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**FAULTY FOUNDATIONS: A SOCIO-LEGAL CRITIQUE OF
THE REGULATION OF FORENSIC SCIENCE
LABORATORIES IN INDIA**

Dr. Ambily P & Ashna D#*

ABSTRACT

The forensic science discipline in India is in a state of crisis. With the rapid advancement of science and interdisciplinary technology, investigations today demand complex evidence collection processes and crime scene analyses to arrive at scientifically precise and unbiased conclusions. At present, the low utilisation of forensic evidence in the Indian criminal justice system is well known. Further, most policy reforms put forth over the past several decades have centred around the enactment of formalistic legislation and policies to remedy structural inadequacies in the field. This paper focusses on the existing regulatory concerns facing Indian forensic science laboratories. Upon comparison of the Indian framework with systems in place in foreign jurisdictions, a severe defect comes to light: there is a significant dearth of empirical research and scholarship on the internal functioning of forensic science laboratories and the different kinds of scientific methodologies they employ. Ultimately this paper argues that the

* The author is an Assistant Professor at National University of Advanced Legal Studies, Kochi and may be contacted at [ambily\[at\]therate\[nuals\]\[dot\]ac\[dot\]in](mailto:ambily[at]therate[nuals][dot]ac[dot]in).

The author is a fourth year student at National University of Advanced Legal Studies, Kochi and may be contacted at [ashnad96\[at\]therate\[dot\]gmail\[dot\]com](mailto:ashnad96[at]therate[dot]gmail[dot]com).

regulatory measures suggested to govern laboratories thus far, albeit relevant, have not been comprehensively evaluated from time to time. This has resulted in an incorrect contextualisation of the many challenges faced by our justice delivery mechanisms from the pre-trial to the sentencing stage and the increasing reliance on unreliable and flawed forensic evidence by judicial decision-makers.

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I. INTRODUCTION

“The man of science in the law is not merely a bookworm. To a microscopic eye for detail, he must unite an insight which tells him what details are significant. Not every maker of exact investigation counts, but only he who directs his investigation to a crucial point.”

– Justice Oliver Wendell Holmes¹

Due to the increasing reliance on scientific methodologies in criminal investigations, forensic science laboratories in India are facing mounting workloads.² Forensic science laboratories play a pivotal role not only in gathering useful scientific evidence but also in presenting timely results of their findings to various stakeholders in the criminal justice system. These findings perceived as accurate, transparent and objective, are, in turn, analysed and interpreted by courts of law to establish the guilt of suspected offenders beyond a reasonable doubt or exonerate the innocent. An ideal forensic laboratory must be equipped with advanced and reliable methods of collecting information at a source and must make use of the highest quality scientific techniques to examine the material. These laboratories must actively engage and influence decision-makers in the criminal justice system by pushing them to adopt the most reliable forensic

¹ Oliver Wendell Holmes, ‘Law in Science and Science in Law’ (1899) 12(7) Harvard Law Review 443.

² ANI, ‘India's state forensic labs expanding infrastructure on back of rising demand for DNA Testing’ *Business Standard* (16 May 2019) <[business-standard.com/article/news-ani/india-s-state-forensic-labs-expanding-infrastructure-on-back-of-rising-demand-for-dna-testing-119051600921_1.html](https://www.business-standard.com/article/news-ani/india-s-state-forensic-labs-expanding-infrastructure-on-back-of-rising-demand-for-dna-testing-119051600921_1.html)> accessed 31 October 2020.

and socio-legal research practices.³ However, the isolated working of forensic laboratories from other stakeholders has resulted in a knowledge gap and a consistent failure to weed out obsolete scientific evidence and unsuitable testing practices.⁴ As a consequence, the potential of these laboratories to revolutionise testing methods and evidentiary procedures is left untapped. They have been unable to arrive at trans-disciplinary solutions with the help of public and private bodies, as well as academic research.⁵

In 2019, the Supreme Court of India (SC) acquitted six men in Maharashtra who had been wrongfully sentenced to death for a crime they did not commit.⁶ After having spent nearly sixteen years in prison, the SC observed that the prosecution had ‘miserably failed’ to prove the rape using cogent forensic evidence. Even multiple trials across appellate courts could not reveal the glaring inconsistencies in the DNA samples and fingerprint evidence presented before them. The root cause of this problem can be traced to a tendency among courts to perceive science as a symbol of conclusive reasoning and consequently assign incontestable value to scientific evidence that is scrutinised in the courtroom. As a result, courts

³ Joseph L Peterson and others, ‘Forensic Science and the Courts: The Uses and Effects of Scientific Evidence in Criminal Case Processing’ (1986) National Institute of Justice January 1986 <<https://www.ncjrs.gov/pdffiles1/pr/102387.pdf>> accessed 31 October 2020.

⁴ Eoghan Casey and others, ‘The Kodak Syndrome: Risks and Opportunities Created by Decentralization of Forensic Capabilities’ (2018) 64 (1) *Journal of Forensic Sciences* 7, 8.

⁵ Erin Murphy, ‘The Mismatch Between Twenty-First-Century Forensic Evidence and Our Antiquated Criminal Justice System’ (2014) 87 *Southern California Law Review* 633.

⁶ *Ankush Maruti Shinde v State of Maharashtra* 2019 SCC OnLine SC 317; Mansi Thapliyal, ‘Five Murders, Six Men and 16 years of Stolen Lives’ *BBC News* (23 June 2019) <[bbc.com/news/world-asia-india-48578767](https://www.bbc.com/news/world-asia-india-48578767)> accessed 31 October 2020.

have a propensity to brush aside the flaws of forensic evidence and treat it as an exact science.⁷

The Central Forensic Science Laboratories (CFSLs), State Forensic Science Laboratories (SFSLs) and District Forensic Science Laboratories (DFSLs) handle many kinds of evidence and have separate divisions for ballistics, toxicology, serology, narcotics, general chemistry, explosives, forensic pathology, DNA and computer forensics.⁸ At present, India does not have a uniform or comprehensive legislative framework to oversee their functioning or ensure that they adhere to strict standard operating procedures and protocols. We argue that there is a growing disconnect between the work done in the fields of law, sociology, forensic science and criminology, as professionals in each field continue to work in separate departments, often unacquainted with the challenges and research practices of their peers in other disciplines.⁹

This paper will first discuss how the dearth of empirical research on the regulation of forensic science and the forensic processes used in laboratories has severely affected their functioning. As a result, the Indian forensic science framework today is comparable to a house of cards built

⁷ Eadaoin O'Brien and others, 'Science in the Court: Pitfalls, Challenges and Solutions' (2015) 370 *Philosophical Transactions of the Royal Society B* 1, 2; *Mukesh and Another v State (NCT of Delhi) and Ors* (2017) 6 SCC 1; *Santosh Kumar Singh v State through Central Bureau of Investigation* (2010) 9 SCC 747; Re Assessment of the Criminal Justice System in Response to Sexual Offences *Suo Moto Writ (Criminal)* No 04 of 2019.

⁸ Ministry of Home Affairs, Directorate of Forensic Sciences 'Forensic Sciences Institutions' <dfs.nic.in/aboutCfsl.html> accessed 31 October 2020; Central Forensic Science Laboratory, 'About Us' <cbi.gov.in/cfsl/about.htm> accessed 31 October 2020.

⁹ Katharine Browning, 'Social Science Research on Forensic Science: The Story Behind One of NIJ's Newest Research Portfolios' (2015) *National Institute of Justice Journal* 1, 3.

on invalidated hypotheses and unsubstantiated or non-existent data.¹⁰ The second section of this paper will analyse the gaps in existing regulation, focussing particularly on the differences in the functioning of public and private labs. This section seeks to identify which regulatory model would be most suitable to govern the Indian forensic lab framework. The third section of this paper will analyse the nature of the deficiencies in the functioning of forensic laboratories, highlighting administrative, bureaucratic, financial, resource-based, and research-related problems. In the final section of this paper, we will highlight the need to explore interdisciplinary solutions to address the three main challenges vis-à-vis the governance of forensic science, namely – empirical research, regulation and laboratory practices. We argue that there is a need for socio-legal solutions to bridge the gap between the working of forensic laboratories, law enforcement agencies, judicial professionals, sociologists and academics. The recommendations proposed will draw from domestic and international best practices that foster a science-led, trans-disciplinary approach to overcome the obstacles facing India's fractured forensic laboratory framework.¹¹

II. CONTEXTUALISING THE PROBLEM: A FLAWED SYSTEM OF GOVERNANCE

¹⁰ Chris M Fabricant and William Tucker Carrington, 'The Shifted Paradigm: Forensic Science's Overdue Evolution from Magic to Law' (2016) 4(1) *Virginia Journal of Criminal Law* 1.

¹¹ Claude Roux, Olivier Ribaux and Frank Crispino, 'Forensic Science 2020 – The End of Crossroads?' (2018) 50(6) *Australian Journal of Forensic Sciences* 607, 615.

In this section, we argue that the existing problems in the governance of forensic science in India can be attributed to three major policy failures: A) The absence of a strong research culture in these forensic laboratories in the form of lacking empirical data, inadequate formal training in research methodologies, and a lack of transparency in information-sharing on internal research practices;¹² B) A largely fragmented and unregulated forensic science framework of public and private laboratories; C) The systematic failure to increase funding for laboratory infrastructure, formulate standardised research practices and invest in professional training for laboratory staff. We highlight that these three issues are interlinked and a failure to address them in tandem raises serious concerns about institutional accountability, the reliability of forensic lab reports and the progress of advanced forensic science research in the country.

A. THE ABSENCE OF EMPIRICAL RESEARCH IN FORENSIC SCIENCE

The reasons for the continued absence of empirically backed forensic science are many. In the past, forensic science was far less advanced, making laboratories ad hoc service providers. The infrequent reliance on forensic specialists offers one explanation as to why no serious efforts were made to scrutinise their techniques. The reports submitted by laboratories were anecdotal and could not even be characterised as science.¹³ However, due to whirlwind advancements in science and

¹² Jonathan Koehler and others, 'The need for a research culture in the forensic sciences' (2011) Faculty Working Papers 26.

¹³ Paul C Giannelli, 'Forensic Science: Why No Research', 38 Fordham Urb LJ 506 (2010).

technology, today, laboratories are permanent service providers that play a central role in determining outcomes in criminal trials.

Various studies recognise how a failure to question the reliability of existing forensic practices using empirical data can disastrously impact justice delivery systems, primarily when advances in science have led to cases whose outcomes may hinge on a single microscopic piece of evidence.¹⁴ This makes empirical testing crucial as it helps determine the validity and accuracy of forensic methods, thereby recognising error-prone and outdated forensic evidence.¹⁵ Another reason for the failure to carry out empirical research is because most laboratories cannot afford to invest in good quality empirical research as this is both expensive and time-consuming.¹⁶ Courts have also contributed to the dearth of research as they often impulsively accept most kinds of forensic techniques as valid, without questioning their premises.¹⁷

Testing existing research practices in the forensic discipline using empirical data can help forensic practitioners distinguish between hunches or anecdotal claims and practices backed by a substantial body of scientific

¹⁴ Brandon L Garrett and Peter J Neufeld, 'Invalid Forensic Science Testimony and Wrongful Convictions' (2009) 95 (1) *Virginia Law Review* 1; Nadine M Smit, Ruth M Morgan and David A. Lagnado, 'A Systematic Analysis of Misleading Evidence in Unsafe Rulings in England and Wales' (2018) 58(2) *Science & Justice* 128; Tim J Wilson, 'Forensic Science is in Crisis – and This Could Have Critical Effects on UK Legal System' *The Conversation* (4 April 2019) <theconversation.com/forensic-science-is-in-crisis-and-this-could-have-critical-effects-on-uk-legal-system-113873> accessed 31 October 2020.

¹⁵ Suzanne Bell and others, 'A call for more science in forensic science' (2018) *Proc Natl Acad Sci USA* 115(18): 4541–4544.

¹⁶ Giannelli (n 13) 508.

¹⁷ *ibid* 509.

data.¹⁸ Further, a lack of empirical research affects the process of standardising forensic techniques. Instead of discussing forensic techniques from a general standpoint, empirical research can yield practical findings on how these techniques are carried out and whether there are procedural flaws.¹⁹ For instance, quality assurance studies can help policymakers identify the variations in testing fingerprint evidence across jurisdictions, and what points of comparison researchers are using while matching fingerprints.²⁰

Thus, at the heart of a fragmented forensic science framework is the shortage of updated research at the micro and macro levels. At the micro-level, the deficit of information pertains to the kinds of forensic methods used by laboratories, quality assurance studies, the existence of good-quality infrastructure, and the presence of professional and ethical practice standards. At the macro level, the dearth of knowledge affects legislative and policy considerations relating to the demographic distribution of forensic labs across the country, the kinds of services offered, case pendency rates, and budgetary problems. The absence of sufficient data at both these levels is detrimental to the public's trust in crime investigation reports and the future development of the forensic science industry in India.

¹⁸ Koehler (n 12) 19.

¹⁹ James MacDonald, 'How Scientific Is Forensic Science?' *Jstor Daily* (2 April 2019) <[daily.jstor.org/how-scientific-is-forensic-science](https://www.jstor.org/stable/44444444)> accessed 31 October 2020.

²⁰ *ibid.*

B. A FRAGMENTED FRAMEWORK OF LABORATORIES & THE PUBLIC-PRIVATE DIVIDE

For a long time, forensic laboratories across the world have remained mostly unregulated, with self-imposed standards and limited public investment to carry out specific research.²¹ One explanation for the absence of regulation is the fragmentation of the forensic science framework. Forensic laboratories are broadly of two types - state or government laboratories and private laboratories. The minimal regulation of these labs has resulted in a scattered distribution of forensic facilities across demographics, with different types of services offered and varying models of governance. Fragmentation occurs in forensic science when there are large disparities in the functioning of laboratories in different parts of the country. These disparities could relate to unevenness in funding, quality of standard practices, access to adequate infrastructure, the availability of skilled forensic specialists, and certification.²² Fragmentation could also stem from a 'piecemeal approach' to forensic science, wherein different segments of the forensic science process are distributed between law enforcement agencies, forensic scientists, and courts.²³ When each of these actors undertakes different roles ranging from collecting samples,

²¹ Linzi Wilson-Wilde, 'The International Development of Forensic Science Standards – A review' (2018) 288 *Forensic Science Intl* 1, 3.

²² National Academy of Sciences, 'Badly Fragmented' Forensic Science System Needs Overhaul' (2009) *Science Daily* 19 February 2009 <sciencedaily.com/releases/2009/02/090218135119.htm> accessed 31 October 2020.

²³ Ruth Morgan, 'Why forensic science is in crisis and how we can fix it' *World Economic Forum* (12 September 2019) <weforum.org/agenda/2019/09/why-forensic-science-is-in-crisis-and-how-we-can-fix-it> accessed 31 October 2020.

analysing them and establishing their evidentiary value, it could lead to a cumulative lack of oversight, accountability²⁴ and cooperation.

In the context of regulating forensic laboratories, it is important to understand that the functioning of different labs is intricately linked with their government and non-governmental affiliations. Therefore, it becomes essential to understand the unique set of challenges faced by both public and private laboratories. Public laboratories often lack administrative independence as they work closely with law enforcement agencies and are exposed to bureaucratic pressures and corruption.²⁵ Paul Giannelli notes that the decisions of forensic laboratories affiliated with law enforcement agencies are often influenced by several biases in adversarial settings due to a tendency to produce 'right results' that fulfil their role of helping prosecutors and the police.²⁶ Further, well-trained personnel employed in public labs may also be incentivised to take up better-paying positions in private labs, leading to vacancies.²⁷ Turning a blind eye to budgetary support

²⁴ *ibid.*

²⁵ Dr TR Baggi, 'Why is Forensic Science Stunted and Static in India?' *The Hindu* (11 September 2011) <thehindu.com/opinion/open-page/why-is-forensic-science-stunted-and-static-in-india/article2442491.ece> accessed 31 October 2020; Richa Banka, 'FSL Officials in Dock for Fake DNA Report' *Hindustan Times* (New Delhi, 1 August 2019) <hindustantimes.com/delhi-news/fsl-officials-in-dock-for-fake-dna-report/story-WmN VrCUKvrKhbit6WPatgL.html> accessed 31 October 2020; Ashlin Mathew, 'Delhi violence: Police, Forensic Lab Under State Govt Delay DNA Testing of Bodies' *National Herald* (India, 21 March 2020) <nationalheraldindia.com/india/delhi-violence-police-forensic-lab-under-state-govt-delay-dna-testing-of-bodies> accessed 31 October 2020.

²⁶ Paul C Giannelli, 'Independent Crime Laboratories: The Problem of Motivational and Cognitive Bias' (2010) 603 *Faculty Publications* 247, 248, 252, 257.

²⁷ William P McAndrew, 'Is Privatization Inevitable for Forensic Science Laboratories?' (2012) 3(1) *Forensic Science & Policy Management: An International Journal* 42, 44.

training has also increased the pendency rates in these labs, consequently spilling over into an overburdened judicial system.²⁸

Concerning private laboratories, although these labs usually function independent, hasten the forensic process, and provide better quality services, they primarily function for commercial purposes, resulting in biased reports and increased costs.²⁹ Such labs could potentially face difficulties in procuring the required information from executive functionaries and may also go unsupervised, thereby affecting the quality of services. Reports from other jurisdictions also suggest that they are more likely to experience financial difficulties, thus making them unsustainable providers in the long run.³⁰ The hurdles in both these spheres could increase political and bureaucratic pressures on forensic experts and result in increased chances of biased reporting, especially in cases that receive significant media attention.

The obvious question then becomes: how should forensic laboratories be regulated? Different jurisdictions have adopted contrasting views. For example, the United Kingdom has tilted in favour of a regulated government approach after recent studies concluded that private labs could

²⁸ Press Trust of India, 'DCW Issues Notice to FSL Seeking Details of Pendency of Cases' *Business Standard* (New Delhi, 3 April 2019) <[business-standard.com/article/pti-stories/dcw-issues-notice-to-fsl-seeking-details-of-pendency-of-cases-119040301035_1.html](https://www.business-standard.com/article/pti-stories/dcw-issues-notice-to-fsl-seeking-details-of-pendency-of-cases-119040301035_1.html)> accessed 31 October 2020; Siraj Qureshi, 'Over 5000 Criminal Cases Pending in UP Due to Lack of Forensic Labs' *India Today* (Agra, 2 August 2019) <indiatoday.in/india/story/over-5000-criminal-cases-pending-in-up-due-to-lack-of-forensic-labs-1576590-2019-08-02> accessed 31 October 2020.

²⁹ McAndrew (n 27) 45.

³⁰ Hannah Devlin, 'Forensic Labs on the Brink of Collapse, Warns Report' *The Guardian* (1 May 2019) <[theguardian.com/science/2019/may/01/forensic-science-labs-are-on-the-brink-of-collapse-warns-report](https://www.theguardian.com/science/2019/may/01/forensic-science-labs-are-on-the-brink-of-collapse-warns-report)> accessed 31 October 2020.

not meet high demands and arrive at impartial findings.³¹ This move came after reports indicated that the privatisation of forensic laboratories had resulted in the police putting pressure on private laboratory scientists to tamper with results and secure more convictions. Thus, experts in the United Kingdom were opposed to the idea of government laboratories losing experienced forensic scientists to private players that they believed prioritised commercial interests over the fundamental need to ensure due process in the criminal justice system.³² On the contrary, in the United States, national forensic authorities have called for the establishment of labs that function independent of law enforcement administrators to avoid sacrificing advanced forensic methodologies³³ for the sake of expediency or adversarial biases.³⁴ In India, a few attempts have been made to introduce certain institutional structures to regulate certain sub-disciplines in forensic science using legislation. However, these interventions have either not been implemented or suffer from several flaws.

For example, the DNA Technology (Use and Application) Regulation Bill 2019 (“DNA Bill”) was introduced in the Lok Sabha in July

³¹ Steve Thomas, ‘Dubious Forensic Evidence? That’s What Happens When We Sell Off Public Services’ *The Guardian* (27 November 2017) <[theguardian.com/public-leaders-network/2017/nov/27/dubious-forensic-evidence-privatisation-public-services](https://www.theguardian.com/public-leaders-network/2017/nov/27/dubious-forensic-evidence-privatisation-public-services)> accessed 31 October 2020.

³² *ibid.*

³³ President’s Council of Advisors on Science and Technology, ‘Report to the President: Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods’ (2016) Executive Office of the President September 2016 <[crime-scene-investigator.net/PDF/forensic-science-in-criminal-courts-ensuring-scientific-validity-of-feature-comparison-methods.pdf](https://www.crime-scene-investigator.net/PDF/forensic-science-in-criminal-courts-ensuring-scientific-validity-of-feature-comparison-methods.pdf)> accessed 31 October 2020 (PCAST Report).

³⁴ Subcommittee on Forensic Science, ‘Strengthening the Forensic Sciences: A Path Forward Committee on Identifying the Needs of the Forensic Sciences Community’ (2014) National Science and Technology Council 2 May 2014 <<https://www.ncjrs.gov/pdffiles1/NIJ/251422.pdf>> accessed 31 October 2020.

2019.³⁵ This proposed law attempts to regulate the use of DNA technology through the establishment of a DNA Regulatory Board to supervise the maintenance of DNA Data Banks that create profiles of suspected offenders and crime scene indices based on fixed criteria at the national and regional level.³⁶ The DNA Bill envisages a broader ambit for the application of DNA profiling to include offences under the Indian Penal Code 1860, the Immoral Traffic (Prevention) Act 1956, Medical Termination of Pregnancy Act 1971, Protection of Civil Rights Act 1955 and the Motor Vehicles Act 1988. The Schedule of the proposed law also lists the various civil matters for which DNA profiling can be used.³⁷

While the proposed legislation is well-intentioned, its execution requires efficiency of the highest order. Experts have repeatedly raised concerns about the low level of training and expertise of DNA analysts, investigation agencies, laboratories, and lawyers as well as a high risk of using improperly collected, stored or analysed samples.³⁸ The DNA Bill also pushes forward a skewed narrative that acknowledges the use of DNA evidence only as a tool to be employed by the prosecution to convict offenders but not by the defence to release wrongfully convicted

³⁵ The DNA Technology (Use and Application) Regulation Bill (2019) (DNA Technology Bill).

³⁶ *ibid.*

³⁷ *ibid* sch pt C.

³⁸ Shambhavi Naik and Murali Neelakantan, 'DNA Technology Bill: Why the Standing Committee Has Its Work Cut Out' *The Wire* (1 November 2019) <thewire.in/government/dna-technology-bill-2018-databank-parliamentary-standing-committee-privacy-consent> accessed 31 October 2020; The Wire Staff, 'Amid Opposition Criticism, Government Tables DNA Technology Bill in Lok Sabha' *The Wire* (8 July 2019) <thewire.in/government/dna-technology-regulation-bill-lok-sabha> accessed 31 October 2020.

individuals languishing in jails.³⁹ What is more concerning is the overriding power granted to a Magistrate to collect samples in cases where an individual refuses to consent. It uses a vague standard to allow the Magistrate to insist on a sample if she is “*satisfied that there is reasonable cause to believe*” that the sample “*may confirm or disprove*” the involvement of a suspect in the commission of an offence.⁴⁰ The reliance on such an ambiguous standard that does not call upon the Magistrate to mandatorily specify the reasoning behind an order is particularly problematic because the Bill leaves much of the procedural formalities vis-à-vis erasing DNA profiles to executive discretion.⁴¹ The SC, in its landmark ruling in *Justice KS Puttaswamy v. Union of India*,⁴² has also expressed apprehensions about the retention and misuse of DNA profiles that could result in invasions into the private lives of individuals.

Another missed opportunity for policymakers to regulate the Indian forensic science framework is the Forensic Regulatory and Development Authority of India (FRDA) Bill (“FDRA Bill”).⁴³ The FDRA Bill, which has gone into cold storage since 2011, seeks to establish a central authority to regulate, standardize and accredit forensic science services in India,

³⁹ Gerald Laporte, ‘Wrongful Convictions and DNA Exonerations: Understanding the Role of Forensic Science’ (2018) National Institute of Justice Journal 1.

⁴⁰ DNA Technology Bill (n 35) s 21.

⁴¹ *ibid* s 31.

⁴² (2017) 10 SCC 1.

⁴³ Dr Gillian Tully, ‘Annual Report 17 November 2018 – 16 November 2019’ (2020) 25 Forensic Science Regulator 25 February 2020 <assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/877607/20200225_FS_SR_Annual_Report_2019_Final.pdf> accessed 31 October 2020; Forensic Regulatory and Development Authority of India (FRDA) Bill (2011).

including the working of forensic science practitioners.⁴⁴ There is little clarity on the interoperability of the FRDA Bill and the DNA Bill vis-à-vis the institutional actors under the two proposed laws, the delineation of their functions and the standards for regulation. Further, while the FRDA Bill emphasises the need to ‘cooperate’ with the private sector and non-governmental organisations (NGOs), it does not clearly outline how such cooperation will be achieved and which laboratories will be regulated.⁴⁵ Without first putting in place a regulatory framework to standardise, accredit and streamline forensic science services, both these bills have missed the forest for the trees. This problem is only worsened in the absence of a sound data protection legislation to remedy potential breaches of privacy.⁴⁶

At present, the Indian forensic science framework has both public and private laboratories offering different quality services but subjected to scanty regulation and oversight. This public-private divide, coupled with a legal vacuum, has made it extremely difficult to develop a coordinated strategy to regulate the industry. Further, a growing demand for forensic science services has led to the hurried establishment of freelance or self-proclaimed forensic experts in the private sector who can be hired for a fee.⁴⁷ This is highly problematic as an increase in the number of forensic

⁴⁴ *ibid* FRDA Preamble.

⁴⁵ FRDA (n 43).

⁴⁶ Rekha Dixit, ‘DNA Technology Bill Raises Serious Concerns Over Right to Privacy’ *The Week* (9 January 2019) <theweek.in/news/india/2019/01/09/dna-technology-bill-raises-serious-concerns-over-right-to-privacy.html> accessed 31 October 2020.

⁴⁷ Dr Gopal J Mishra and Dr C Damodaran, ‘Perspective Plan for Indian Forensics’ (2010) Ministry of Home Affairs, Government of India, July <[http://dfs.nic.in/pdfs/IFS\(2010\)-FinalRpt_0.pdf](http://dfs.nic.in/pdfs/IFS(2010)-FinalRpt_0.pdf)> accessed 31 October 2020.

laboratories within an already fragmented laboratory framework could come at the cost of greater backlogs, rampant errors and quality control failures.⁴⁸

C. INADEQUACIES VIS-À-VIS INFRASTRUCTURE, STANDARDISATION, RESEARCH AND TRAINING

Any forensic laboratory tasked with delivering accurate scientific results must have standard infrastructure accompanied by professionally trained and qualified staff.⁴⁹ Indian forensic experts have raised specific concerns regarding the varying quality of services offered by forensic labs situated in different geographical regions.⁵⁰ These apprehensions mainly arise due to the differences in professional training, infrastructure, availability of resources nearby, employment conditions, population size, as well as the nature and volume of crime in different regions.⁵¹

Available studies from Uttar Pradesh have highlighted issues such as the underutilisation of procured equipment, and problems in the procurement of mobile forensic vans for strengthening forensic services at the district level.⁵² Inordinate delays in sanctioning and executing building

⁴⁸ Brandon L Garrett, 'The Costs and Benefits of Forensics' (2020) 57 Houston Law Review 593, 600-602.

⁴⁹ United Nations Office on Drugs and Crime, 'Staff Skill Requirements and Equipment Recommendations for Forensic Science Laboratories' (2011) United Nations <unodc.org/documents/scientific/Ebook_STNAR_02Rev1_E.pdf> accessed 31 October 2020 (UNODC Staff Skills Report).

⁵⁰ Mishra and Damodaran (n 47).

⁵¹ *ibid.*

⁵² Government of Uttar Pradesh, 'Modernisation of Forensic Science Laboratories' (Report No 3 of 2017 - Office of the Comptroller and Auditor General of India, 31 March 2016) <agup.gov.in/pag/en/docs/rep-03-of-2017-MPF-Eng.pdf> accessed 31 October 2020 (Government of Uttar Pradesh Report).

work to provide necessary infrastructural facilities in regional laboratories, including important specialisations such as cybercrime labs, have only intensified the problem.⁵³ The study found that nearly 44% of these laboratories' constructions were incomplete, with tenders having lapsed, budgets left unspent, and district field units lacking important modern equipment.⁵⁴ Further, there was a steep decline in technical workforce availability over the years, resulting in junior lab assistants with inadequate qualifications being posted to different forensic units to make up for the massive pendency in sample examination.⁵⁵

Cumulatively, these failures led to the increased workload of the aged or senior staff, the improper collection and analysis of samples, poorly maintained stock and records, and rampant delays in investigations.⁵⁶ Research shows that it is not uncommon for many CFSL scientists to be sent for crime scene investigations on an ad-hoc basis, after being chosen from a pool of scientists from different labs, thereby eating away time from urgent cases.⁵⁷ While there is no official record of the exact number of

⁵³ Murari Shetye, 'No Takers: Government Invites Bidders to Set Up Cyber Forensic Lab for Third Time' *Times of India* (Panaji, 26 September 2020) <<https://timesofindia.indiatimes.com/city/goa/no-takers-govt-invites-bidders-to-set-up-cyber-forensic-lab-for-third-time/articleshow/78325674.cms>> accessed 31 October 2020.

⁵⁴ Government of Uttar Pradesh Report (n 52).

⁵⁵ *ibid.*

⁵⁶ Devesh K Pandey, '75 Cases in 100 days at India's First Pvt. Forensic Lab' *The Hindu* (New Delhi, 7 December 2009) <thehindu.com/news/cities/Delhi/75-cases-in-100-days-at-Indias-first-pvt-forensic-lab/article16851973.ece> accessed 31 October 2020.

⁵⁷ Dr C Damodaran and others, 'Report on Scientific Performance Audit of DFSS HQ and its CFSLs' (2011) Scientific Performance Audit Committee, Ministry of Home Affairs, October 2011 <[dfs.nic.in/pdfs/SPAC%20REPORT%20\(FINAL\).pdf](http://dfs.nic.in/pdfs/SPAC%20REPORT%20(FINAL).pdf)> accessed 31 October 2020 (SPA Report); Dr Justice VS Malimath and others, 'Committee on Reforms of Criminal Justice System' (2003) Ministry of Home Affairs March 2003

pending cases in each of these laboratories, estimates indicate that thousands of cases remain pending annually, in both central and regional labs.⁵⁸

A health crisis such as the COVID-19 pandemic has further worsened the situation due to intermittent lockdowns which have hampered work and the shutting down of some labs as a result of lab staff testing positive for the virus.⁵⁹ In Maharashtra, nearly 61,000 cases remain pending, with a reduced workforce left to handle urgent cases on a priority basis.⁶⁰ Regulatory and functional gaps are compounded by the lack of operational principles and standardisation procedures in forensic laboratories. A recent audit that analysed the CFSLs in India found that most of them fell short in their scientific performance credibility even though they were overseen by quality control bodies.⁶¹ The study found

<mha.gov.in/sites/default/files/criminal_justice_system_2.pdf> accessed 31 October 2020.

⁵⁸ ANI, 'India's State Forensic Labs Expanding Infrastructure on Back of Rising Demand for DNA Testing' *Business Standard* (16 May 2019) <business-standard.com/article/news-ani/india-s-state-forensic-labs-expanding-infrastructure-on-back-of-rising-demand-for-dna-testing-119051600921_1.html> accessed 31 October 2020.

⁵⁹ Dhaval Kulkarni, 'Coronavirus impact in Maharashtra: Forensic science department says 61,000 pending cases remain' *Free Press Journal* (Mumbai, 25 July 2020) <freepressjournal.in/mumbai/coronavirus-impact-in-maharashtra-forensic-science-department-says-61000-pending-cases-remain> accessed 31 October 2020; HM Chaithanya Swamy 'Forensic lab sealed after staff tests Covid-19 positive' *Deccan Herald* (Bengaluru, 9 July 2020) <deccanherald.com/city/life-in-bengaluru/forensic-lab-sealed-after-staff-tests-covid-19-positive-858784.html> accessed 31 October 2020; Ashish Bhosale 'Central Forensic Science Lab in Hyderabad closed after 3 of its employees test +ve' *News Meter* (Hyderabad, 4 August 2020) <newsmeter.in/central-forensic-science-lab-in-hyd-closed-for-two-days-after-3-of-its-employees-test-ve> accessed 31 October 2020.

⁶⁰ *ibid* Dhaval Kulkarni.

⁶¹ SPA Report (n 57).

that the chain of custody was not maintained while documenting and analysing evidentiary material, and many final reports were inconclusive.⁶²

These seemingly small errors become manifestly clear when they trickle into the trial process and are relied on by judges in adjudicating cases. This becomes particularly troubling in criminal cases when judges rely on the disputed testimony of experts to make vital decisions in a case. For instance, in the Arushi Talwar case, there was blatant mishandling of critical crime scene evidence by the investigation officers.⁶³ The SC drew its conclusions based on questionable forensic testimony by a government genetics scientist. The lack of awareness on the part of the SC and the expert about the relatively rare technique used led to the dismissal of a request to collect and analyse fresh evidence.⁶⁴

A rise in heinous crimes, particularly sexual offences, has resulted in a substantial increase in the use of DNA profiling and other biological techniques, which many labs are ill-equipped to handle.⁶⁵ Certified

⁶² *ibid.*

⁶³ Pranjal Kshirsagar, 'Aarushi Trial: A Double Murder of Forensics and Investigation' *Firstpost* (26 November 2013) <firstpost.com/india/why-the-aarushi-trial-was-a-double-murder-of-forensics-investigation-1250025.html> accessed 31 October 2020.

⁶⁴ Press Trust of India, 'Aarushi Murder Case: Talwars' Plea for Forensic Expert's Cross-Examination Rejected' *NDTV* (Ghaziabad, 25 September 2013) <ndtv.com/ghaziabad-news/aarushi-murder-case-talwars-plea-for-forensic-experts-cross-examination-rejected-535715> accessed 31 October 2020.

⁶⁵ PTI, 'Need of the hour: Stepping up DNA technology in India to combat surge in rape cases' *Economic Times* (2 June 2020) <economictimes.indiatimes.com/news/science/need-of-the-hour-stepping-up-dna-technology-in-india-to-combat-surge-in-rape-cases/role-of-forensic-dna-technology-in-fighting-crime/slideshow/76151396.cms> accessed 31 October 2020; The logical Indian Crew, 'Samples Taken After 11 Days: Experts Question State Forensic Lab's "No Rape" Claim In Hathras Case' *The Logical Indian* (Uttar Pradesh, 5 October 2020) <thelogicalindian.com/humaninterest/hathras-forensic-report-24152> accessed 31 October 2020.

reference materials to guide specialists are unavailable, and unduly lengthy standard operating procedures are not followed.⁶⁶ A failure to lay down standard ethical codes diminishes objectivity in testing processes.⁶⁷ This could result in increased unethical practices such as the misuse of professional positions, misinformation, increased reliance on private players and the exploitation of clients.

Thus, it becomes clear that there are several structural and implementation problems in the day-to-day functioning of forensic laboratories in India. A failure to urgently address these concerns threatens the very foundations of our criminal justice system.

D. THE FAILURE OF COURTS TO REGULATE FORENSIC SCIENCE

As a general trend, Indian criminal courts substantially rely on oral witness testimony, confessions, and circumstantial evidence, shockingly, even in cases involving capital punishment.⁶⁸ Over the years, Indian courts have failed to clearly enunciate the weightage to be assigned to forensic evidence in criminal law proceedings. Further, discussions on scientific evidence have been largely confined to the opinions of experts under Section 45 of the Indian Evidence Act 1872 and other provisions under the

⁶⁶ SPA Report (n 57).

⁶⁷ JC Upshaw and Anjali Ranadive Swienton, *Ethics in Forensic Science* (ch 4, Academic Press 2012) 81-135.

⁶⁸ Law Commission of India, *Expeditious Investigation and Trial of Criminal Cases Against Influential Public Personalities* (Law Commission No 239, 2012); Bikram Jeet Batra and others, 'Lethal Lottery: The Death Penalty in India' (2008) Amnesty International (May 2008) <amnesty.org/download/Documents/52000/asa200072008eng.pdf> accessed 31 October 2020; Nita Bhalla, 'Analysis: How India's Police and Judiciary Fail Rape Victims' *Reuters* (New Delhi, 16 January 2013) <in.reuters.com/article/india-delhi-gang-rape-women-safety-police/analysis-how-indias-police-and-judiciary-fail-rape-victims-idINDEE90F0AY20130116> accessed 31 October 2020.

Code of Criminal Procedure 1973. These provisions are archaic and outdated in comparison to the rapid developments taking place in the forensic discipline. Courts have also been reluctant to proactively rely on forensic evidence and dynamically interpret these provisions.⁶⁹ Till date, Section 45 of the Indian Evidence Act determines the admissibility of scientific evidence provided by experts.⁷⁰ This provision was drafted at a time when there was little advancement in the field of forensic science and does not empower courts to order parties to provide physical samples such as blood, semen, saliva and hair for the purpose of scientific examination.⁷¹ Further, Section 45 does not provide any guidance to courts on how to examine the scientific validity of forensic evidence given by experts.⁷²

There are also practical impediments to the implementation of various provisions. For instance, Section 164-A of the Code of Criminal Procedure makes it mandatory for victims to be examined by a registered medical practitioner under consent within twenty-four hours of receiving the complaint.⁷³ However, in practice, court convictions hinge on the presence of genital or bodily injuries and do not scrutinise other relevant

⁶⁹ The Indian Evidence Act 1872, s 45; Subhash Chandra Singh, 'DNA Profiling and the Forensic Use of DNA Evidence in Criminal Proceedings' (2011) 53 (2) *Journal of the Indian Law Institute* 195, 217; NV Krishna Kumar, 'Prudent to Use Forensic Evidence, to Decide Cases Justly and Conclusively' *The Leaflet* (18 November 2020) <theleaflet.in/prudent-to-use-forensic-evidence-to-decide-cases-justly-and-conclusively> accessed 23 November 2020.

⁷⁰ The Indian Evidence Act 1872, s 45.

⁷¹ Malimath Committee Report (n 57) 123.

⁷² Shreya Rastogi and others, 'Forensic Science In The Dock: The Questions We Are Not Asking' *LiveLaw* (12 August 2020) <livelaw.in/columns/forensic-science-in-the-dock-the-questions-we-are-not-asking-161313> accessed 31 October 2020.

⁷³ Code of Criminal Procedure 1973, s 164.

medical evidence or refer to the findings of forensic reports.⁷⁴ Similarly, Section 293 of the Code of Criminal Procedure does not make it mandatory for courts to examine the author of a forensic report that is used as evidence in a criminal trial to test the veracity of their claims.⁷⁵ Recent judgments have reiterated that these reports are admissible if they are merely tendered in evidence by a witness and that the contents of such reports do not need to be proved in the course of the trial.⁷⁶

Further, even while admitting expert evidence, courts have been sceptical of their value and characterised them as ‘weak’ and unsafe to rely upon without ‘substantial corroboration’.⁷⁷ For example, in a case involving footprint evidence, the SC observed that although the identification of footprints is not a fully developed science, if the evidence presented on footprints is found to be ‘satisfactory’ it can be given ‘sufficient weightage’ only to reinforce conclusions drawn from other evidence.⁷⁸

Courts have even held that unless there is an irreconcilable conflict between medical evidence and ‘reliable’ ocular or oral evidence, the latter should be preferred.⁷⁹ The SC has observed that a court cannot surrender

⁷⁴ Anupriya Singh, ‘Medical Evidence in Rape Cases and Poor Court Outcomes’ *The Leaflet* (19 October 2020) <theleaflet.in/medical-evidence-in-rape-cases-and-poor-court-outcomes> accessed on 31 October 2020.

⁷⁵ Code of Criminal Procedure 1973, s 293.

⁷⁶ *Dharampal and Anr v State* [2011] Criminal Appeal No 140/1999; *Chhotu Kumar v State (Govt of NCT of Delhi)* [2021] Criminal Appeal No 331/2017.

⁷⁷ *S Gopal Reddy v State of Andhra Pradesh* (1996) 4 SCC 596; *Magan Bibari Lal v State of Punjab* (1977) 2 SCC 210.

⁷⁸ *Mohd Aman and Anr v State of Rajasthan* AIR 1997 SC 2960; *Pritam Singh v State of Punjab* AIR 1956 SC 415.

⁷⁹ *Ram Swaroop v State of Rajasthan* [2008] Appeal (criminal) 548 of 2008; *State of Uttar Pradesh v Hari Chand* (2009) 13 SCC 542; *Malappa Sidappa Alakumar v State of Karnataka* [2009] AIR SC 2959.

its own judgment by delegating its authority to experts who provide ‘inadequate’ or ‘cryptic’ testimonies.⁸⁰ In none of these cases did the courts clarify what the terms ‘reliable’, ‘inadequate’ or ‘cryptic’ meant. Instead, an expert’s opinion is treated as advisory in nature, leaving it for the court to form its own judgment based on the scientific material.⁸¹ Thus, by and large, courts have been silent on the standards used to judge the credibility of forensic evidence.

Most recently in the Hathras gangrape incident, reports have shed light on how the egregious mishandling of crime scene evidence and attempts to jeopardise the forensic investigation often go unnoticed by courts.⁸² When judges show ‘de factor deference’ to the weight assigned to forensic science, be it in the form of expert testimony, scholarly literature or laboratory reports they base their rulings on mere intuitions and deductions. In the process, complex questions of reliability, and ethical or human rights considerations may be ignored.⁸³

The above cases indicate that Indian courts are unwilling to rely on expert testimony without independent corroboration and consequently determine outcomes in criminal trials based on the subjective intuitions of

⁸⁰ *Mahindra v Sajjan Gajja Rankhamb & Ors* [2017] AIR SC 2397.

⁸¹ *Madan Gopal Kakkad v Naval Dubey and Anr* 1992 3 SCC 204; *Kishan Chand v Sita Ram* AIR 2005 P&H 156.

⁸² The Wire Staff, ‘Hathras Case: PIL Seeks Action Against Government Officials for “Destroying Evidence”’ *The Wire* (14 October 2020) <[thewire.in/law/hathras-gangrape-pil-sc-evidence-destruction](https://www.thewire.in/law/hathras-gangrape-pil-sc-evidence-destruction)> accessed 31 October 2020.

⁸³ Micheal Brennan and others, ‘Finding and Researching Experts and Their Testimony’ White Paper, May 2009 22; Paul W Grimm, ‘Challenges Facing Judges Regarding Expert Evidence in Criminal Cases’ (2018) 86 (4) *Fordham Law Review* 1601, 1612.

judges⁸⁴. The reluctance of courts to challenge and meaningfully engage with forensic evidence is all the more concerning in light of the problems highlighted in the previous sections.

III. BEST PRACTICES: ADOPTING A PARTICIPATORY APPROACH TO FORENSIC SCIENCE

A. FOSTERING A STRONG RESEARCH CULTURE

Countries with far more advanced forensic science research periodically carry out comprehensive data collection studies or proficiency tests to identify limitations in the functioning of their labs, with a particular focus on quality assurances.⁸⁵ Updated empirical data can avoid tendencies among practitioners to focus on biased forensic data that confirm preconceived expectations.⁸⁶ For example, studies on forensic odontology confirm that bite-mark evidence changes with time and is easily distorted, resulting in a high potential for bias on the part of experts who may be persuaded into matching a bite wound with the teeth of a known suspect.⁸⁷ When forensic scientists are trained with updated empirical research, they are far less likely to provide erroneous testimony.

⁸⁴ *State of Uttar Pradesh v Krishna Gopal and Anr* AIR 1988 SC 2154.

⁸⁵ Andrea M Burch and others, 'Publicly Funded Forensic Crime Laboratories: Quality Assurance Practices, 2014' (2016) Bureau of Justice Statistics 22 November 2016 <bjs.gov/index.cfm?ty=pbdetail&iid=5828> accessed 31 October 2020.

⁸⁶ Eric H Holder Jr and others, 'The Impact of Forensic Science Research and Development' (2015) National Institute of Justice April 2015 <ncjrs.gov/pdffiles1/nij/248572.pdf> accessed 31 October 2020.

⁸⁷ Erik Eckholm, 'Mississippi Death Row Case Faults Bite-Mark Forensics' *The New York Times* (15 September 2014) <nytimes.com/2014/09/16/us/mississippi-death-row-appeal-highlights-shortcomings-of-bite-mark-identifications.html?module=Search&mabReward=relbias%3Ar&r=0> accessed 31 October 2020.

Conducting such studies within laboratories is also a good way to identify whether forensic analysts have access to updated techniques and relevant technical standards while analysing samples or relying on invalidated research.⁸⁸ In-depth research exercises undertaken in other jurisdictions painstakingly document crime rates, population levels, police force strength, lab management systems and how the nature of crime labs and their governance affects productivity.⁸⁹

Other studies show how cognitive biases may be formed in the minds of examiners at the crime scene and within labs; how judicial actors interpret evidence and how laboratories can eliminate unconscious biases before arriving at conclusions.⁹⁰ There are also empirical findings based on the results of crime lab surveys on the nature of cases handled by central, state and private laboratories, case pendency rates, types of examinations carried out, number of employees and budget allocation.⁹¹ A periodic study carried out by the Bureau of Justice Statistics in 2014 revealed that the backlog in crime labs in the United States had declined by nearly 33% in comparison to 2009 and that there was a 10% increase in the outsourcing

⁸⁸ Koehler (n 12) 48, 50; Giannelli (n 13) 510.

⁸⁹ James M Anderson and others, 'The Unrealized Promise of Forensic Science: An Empirical Study of its Production and Use' (2018) RAND Justice, Infrastructure, and Environment/Justice Policy Working Paper, <rand.org/content/dam/rand/pubs/working_papers/WR1200/WR1242/RAND_WR1242.pdf> accessed 31 October 2020.

⁹⁰ Jonathan J Koehler and John B Meixner Jr, 'An Empirical Research Agenda for the Forensic Sciences' (2016) 106 (1) *Journal of Criminal Law and Criminology* 1, 21.

⁹¹ Nicole S Jones and Erica-Fornaro, '2020 National Institute of Justice Forensic Science Research and Development Symposium' (2020) RTI Press Publication No CP-0012-2003 March 2020 <rti.org/rti-press-publication/2020-nij-rd-symposium/fulltext.pdf> accessed 31 October 2020; Matthew R. Durose and others, 'Publicly Funded Forensic Crime Laboratories: Resources and Services, 2014' (2016) *NCJ* 250152 November 2016 <ojp.gov/library/abstracts/publicly-funded-forensic-crime-laboratories-resources-and-services-2014> accessed 31 October 2020.

of forensic facilities by publicly funded crime labs to private labs or other public facilities in order to meet increasing demands.⁹² Similarly, the National Institute of Justice in the United States regularly shares the results of empirical research to inform forensic science specialists about the reliability and accuracy of different kinds of forensic examinations (e.g., firearm and toolmark examinations).⁹³ These surveys provide policymakers with key information on the internal functioning of forensic labs and the gaps in implementing standardised work norms. In India, apart from a handful of pertinent studies undertaken by experts in the past,⁹⁴ there is little empirical data on the working of forensic science laboratories. This raises several questions about the reliability of the reports they produce and whether laboratory practices are grounded in updated empirical findings or obsolete research.

In India, particularly in the nascent stages of conducting empirical research, the process should involve institutional oversight. Researchers tasked with carrying out these studies should be highly qualified forensic specialists who possess casework experience and possess the required knowledge to oversee the process and interpret results.⁹⁵ A good model to emulate is the performance audit carried out in forensic science laboratories in Uttar Pradesh under the oversight of the Comptroller and Auditor

⁹² *ibid* Matthew R Durose.

⁹³ Burch and others (n 85); Holder Jr and others (n 86).

⁹⁴ National Human Rights Commission, 'Annual Report 1999-2000' (NHRC, 2000) <nhrc.nic.in/annualreports/1999-2000> accessed 31 October 2020; Mishra and Damodaran (n 47); Government of Uttar Pradesh (n 52); SPA Report (n 57); Malimath Committee Report (n 57).

⁹⁵ ANZPAA and NFIS, 'Empirical Study Design in Forensic Science' (2019) 2 Australia New Zealand Policing Advisory Agency.

General's office in collaboration with the Directorate of Forensic Science.⁹⁶ Such a model takes care of funding and time constraints as they are carried out by independent authorities. However, these studies must be carried out not as litmus tests alone but as periodic verification and quality control tests in all states.⁹⁷

As a general practice, encouraging researchers to share available data on existing laboratory practices can help acknowledge errors and develop future research.⁹⁸ Creating spaces within laboratories to critically analyse forensic practices using data can also change the way courts approach forensic evidence. For example, when forensic odontologists are trained to justify their expert testimonies using updated research in the field, they will be required to highlight the high error rates in the analysis of bitemark evidence as proved by recent studies.⁹⁹ In such a situation, courts will focus less on the experience or level of training of the expert and more on the reliability of existing forensic practices, based on actual forensic casework.¹⁰⁰ Adopting a research-oriented culture in the field of forensic science will significantly improve the reliability of laboratory practices and lay the foundation for an accountable criminal justice system.

⁹⁶ SPA Report (n 57); Malimath Committee Report (n 57).

⁹⁷ Rajesh Kumar Singh, 'Uttar Pradesh's forensic science labs fail CAG's litmus test' *Hindustan Times* (Lucknow, 24 July 2017) <hindustantimes.com/lucknow/uttar-pradesh-s-forensic-science-labs-fail-cag-s-litmus-test/story-or0VQhFyy4zhkR2dAvcQWK.html> accessed 31 October 2020.

⁹⁸ Koehler (n 12) 20.

⁹⁹ Erica Beecher-Monas, 'Reality Bites: The Illusion of Science in Bite-Mark Evidence' (2009) 30(4) *Cardozo Law Review* 1369.

¹⁰⁰ Koehler (n 12) 22.

B. ADOPTING A COMPREHENSIVE REGULATORY MODEL: BRIDGING THE PUBLIC-PRIVATE DIVIDE

While devising the most suitable model of governance, Indian policymakers must seek to balance the advantages and disadvantages of public and private forensic laboratories. Since forensic science laboratories work so closely with state agencies, it is extremely difficult to entirely separate the two entities. However, a great level of independence can be secured by putting in place certain checks on the accountability of all actors. As Professor Giannelli notes, “*there is a difference between working with someone extensively and working with someone who is a superior within the same organisation*”. The latter is what commonly leads to the police and prosecutors putting pressure on forensic professionals to manipulate laboratory findings to favour the state. That said, purely independent laboratories might suffer from limitations in the form of a shortage of funds. To strike a balance between the two models, Professor Max M Houck, an international forensic expert argues in favour of a hybrid model involving both public and private laboratory professionals that function within an internal-external framework.¹⁰¹

Within such a framework the governance of forensic science laboratories is substantially free from administrative oversight by law enforcement agencies and each independent laboratory must be keenly aware of its operations, goals and values.¹⁰² The internal laboratory

¹⁰¹ Max M Houck, ‘What does independence mean for a forensic laboratory?’ *Evidence Technology Magazine* <evidencemagazine.com/index.php?option=com_content&task=view&id=1385> accessed 31 October 2020.

¹⁰² *ibid.*

framework will be governed by the autonomous decisions taken by laboratory staff with respect to forensic protocols adopted, budgetary matters, values and goals of the laboratory and the overall architecture of the laboratory.¹⁰³ Within this framework, forensic scientists will be able to carry out independent examinations of the evidence thereby reducing various biases among forensic experts that tend to favour the outcomes desired by law enforcement professionals.¹⁰⁴ The erasure of these biases in state investigations will also help expand forensic science services to defendants who are otherwise reluctant to seek out such services fearing manipulated reports.¹⁰⁵ Leadership at senior levels of forensic laboratories must be taken up by strong professional bodies that include a scientist or forensic professional to safeguard scientific integrity in regulation.¹⁰⁶

The external laboratory framework shall consist of a carefully negotiated agreement between independent forensic specialists and allied stakeholders such as the police, courts, and governments.¹⁰⁷ The rationale behind this model is to set clear boundaries between a laboratory's relationship with aligned agencies to accommodate the differences between scientific and administrative roles. For instance, an administrative laboratory director lacks scientific training in comparison to a DNA profiler. Yet, both individuals play a major role in ensuring the quality of

¹⁰³ *ibid.*

¹⁰⁴ Kavita Pillai, 'Another Competitive Enterprise: A Balanced Private-Public Solution to North Carolina's Forensic Science Problem' (2011) 90 NCL Rev 253, 266.

¹⁰⁵ *ibid* 274, 275.

¹⁰⁶ James Robertson, 'Should Forensic Science Services Be Independent of Policing - A Critical Reflection' (2012) 24 Current Issues Crim Just 131, 134, 136.

¹⁰⁷ Evidence Magazine (n 101).

evidence and its ultimate utilisation by stakeholders. Professor Houck notes that all stakeholders working together within the internal-external framework (independent forensic professionals and law enforcement agencies) must put scientific truth first while managing their resources and operations.¹⁰⁸

Such a public-private partnership model combines the independence of the private sector with strict government regulation.¹⁰⁹ Similarly, it provides a stable source of public funding but also ensures cost-savings arising out of competitive and profit-maximising private incentives.¹¹⁰ The argument favouring some form of external regulation takes into account the risks of unsupervised commercially exploitative labs making use of self-proclaimed experts.¹¹¹ By infusing innovative ideas from private business models, FSLs can develop field-deployable, user-friendly, time-saving forensic tools like breath analysers or rapid DNA profile testing kits.¹¹²

Within the external framework, strategic oversight can be ensured by setting up independent forensic science commissions for each state that set standards for labs in line with national legislation and approved international standards.¹¹³ With regard to accreditation, these commissions must follow the standards laid down by reputable organisations in the field (e.g., the International Organization for Standardization, or other nationally

¹⁰⁸ *ibid.*

¹⁰⁹ Pillai (n 104) 265.

¹¹⁰ *ibid* 287.

¹¹¹ Casey (n 4).

¹¹² O'Brien (n 7).

¹¹³ Garrett (n 48) 615.

reputed bodies).¹¹⁴ In the Indian context, national regulatory bodies such as the Indian Council for Medical Research (ICMR) and the FDRA must lay down the minimum standards for testing norms, amend and supervise police manuals in different states and also define key portfolios.¹¹⁵ State-level forensic science commissions must encourage collaborations between forensic research institutes, law schools and independent forensic professionals while framing policies for state laboratories.¹¹⁶ They can also study the validity of various forensic techniques, carry out regular audits, and ensure inter and intrastate information-sharing on identified errors and positive scientific advancements.¹¹⁷ This model may be further decentralised to ensure the timely deployment of forensic science services to areas that might otherwise be unable to access these services.¹¹⁸

To truly ensure laboratory independence within the public-private model, the identity of suspects, clients and the side they represent (prosecution or defence) must be kept confidential.¹¹⁹ Similarly, forensic examiners must not be allowed to extend the scope of their testimonies beyond what they have recorded in their reports to prevent any chance of manipulation of their statements by lawyers.¹²⁰

An example in India that somewhat resembles the proposed model is Truth Labs, which is a non-profit, non-government public-private

¹¹⁴ Pillai (n 104) 278.

¹¹⁵ Malimath Committee Report (n 13); Mishra and Damodaran (n 47).

¹¹⁶ Pillai (n 104) 280.

¹¹⁷ Garrett (n 48) 615-616; Pillai (n 104) 288.

¹¹⁸ Aaron O Amankwaa, 'Forensic science in Ghana: A review' (2019) 1 *Forensic Science Intl Synergy* 151, 158.

¹¹⁹ Giannelli (n 26) 263.

¹²⁰ *ibid* 265.

partnership project that has been set up by an ex-government official.¹²¹ The lab works closely with national agencies such as the National Investigation Agency, Central Bureau of Investigation, state governments, high courts, district courts, corporates, law firms, universities, hospitals, banks and private individuals.¹²² The rationale of this project is to set up an independent FSL that disburses speedy justice and eases the huge burden of case pendency in India.¹²³ However, while expanding the number of independent forensic laboratories in India, policymakers must implement the above-mentioned suggestions.

In the Indian context, it is critical for the government to pass the FDRA Bill and the DNA Bill and meaningfully engage with the responses from medical, forensic and legal professionals as well as the general public while making the necessary amendments. DNA databases are no doubt beneficial in crime scene investigations, but it is naïve to frame simplistic legislation, dodge regulatory controversies and expect faultless results.¹²⁴ Worldwide, DNA regulators are working towards addressing the complex questions that crop up while regulating DNA evidence. For instance, in the United Kingdom, years of research helped shed light on the resource

¹²¹ HT Correspondent, 'In city: A forensic lab for common people' *Hindustan Times* (New Delhi, 27 August 2009) <<https://www.hindustantimes.com/delhi/in-city-a-forensic-lab-for-common-people/story-OMCny7mwjQDNCXid2PjEiP.html>> accessed 30 October 2020.

¹²² 'About Us' Truth Labs <<https://www.truthlabs.org/about-us/>> accessed 31 October 2020.

¹²³ 'FAQs' Truth Labs <<https://www.truthlabs.org/faqs/>> accessed 31 October 2020.

¹²⁴ Samuel Hodge, 'Current Controversies in the Use of DNA in Forensic Investigations' (2018) 48 (1) *University of Baltimore Law Review* 39, 61; Giannelli (n 26) 59.

restrictions of forensic regulators and the fallibility of established accreditation systems while sharing DNA evidence.¹²⁵

Thus, in answering questions concerning technical standards, limiting access, independent oversight, and corroborative mechanisms involved in DNA databases, researchers first need to perform comparative studies of the best practices and limitations in the models being adopted by other countries.¹²⁶ As observed by the Law Commission of India, the use of DNA evidence involves scientific concerns such as quality assurances, adherence to acceptable laboratory practices, and questions of reliability of identifications and false positives.¹²⁷ While collecting and using DNA evidence, authorities must respect each individual's right to privacy, dignity and bodily integrity.¹²⁸ Tampering may also take place during the transfer of samples from investigating officers to forensic labs.¹²⁹ There is a strict duty to maintain confidentiality and to use the evidence only as per

¹²⁵ Carole McCartney and Emmanuel Nsiah Amoako, 'The UK Forensic Science Regulator: A Model for Forensic Science Regulation?' (2018) 34(4) *Georgia State University Law Review* 945, 973.

¹²⁶ Forensic Genetics Policy Initiative, 'Establishing Best Practice for Forensic DNA Databases' *FGPI* (September 2017) <<http://dnapolicyinitiative.org/report/>> accessed 31 October 2020.

¹²⁷ Law Commission of India, *Human DNA Profiling – A Draft Bill for the Use and Regulation of DNA-Based Technology* (Law Commission No 271, 2017).

¹²⁸ *ibid*; Mairi Levitt, 'Forensic Databases: Benefits and Ethical and Social Costs' (2007) 83 (1) *British Medical Bulletin* 235, 245; Margarita Guillén and others, 'Ethical-legal Problems of DNA Databases in Criminal Investigation' (2000) 26 *Journal of Medical Ethics* 266, 267.

¹²⁹ United Nations Office on Drugs and Crime, 'Crime Scene and Physical Evidence Awareness for Non-Forensic Personnel' United Nations (2009) <https://www.unodc.org/documents/scientific/Crime_scene_awareness_Ebook.pdf> accessed 31 October 2020; Vikram Dodd, 'Forensic Science Failures Putting Justice At Risk, Says Regulator' *The Guardian* (25 February 2020) <<https://www.theguardian.com/science/2020/feb/25/forensic-science-failures-putting-justice-at-risk-says-regulator>> accessed 31 October 2020.

prescribed guidelines.¹³⁰ Therefore, Indian authorities must work to plug regulatory loopholes in the status quo and create a framework that functions in sync with each of its parts.

C. STANDARDISING INTERNAL LABORATORY MANAGEMENT PRACTICES

i. Uniform Testing and Accreditation Systems

Within each laboratory's internal regulation, there is a need to adopt uniform testing methods and accreditation systems for all FSLs (both public and private), which are in line with established international standards.¹³¹ At present, the standards being developed by the International Organization for Standardization (ISO) are well accepted and respected by forensic practitioners worldwide.¹³² These international standards ensure a greater degree of reliability, transparency and consistency in the forensic science community and benefit the police, lawyers, as well as the public.¹³³ Evaluations of quality assurance in labs must focus on multi-jurisdictional peer review and comparative analysis rather than self-assessment.¹³⁴ For this, it is important to first study the effectiveness and validity of newly introduced technologies in the Indian context and identify viable alternatives on a case-by-case basis in each laboratory. It is essential to understand that the power of standardisation lies in its continuous

¹³⁰ Wilson-Wilde (n 21).

¹³¹ Law Commission No 271 (n 127).

¹³² NAS 2009 Report (n 22); Wilson-Wilde (n 21) 301.

¹³³ 'Forensic Sciences - Part 1: Terms and definitions' ISO <<https://www.iso.org/obp/ui/#iso:std:iso:21043:-1:ed-1:v1:en>> accessed 31 October 2020.

¹³⁴ Leslie Myles, 'Quality Assured Science: Managerialism in Forensic Biology' (2009) 35(3) *Science, Technology & Human Values* 283, 290.

implementation.¹³⁵ Therefore, these testing and accreditation systems must be supervised by a national regulator and reviewed periodically. For example, in the United States, standard reference material popularly known as the ‘gold standard’ is issued by the National Institute of Standards and Technology (NIST) to guide laboratories to test out different calibration methods before arriving at an acceptable standard for individual labs.¹³⁶ A similar standard must be adopted in India by the Directorate of Forensic Science in collaboration with experienced professional bodies such as the Indian Council for Medical Research as well institutions carrying out advanced research in the discipline like the Lok Nayak Jayaprakash Narayan National Institute of Criminology and Forensic Science.

ii. Developing Quality Infrastructure & Avoiding Bureaucratic Delays

There can be no straightjacket plan while designing laboratories. Each lab must be constructed according to specific needs, including the functional requirements of the envisaged forensic disciplines engaged in and the equipment to be procured.¹³⁷ Experts note that environmental

¹³⁵ Simon A Cole, ‘Who Will Regulate American Forensic Science?’ (2018) 48(3) *Seton Hall Law Review* 563, 580.

¹³⁶ Robert L Zimmerman Jr, ‘10 Best of Good Laboratory Practices for Forensic Facilities: A Key to Satisfying Daubert’s Gatekeeper and Rule 702’ (2011) 2(4) *Forensic Science Policy & Management* 187, 191.

¹³⁷ National Institute of Justice, ‘Needs Assessment of Forensic Laboratories and Medical Examination/Coroner Officer’ (2019) Office of Justice Programs <<https://www.ncjrs.gov/pdffiles1/nij/253626.pdf>> accessed 31 October 2020; National Institute of Justice, ‘Education and Training in Forensic Science: A Guide for Forensic Science Laboratories, Educational Institutions, and Students’ (2004) Office of Justice Programs, <<https://www.ncjrs.gov/pdffiles1/nij/203099.pdf>> accessed 31 October 2020; Mishra and Damodaran (n 47).

conditions such as adequate lighting, energy sources and clean rooms with proper temperature conditions must be secured and unwanted interferences should be avoided.¹³⁸ In order to maximise organisational efficiency without compromising on safety needs, different stages may be considered by the planning team in order to account for changing costs as a function of time, future relocation of blueprints and a dynamic needs assessment.¹³⁹ Procedures to delineate different administrative and scientific departments, provide standard waste disposal systems, and efficiently record and store data must be put in place.¹⁴⁰ The high number of vacancies in public laboratories¹⁴¹ can be reduced if department heads periodically review the staff strength and workloads of their respective department and take immediate measures to fill vacant posts.¹⁴²

The Law Commission of India in its 239th Report identified that bureaucratic delays within individual forensic science laboratories result in frequent court delays.¹⁴³ In order to improve efficiency in the internal

¹³⁸ Mishra and Damodaran (n 47); UNODC Staff Skills Report (n 49).

¹³⁹ National Institute of Standards and Technology, 'Forensic Science Laboratories: Handbook for Facility Planning, Design, Construction, and Relocation' (2013) US Department of Commerce, June <https://tsapps.nist.gov/publication/get_pdf.cfm?pub_id=913987> accessed 31 October 2020.

¹⁴⁰ Mishra and Damodaran (n 47); UNODC Staff Skills Report (n 49).

¹⁴¹ 'NHRC Webinar on Forensic Science Setup Dominates the Sentiment that the Country Lacks the Adequate Number of Forensic Laboratories and Manpower to Handle Them' *National Human Rights Commission* (11 August 2020) <<https://nhrc.nic.in/media/press-release/nhrc-webinar-forensic-science-setup-dominates-sentiment-country-lacks-adequate>> accessed 31 October 2020.

¹⁴² 'Revised Work Norms of National Forensic Science Laboratories and Government Examiners' (2002) Ministry of Home Affairs, Government of India, November <<http://dfs.nic.in/pdfs/worknorms2002.pdf>> accessed 31 October 2020 (2002 Work Norms).

¹⁴³ Law Commission No 239 (n 68).

functioning of forensic science laboratories, the 2002 Revised Work Norms of Forensic Science Laboratories issued by the Ministry of Home Affairs provides clear guidance to labs on how to efficiently allocate work to designated laboratory officers, each with specific tasks to complete in their respective sub-disciplines.¹⁴⁴ For example, the Work Norms stipulate that Deputy Directors of the Biological Science Wing can supervise the work of Assistant Directors and other technical staff.¹⁴⁵ Similarly, having a separate administrative section can save the time of technical lab officers and avoid duplication of work, with each laboratory creating a system of oversight within departments.¹⁴⁶ There is also a need for improved coordination of forensic laboratories with the police force. A relevant example is the SVP National Police Academy in Hyderabad, where police officers are regularly trained in forensic science procedures, thus reducing the workload on laboratory scientists.¹⁴⁷ Laboratories must devise seamless communication channels and systems of data management in order to avoid delays in sending medical reports to investigating officers and keep pace with the changing nature of crimes.¹⁴⁸ Similarly, law enforcement authorities must reduce disruptive bureaucratic procedures that result in frequent transfers of investigating officers.

¹⁴⁴ 2002 Work Norms (n 142).

¹⁴⁵ *ibid.*

¹⁴⁶ *ibid.*

¹⁴⁷ Mishra and Damodaran (n 47).

¹⁴⁸ Micheal Schlicht, 'Recommendations for a Best Practices Model for Communication among Forensic Analysts and Crime Scene Processors in Multidisciplinary Criminal Investigations' (Seminar Paper presented to the University of Wisconsin – Platterville, November 2016); Leone M Howes and Nenagh Kemp, 'Discord in the Communication of Forensic Science: Can the Science of Language Help Foster Shared Understanding?' (2016) *Journal of Language and Social Psychology* 1, 4.

iii. Staff Training and Empirical Testing Practices

Indian forensic science laboratories must introduce blind proficiency tests as a part of their daily work. During blind proficiency tests, laboratory staff are provided samples as if they are real cases and are not aware that they are being tested.¹⁴⁹ The results of these tests are then evaluated to identify levels of accuracy, biases, and error rates, and discussed with staff to help improve their performance.¹⁵⁰ Experience from the Houston Forensic Science Center reveals that formulating efficacious blind testing systems significantly helps determine error rates and preconceived biases in existing laboratory practices.¹⁵¹ These systems also help identify the distinct challenges a laboratory is facing vis-à-vis how evidence is collected, cases are sorted and categorised and results are being interpreted and documented while issuing final reports.¹⁵² Another suggestion is to make use of a process called ‘sequential unmasking’ which requires keeping some information hidden from forensic scientists to reduce inappropriate biases and untrustworthy analyses.¹⁵³ For example, while identifying whether the DNA type of a suspect matches a sample extracted from the crime scene, the reference sample from the crime scene is kept hidden until the forensic analyst characterises the DNA type

¹⁴⁹ Robin Mejia and others, ‘Implementing blind proficiency testing in forensic laboratories: Motivation, obstacles, and recommendations’ (2020) 2 *Forensic Science International Synergy* 293.

¹⁵⁰ *ibid.*

¹⁵¹ Randolph N Jonakait, ‘Forensic Science: The Need for Regulation’ (1991) 4(1) *Harvard J L & Tech* 109, 119; Brandon Garrett, ‘Forensics, Statistics and Law: Ten Years After “A Path Forward”’ (2020) 69 *Duke Law Journal Online* 22.

¹⁵² *ibid.*

¹⁵³ Glen Whitman & Roger Koppl, ‘Rational Bias in Forensic Science’ (2010) 9 *Law, Prob & Risk* 69, 85.

of the suspect.¹⁵⁴ These checking mechanisms at the laboratory stage will help prevent a multiplying of errors as the evidence enters the judicial process.¹⁵⁵ In order to further enhance the knowledge of laboratory staff, the results of Periodic Scientific Performance Audits must be shared with them to ensure dynamic knowledge, ability, and awareness of qualified staff.¹⁵⁶

Scholars who oppose empirical testing argue that it imposes unsustainable costs, and may be perceived as an unfair method to evaluate the work of laboratory professionals and could threaten their employment. However, such apprehensions can be kept at bay by sharing and exchanging data samples and results among crime labs, legally mandating blind proficiency testing and assuring employees that test results will only be used to create better laboratory protocols to judge their work in the future.¹⁵⁷ These tests are also an excellent way to overcome false positives in sensitive forensic techniques and build relationships and joint case management tracking systems with law enforcement agencies in the long run.¹⁵⁸ Furthermore, flexible work hours with greater autonomy involves formulating helpful laboratory practices and a high level of awareness among all stakeholders.

¹⁵⁴ *ibid.*

¹⁵⁵ Jonakait (n 151); Brandon Garrett, 'Forensics, Statistics, and Law: Ten Years After "A Path Forward"' (2020) 69 *Duke Law Journal Online* 22.

¹⁵⁶ National Research Council, 'The Evaluation of Forensic DNA Evidence' (1996) *The National Academic Press* <<https://doi.org/10.17226/5141>> accessed 31 October 2020; SPA Report (n 57).

¹⁵⁷ Jonakait (n 151) 156.

¹⁵⁸ Sandra Guerra Thompson and Nicole Bremmer Casarez, 'Solving Daubert's Dilemma for the Forensic Sciences through Blind Testing' 57(3) *Houston Law Review* 617.

Thus, when foundational practices are rectified in laboratories, they will also help courts identify and engage with inaccurate or dubious expert testimony.¹⁵⁹

D. JUDICIAL REGULATION

Criminal trials involve complex evidence and depend on accurate fact-finding exercises: a function that forensic function plays a crucial role in fulfilling.¹⁶⁰ Even when experienced professionals with near-flawless technical and analytical skills handle cases, if a method's foundational validity is based on an erroneous premise, the harms that accrue will remain the same.¹⁶¹ Evidence on bite marks, footprints and firearms have been regularly disputed.¹⁶² Despite this, the consistent codification of non-empirical findings of accuracy has led to their frequent use in courtrooms.¹⁶³ Thus, courts play an essential role in regulating the forensic science discipline.

It was in the case of *Selvi v. State of Karnataka*¹⁶⁴ (“*Selvi*”) that the SC provided some guidance on the standards to be used while analysing the reliability of scientific evidence. The SC in *Selvi* was tasked with analysing the scientific and legal validity of polygraph examinations and Brain Electrical Activation Profile (BEAP) tests that are used a part of criminal investigations. The SC held that polygraph examinations and other similar

¹⁵⁹ Holder Jr and others (n 86).

¹⁶⁰ Mohan Pan and Kaixin Zheng, ‘A Study on the Model of Fact-Finding in Criminal Investigation’ (2019) 5(3) Journal of Forensic Science and Medicine 156, 158.

¹⁶¹ PCAST Report (n 33).

¹⁶² Beecher-Monas (n 99); PCAST Report (n 33).

¹⁶³ PCAST Report (n 33).

¹⁶⁴ *Selvi v State of Karnataka* (2010) 7 SCC 263.

tests that rely on the testimonial responses of a defendant have been empirically proven to suffer from numerous limitations including errors associated with false positives and false negatives, drawing ‘confirmatory’ inferences based on the physiological responses of the defendant (such as nervousness, anxiety, confusion), and errors arising from false memories or traumatic recollections of an incident.¹⁶⁵ The SC observed that such tests often diluted an examiner’s ability to recognise deliberate attempts on the part of the subject to manipulate test results and did not provide any conclusive guidance as to the nature of the subject’s involvement in a crime.¹⁶⁶ The SC concluded that for scientific evidence to be treated as reliable, it should meet the ‘beyond a reasonable doubt’ standard necessitated in criminal cases.¹⁶⁷

The SC’s judgment in *Sehi* is also instructive on the issue of testing the validity of forensic evidence using constitutional standards. According to the SC, psychiatric examinations like narco-analysis, brain mapping and lie detector tests cause the subject to enter into a hypnotic trance, allowing investigating officers to gain access to the privacy of a human mind. Such tests are an intrusion into the subject’s mental privacy, thereby violating the right to privacy and personal liberty under Article 21 of the Constitution.¹⁶⁸ As a result, such techniques dilute the voluntariness of the statements made by the subject and hence violate the requirement of free consent and the right against self-incrimination under Section 20(3) of the Constitution of

¹⁶⁵ *ibid.*

¹⁶⁶ *ibid.*

¹⁶⁷ *ibid.*

¹⁶⁸ *ibid.*

India. This finding was in stark contrast to SC's highly controversial judgment in *State of Bombay v. Kathi Kalu Oghad*, which held that the taking of bodily samples or impressions such as fingerprints, and handwriting samples by an investigating officer in custody or under court orders were a necessary part of the investigative process and hence not in violation of Section 20(3) of the Constitution.¹⁶⁹ Thus, in *Selvi*, the SC emphasised the need to test the validity of such forensic evidence on the basis of constitutional safeguards and a 'broader standard of reasonableness' to ensure that the defendant's free trial rights, right to privacy and personal liberty and the right against inhuman or cruel treatment are not violated.¹⁷⁰

Despite the ruling in *Selvi*, reports reveal that investigating officials that rely on defendants as the main source of evidence continue to routinise the use of torture and other forms of coercion to extract bodily samples, conduct psychological tests and obtain involuntary confessions in custodial environments.¹⁷¹ This raises concerns about the effective implementation of the ruling in *Selvi*. As Jinee Lokaneeta argues, the decision in *Selvi* largely focussed on the dilution of consent and inadmissibility of psychological tests, but did not recognise the role of forensic psychologists in continuing

¹⁶⁹ *ibid.*

¹⁷⁰ *ibid.*

¹⁷¹ Abhinav Sekhri, 'The right against self-incrimination in India: the compelling case of Kathi Kalu Oghad' (2019) SSRN 13 <<https://dx.doi.org/10.2139/ssrn.3304431>> accessed 31 October 2020; Jinee Lokaneeta, 'Why Police in India Use "Third-Degree" Torture Methods for Interrogation' *The Wire* (23 July 2020) <<https://the.wire.in/books/police-torture-interrogation-jinee-lokaneeta-excerpt>> accessed 30 October 2020; Scroll Staff, 'Thoothukudi custodial deaths: Father, son were tortured for 7 hours, made to clean blood, says CBI' *Scroll* (27 October 2020) <<https://scroll.in/latest/976893/thoothukudi-custodial-deaths-father-son-were-tortured-for-7-hours-made-to-clean-blood-says-cbi>> accessed 30 October 2020.

to allow the extraction of confessions in forensic laboratories.¹⁷² She notes that the Indian government's decision to legitimise the use of such "*scientific investigations*" to replace physical torture is misplaced as forensic psychologists operating in hospitals and FSLs who vouched for the utility of such methods have "*unofficially replaced the police as interrogators*" and have "*created another confessional site for interrogation*".¹⁷³

Recent judicial precedents on the use of scientific evidence in India disclose that courts have failed to condemn the use of unreliable forensic techniques and have even relied on techniques that have been proven to be junk science. For instance, a large proportion of narco-analysis tests occurred after the SC's verdict in *Sehvi*, with the Delhi High Court in 2019 insisting on the availability of a narco-test facility in a Delhi FSL.¹⁷⁴ Similarly, while imposing the death penalty on the four accused during the trial of the Nirbhaya gang-rape case, the SC extensively relied on bitemark evidence that has resulted in wrongful convictions around the world and has been proven to be grossly misleading.¹⁷⁵ In this case, the SC selectively drew from one-sided academic literature and limited expert testimony to

¹⁷² Jinee Lokaneeta, 'Police Torture & the Truth Machines of India' *Article 14* (10 August 2020) <<https://www.article-14.com/post/police-torture-the-truth-machines-of-india>> accessed 30 October 2020.

¹⁷³ Jinee Lokaneeta, *Truth Machines Policing, Violence, and Scientific Interrogations in India* 135, 139, 184.

¹⁷⁴ *ibid* 159, 162.

¹⁷⁵ *In Re: Assessment of the Criminal Justice System in Response to Sexual Offences* Suo Moto Writ (Crl) No 04 of 2019; Adebola Olufunmi Olaborede and Lirieka Meintjes-van der Walt, 'The Dangers of Convictions Based on a Single Piece of Forensic Evidence' (2020) 23 *Potchefstroom Electronic Law Journal* 1, 34; Kelly Kostelnik, Dr Kenneth Cohn and Dr Jason Byrd, 'Freeing the Innocent: When Guilty Convictions are Overturned due to Errors in Bite Mark Analysis' University of Florida College of Medicine <<https://ufdc.ufl.edu/A00060974/00001>> accessed 31 October 2020.

conclude based on a dubious standard of proof that the marks were ‘most likely’ caused by the accused persons.¹⁷⁶ The use of the ‘reasonable medical certainty’ standard by the judiciary to evaluate bitemarks has been harshly criticised as there is no accepted threshold or measurable scientific criteria to determine its application in different cases.¹⁷⁷ Further, justifying forensic evidence merely because there was no visible tampering with the samples in question does not meet the standard of proof ‘beyond a reasonable doubt’.¹⁷⁸

Thus, in comparison to foreign jurisdictions, the reluctance of Indian courts to consistently make use of accepted standards to determine reliability of forensic evidence is indicative of the gaps in the law as well as a cumulative failure to embrace empirical and science-driven approaches to the law.

In contrast, the decision of the Supreme Court of the United States (SCOTUS) in *Daubert v. Merrell Dow Pharmaceuticals, Inc.* (“*Daubert*”), is dubbed to have revolutionised the standards for evaluating scientific evidence.¹⁷⁹ The question before the SCOTUS in *Daubert* was to establish

¹⁷⁶ *Mukesh* (n 7) 36.

¹⁷⁷ Micheal J Saks and others, ‘Forensic Bitemark Identification: Weak foundations, Exaggerated Claims’ (2016) 3(3) *Journal of Law and the Biosciences* 538, 558; Daniel Selby, ‘Why Bite Mark Evidence Should Never Be Used in Criminal Trials’ (2020) *Innocence Project* 26 April <<https://www.innocenceproject.org/what-is-bite-mark-evidence-forensic-science/>> accessed 31 October 2020; National Commission on Forensic Science, ‘Testimony using the term “Reasonable Scientific Certainty”’ (2016) *National Institute of Standards and Technology* <<https://www.justice.gov/ncfs/file/795336/download>> accessed 31 October 2020 (citing Prof Paul Giannelli).

¹⁷⁸ *Mukesh* (n 7) 224.

¹⁷⁹ *Daubert v Merrell Dow Pharmaceuticals, Inc* 509 US 579 (1993); David L Faigman, ‘The Daubert Revolution and the Birth of Modernity: Managing Scientific Evidence in the Age

what criteria judges must follow while identifying the admissibility of scientific evidence. Before *Daubert*, courts relied on the ruling in *Frye v. United States* (“*Frye*”), in which the Circuit Court laid down the imprecise ‘general acceptance test’ to hold that all scientific evidence that was ‘sufficiently established to have gained general acceptance in the particular field in which it belongs’ be deemed admissible. In determining what constituted general acceptance, the *Frye* standard valued the testimony of forensic practitioners and not empirical validity.¹⁸⁰ Thus, when the petitioners subsequently challenged this vague standard in *Daubert*, the SCOTUS formulated four relevant criteria to determine admissibility. They were: 1) whether the scientific knowledge can be tested or falsified; 2) whether the scientific technique used has been published or subjected to peer review; 3) the potential error rate of the technique employed; 4) how far it agrees with the *Frye* standard of general acceptance.¹⁸¹

It is interesting to note that the SC in *Selvi* acknowledged the relevance of the *Daubert* standard and extensively relied on prior empirical studies carried out in the relevant forensic sub-discipline.¹⁸² Unfortunately, Indian courts are far behind and are yet to formulate a standard to evaluate the reliability of scientific evidence. There are also very few instances in which Indian courts have relied on the *Daubert* standard while testing the

of Science’ (2013) 46 University of California at Davis Law Review 893, 902; *Dharam Deo Yadav v State of Uttar Pradesh* (2014) 5 SCC 509.

¹⁸⁰ Paul C Giannelli, ‘Forensic Science: Daubert’s Failure’ (2017) 59 Case Western Reserve Law Review 869, 871.

¹⁸¹ *Daubert* (n 179).

¹⁸² *Selvi* (n 165).

scientific validity of forensic evidence.¹⁸³ As highlighted in previous sections, judicial engagement with scientific evidence revolves around the admissibility of expert evidence using vague standards. Very rarely have courts stressed on the need to adopt a practical and rational approach while accepting scientific evidence and rejecting such evidence only on justifiable grounds.¹⁸⁴

Courts must tread a fine line while interpreting forensic methods: they must avoid overemphasising the validity of specific tests, particularly in cases involving sexual offences, and keep up with the changing research techniques employed by specialists.¹⁸⁵ In the long run, checking mechanisms must encourage courts to devise a higher and practically determinable standard of proof and to carry out their verification exercises when reports and forensic testimony come before them.¹⁸⁶ Even well-accepted judicial standards should not be treated as the final solution and must be scientifically critiqued. For example, the SCOTUS' much-lauded decision in *Daubert* has recently been criticised for having failed to demand that rigorous systematic research must first be carried out to understand the advantages and defects of different forensic methods and validate their

¹⁸³ *Rajli @ Rajjo v Kapoor Singh and Ors* 2013 SCC OnLine P&H 25166; *Harjinder Kaur v State of Punjab* 2012 SCC OnLine P&H 13445.

¹⁸⁴ *Chellapan v State of Kerala* 2013 (2) KLJ 279.

¹⁸⁵ Dr Padma Bhate Deosthali and Sangeeta Rege, 'Hathras Rape Case: Right to Medico-Legal Care for Survivors Has a Long Way to Go' *The Leaflet* (5 October 2020) <<https://www.theleaflet.in/hathras-rape-case-right-to-medico-legal-care-for-survivors-has-a-long-way-to-go/#>> accessed 31 October 2020; Scroll Staff, 'Hathras case: This is What is Wrong with the 'No Sperm, No Rape' Line Being Pushed by UP Police' *Scroll* (5 October 2020) <<https://scroll.in/article/974972/hathras-case-this-is-what-is-wrong-with-the-no-sperm-no-rape-line-being-pushed-by-up-police>> accessed 31 October 2020.

¹⁸⁶ Thompson and Casarez (n 158).

accurate implementation in changing contexts.¹⁸⁷ Scholars argue that in the absence of foundational testing of these methods, the *Daubert's* test stands on shaky ground.¹⁸⁸ Such engagement with judicial precedent helps courts constantly reinvent evidentiary standards to keep up with changes in the field of forensic science. Perhaps the greatest reward to the forensic science community has come post-*Daubert* when researchers have begun finding new ways for courts to overcome challenges using error rate comparisons which are explicitly defined in each factual circumstance.¹⁸⁹

Judges must go beyond perfunctory examinations of expert statements and judiciously engage with contrasting precedent before arriving at decisive conclusions on admissibility.¹⁹⁰ Questioning scientific experts on their reports and testimonies will keep out scientific conclusions that are drawn by incompetent or even fraudulent forensic professionals.¹⁹¹ Further, the high standard of 'beyond a reasonable doubt' must be strictly followed while admitting scientific evidence. Disregarding accurate scientific testimony as well as overvaluing scientific proof as fully conclusive can seriously disadvantage either party. For example, in the United States, a party that admits blood sample evidence is at an advantage as courts have tended to liberally admit such samples without seeking expert

¹⁸⁷ Giannelli (n 181) 873.

¹⁸⁸ *ibid* 875; Leah A Vickers, 'Daubert, Critique and Interpretation: What Empirical Studies Tell Us About the Application of Daubert' (2005) 40(1) University of San Francisco Law Review 109, 137.

¹⁸⁹ Munia Jabbar, 'Overcoming Daubert's Shortcomings in Criminal Trials: Making the Error Rate the Primary Factor in Daubert's Validity Inquiry' (2010) 85 (6) New York University Law Review 2034, 2050.

¹⁹⁰ Brandon L Garret and Chris Fabricant, 'The Myth of the Reliability Test' (2018) 86(4) Fordham Law Review 1559, 1576; Beecher-Monas (n 99).

¹⁹¹ Pillai (n 104) 290; *Melendez-Diaz v Massachusetts* 129 S Ct 2527 (2009).

opinion or verifying the accuracy of forensic findings.¹⁹² Therefore, the weight attached to scientific evidence by courts must be justified and detailed with cogent reasons provided by judges while testing the admissibility and reliability of such evidence.

Since all stakeholders do not directly handle forensic traces, it is essential to train officials at every step of the process to foster a culture of understanding from common knowledge, to avoid delays in delivering reports and court documents.¹⁹³ To illustrate, the Forensic Sciences Department under the government of Tamil Nadu has created a system that provides all laboratories with a copy of court judgments in every case.¹⁹⁴ This also means that lab reports are brought on the court's record. Such an exercise connects legal and scientific information while simultaneously saving the valuable time of both lawyers and forensic lab experts who do not have to go through any hardships to find these documents. By creating awareness among all stakeholders (judiciary, prosecution, police, social welfare, and laboratories) to pass on vital information made available to them regularly, testing costs can be minimised, standards improved, and scientific methods strictly followed.¹⁹⁵

There must also be a greater degree of inclusion of forensic specialists within the legal system that can help balance out unbalanced

¹⁹² *ibid* 284.

¹⁹³ Science and Technology Select Committee, 'Forensic Science and the Criminal Justice System: A Blueprint For Change' (2019) House of Lords UK <<https://publications.parliament.uk/pa/ld201719/ldselect/ldsctech/333/333.pdf>> accessed 31 October 2020 (House of Lords Report).

¹⁹⁴ Mishra and Damodaran (n 47).

¹⁹⁵ House of Lords Report (n 194).

narratives. Some scholars suggest that courts should be allowed to turn down evidence from facilities that did not previously meet quality thresholds, carry out lab inspections at random by regulatory authorities and disclose the results of quality checks to the public.¹⁹⁶ These measures will incentivise laboratories to perform better, enhance transparency and accountability and improve the trust that various stakeholders place in these facilities.¹⁹⁷ The establishment of clear standard practices followed by forensic laboratories to test the validity of different scientific techniques can further assist judges in determining the reliability of different kinds of evidence.¹⁹⁸

Training judges to read and understand scientific documents like forensic reports is also of utmost significance. While determining whether a given evidentiary sample is a match, judges must be trained to understand the trade-off between false positives and false negatives before arriving at the likelihood ratio. A likelihood ratio will help decision-makers approximate to what extent prior odds of a particular fact or evidentiary narrative have changed when the given forensic findings are taken into account.¹⁹⁹ With the help of this numerical or verbal calculation, judges can go beyond relying on textbook opinions and identify for themselves by testing the hypothesis of a match, whether the likelihood ratio satisfies the

¹⁹⁶ Erin Murphy (n 5) 660.

¹⁹⁷ *ibid.*

¹⁹⁸ Pillai (n 104) 285.

¹⁹⁹ Anders Nordgaard and Birgitta Rasmusson, 'The Likelihood Ratio as Value of Evidence – More than a Question of Numbers' (2012) 11(4) *Law, Probability and Risk* 303, 308.

standard of proof in the given case.²⁰⁰ However, in order for judges to be able to compare likelihood ratios and measure their impact vis-à-vis forensic methods, they must be taught to interpret statistical information and understand how the threshold of proof may vary depending on the kind of forensic evidence. This would imply that forensic methods that are known to be less reliable, such as handwriting samples or shoe marks, would have to be held up to a higher likelihood ratio as opposed to DNA profiles created in a sexual offence. One way to implement this would be to train forensic professionals to brief judges by simplifying methods and effectively communicating to them what is at stake in cases involving complex forensic evidence.

Rather than tailor laboratory procedures to suit courtroom practices, future discourse within the discipline must aim to expand its scope into social policy, medicine, data analytics, intelligence, criminology, security, as well as sentencing and punishment procedures. As Professor Erin Murphy argues, the shift in forensic practices from first-generation forensic evidence (hair or pattern analysis, bite marks, firearms, and ballistic) towards ‘second-generation forensic evidence’ (location tracking, biometrics, digital forensics, and other database-driven techniques) should also take place in courtrooms.²⁰¹ In conclusion, only if judges, lawyers and investigating authorities are trained in the fundamentals of forensic science techniques and are taught to monitor how evidence is handled and

²⁰⁰ David H Kaye, ‘Hypothesis Testing in Law and Forensic Science: A Memorandum’ (2017) 130 (5) *Harvard Law Review Forum* 127, 132; Edward K Cheng, ‘The Burden of Proof and Presentation of Forensic Results’ (2017) 130 *Harvard Law Review* 154, 156.

²⁰¹ Murphy (n 5) 636.

interpreted during criminal trials can they add value to the criminal justice process.

IV. CONCLUSION

The chain of forensic science is only as strong as its weakest link. Understandably, the Indian government wants to speed up the regulation of the forensic industry to meet rising demands. Nevertheless, without a thorough reevaluation of existing systemic deficiencies using data backed by science, no amount of policy-making can address on-ground challenges faced by forensic science laboratories in India. The consistent failure on the part of governments to regulate the forensic science discipline has resulted in a considerable absence of updated, reliable empirical research on the functioning of forensic science laboratories. Critical gaps in legislation and oversight have created a fragmented framework of public and private forensic laboratories resulting in the duplication of costs, and the sprouting of superfluous, unsupervised, and ill-equipped laboratories that indulge in profiteering.

Today, there are large disparities in the internal functioning of forensic laboratories in terms of the quality of services offered, levels of funding, staff availability and accreditation systems. Existing laboratory practitioners bear excessive workloads, face several bureaucratic hurdles and have no standard procedures to guide their work. This has resulted in rampant mishandling of scientific evidence, error-prone data records, disgruntled and disincentivised staff, unreliable expert testimony and outdated research techniques.

A comprehensive analysis of these problems leads us to an inevitable conclusion: the existing forensic science landscape in India is far from perfect. Experience from other jurisdictions presents a guiding plan to Indian regulators on how not to perceive forensic regulation as an oversimplified exercise free from all imperfections. A future regulatory model must account for the unique developmental needs of individual laboratories derived from extensive scientific research. Using empirical findings, a public-private model that values laboratory independence while simultaneously recognising the need for external supervision is proposed. Ultimately, revamping Indian forensic laboratories using a dynamic participatory approach that involves key socio-legal stakeholders is an idea worth exploring. From the viewpoint of a disintegrating criminal justice system, it is undoubtedly a step in the right direction.