering to stringent scientific protocols to ensure the validity and reliability of forensic evidence.

Chain of Custody

Maintaining a clear and unbroken chain of custody is crucial for the admissibility of forensic evidence. The chain of custody refers to the documented process that records the seizure, custody, control, transfer, analysis, and disposition of physical or electronic evidence. Any break or discrepancy in this chain can cast doubt on the integrity and authenticity of the evidence, potentially rendering it inadmissible.

The Supreme Court of India has emphasized the importance of chain of custody in several rulings. In the case of *State of Rajasthan v. Daulat Ram* (1980)³², the Court highlighted that the prosecution must establish an unbroken chain of custody to prove that the evidence has not been tampered with or contaminated. The court ruled that any failure in maintaining the chain of custody could lead to the exclusion of the evidence from consideration.

Maintaining an unbroken chain of custody involves meticulous documentation at every stage, ensuring that each person who handles the evidence is accounted for and that the evidence remains in a secure and controlled environment. This process requires rigorous training for law enforcement and forensic personnel, as even minor lapses can compromise the entire evidentiary process.

Expert Qualification and Bias

The qualifications and credibility of forensic experts play a significant role in the admissibility of their testimony. Forensic experts must be thoroughly vetted to ensure they possess the necessary qualifications, experience, and impartiality to provide reliable and unbiased testimony. The case of *Ram Narain Singh v. State of Punjab* (1975)³³, dealt with the qualifications and credibility of forensic experts, emphasizing the need for impartiality and competence. The Supreme Court of India underscored that the expert's testimony must be based on scientific principles and free from any personal or professional biases that could influence the outcome of the case.

Ensuring the impartiality of forensic experts involves rigorous scrutiny of their professional backgrounds, affiliations, and prior testimonies. Courts must be vigilant in identifying potential conflicts of interest or biases that could undermine the integrity of the expert's testimony³⁴. Additionally, forensic experts should adhere to established codes of conduct and ethical standards to maintain their credibility and the trust of the judicial system.

Judicial Awareness and Understanding

The complexity of forensic science requires that judges have a certain level of understanding to effectively evaluate forensic evidence. Judges must be able to critically assess the scientific methods and principles underlying forensic evidence to determine its admissibility and relevance.

Judicial training programs on forensic science can significantly enhance judges' ability to make informed decisions. Recognizing the need for specialized training, the Indian judiciary has established judicial academies that focus on forensic science education. These programs provide judges with the knowledge and skills needed to understand complex scientific evidence, ask pertinent questions, and critically evaluate expert testimony.

For instance, the National Judicial Academy in Bhopal offers specialized courses and workshops on forensic science for judges, equipping them with the tools to navigate the intricacies of forensic evidence³⁵. Such training

³¹ Parvez, A., & Verma, S. (2021). Institutional problems in the Indian judicial system relating to admissibility of scientific evidence: Causes and remedies. *IP International Journal of Forensic Medicine and Toxicological Sciences*, 6(1), 43-46. <https://doi.org/10.18231/j.ijfmts.2021.011>

³² State of Rajasthan v. Daulat Ram, AIR 1980 SC 1314.

³³ Ram Narain Singh v. State of Punjab, AIR 1975 SC 1727

³⁴ Roman, J. K., Reid, S. E., & Reid, J. (2018). Forensic science evidence and the policing of crime: The case for a new conceptual framework for understanding the impact of forensic science evidence. *Criminology & Public Policy*, 17(2), 505-536.

³⁵ Shali, S. K. (2018). Applicability of forensic science in criminal justice system in India with special emphasis on crime scene investigation. *Medico-Legal Desire Media and Publications, Medico-Legal Reporter, Inaugural Issue, June 2018*. ISSN NO: 2347-3525.

programs are essential in bridging the gap between scientific advancements and legal standards, ensuring that judges are well-prepared to handle forensic evidence in court.

The admissibility of forensic evidence in Indian courts is a multifaceted challenge that requires careful consideration of scientific reliability and validity, chain of custody, expert qualification and bias, and judicial awareness and understanding³⁶. Addressing these challenges is essential to maintaining the integrity and reliability of the judicial process.

- **Scientific Reliability and Validity:** Ensuring that forensic techniques are scientifically valid and reliably applied is crucial. Indian courts rely on precedents and expert testimony to assess the scientific basis of forensic evidence, drawing on principles similar to the Frye Test and Daubert Standard.
- **Chain of Custody:** Maintaining an unbroken chain of custody is vital to preserving the integrity and authenticity of forensic evidence. Proper documentation and secure handling of evidence at every stage are necessary to prevent tampering and contamination.
- **Expert Qualification and Bias:** The qualifications and impartiality of forensic experts are critical to the credibility of their testimony. Courts must rigorously vet experts to ensure they possess the necessary expertise and are free from biases that could influence their opinions.
- **Judicial Awareness and Understanding:** Enhancing judges' understanding of forensic science through specialized training programs is essential. Judicial academies and educational initiatives play a pivotal role in equipping judges with the knowledge needed to evaluate complex scientific evidence effectively.

Findings of the Study

The study on the role of forensic science in DNA profiling, specifically in Karnataka, India, reveals significant insights into the role of DNA evidence in criminal justice. These findings focus on the reliability, admissibility, and legal implications of DNA evidence, with an emphasis on technical, ethical, and procedural challenges. By analyzing the evolving forensic landscape, the study highlights the implications of recent legislative developments in DNA profiling and its transformative effect on the criminal justice system.

Role and Importance of DNA Evidence in Criminal Trials: Admissibility, Reliability, and Judicial Impact

One of the key findings of the study is the increasing reliance on DNA evidence in criminal trials, particularly in Karnataka. The judiciary recognizes DNA profiling's scientific accuracy and its ability to establish an individual's identity beyond reasonable doubt. Courts in Karnataka, especially in cases of homicide, sexual assault, and missing persons, have acknowledged the pivotal role of DNA evidence in corroborating other forensic and circumstantial evidence. However, the admissibility of DNA evidence is contingent on strict procedural safeguards, including the proper chain of custody, forensic expert testimony, and corroborative evidence. These safeguards ensure that DNA evidence does not stand alone but rather complements other investigative findings.

Admissibility of DNA Evidence

The study confirms that the legal framework surrounding the admissibility of DNA evidence has evolved in response to recent legal reforms, particularly the Bharatiya Nagarik Suraksha (Second) Sanhita, 2023 and the Bharatiya Sakshya (Second) Bill, 2023. These reforms reinforce the requirement for rigorous protocols to be followed in the collection and handling of DNA evidence. The study also highlights the consistent judicial challenges DNA evidence faces in terms of sample integrity, with defense lawyers often questioning the possibility of contamination or mishandling of samples.

Reliability of DNA Evidence

DNA evidence is highly reliable when analyzed under standardized conditions, but the study identifies persistent challenges in its application. Inconsistent lab results due to degraded DNA samples, human error, and the misinterpretation of statistical probabilities remain significant obstacles. Judicial caution in interpreting DNA evidence, particularly in low-template DNA cases, highlights the balance courts must maintain between forensic evidence and other forms of proof, such as eyewitness testimony.

Impact on Judicial Outcomes

DNA profiling has significantly influenced criminal adjudication in Karnataka, with findings indicating: Higher conviction rates in cases where DNA evidence corroborates other investigative findings; Increased exonerations, especially for those wrongfully accused, underscoring DNA's role in ensuring justice; a reduction in the reliance on flawed eyewitness testimony, which has been historically prone to errors. However, inconsistent use and understanding of DNA evidence, especially in rural districts, suggest that further training and standardization are required for equitable application across the judicial system.

³⁶ Zapf, P. A., & Dror, I. E. (2017). Understanding and mitigating bias in forensic evaluation: Lessons from forensic science. *International Journal of Forensic Mental Health*, 16(3), 227-238.

Suggestions

The study recommended the following:

- **Enactment of a Comprehensive DNA Law:** India should introduce a comprehensive legal framework governing DNA profiling, including clear guidelines on collection, storage, use, and destruction of DNA samples. The DNA Technology (Use and Application) Regulation Bill, which has been under discussion for years, must be enacted with necessary safeguards to prevent misuse and ensure ethical use of forensic DNA evidence.
- **Establishment of a National DNA Database with Strong Privacy Protections:** A centralized DNA database can significantly aid criminal investigations, but it must be governed by strict privacy laws. The legal system should ensure that DNA data is stored securely, access is restricted to authorized personnel, and individuals have the right to request the removal of their DNA data if acquitted or found innocent.
- **Judicial Training in Forensic Science:** Judges and legal practitioners should receive specialized training in DNA profiling and forensic science to enhance their understanding of forensic evidence. This would help courts accurately assess DNA evidence, prevent misinterpretation, and ensure its appropriate use in judicial proceedings.
- **Mandatory Accreditation for Forensic Laboratories:** All forensic laboratories handling DNA profiling should be mandatorily accredited by a national regulatory authority to ensure standardized procedures, quality control, and accuracy in forensic testing. This will minimize wrongful convictions due to forensic errors and improve the credibility of forensic evidence in courts.

Conclusion

The study provides a comprehensive understanding of the role of DNA profiling in the Indian criminal justice system, particularly within Karnataka. The research highlights that DNA profiling has become an indispensable forensic tool that aids in criminal investigations, ensuring accurate identification of suspects, exoneration of the wrongfully accused, and strengthening of judicial outcomes. However, despite its scientific accuracy and evidentiary strength, DNA profiling in Karnataka still faces challenges related to infrastructure, legal admissibility, ethical concerns, and public perception. The findings of this study underscore the urgent need for legal and procedural reforms, the expansion of forensic capabilities, and a greater understanding of DNA evidence among legal professionals and law enforcement agencies.

One of the key takeaways from this research is the growing acceptance of DNA profiling as admissible evidence in criminal trials. Courts in Karnataka, in alignment with broader Indian judicial practices, have increasingly relied on DNA evidence in cases of sexual assault, homicide, paternity disputes, and missing persons investigations. DNA profiling has significantly improved conviction rates and played a crucial role in exonerating individuals who were wrongfully accused. However, while higher courts have largely acknowledged the reliability of DNA-based evidence, inconsistencies remain in its interpretation, particularly in lower courts, where forensic awareness and technical expertise among legal professionals remain limited.

The study also identifies significant technical and procedural challenges associated with DNA profiling in Karnataka. A primary concern is the limited forensic infrastructure, with forensic labs facing severe case backlogs, delays in processing, and a shortage of trained DNA analysts. These issues hinder timely justice delivery and can lead to misinterpretations of forensic findings, thereby affecting judicial decisions. Additionally, errors in DNA sample collection, preservation, and analysis have raised concerns about the integrity and reliability of forensic DNA evidence. Ensuring standardized forensic protocols and investing in forensic training programs for law enforcement and forensic experts is critical to mitigating these challenges.

BIBLIOGRAPHY

Laws and Acts

1. Bharatiya Sakshya (Second) Bill, 2023
2. Bharatiya Nyaya (Second) Sanhita, 2023
3. Indian Evidence Act, 1872

Online Research Journals and Blogs

1. Parvez, A., & Verma, S. (2021). *Institutional problems in the Indian judicial system relating to admissibility of scientific evidence: Causes and remedies*. IP International Journal of Forensic Medicine and Toxicological Sciences, 6(1), 43-46. <https://doi.org/10.18231/j.ijfmts.2021.011>
2. Sanjeev Kumar & Deeksha (2020). *Use of Scientific and Modern Techniques in Forensic Science and Their Utility in Criminal Justice System: An Indian Perspective*, Career Point University, Hamirpur.
3. Shubhi Mack & Dr. Ishita Chatterjee (2021). *Role of Forensic Evidence in Criminal Justice Delivery System in India*, Nat. Volatiles & Essent. Oils 8: 5765–5770. Link
4. Priya Sharma, Mohinder Singh & Om Prakash Jasuja (2021). *Forensic Examination of Electronic Signatures: A Comparative Study*, Forensic Science Journal.

5. Roman, J. K., Reid, S. E., & Reid, J. (2018). *Forensic science evidence and the policing of crime: The case for a new conceptual framework*, *Criminology & Public Policy*, 17(2), 505-536.
6. Zapf, P. A., & Dror, I. E. (2017). *Understanding and mitigating bias in forensic evaluation: Lessons from forensic science*, *International Journal of Forensic Mental Health*, 16(3), 227-238.
7. Shali, S. K. (2018). *Applicability of forensic science in criminal justice system in India with special emphasis on crime scene investigation*, *Medico-Legal Reporter*, Inaugural Issue.

Conference Proceedings

1. Dipo Dunsin, Mohamed C. Ghanem & Karim Ouazzane (2022). *The Use of Artificial Intelligence in Digital Forensics and Incident Response (DFIR) in a Constrained Environment*.
2. Ayush Verma & Krishnan Ramanathan (2022). *Data Privacy Preservation in Digital Forensics Investigation*, AIP Conference Proceedings. <https://doi.org/10.1063/5.0109813>
3. Thakare V. et al. (2023). *Forensic Science Analysis as an Emerging New Dimension of Environmental Issues*, Regional Forensic Science Laboratory, Nagpur. PDF

Case Law

1. Selvi & others vs. State of Karnataka & Anr, (2010) 7 SCC 263
2. Machindra v. Sajjan Galfa Rankhamb and Others, (2017) 13 SCC 491
3. State of Maharashtra v. Prakash Mangal Gopal, AIR 1994 SC 1599
4. Gautam Kundu v. State of West Bengal, (1993)
5. State of Madhya Pradesh v. Sukhdev Singh, (1992)
6. State (Delhi Administration) v. Pali Ram, (1979)
7. Hanumant Govind Nargundkar v. State of Madhya Pradesh, (1952)
8. Anvar P.V. v. P.K. Basheer, (2014)
9. State of Rajasthan v. Daulat Ram, AIR 1980 SC 1314
10. Ram Narain Singh v. State of Punjab, AIR 1975 SC 1727