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Scientific Error, Wrongful Convictions and Article 21: Rethinking the Right to a Fair Trial in India

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From ancient times to the present, forensic science has become an integral part of criminal cases in India, as courts rely on DNA profiling, ballistics, computer forensics, and other scientific methods to establish criminal liability. However, scientific reliability, proper evidence collection and preservation, and the objectivity of expert opinion may impact the evidentiary value of forensic evidence. Contamination, chain of custody violations, methodology flaws, cognitive biases, as well as inflated expert conclusions could even cause wrongful convictions. This article analyses the constitutional implications of forensic reliability with respect to Article 21 of the Constitution of India, which provides a guarantee of the 'Right to a fair trial.' It identifies the real absence of a thorough legal framework for evaluating forensic reliability. Using a doctrinal and analytical approach, this research examines the statutes, Supreme Court cases, and comparative approaches in relation to forensic reliability, and suggests measures that can effectively prevent wrongful convictions. It highlights that the forensic evidence originating from an accredited laboratory should not always be considered authoritative evidence unless its validity, integrity, interpretation, and evidentiary limitations are carefully examined. Incorporating the use of comparative analysis based on the Daubert Standard set in the United States, this article suggests a system of testing judicial reliability, quality-control and accreditation measures for labs, presentation of relevant forensic documents, independent oversight, and training of judges in this area. Finally, this article argues that strengthening all of these safeguards are necessary to avoid miscarriage of justice and for proper assessment of forensic evidence in conformity with the fundamental right, especially the right to a fair trial guaranteed by Article 21.

Keywords: *forensic evidence, wrongful conviction, article 21, fair trial, expert opinion.*

INTRODUCTION

The use of scientific methods and concepts to solve crimes and support legal experts in investigations is known as forensic science. The word 'forensic' originates from the Latin term 'forensis,' which means 'of or before the forum', and the term science has been derived from the Latin word 'scire,' which means 'to know.'[1] The genesis of the word forensic can be traced back to Roman times, where criminal proceedings were frequently heard in public forums, and conflicts were settled by the presentation of evidence. Although the origin of forensic science is still unrevealed, most historians believe that its origin can be traced back to the 6th century in China in a book titled 'Xi Yuan Lu,' or 'The Washing Away of Wrongs'. There, the writer Song Ci, who was also called the father of forensic science, established the methods for inspecting wounds and identifying reasons for death, as well as techniques for differentiating accidental fatalities from homicides.[2]

Gradually, the 19th century experienced significant progress in forensic techniques. Sir Francis Galton's pioneering studies on fingerprints validated their function as distinct personal identifiers. During that period, Alphonse Bertillon developed a technique for documenting physical measurements, establishing the groundwork for contemporary biometrics. Then, in the 20th century, Edmond Locard established the world's first official police crime lab in Lyon, France, creating the basic principle that 'Every contact leaves a trace.' Meanwhile, the groundbreaking discovery of DNA profiling by Sir Alex Jeffreys introduced genetic matching, which is an accurate pillar of modern evidentiary review.[3]

With the evolution and betterment of forensic science in the international arena, India also started to incorporate and keep pace with forensic science development in the world. Though Kautilya's Arthashastra provided detailed methods for detecting crime, tracking signs of

[1] Kavya Hemanth, Maithri Tharmavaram, and Gaurav Pandey, 'History of Forensic Science' in Deepak Rawtani and Chaudhery Mustansar Hussain (eds), *Technology in Forensic Science: Sampling, Analysis, Data and Regulations* (WILEY-VCH GmbH 2020)
[2] 'History and Development of Forensic Science' (*SIFS India*, 27 October 2024) <https://www.sifs.in/blog-details/history-of-forensic-science> accessed 11 September 2026
[3] 'The Evolution of Forensic Science in Solving Crimes' (*University of Greater Manchester,* 30 October 2023) <https://greatermanchester.ac.uk/blogs/the-evolution-of-forensic-science-in-solving-crimes> accessed 11 September 2026

poisoning, and examining unnatural deaths, India began to employ contemporary formal forensic science in 1849 with the founding of the Chemical Examiner's Laboratory in Madras.[4]

The ultimate objective of using forensic science in the criminal justice system is to provide justice. The shift from confession-centric, testimonial, and circumstantial evidence towards an empirical model of proof by using DNA profiling, ballistic comparison, digital forensics, handwriting identification, and, in a contested minority of cases, neuroscientific techniques such as polygraph examination and narcoanalysis shows the growing dependency of the Indian Judiciary on forensic evidence.[5] But what happens when the science relied upon by a criminal court is itself wrong, inadequately applied or insufficiently tested? The very scientific evidence that can provide fairness to a victim or can save an innocent accused person turns into a weapon against them. It violates the Constitutional guarantee of the 'Right to a fair trial', which was incorporated as one of the facets of Article 21 of the Constitution of India because a fair trial cannot be ensured solely by following set procedures if the evidence establishing guilt is scientifically flawed. This gravest failure not only undermines justice but also deprives an innocent person's liberty, damages their reputation, disrupts their family life, and weakens public confidence in legal institutions.[6]

The central argument of this article is that the constitutional guarantee of a fair trial requires courts to evaluate not only the legal admissibility of forensic evidence but also the reliability of its scientific foundation, how it is handled and how it is interpreted, in order to validate its use in criminal proceedings. This does not mean that every scientific mistake automatically invalidates a trial. Instead, courts must assess the kind of error, its effect on the evidence and its significance in proving guilt.

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[4] Saumitra Basu, 'Hundred Years of Forensic Science in India (1849–1947): A Historical Perspective' (2020) 55(1) Indian Journal of History of Science <https://insa.nic.in/writereaddata/UpLoadedFiles/IJHS/Vol55_1_2020__Art07.pdf> accessed 11 September 2026

[5] Rajneesh Kumar and Dr Gurminder Kaur, 'Scientific Integrity and the Right to Fair Trial: Reassessing the Admissibility of Forensic Evidence in Indian Criminal Trials' (2026) 1(3) International Journal of Current Academic Trends in Multidisciplinary <https://ijcatmjournal.com/uploads/articles/IJCATM2026136.pdf> accessed 11 September 2026

[6] Antima and Rajesh Hooda, 'DNA evidence and the crisis of wrongful convictions in India: a socio-legal critique of investigative and adjudicatory loopholes' (2026) 6(2) International Journal of Law, Justice and Jurisprudence <https://www.lawjournal.info/article/287/6-2-6-108.pdf> accessed 11 September 2026

RESEARCH METHODOLOGY

This article adopts a doctrinal and analytical research methodology, supplemented by a comparative legal approach. It examines primary sources such as the Constitution of India, relevant statutory provisions from the Bharatiya Sakshya Adhiniyam, 2023, and the Bharatiya Nagarik Suraksha Sanhita, 2023, and judicial decisions to assess the legal framework governing forensic evidence and its implications for the right to a fair trial. It also examines secondary sources such as scholarly articles, legal commentaries, and reports on forensic science. It further examines how contamination, chain-of-custody failures, methodological errors, and cognitive bias may contribute to wrongful convictions. A comparative analysis of the Daubert standard in the United States is undertaken to identify potential safeguards for evaluating scientific reliability. Based on these findings, the article proposes legal and institutional reforms to strengthen forensic accountability and protect the constitutional guarantee of a fair trial under Article 21.

Scientific Error in Forensic Evidence and its Contribution to Wrongful Conviction: The Supreme Court of India in ***Dharam Deo Yadav v State of U.P.***[7] has expounded the importance of Crime scene investigation and forensic evidence to reach a conclusion in a crime. The rationale behind this is that physical or biological traces are scientifically examined in forensic examination. Whereas oral evidence can be based on a person's memory, beliefs, emotions, perceptions, or account of an event. Its reliability always depends on the scientific, technical, human, and legal factors. Thus, the mere presence of scientific evidence does not make it automatically accurate.

Determining factors for the Reliability of Forensic Evidence:

- Scientific validity, as well as empirical research, testing, and scientific standards of forensic techniques.
- Appropriate procedures, equipment, and protective measures followed during the collection of evidence.
- Proper documentation of the identity, integrity, storage, sealing, and transfer of evidence must be adhered to, to avoid degradation of valuable evidence.

[7] *Dharam Deo Yadav v State of U P* (2014) SCC 509

- Accuracy of forensic report and quality control procedure opted while testing the forensic evidence in laboratory.
- Proper competency, appropriate training, impartiality, experience, and knowledge of the limitations of the scientific method by the forensic examiner.
- Valid statistical data to measure the possibility of error and the strength of evidence.
- Circumstances in which the forensic evidence is found and the way of interpretation of forensic findings.
- Transparency, availability for appropriate scrutiny and independent verification.[8]

If one of the factors affecting forensic evidence is compromised, the reliability of that evidence decreases. The scientific conclusion may become misleading and in worst scenario it can arbitrarily cause wrongful conviction and even death penalty for rearrest of rear case. Even though one compromised factor does not automatically render the whole forensic evidence inadmissible, because the impact of the defect in evidence depends upon the nature and seriousness of the disobedience of the determining factor.

As a result, there can be several kinds of forensic investigation and analysis mistakes such as:

Collection and Contamination Error: This kind of error can happen due to several reasons. It can occur when crime scenes are secured improperly without proper precautions, or it can also occur when law enforcement personnel or lab technicians handle them without following proper procedures. Other than that, if samples from different sources are mixed or improperly handled, then this kind of contamination can also happen. As a result, the analysis may not reliably establish the connection alleged by the prosecution.

Preservation Error: Biological samples need proper storage to prevent erosion and breakdown. If the samples are not properly stored, then this kind of error may happen, which reduces trust in the identity and integrity of the material being examined.

Chain of Custody Error: Collection, moving, storing, and handling of evidence are included in the chain of custody. Without proper documentation, the forensic evidence should not be

[8] V R Dinkar, 'Forensic scientific evidence: problems and pitfalls in India' (2015) 3(2) International Journal of Forensic Science & Pathology <https://doi.org/10.19070/2332-287X-1500020> accessed 11 September 2026

admissible in a court of law. Gaps in the chain of custody of forensic evidence can raise doubts about the collection and testing of it.

Methodological Error: This kind of error may arise when laboratories use nullified procedures, unsuitable techniques, or do not adequately document their analysis.

Cognitive Bias: An examiner who knows whom the police officers are suspecting may interpret forensic findings in a biased way that supports their specific suspicion. This goes against the fundamental idea of 'Innocent until proven guilty', which violates the constitutional right to a fair trial.

Overstating the Importance of Evidence: Law enforcement and prosecutors give greater importance to forensic evidence. Sometimes, they present probabilistic findings as a conclusive one. But their job is to unravel the truth rather than secure a conviction at any cost. Therefore, sometimes overreliance on forensic evidence may cause injustice to an accused person.

- **Interpretive Error:** Although forensic analysis is based on science and objective facts, it can sometimes be subjective. Incorrect conclusions may happen due to misinterpretation of forensic evidence.
- **Error from Lack of Experience:** Extensive education, training, and experience is a need in forensic analysis field. Otherwise, a lack of experience in forensic experts can cause mistakes in interpretation, or they can mishandle evidence, which can lead to a wrongful conviction.
- **Error from Improperly Calibrated Equipment:** To get accurate forensic results, lab equipment must be properly cleaned, maintained, and calibrated. In a lab environment, the details matter. Any deviation from proper practices may potentially invalidate evidence or analysis.[9]

Another serious concern in India is that the control of forensic labs is in the hands of law enforcement authorities. It often times create pressure on forensic personals for prompt result without following appropriate methodology, which may result in erroneous forensic result.

[9] 'Common Forensic Analysis Mistakes in Criminal Investigations' (*Michael Alarid*) <https://www.alariddefense.com/blog/common-forensic-analysis-mistakes-in-criminal-investigations> accessed 11 September 2026

With the passage of time, bite mark analysis, Footwear and Shoe Print Analysis, Hair Comparison, Firearm and Toolmark Identification and other methods of forensic science are becoming inadmissible or heavily restricted due to a lack of scientific validity, high error rates, or violation of constitutional rights.[10]

Moreover, Judges also have limited knowledge about forensic science, which may lead to erroneous interpretation of reports or overdependence on experts' forensic reports. So, these factors can contribute, either individually or collectively, to wrongful conviction. Without proper checks and balances, the very forensic evidence whose primary goal is to prevent miscarriage of justice becomes a tool to cause injustice.

ARTICLE 21 AND THE CONSTITUTIONAL RIGHT TO A FAIR TRIAL

According to Article 21 of the Constitution of India, "No person shall be deprived of his life or personal liberty except according to procedure established by law."[11]

It denotes that a person, whether they are a citizen or a non-citizen, their life and personal liberty should not be hindered by a member of the executive unless he can support his action with legal justification. It provides us both the right to life and the right to Personal liberty as fundamental rights. The Supreme Court of India calls it the heart of fundamental rights and the core of the Constitution, as other rights depend on it to be meaningful.

From *A.K. Gopalan*[12] to *Maneka Gandhi*[13], the judicial exploration has completed its trek from the north to the south pole.[14] Prior to Maneka Gandhi's decision, the right to life and personal liberty was guaranteed to citizens only for the arbitrary action of the state, not for the arbitrary action of the legislature. After Maneka Gandhi's decision, legislative actions are also included, against which citizens are guaranteed the right to life and personal liberty. So, the procedure established by law must be just, fair and reasonable.

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[10] 'The Impact of False or Misleading Forensic Evidence on Wrongful Convictions' (*The National Institute of Justice,* 28 November 2023) <https://nij.ojp.gov/topics/articles/impact-false-or-misleading-forensic-evidence-wrongful-convictions> accessed 11 September 2026

[11] The Constitution of India 1950, art 21

[12] *A K Gopalan v State of Madras* AIR 1950 SC 27

[13] *Maneka Gandhi v Union of India* (1978) 1 SCC 248

[14] D D Basu, *Introduction to THE CONSTITUTION of INDIA* (26th edn, Educational Printed 2022)

Following Maneka Gandhi's case, the Supreme Court of India held that the right to life includes the right to live with dignity, not mere animal existence or physical survival.[15] This contention was provided in ***Francis Coralie Mullin v Union Territory of Delhi***[16].

Article 21 is not a watertight compartment. It has been given the widest amplitude, covering a variety of rights which needed additional protection. The right to a fair trial is one of them. The right to a fair trial is a facet of natural justice, due process of law, and a fundamental component of the right to life and personal liberty guaranteed under Article 21 of the Constitution of India. It is the heart of the Constitution of India and an important facet of a democratic country that is governed by the Rule of Law.

In ***Hussainara Khatoon v Home Secretary, State of Bihar***[17], the Supreme Court emphasised the importance of effective criminal procedure and speedy trial in protecting individual liberty, which is one of the aspects of a fair Trial.

In ***Zahira Habibullah Sheikh and Ors v State of Gujarat and Ors***[18], the Supreme Court of India observed that denial of a fair trial is not only an injustice to the accused but also an injustice to the victim as well as society. The right to a fair trial is a fundamental protection to ensure that individuals are protected not only from arbitrary deprivation of their human rights and freedoms but also from the deprivation of the right to liberty and security of person. A fair trial includes a fair prosecutor, an unbiased judge and an atmosphere of judicial impartiality. It described a fair trial as one in which neither the prosecution nor the defence is handicapped, and in which the judge is an active participant in the search for truth rather than a passive umpire. Likewise, correct forensic evidence is essential for providing justice; otherwise, it can cause injustice to citizens as well as society at large.

The Supreme Court of India *in* ***Rattiram v State of Madhya Pradesh***[19] reaffirmed that fairness is the heart of criminal procedure. The accused must know the case against them and have a real chance to defend themselves. The denial of a fair trial is the crucifixion of human

[15] Dr J N Pandey, *CONSTITUTIONAL LAW OF INDIA* (63rd edn, Central Law Agency 2026)
[16] *Francis Coralie Mullin v The Administrator, Union Territory of Delhi & Ors* (1981) 1 SCC 608
[17] *Hussainara Khatoon & Ors v Home Secretary, State of Bihar, Patna* (1980) 1 SCC 98
[18] *Zahira Habibullah Sheikh and Anr v State of Gujarat and Ors* (2004) 4 SCC 158
[19] *Rattiram and Ors v State of M P Through Inspector of Police* (2012) 4 SCC 516

rights. Likewise, the same fairness cannot be preserved if there is scientific error in forensic evidence.

In ***Irfan @ Bhayu Mevati v State of Madhya Pradesh***[20]**,** the Supreme Court of India quashed a death sentence and ordered a de novo trial specifically because the trial court relied on a DNA report without calling the forensic experts to be cross-examined. The Supreme Court also stated that although expeditious disposal of criminal matters is a natural part of a fair trial, it should not be at the expense of the basic elements of fairness and the opportunity to the accused, on which the entire criminal administration of justice is founded.

In ***Nirmal Singh Kahlon v State of Punjab***[21], the court held that a fair trial includes a fair investigation, which is indispensable for the preservation of the fundamental rights of the accused as well as the victim. The same concept is also applicable to forensic investigation. A fair trial doesn't begin when the accused enters the court. It always begins before they enter the courtroom. If investigators collect only evidence that supports their existing suspicion, fail to preserve potentially exculpatory material or communicate contextual assumptions to forensic examiners, scientific evidence may become an instrument of confirmation rather than an independent means of testing the prosecution's case.

In ***Kali Ram v State of Himachal Pradesh***[22], the Supreme Court highlighted how important the presumption of innocence is. The presumption of innocence means a person is innocent until proven guilty and that reasonable doubt must help the accused. This idea is a basic part of the criminal justice system. Similarly, forensic evidence must be looked at while keeping this idea in mind. A DNA match, a fingerprint comparison, or a toxicological result should not be seen as proof unless we consider the limits of the test and how the evidence was taken.

Therefore, the fair-trial guarantee under the Indian Constitution extends to Fair Forensic evidence, which is becoming one of the most important decisive factors for conviction or Judgement.

Essential components of the fair trial guarantee bear directly on forensic evidence:

- The accused must be provided with the forensic material during the trial.

[20] *Irfan v State of Madhya Pradesh* (2025) LiveLaw (SC) 167
[21] *Nirmal Singh Kahlon v State of Punjab & Ors* (2009) 1 SCC 441
[22] *Kali Ram v State of Himachal Pradesh* (1973) 2 SCC 808

- The accused must be provided a reasonable opportunity to challenge the forensic material.
- The court should independently evaluate the evidentiary material rather than accepting the conclusions of an expert.
- The process to assess the forensic evidence must be a reliable one to justify the serious consequences that may follow, such as criminal conviction.
- The state must prove guilt beyond reasonable doubt using reliable scientific forensic evidence, rather than relying on flawed, fabricated, or unreliably handled forensic evidence.
- The accused must be given protection against coercive extraction of evidence from their body as guaranteed under Articles 20(3) and 21[23].

Nevertheless, where decisive forensic evidence is scientifically questionable, and the accused is denied an effective opportunity to challenge it, the resulting conviction raises a substantial constitutional concern. The constitutional framework treats error in forensic evidence as a defect in the procedure, which is a threat to liberty guaranteed under Article 21[24].

THE EVIDENTIARY FRAMEWORK AND JUDICIAL APPROACH TO FORENSIC EVIDENCE IN INDIA

Forensic evidence is given great importance under newly enacted criminal laws. Under Section 176(3) of the Bharatiya Nagarik Suraksha Sanhita,2023[25], the officer-in-charge of the police station is duty-bound to ensure that a forensic expert visits the crime scene to collect physical and scientific evidence for any offence punishable with 7 years or more of imprisonment.

Under the Bharatiya Sakshya Adhiniyam, 2023, Forensic evidence is dealt with under Section 39[26]. According to this section, 'When the Court has to form an opinion upon a point of foreign law or of science or art, or any other field, or as to identity of handwriting or finger impressions, the opinions upon that point of persons specially skilled in such foreign law,

[23] The Constitution of India 1950, arts 20(3) and 21
[24] The Constitution of India 1950, art 21
[25] Bharatiya Nagarik Suraksha Sanhita 2023, s 176(3)
[26] Bharatiya Sakshya Adhiniyam 2023, s 39

science or art, or any other field, or in questions as to identity of handwriting or finger impressions are relevant facts and such persons are called experts.'

In ***Bal Krishna Das Agrawal v Radha Devi and Ors***[27], an expert was defined as a person who, by his training and experience, has acquired the ability to express an opinion. It is a quality which an ordinary witness does not possess. The opinion of an expert is such evidence which is based on his expertise and experience.

The legislative intent behind this provision is that judicial competence does not extend to technical scientific matters, so there is a practical necessity for expert opinion and their specialised knowledge in judicial decision-making. However, relevance and reliability are completely different. Section 39 deals with the relevance of expert opinion. This does not mean every opinion given by an expert is reliable or accurate. The judiciary remains responsible for evaluating the reason behind the opinion, corroborative materials and the creation of a chain with other evidence. Therefore, the expert testimony should assist judicial reasoning, not replace it.

In ***State of H.P. v Jai Lal***[28], the Supreme Court of India clarified what expert evidence entails and why courts must judicially assess the reasoning given by an expert. An expert exists to help the court on issues that demand specialised knowledge, while the final evaluation stays with the judiciary. This principle matters especially when the scientific finding forms the core of the prosecution's case. A report ought not to be regarded as self-explanatory simply because a qualified professional has authored it.

Similarly, a forensic report cannot be deemed acceptable simply because a government laboratory has issued it. The court has a duty to scrutinise the type of examination conducted, the foundation of the conclusion, and how much the opinion helps in resolving the facts in dispute.

This section also made it clear that expert opinion is a relevant fact in a court of law but not conclusive proof. Indian courts also preserved its advisory nature, which needs corroborative evidence for meaningful conviction.

[27] *Bal Krishna Das Agrawal v Radha Devi and Ors* AIR (1989) All 133
[28] *State of HP v Jai Lal & Ors* (1999) 7 SCC 280

The Supreme Court, in the case of ***Murari Lal v State of Madhya Pradesh***[29], ruled that expert evidence typically needs corroboration and cannot be regarded as conclusive proof. Likewise, in ***Chennadi Jalapathi Reddy v Baddam Pratapa Reddy***[30], the Court held that expert testimony by itself is not enough to uphold a conviction.

Likewise, forensic evidence is one of the types of expert opinion, and it is a relevant fact for adjudicating a matter, but it is not a conclusive one. It also needs corroborative evidence to establish a complete chain of evidence.

The Supreme Court of India in ***Pattu Rajan v State of Tamil Nadu***[31] recognised the infallibility of DNA evidence and stated that its evidentiary weight must be assessed while taking into account the whole case. The circumstances in which evidence is obtained and presented are also important to establish the guilt.

The Supreme Court of India in ***Rahul v State of Delhi, Ministry of Home Affairs***[32], stated that the reliability of the method used in examination and its application by the expert must be properly examined by the court; otherwise, the DNA report should not be considered as conclusive evidence even though it may be issued by a proper forensic laboratory.

In ***Dharam Deo Yadav v State of Uttar Pradesh***[33], the Supreme Court emphasised that the evidentiary value of DNA evidence depends upon the quality-control and quality-assurance procedures of laboratories. It also recognised the need for protection against contamination during the collection, packing, transportation and handling of physical evidence.

The Supreme Court of India is gradually recognising the fact that forensic evidence, to be reliable for conviction or to pass final judgement, needs corroborative evidence, chain of custody, as well as quality procedures, so that they are not contaminated or fabricated. But in India, there is no single, unified statutory standard or specialised test like the Dubert standard in the United States, where five factors such as testability, peer review and publication, potential error rate existence and maintenance of standards and controls, and general acceptance are taken into account for scientifically evaluating the validity of forensic

[29] *Murari Lal S/O Ram Singh v State of Madhya Pradesh* (1980) 1 SCC 704
[30] *Chennadi Jalapathi Reddy v Baddam Pratapa Reddy (Dead) Thr LRs & Anr* (2019) 14 SCC 220
[31] *Pattu Rajan v State of Tamil Nadu* (2019) 4 SCC 771
[32] *Rahul v State of Delhi, Ministry of Home Affairs* (2023) 1 SCC 83
[33] *Dharam Deo Yadav v State of UP* (2014) 5 SCC 509

evidence. In the absence of a specialised statutory act for forensic science, the validity, chain of custody, and weight of forensic reports such as DNA, ballistics, or handwriting are shaped on a case-by-case basis through Supreme Court and High Court precedents. Greater reliance is given to the judiciary, which doesn't have a specified standard procedure. Without proper procedure, the forensic evidence may result in a violation of the right to a fair trial assured under Article 21 of the Constitution of India.

REFORMING THE INDIAN FRAMEWORK: A CONSTITUTIONAL AND INSTITUTIONAL APPROACH

The Bharatiya Sakshya Adhiniyam 2023 acknowledges expert opinion as a relevant fact, while the Indian Constitution protects fair investigation and trial. But both these legal frameworks don't provide a uniform and all-encompassing framework for evaluating forensic evidence. To make forensic evidence more reliable, avoid wrongful convictions, and to meet the right to a fair trial as guaranteed by Article 21 of the Indian Constitution, both the legal system and evidentiary law need amendment.

Indian courts have the competence and the responsibility to assess expert evidence. The suggestion here is not of a novel constitutional right, or of a new mechanism wholly substituting for the judicial function. It is a proposal for a systematic method for the judiciary to perform its existing functions transparently and predictably.

The following measures help to reform the current Indian framework to be suitable for constitutionally validated forensic evidence:

A Reliability Test for Admissibility: Courts should replace weaker admissibility rules with a structured approach like Daubert-style standards requiring proof of peer review, known error rates, and general scientific acceptance before a technique is used in court for evaluating disputed evidence. They should assess the following issues:

- Whether the scientific technique has been properly validated for the intended purpose.
- Whether the examiner has proper qualifications and training to examine forensic evidence.

- Whether the collection, preservation, processing and examination are as per the established procedure.
- Whether there is a disclosure of uncertainties, limitations, and possible alternative explanations of forensic evidence.
- Whether the conclusion is consistent with the rest of the evidence or not.

Forensic techniques that fail the test, such as bite mark analysis, should either be excluded or be limited to corroboration.

Strengthening Laboratory Accreditation and Professional Standards: The system of accreditation, quality control and assurance of forensic laboratories must be improved and strengthened through new legislative amendments and enactments. Accreditation requires audits, proficiency testing, standard operating procedures and adequate corrective action in cases of deficiencies. Professional standards would cover issues such as continuing education, conflict of interest, reporting practice and communication of uncertainty. In the case where the laboratory realises that it has made an error in a previous test, there should be a procedure for informing all the stakeholders. These measures would enable one to differentiate scientific problems from avoidable institutional problems.

Disclosure and Equality of Arms: The accused person must receive the forensic file along with the final certificate. That forensic file should contain data, bench notes, chain of custody, and any inconclusive or contrary results. If the accused cannot afford an expert, the State has a responsibility to provide an expert in such cases. Under section 329 of BNSS,2023, the certificates must be rebuttable in practice, not in theory, and courts should be ready to summon the examiner whenever requested.

Ensuring Independence and Confirmation Bias: Forensic practitioners should not be pressurised by prosecuting authorities while exercising their professional judgement. Predetermined investigative theories should not be the basis for scientific conclusions. Information about forensic conclusions should be limited to a specific person, so that there is no bias. Wherever appropriate, there should be an opportunity for independent verification, which will enhance the reliability of forensic evidence. Laboratories should record the information provided to the examiner and keep a record of the analysis process. This would

enable the court to determine whether the conclusion was obtained using a scientific method or not.

Chain of Custody, as a Rule of Law: Sealing, labelling, storage and transfer protocols should be statutory or judicially mandated. If these protocols are broken, there must be a presumption that the reliability is lost. This principle should become routine at trial.

Independent Oversight Commissions: An autonomous Forensic Science Commission should be created which must be free from police and prosecution control. The autonomous Forensic Science Commission should set its ethics codes, audit lab performance and this body should also investigate reports of faulty or falsified testing.

Preserving and Reviewing potentially Exculpatory Evidence: There must be a clear policy for investigators and labs to keep samples and materials that could help the defence. Necessary evidence should not be destroyed beforehand. Otherwise, this can hinder later verification in appeals or other proceedings.

A Statute on DNA that protects Privacy: DNA should be protected under privacy laws. A new law must set limits on how long DNA data can stay in a system, who can see it and how it can be used. The law must create a body that watches over DNA use. Justice K.S. Puttaswamy's proportionality test should guide the design of this law.

A Clear End to Coercive Pseudo-Science: ***Selvi v State of Karnataka***[34] already stops forced narco-analysis, polygraph and BEAP tests. Courts should not let evidence from these tests be used unless it is proven true by means. Police training must make it clear that the exception in section 27 does not give a pass for use. This will protect people from wrongful conviction.

An Institution to Review Claimed Miscarriages: Similar bodies like the Criminal Cases Review Commission in the United Kingdom or State Innocence Commissions in the United States could look into claims of innocence using forensic skills which cannot be single-handedly done by appellate courts.

A Compensatory and Accountability Statute: The Law Commission's 2018 proposals, building on Kishanbhai's case, should be enacted. Compensation should be an entitlement.

[34] *Selvi & Ors v State of Karnataka & Anr* (2010) 7 SCC 263

Misconduct or gross negligence findings should lead to disciplinary action, and where warranted, criminal consequences for investigating officers as well as forensic practitioners.

Judicial and Bar Training: Members of the Bar as well as the Bench need specialised training on forensic evidence evaluation, especially on statistical DNA interpretation, digital forensics and cognitive bias. They must have enough knowledge to differentiate between reliable evidence and exaggerated claims. These trainings should not be an optional one but it should be a core requirement. Training will help them to see the limits of testimony, understand basic probability and uncertainty, and know when more explanation is needed.

CONCLUSION

Forensic evidence plays an important role in the modern criminal justice system. By following a proper collection process, thorough verification, and scientific analysis, scientific evidence can become one of the strongest factors in crime investigation. This can eventually help in verifying the testimony and arriving at the truth. However, this kind of evidence can also create injustice because of technical exaggerations, contamination of the samples, insufficient validation of methodology, and the inability of the accused person to challenge expert analysis.

Article 21 provides the constitutional grounds for such issues to be taken care of. While the principle of fair procedure may not be equated with following the formal procedure of trial, when incorrect evidence may affect the outcome that deprives a person of his liberty, it is important to have the principles of fair investigation, presumption of innocence, and careful judicial review.

The Bharatiya Sakshya Adhiniyam,2023 and Bharatiya Nagarik Suraksha Sanhita,2023 provide an essential legislative base for the introduction of expert evidence, which includes forensic evidence and forensic investigation in criminal proceedings. It is very important to have complementary measures such as transparent forensic methods, appropriate laboratory standards, provision of scientific material, expert assistance, and judicial consideration of the reliability of the evidence.

It is not the contention that scientific evidence should not be given weight, but that scientific evidence be accorded weight proportional to its reliability. The fact that forensic evidence is

derived from an expert or a government laboratory does not necessarily give it a conclusive weight.

At the end of the day, the validity of the criminal justice system does not lie in the pretension of scientific certainty, but in the validity of the process used to establish the guilt of a person. To rethink Article 21 in the context of forensic error involves recognising the right of the accused to a fair trial and protection against being found guilty on the basis of scientifically unreliable evidence.