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Forensic Science and Indian Law: Navigating the Standards of Admissibility and Evidentiary Value of Scientific Evidences in Indian Jurisprudence

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ABSTRACT

This paper examines the standards governing the admissibility and evidentiary value of scientific evidence in Indian jurisprudence, with particular attention to the transition from the Indian Evidence Act, 1872 to the Bharatiya Sakshya Adhiniyam, 2023. It analyses the statutory framework for expert opinion under Sections 39, 40 and 44 of the Bharatiya Sakshya Adhiniyam and the special treatment of electronic evidence, observing that the statute, like its predecessor, is silent on the reliability of the underlying scientific technique. Surveying judicial pronouncements concerning DNA profiling, fingerprinting, ballistics, and contested techniques such as narco-analysis, polygraphy and brain-mapping, the paper traces the emergence of a sui generis judicial standard resting on relevancy, reliability and corroboration. Through a comparative assessment of the Frye and Daubert standards in the United States, it identifies persistent lacunae, including the risk of admitting unreliable science, the absence of structured judicial training, and the uneven quality of forensic infrastructure. The paper concludes by advocating the codification of a flexible reliability standard, systematic capacity-building for the judiciary and the Bar, and the strengthening of forensic institutions.

Keywords: *Forensic science, scientific evidence, Bharatiya Sakshya Adhiniyam 2023, admissibility, reliability, expert opinion, DNA profiling, narco-analysis, Daubert standard, corroboration.*

I. INTRODUCTION

The convergence of law and science is one of the most defining features of the modern justice delivery system. In an era in which traditional forms of evidence may be fallible or easily fabricated, scientific evidence offers an aura of objectivity and precision that is deeply appealing to the adjudicatory process. The ability of a DNA sample to link a suspect to a crime scene with

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astronomical certainty, or of a ballistic report to match a bullet to a specific firearm, can often prove determinative between conviction and acquittal. The Indian judiciary, like its counterparts worldwide, is increasingly confronted with a diverse array of forensic sciences, which compels it to grapple with complex questions of admissibility and evidentiary weight.

When Lord Macaulay drafted the Indian Evidence Act, 1872, he could scarcely have imagined that twenty-first century Indian courtrooms would be debating mitochondrial DNA, brain-fingerprinting, or metadata extracted from cloud servers. That colonial-era legislation governed evidentiary rules for over 150 years, creating tension between an outdated statutory text and rapidly evolving forensic technologies. The recent enactment of the Bharatiya Sakshya Adhiniyam, 2023 (BSA) marks a long-awaited legislative modernisation. While the BSA largely reproduces the evidentiary philosophy of the Indian Evidence Act, it expressly incorporates digital and electronic evidence, updates the definitional scope of documents, and streamlines the provisions concerning expert testimony, now codified in Section 39. In doing so, the BSA acknowledges that forensic science and digital technology are central to contemporary adjudication.¹

This statutory update does not, however, fully resolve the jurisprudential vacuum that has historically affected Indian law on scientific evidence. The central problem that animates this paper remains that India still lacks a codified, uniform and consistent gatekeeping standard for scientific evidence. Unlike the United States, which evolved from the general acceptance test of *Frye v. United States* to the more rigorous reliability framework articulated in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, the Indian approach continues to be amorphous, guided primarily by the broad principle of relevancy and by judicial discretion. This has produced a measure of ad hocism, in which the admissibility of novel scientific techniques often turns on the scientific acumen, caution or confidence of individual judges rather than on a predictable statutory standard.

Against this backdrop, this paper seeks to answer several questions. First, what is the existing statutory and judicial framework under the BSA governing the admissibility and appreciation of scientific evidence in India? Second, how have Indian courts interpreted and applied these provisions to different categories of scientific evidence, ranging from well-established disciplines such as DNA profiling and ballistics to contested techniques such as narco-analysis and brain-mapping? Third, how does India's pragmatic approach compare with the more structured standards prevalent in other common law jurisdictions, and what lessons may be

¹ Bharatiya Sakshya Adhiniyam, 2023, No. 47, Acts of Parliament, 2023 (India), § 39.

drawn for future reform? Finally, what systemic challenges, such as the threat of unreliable science, inadequate forensic infrastructure, and the absence of specialised judicial training, continue to undermine the reliability of forensic evidence in Indian courts?

This paper argues that the Indian judiciary, through a series of cautious and pragmatic decisions, has evolved an implicit functional standard that emphasises not only the relevance of scientific evidence but also its reliability, frequently requiring corroboration as a matter of prudence. While this judge-made framework is commendable, it cannot adequately substitute for a clear legislative mandate. The enactment of the Bharatiya Sakshya Adhiniyam represents a significant step toward modernisation; however, in the absence of a well-defined reliability threshold comparable to a Daubert-inspired model adapted to Indian conditions, concerns of inconsistency and unpredictability persist. Accordingly, this paper contends that India should adopt a codified yet flexible gatekeeping standard, reinforced by judicial training and institutional reform, to ensure that the integration of science and law under the BSA is both effective and just.

II. STATUTORY FRAMEWORK UNDER THE BHARATIYA SAKSHYA ADHINIYAM, 2023

A. Section 39 and the admissibility of expert opinion

Section 39 of the Bharatiya Sakshya Adhiniyam, 2023 governs the admissibility of expert opinions in Indian courts. It provides that when the court has to form an opinion upon a point of foreign law, of science or art, or as to the identity of handwriting or finger impressions, the opinions upon that point of persons specially skilled in such foreign law, science or art, or in questions as to the identity of handwriting or finger impressions, are relevant facts, and that such persons are called experts. This provision, substantially carried forward from Section 45 of the Indian Evidence Act, continues to form the statutory basis for admitting expert testimony. A plain reading of the section reveals two critical components.

The first concerns the scope of admissible subjects. The provision specifies that expert opinion may be admitted on matters of foreign law, science, art, or the identification of handwriting and finger impressions. The phrase science or art retains wide latitude, and Indian courts have interpreted it to encompass fields unknown to the drafters of the nineteenth-century Evidence Act. Disciplines such as DNA profiling, ballistic science, forensic toxicology, cyber-forensics, medical jurisprudence, psychiatry, and even emerging fields such as forensic accounting are therefore well within its ambit.

The second concerns the definition of an expert. Section 39 defines an expert as a person specially skilled in the relevant field. Importantly, the statute does not restrict expertise to holders of formal academic qualifications. The requisite skill may be acquired through professional practice, sustained observation, or systematic study. This flexible approach enables courts to recognise a range of expertise. A forensic scientist trained in DNA sequencing, a ballistics analyst from a government laboratory, or even a seasoned artisan with traditional knowledge may, for instance, qualify as an expert.

The Supreme Court has consistently emphasised that expertise is measured not merely by degrees, but by demonstrated knowledge and the reliability of methods. In *State of H.P. v. Jai Lal*,² the Court affirmed that an expert is one who possesses special knowledge, skill or experience in a science, art, trade or profession, and that such knowledge may be acquired through study, training or practical experience rather than only through formal education.

The adoption of Section 39 in the BSA demonstrates legislative continuity while signalling adaptability to contemporary challenges. By retaining the open-ended formulation of science or art, the law ensures that new forensic sciences, as they emerge, will naturally fall within the evidentiary framework without the need for constant statutory amendment. While Section 39 is the primary gateway for expert opinion, its operation is reinforced by ancillary provisions that ensure both contextual relevance and methodological transparency.

B. Section 40: facts supporting or contradicting expert opinion

Section 40 of the BSA, corresponding to Section 46 of the Indian Evidence Act, provides that facts which are not otherwise relevant may become relevant if they either support or contradict the opinion of experts.³ This enables courts to go beyond the mere assertion of an expert and to scrutinise the underlying data, methodology and scientific principles upon which the opinion rests. Where, for example, a DNA expert testifies to a match, Section 40 permits the introduction of evidence regarding the statistical probability of a coincidental match, the integrity of the chain of custody of biological samples, or scientific critiques of the particular testing protocol used. Similarly, in ballistics, evidence about the reliability of the firearm-testing procedure itself may be led to test the robustness of the expert's conclusion.

C. Section 44: grounds of expert opinion

Section 44 of the BSA, corresponding to Section 51 of the Indian Evidence Act, provides that whenever the opinion of any living person is relevant, the grounds on which that opinion is

² *State of H.P. v. Jai Lal*, AIR 1999 SC 3318 (India).

³ Bharatiya Sakshya Adhiniyam, 2023, No. 47, Acts of Parliament, 2023 (India), § 40.

based are also relevant.⁴ This provision is of critical importance because it requires an expert to furnish a reasoned opinion rather than a bare conclusion. The rationale and methodology underlying the opinion must be disclosed to enable the court to understand and evaluate the logic of the inference. It also empowers the opposing party to cross-examine the expert not only on the final result but also on the scientific process, the assumptions made, and the possible sources of error that informed the conclusion. The Supreme Court has consistently emphasised that an expert opinion bereft of reasoning carries little evidentiary weight.⁵

D. The silence of the statute on reliability

Together, Sections 39, 40 and 44 of the BSA establish a statutory framework for the admissibility and evaluation of expert testimony. This framework rests on two pillars: the relevance of the subject matter, which must pertain to science, art or specialised skill, and the qualification of the expert, who must be specially skilled in that field. However, as with the Indian Evidence Act, the BSA remains silent on a third and equally critical question, namely the reliability of the underlying scientific principle or technique itself. It does not prescribe that the science be generally accepted in the scientific community, nor does it require the disclosure of error rates or peer-reviewed validation as gatekeeping criteria.

This legislative silence continues to place the burden of scientific gatekeeping squarely upon the judiciary. Courts must determine, often on a case-by-case basis, whether a novel scientific technique meets minimum thresholds of reliability before it can be admitted as evidence. While this judicial discretion has the advantage of flexibility, it also creates unpredictability and risks the admission of untested or unreliable science in the absence of a codified reliability standard.

III. THE JUDICIAL GAUNTLET: FROM RELEVANCY TO RELIABILITY

In the absence of a codified reliability standard within the Bharatiya Sakshya Adhiniyam, 2023, Indian courts continue to evolve a sui generis framework for the admissibility and appreciation of scientific evidence. The BSA reproduces the structure of the Indian Evidence Act, 1872, under which Section 39 admits expert opinions, supported by Sections 40 and 44 that allow scrutiny of the underlying facts and reasoning. Yet the statute remains silent on the scientific validity of the methods themselves. This lacuna has compelled the judiciary to assume the role of gatekeeper, crafting a hybrid standard rooted in relevancy, reliability and corroboration.

⁴ *Id.* § 44.

⁵ *State of H.P. v. Jai Lal*, AIR 1999 SC 3318 (India).

A. *State of H.P. v. Jai Lal* and the nature of expert evidence

In *State of H.P. v. Jai Lal*, the Supreme Court laid down several foundational principles. The expert is not a witness of fact but one who aids the court in forming an opinion. Courts must not abdicate their judgment to the expert, for judicial scrutiny is paramount. The expert's credibility and the adequacy of the material relied upon must be established. Opinions must be reasoned, with the reasons and the methodology explicitly disclosed.⁶ This marked a doctrinal position under which expert testimony is not binding but only advisory evidence, to be weighed like any other. Courts must probe both the expert's qualifications and the methodological reliability of the evidence.

B. Reliability through process integrity

Subsequent jurisprudence has sharpened this focus on reliability. In *Tomaso Bruno v. State of U.P.*, the Court stressed that scientific evidence is not infallible and must be shown to have been collected and analysed through reliable and untampered processes.⁷ Similarly, in the digital sphere, *Anvar P.V. v. P.K. Basheer* recast electronic evidence law by requiring strict compliance with Section 65B certification, a principle reaffirmed in *Arjun Panditrao Khotkar v. Kailash Kushanrao Gorantyal*.⁸ The insistence on authentication reflects a broader judicial concern with the integrity of the process by which scientific evidence is generated.

In *P. Gopalkrishnan @ Dileep v. State of Kerala*,⁹ the Court further held that the accused must have access to the original digital materials relied upon by the prosecution, recognising that fair-trial rights are inseparably tied to the reliability of forensic processes. These decisions illustrate how the judiciary has increasingly moved toward an inquiry into process validity, echoing Daubert-like concerns with error rates, testing and transparency, albeit without formally codifying them.

C. An implicit tripartite standard

The emerging Indian standard under the BSA may thus be summarised as a tripartite one. The first element is relevancy: whether the expert evidence is admissible under Sections 39 to 44 of the BSA, and whether the expert is suitably qualified. The second element is reliability: whether the evidence has been generated through a scientifically dependable process, with adequate safeguards against error or tampering, a requirement that is judicially imposed rather than statutory. The third element is corroboration: whether, as a matter of prudence, the expert

⁶ *Id.*

⁷ *Tomaso Bruno v. State of U.P.*, (2015) 7 SCC 178 (India).

⁸ *Arjun Panditrao Khotkar v. Kailash Kushanrao Gorantyal*, (2020) 7 SCC 1 (India).

⁹ *P. Gopalkrishnan @ Dileep v. State of Kerala*, (2020) 9 SCC 161 (India).

evidence is supported by other independent material on record, reflecting the judiciary's traditional caution against resting a conviction on science alone.

This tripartite framework illustrates the pragmatism of Indian courts. Through judicial innovation, they have sought to strike a balance between embracing scientific advancements and guarding against wrongful convictions based on untested or unreliable science. However, the absence of a codified reliability threshold under the BSA continues to produce uncertainty, which makes the case for legislative reform all the more pressing.

IV. A COMPARATIVE GLANCE: FRYE, DAUBERT AND THE INDIAN POSITION

To situate the Indian experience under the Bharatiya Sakshya Adhiniyam, 2023, it is instructive to examine the more structured standards developed in the United States for admitting scientific evidence.

A. The Frye general acceptance test

For much of the twentieth century, American courts followed the precedent set in *Frye v. United States*.¹⁰ The case involved the admissibility of an early lie-detector test. The Court of Appeals for the District of Columbia Circuit held that a scientific principle or discovery is admissible only if it is sufficiently established to have gained general acceptance in the particular field in which it belongs.

This general acceptance test is conservative. It effectively delegates the question of reliability to the scientific community, requiring judges merely to determine whether experts broadly accept the method. Its strength lies in preventing untested or speculative techniques from reaching the courtroom. Its weakness is rigidity, for legitimate scientific innovations may be excluded until they achieve widespread acceptance, thereby slowing the law's ability to incorporate new developments.

B. The Daubert reliability standard

The decision of the United States Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*¹¹ transformed this landscape. Interpreting the Federal Rules of Evidence, the Court held that Frye had been displaced and established the judge as a gatekeeper tasked with ensuring not only relevance but also reliability.

The Court identified a non-exhaustive list of factors. The first is testability, that is, whether the theory or technique can be tested and has been tested. The second is peer review and publication,

¹⁰ *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

¹¹ *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).

namely whether the method has been subjected to scrutiny through publication. The third is the error rate, that is, whether the error rate is known or knowable. The fourth is general acceptance, namely whether the method has achieved recognition in the scientific community, with the Frye criterion thus retained as one factor among several.¹²

The Daubert standard is more flexible but also more demanding. It empowers courts to admit novel but reliable evidence while imposing a heavy burden on judges to engage with scientific methodology. The risk lies in judicial capacity, for trial judges may lack the scientific expertise to apply these criteria rigorously.

C. India's judicial gatekeeping without codification

The Indian statutory framework remains far less prescriptive. The BSA does not articulate any Daubert-like reliability factors, nor does it adopt a Frye-style general acceptance threshold. Instead, it relies on the judiciary to apply broad principles of relevancy and reasoned opinion.

Indian courts have emphasised that expert evidence is only advisory, must be backed by cogent reasoning, and is subject to independent judicial scrutiny. In electronic evidence cases, most notably *Anvar P.V. v. P.K. Basheer*¹³ and *Arjun Panditrao Khotkar v. Kailash Kushanrao Gorantyal*,¹⁴ the Supreme Court has adopted strict authentication requirements that mirror Daubert's emphasis on the reliability of the process.

The Indian approach under the BSA may therefore be described as pragmatic judicial gatekeeping without codification. Like Daubert, Indian courts inquire into the reliability of methods; unlike the United States, however, there is no structured statutory checklist. The result is a jurisprudence that is flexible but at times unpredictable, dependent on judicial temperament and forensic capacity.

V. ADMISSIBILITY AND VALUE OF SPECIFIC SCIENTIFIC EVIDENCE IN INDIA

The practical application of India's evidentiary standards is best understood through the judicial treatment of specific categories of forensic techniques. The Bharatiya Sakshya Adhiniyam, 2023, which repeals and replaces the Indian Evidence Act, 1872, substantially retains the provisions on expert opinion. Sections 39 to 44 of the BSA, corresponding to Sections 45 to 51 of the Indian Evidence Act, provide that expert testimony on matters of science, handwriting, foreign law and related fields is admissible when the court has to form an opinion on such

¹² *State of H.P. v. Jai Lal*, AIR 1999 SC 3318 (India).

¹³ *Anvar P.V. v. P.K. Basheer*, (2014) 10 SCC 473 (India).

¹⁴ *Arjun Panditrao Khotkar v. Kailash Kushanrao Gorantyal*, (2020) 7 SCC 1 (India).

matters.¹⁵ Yet, beyond this skeletal framework, it is the Indian courts that have actively shaped the standards of admissibility and evidentiary weight.

A. DNA evidence: the gold standard

DNA profiling has emerged as the most authoritative forensic technique, celebrated for its ability to establish identity with near certainty.¹⁶ Under Section 39 of the BSA, expert opinion on scientific matters, including DNA analysis, is admissible.

In *Santosh Kumar Singh v. State (NCT of Delhi)*, the Priyadarshini Mattoo case, DNA profiling was decisive in reversing the trial court's acquittal and securing a conviction, demonstrating its power to correct miscarriages of justice.¹⁷ Similarly, in *Mukesh v. State (NCT of Delhi)*, the Nirbhaya case, the Supreme Court treated DNA evidence as central in linking the accused to the crime scene.¹⁸

Courts have, however, consistently emphasised that procedural integrity governs admissibility. In *Krishna Kumar Malik v. State of Haryana*, the Court declined to rely on DNA evidence where lapses in sealing and custody compromised reliability.¹⁹ The judiciary has thus insisted on an unbroken chain of custody, adherence to forensic protocols, and demonstration of the expert's competence.

The absence of a dedicated statutory regime remains problematic. The DNA Technology (Use and Application) Regulation Bill, 2019, which sought to regulate laboratories, maintain databases, and safeguard consent and privacy, lapsed without enactment.²⁰ In this vacuum, courts have invoked the constitutional principles of privacy and proportionality recognised in *Justice K.S. Puttaswamy (Retd.) v. Union of India* to test compelled DNA collection.²¹ Accordingly, while DNA evidence is highly probative, it is not treated as conclusive proof, and corroboration remains a judicially required safeguard in criminal trials.²²

B. Fingerprint and ballistics evidence

Fingerprint evidence has long been judicially entrenched. It is expressly contemplated by Section 39 of the BSA and treated as nearly conclusive when properly collected. In *State of Bombay v. Kathi Kalu Oghad*, the Supreme Court held that compelling an accused to provide

¹⁵ Bharatiya Sakshya Adhiniyam, 2023, No. 47, Acts of Parliament, 2023 (India), §§ 39-44.

¹⁶ K. Dhananjay, *DNA Profiling and the Criminal Justice System in India*, 5 Indian Journal of Forensic Science & Criminology 112 (2020).

¹⁷ *Santosh Kumar Singh v. State (NCT of Delhi)*, (2010) 9 SCC 747 (India).

¹⁸ *Mukesh v. State (NCT of Delhi)*, (2017) 6 SCC 1 (India).

¹⁹ *Krishna Kumar Malik v. State of Haryana*, (2011) 7 SCC 130 (India).

²⁰ The DNA Technology (Use and Application) Regulation Bill, 2019, Bill No. 128 of 2019 (India) (lapsed).

²¹ *Justice K.S. Puttaswamy (Retd.) v. Union of India*, (2017) 10 SCC 1 (India).

²² *Ravinder Singh v. State of Haryana*, (2015) 11 SCC 588 (India).

fingerprints or handwriting specimens does not amount to testimonial compulsion under Article 20(3) of the Constitution.²³ More recently, in *Sonvir v. State (NCT of Delhi)*, the reliability of fingerprint evidence was again examined, the Court reiterating that such evidence must satisfy the requirements of proper collection and an unbroken evidentiary chain.²⁴

Ballistics evidence, by contrast, is approached with greater caution. It involves matching bullets or cartridge cases with firearms, and courts recognise the possibility of error. In *State of Punjab v. Jugraj Singh*, the Supreme Court stressed that ballistic opinion requires corroboration with other evidence before a conviction can be sustained.²⁵ Similarly, in *Kalua v. State of U.P.*, the High Court set aside a conviction where the ballistic report was inconclusive.²⁶ This doctrinal approach reflects judicial recognition that, while fingerprint identification rests on more than a century of acceptance, ballistics is more probabilistic and therefore corroborative rather than determinative.

C. The contested trio: narco-analysis, polygraph and brain-mapping

Perhaps the most contested category of forensic techniques in India involves narco-analysis, the polygraph, and the Brain Electrical Activation Profile (BEAP) test. These purport to extract information from subjects by bypassing conscious volition, raising profound constitutional concerns.

The landmark case is *Selvi v. State of Karnataka*, in which the Supreme Court, after extensive engagement with scientific and comparative jurisprudence, declared that the involuntary administration of these tests violates Article 20(3), the right against self-incrimination, and Article 21, the right to life, dignity and mental privacy.²⁷ The Court held that only voluntary administration with informed consent is permissible, but that even then the test results are inadmissible as substantive evidence. At best, derivative evidence discovered through such statements may be admitted under Section 23 of the BSA, formerly Section 27 of the Indian Evidence Act.

Following *Selvi*, courts have strictly policed the requirement of consent. The Delhi High Court in *Rohit Shekhar v. State (NCT of Delhi)* insisted that consent must be genuine and free from coercion.²⁸ Although investigative agencies have sought these tests in sensational cases,

²³ *State of Bombay v. Kathi Kalu Oghad*, AIR 1961 SC 1808 (India).

²⁴ *Sonvir v. State (NCT of Delhi)*, (2018) 8 SCC 24 (India).

²⁵ *State of Punjab v. Jugraj Singh*, (2019) 8 SCC 746 (India).

²⁶ *Kalua v. State of U.P.*, 2020 SCC OnLine All 1468 (India).

²⁷ *Selvi v. State of Karnataka*, (2010) 7 SCC 263 (India).

²⁸ *Rohit Shekhar v. State (NCT of Delhi)*, 2012 SCC OnLine Del 1926 (India).

including the Aarushi Talwar murder investigation, courts have consistently reiterated that such reports are inadmissible except for the discovery of material facts.²⁹

The recognition of the right to privacy as a fundamental right in *Puttaswamy* has further fortified *Selvi*, subjecting any intrusion into cognitive liberty to the four-part proportionality test.³⁰ Narco-analysis, the polygraph and brain-mapping thus remain investigative aids at best, with the judiciary drawing a sharp line between forensic innovation and constitutionally protected autonomy.

VI. THE EVIDENTIARY VALUE AND CORROBORATION CONUNDRUM

Once scientific evidence clears the threshold of admissibility, the next pressing question concerns its probative value. Indian jurisprudence has consistently emphasised that expert opinion is merely advisory and not conclusive upon the court.³¹ The expert assists in the administration of justice but is not its final arbiter. Ultimately, the judge must apply an independent judicial mind to determine the weight to be accorded to the evidence.³²

This principle underpins what has come to be called the rule of prudence, under which courts generally insist on corroboration of expert opinion, particularly where the science is probabilistic or subject to interpretive subjectivity. While DNA profiling enjoys a reputation as the gold standard owing to its near-absolute statistical accuracy,³³ courts still emphasise corroboration to guard against laboratory lapses, breaks in the chain of custody, or procedural contamination.³⁴

Conversely, with more subjective sciences such as handwriting analysis, the judiciary has expressed deep scepticism. In *Magan Bihari Lal v. State of Punjab*, the Supreme Court held that handwriting expert opinion is a weak type of evidence that cannot by itself sustain a conviction without substantial corroboration.³⁵ This caution stems from several rationales. First, even well-established techniques are not infallible, for error rates, though low, can never be eliminated entirely. Second, experts engaged by the prosecution or the defence may consciously or unconsciously slant their findings. Third, the reliability of evidence depends not only on the technique but on the individual expert's skill, training and diligence. Fourth, given the grave consequences of wrongful conviction, corroboration functions as a safeguard for liberty.

²⁹ *Nupur Talwar v. CBI*, 2012 SCC OnLine All 2203 (India).

³⁰ *Justice K.S. Puttaswamy (Retd.) v. Union of India*, (2017) 10 SCC 1 (India).

³¹ Bharatiya Sakshya Adhiniyam, 2023, No. 47, Acts of Parliament, 2023 (India), §§ 39-44.

³² *Ram Chandra v. State of U.P.*, (1957) SCR 195 (India).

³³ *Santosh Kumar Singh v. State (NCT of Delhi)*, (2010) 9 SCC 747, 747 (India).

³⁴ *Krishna Kumar Malik v. State of Haryana*, (2011) 7 SCC 130 (India).

³⁵ *Magan Bihari Lal v. State of Punjab*, (1977) 2 SCC 210 (India).

This insistence on corroboration is not, however, absolute. Where the science is inherently robust and procedural integrity is beyond reproach, courts have occasionally based convictions primarily on such evidence. A clear fingerprint match, or an unassailable DNA profile supported by a documented chain of custody, may in rare cases constitute sufficient proof without independent corroboration.³⁶ Ultimately, the quantum of corroboration required is context-sensitive, depending on the nature of the science, the reliability of the laboratory process, and the broader evidentiary mosaic.

VII. CHALLENGES AND THE PATH FORWARD

Despite judicial ingenuity in evolving a framework of relevancy, reliability and corroboration, systemic infirmities persist. The transition from the Indian Evidence Act, 1872 to the BSA has modernised the statutory language but has not resolved the underlying structural problems.

A. Systemic challenges

The first challenge is the absence of a codified standard. Unlike the United States, which now applies the Daubert reliability test under Rule 702 of the Federal Rules of Evidence,³⁷ India lacks a codified standard for admitting scientific evidence. Judicial discretion fills this vacuum, but at the cost of inconsistency and unpredictability, with trial courts, often the first gatekeepers, varying widely in their approach.

The second challenge is the threat of unreliable science. Without statutory guardrails, there is a real risk of pseudoscientific techniques infiltrating trials. The history of narco-analysis, polygraphy and brain-mapping, struck down as unconstitutional in *Selvi v. State of Karnataka*,³⁸ illustrates the judiciary's belated correction of investigative overreach.

The third challenge is a deficit in judicial capacity. Most judges lack formal scientific training. As the Daubert Court itself observed, the gatekeeper role demands engagement with the methodology of science.³⁹ In India, judges frequently find it difficult to distinguish valid science from unreliable speculation, particularly in the lower courts.

The fourth challenge concerns deficits in forensic infrastructure. Indian forensic laboratories are affected by backlogs, inadequate staffing, outdated technology and a lack of accreditation.⁴⁰

³⁶ *Sonvir v. State (NCT of Delhi)*, (2018) 8 SCC 24 (India).

³⁷ *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).

³⁸ *Selvi v. State of Karnataka*, (2010) 7 SCC 263 (India).

³⁹ *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 597 (1993).

⁴⁰ National Crime Records Bureau, *Crime in India 2022*, at 120-24 (2023).

The credibility of scientific evidence is inseparable from the credibility of the institutions that generate it.

The fifth challenge is the prevalence of partisan experts. The adversarial system incentivises the production of experts whose opinions align with the interests of the party engaging them. Without mechanisms for neutral expertise, the objectivity of expert testimony is compromised.

B. Recommendations for reform

The first recommendation is the codification of a reliability standard. The BSA should be amended to incorporate a reliability-based admissibility test, modelled on Daubert but adapted to Indian conditions. Judicial consideration should include testability, peer review, error rates, the existence of professional standards, and general acceptance. No single factor should be dispositive. This would provide both flexibility and predictability.

The second recommendation concerns judicial training in forensic science. A programme of continuing judicial education, including collaboration with scientists and forensic experts, is essential. Specialised training can enable trial judges to act as effective gatekeepers.

The third recommendation is the strengthening of forensic infrastructure. Investment in modernising forensic laboratories, hiring qualified personnel, and mandating accreditation, for example through the National Accreditation Board for Testing and Calibration Laboratories, is crucial. Accreditation would ensure standardisation, reduce error rates, and enhance confidence in forensic outputs.⁴¹

The fourth recommendation is the enactment of a DNA regulation law. The now-lapsed DNA Technology (Use and Application) Regulation Bill, 2019 should be revived and enacted.⁴² Such a statute would establish clear standards for the collection, storage and use of genetic data, balancing investigative utility with the constitutional privacy safeguards recognised in *Justice K.S. Puttaswamy (Retd.) v. Union of India*.⁴³

The fifth recommendation concerns protocols for court-appointed experts. Courts should more frequently invoke the provisions of the Code of Civil Procedure, 1908 to appoint neutral experts. A roster of accredited, court-approved experts could mitigate adversarial bias and provide unbiased assistance to the judiciary.

⁴¹ National Accreditation Board for Testing and Calibration Laboratories, *Criteria for Accreditation of Forensic Science Laboratories* (2022).

⁴² The DNA Technology (Use and Application) Regulation Bill, 2019, Bill No. 128 of 2019 (India) (lapsed).

⁴³ *Justice K.S. Puttaswamy (Retd.) v. Union of India*, (2017) 10 SCC 1 (India).

VIII. CONCLUSION

The uneasy partnership between science and law in India reflects both promise and peril. While science offers the allure of objectivity and precision, the law must safeguard liberty, dignity and due process. Indian courts, long operating under a statute originally framed in 1872, improvised a functional framework. The ruling in *Selvi*, reaffirmed after *Puttaswamy*, illustrates the judiciary's vigilance in reconciling forensic innovation with constitutional rights.

Yet this ad hoc judicial balancing act is not sustainable in an era of rapid technological change. From digital forensics and artificial-intelligence-based facial recognition to predictive policing tools, novel sciences will increasingly test the resilience of the legal system. The time is ripe for the legislature to codify a modern, reliability-based admissibility framework, complemented by judicial training and forensic capacity-building.

Only within such a framework can the gavel and the microscope operate in harmony, with science elucidating facts and law upholding justice. A justice system that is both evidence-based and rights-oriented will not only secure convictions but also sustain its legitimacy within a constitutional democracy.
